

**SANTA MONICA MOUNTAINS NATIONAL
RECREATION AREA
CALIFORNIA**

REBUILD PARAMOUNT RANCH

SAMO
PMIS NO. 303051

100% Final Construction Documents

PROJECT SPECIFICATIONS



NATIONAL PARK SERVICE
July 15, 2022

This page intentionally blank

SECTION 00 01 07- SEALS PAGE

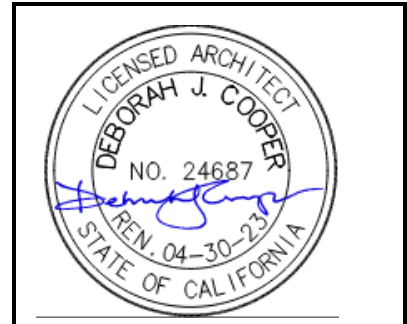
1.1 DESIGN PROFESSIONALS OF RECORD

ARCHITECT

Deborah Cooper, FAIA

Architectural Resources Group
Pier 9 The Embarcadero,
San Francisco, CA 94111

Ph. 415-421-1680



STRUCTURAL ENGINEER

Farshad Khodayari, SE

SOHA Engineers
594 Howard Street, Suite 400
San Francisco, CA 94105

Ph. 415.989.9900

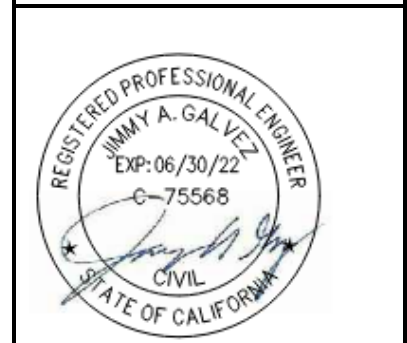


CIVIL ENGINEER

Jimmy Galvez

Sherwood Design Engineers
2301 E. 7th Street, Suite A-238,
Los Angeles CA 90023

Ph. 213.921.4623



LANDSCAPE ARCHITECT

René Bihan

SWA Group
530 Bush Street, 6th Floor
San Francisco, CA 94108

Ph. 510.502.0462



ELECTRICAL
ENGINEER

Thomas Jun, P.E.

Interface Engineering, Inc.
135 Main Street, Suite 400
San Francisco, CA 94105

Ph. 415.489.7240



MECHANICAL
ENGINEER

Rick Russell, P.E.

Interface Engineering, Inc.
135 Main Street, Suite 400
San Francisco, CA 94105

Ph. 415.489.7240



END OF SECTION 00 01 07

TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	Summary of Work Appendix 1: Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountains National Recreation Areas SAMO, Los Angeles County, California” prepared by Kleinfelder, updated August 30, 2021, 46 pages.
01 26 01	Contract Modification Procedures
01 27 00	Definition of Contract Line Items
01 31 00	Project Management & Coordination
01 32 16	Construction Schedule
01 32 33	Photographic Documentation
01 33 23	Submittal Procedures
01 35 13.22	Archeological Protection
01 35 23	Safety Requirements
01 40 00	Quality Requirements
01 42 00	Reference Standards
01 50 00	Temporary Facilities and Controls
01 56 39	Temporary Tree and Plant Protection
01 57 19.11	Indoor Air Quality Management
01 57 19.12	Noise & Acoustics Management
01 57 23	Temporary Storm Water Pollution Prevention
01 67 00	Product Requirements
01 73 40	Execution
01 74 19	Construction Waste Management and Disposal
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
0179 00	Demonstration and Training
01 81 13	Sustainable Design Requirements
01 91 14	Total Building Commissioning

DIVISIONS 02 - EXISTING CONDITIONS

02 41 00	Selective Demolition
----------	----------------------

DIVISION 03 - CONCRETE

03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete

DIVISION 04 - MASONRY

Not Used

DIVISION 05 - METALS

05 12 00	Structural Steel Framing
05 52 13	Pipe and Tube Railings

DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

06 10 00	Rough Carpentry
06 13 00	Heavy Timber Construction
06 13 26	Timber Trusses
06 16 00	Sheathing
06 20 00	Finish Carpentry
06 20 13	Exterior Finish Carpentry for Landscape Elements

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 00	Building Insulation
07 25 00	Weather Barriers
07 41 13	Metal Roof Panels
07 42 13	Metal Wall Panels
07 46 46	Fiber Cement Siding
07 62 00	Sheet Metal Flashing And Trim
07 90 05	Joint Sealants

DIVISION 8 - OPENINGS

08 14 33	Solid Core Wood Doors with Decorative Wood Facings
08 31 00	Access Doors And Panels
08 52 00	Wood Windows
08 71 00	Door Hardware
08 91 00.19	Fixed Louvers and Vents

DIVISION 09 – FINISHES

09 21 16	Gypsum Board
09 78 00	Interior Wall Paneling
09 91 13	Exterior Painting
09 91 23	Interior Painting
09 93 00	Staining and Transparent Finishes

DIVISION 10 - SPECIALITIES

10 14 00	Signage
10 21 13.19	Plastic Toilet Compartments
10 28 00	Toilet Accessories
10 44 00	Fire Protection Specialties

DIVISION 11 – FOODSERVICE EQUIPMENT

11 40 00	Food Service Equipment
11 40 01	Custom Fabricated Foodservice Equipment

DIVISION 12 - FURNISHINGS

12 36 00	Countertops
----------	-------------

DIVISIONS 13 - 20

Not Used

DIVISION 21 - FIRE SUPPRESSION

21 00 00	Fire Suppression Basic Requirements
21 05 00	Common Work Results For Fire Suppression
21 13 00	Fire Suppression Sprinkler Systems
21 13 19	Fire Suppression Deluge Sprinkler Systems

DIVISION 22 - PLUMBING

22 00 00	Plumbing Basic Requirements
22 05 19	Plumbing Devices
22 05 23	General-Duty Valves For Plumbing Piping
22 05 29	Hangers And Supports For Plumbing Piping And Equipment
22 05 53	Identification For Plumbing Piping And Equipment
22 07 00	Plumbing Insulation
22 10 00	Plumbing Piping
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 00	Heating, Ventilating And Air Conditioning (HVAC) Basic Requirements
23 05 13	Common Motor Requirements For HVAC Equipment
23 05 29	Hangers And Supports For HVAC Ductwork And Equipment
23 05 48	Vibration And Seismic Controls For HVAC Equipment
23 05 53	Identification For HVAC Piping, Ductwork And Equipment
23 05 93	Testing, Adjusting, And Balancing For HVAC
23 07 00	HVAC Insulation
23 08 00	Commissioning Of HVAC
23 09 33	Electric And Electronic Control System For HVAC
23 21 13	HVAC Piping
23 31 00	HVAC Ducts And Casings
23 33 00	Air Duct Accessories
23 34 00	HVAC Fans
23 37 00	Air Outlets And Inlets
23 40 00	HVAC Air Cleaning Devices

DIVISIONS 24-25

Not Used

DIVISION 26 - ELECTRICAL

26 00 00	Electrical Basic Requirements
26 00 05	Electrical Pre-Closeout Checklist
26 05 09	Equipment Wiring

26 05 19	Low-Voltage Electrical Power Conductors And Cables
26 05 26	Grounding And Bonding For Electrical Systems
26 05 29	Hangers And Supports For Electrical Systems And Equipment
26 05 33	Raceways
26 05 34	Boxes
26 05 43	Electrical Vaults And Underground Raceways
26 05 53	Identification For Electrical Systems
26 05 73	Electrical Distribution System Studies
26 08 05	Electrical Acceptance Testing
26 08 10	Building Lighting Acceptance Testing And Documentation
26 09 25	Digital Lighting Controls
26 24 13	Switchboards
26 24 16	Panelboards
26 27 13	Electrical Metering
26 27 26	Wiring Devices
26 28 00	Overcurrent Protective Devices
26 28 16	Enclosed Switches And Circuit Breakers
26 33 23	Central Battery Equipment
26 43 00	Surge Protective Devices
26 51 00	Lighting

DIVISION 27 - COMMUNICATIONS

27 00 00	Communications Basic Requirements
27 05 28	Pathways For Communications Systems
27 05 28.28	Firestopping For Communications Systems
27 05 43	Underground Ducts And Raceways For Communication Systems
27 11 00	Communication Equipment Rooms
27 13 00	Communications Backbone Cabling
27 15 00	Communications Horizontal Cabling
27 41 16	Integrated Audio-Video Systems And Equipment
27 51 29	Emergency Responder Radio Coverage System (Errcs)
27 53 20	Cable Television Distribution System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 00 00	Electronic Safety And Security Basic Requirements
28 08 01	Commissioning And Testing Of Security System
28 10 00	Access Control And Intrusion Detection
28 23 00	Video Surveillance
28 31 00	Fire Detection And Alarm

DIVISIONS 29-30

Not Used

DIVISION 31 - EARTHWORK

31 10 00	Erosion Control
31 23 16	Structure Excavation
31 23 33	Utility Trenching And Backfill

31 30 00	Earthwork And Grading
31 22 19	Landscape Grading

DIVISION 32: EXTERIOR IMPROVEMENTS

32 12 16	Asphalt Paving
32 13 13	Concrete Paving
32 15 00	Aggregate Surfacing
32 33 00	Site Furnishings
32 84 00	Planting Irrigation
32 91 13	Soil Preparation
32 93 00	Planting
32 98 13	Landscape Establishment

DIVISION 33: UTILITIES

33 14 16	Water Utilities For Potable And Non Potable Systems
33 30 00	Sanitary Sewer
33 40 00	Storm Drainage Utilities
33 46 00	Subdrainage

DIVISIONS 34-48

Not Used

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Work Covered by Contract Documents
2. Work Phases
3. Work Under Other Contracts
4. Contractor Use of Site
5. Public Use of Site
6. Occupancy Requirements for Buildings
7. Conduct of Operations
8. Work Restrictions
9. Special Construction Requirements
10. Soils Investigation Report
11. Additional Reports

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Location: Paramount Ranch, Santa Monica Mountains National Recreation, 2903 Cornell Road, Agoura Hills, CA 91301. The project site is generally on the western side of Medea Creek within the Park, across the Medea Creek Bridge from the group of Park buildings that include the Longhorn Ranger Station, Restroom Building and Mill Building. Access is via the main public Park entrance on Cornell Road.

B. The Work consists of:

1. The project is a rebuilding of a portion of Paramount Ranch where buildings were lost in the Woolsey Fire in 2018. Major components of the work include four new structures, related site grading and landscape improvements, new utility infrastructure, and new accessible parking.

C. Project will be constructed under a single prime contract.

1.3 WORK PHASES

A. The Work shall be conducted in a single phase.

1.4 WORK UNDER OTHER CONTRACTS

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

1.5 CONTRACTOR USE OF SITE

- A. General: Contractor shall have limited use of site for construction operations. Limit use of premises to Construction limits indicated on drawings, along with designated parking and staging areas as determined by the Contracting Officer. Do not disturb portions of Project site beyond areas in which the Work is indicated.
- B. Storage of Materials: Confine storage of materials to the Construction limits indicated on drawings, along with potential areas shown on the drawings west of Medea Creek. Additional staging areas may be available east of Medea Creek as well. Confirm final areas to be used for staging with the Contracting Officer.
- C. Parking: Confine parking to the Construction limits indicated on drawings, along with designated parking areas east of Medea Creek as determined by the Contracting Officer.
- D. Preservation of Natural Features:
 - 1. Prevent damage to natural surroundings. Restore damaged areas, repairing or replacing damaged trees and plants, at no additional expense to the Government.
 - 2. Provide temporary barriers to protect existing trees and plants and root zones.
 - 3. Do not remove, injure, or destroy trees or other plants without prior approval. Consult with Contracting Officer (CO) and remove agreed-on roots and branches that interfere with construction.
 - 4. Do not fasten ropes, cables, or guys to existing trees.
 - 5. Carefully supervise excavating, grading, filling, and other construction operations near trees to prevent damage.
- E. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Government employees, and emergency vehicles at all times. Do not use for parking or storage of materials.
 - 1. Schedule deliveries to minimize use of driveways and entrances.
 - 2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- F. Construction Camp: Establishment of a camp within park will not be permitted.
- G. Hauling Restrictions: Comply with legal load restrictions in hauling of materials. Load restrictions on park roads are identical to state load restrictions with such additional regulations as may be imposed by the Park Superintendent. Information regarding rules and regulations for vehicular traffic on park roads may be obtained from the Office of the Park Superintendent. A special permit will not relieve Contractor of liability for damage which may result from moving of equipment.
- H. Bridge Restrictions beyond NPS Property: Identify jurisdictions, load restrictions, permit requirements, time and calendar restrictions as outlined.
- I. Bridge Restrictions on NPS Property: The Medea Creek Bridge between the east and west sides of Medea Creek has a Operating Rating (Maximum Load) of weight limit of 37.0 tons. Loading

and unloading can also take place as needed on the east side of Medea Creek upon approval of the Contracting Officer.

1.6 PUBLIC USE OF SITE

- A. The Medea Creek Bridge will remain open to the public during construction and the public can use areas west of the creek beyond the limits of construction. Coordinate needed temporary closures for utility and site improvement work with the Contracting Officer.
- B. Contractor shall conduct his operations to ensure the least inconvenience to public. Road closures may be permitted, when required, upon specific approval of Contracting Officer.

1.7 OCCUPANCY REQUIREMENTS FOR BUILDINGS

A. New Buildings

- 1. Government Occupancy of Completed Areas of Construction: Government reserves right to occupy and to place and install equipment in completed areas of building, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the entire project.
 - a. Contracting Officer will prepare a Beneficial Occupancy letter for each specific portion of the Work to be occupied before Government occupancy.
 - b. Obtain a Certificate of Occupancy from National Park Service (NPS) before Government occupancy.
 - c. Before partial Government occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Government will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - d. On occupancy, Government will assume responsibility for maintenance and custodial service for occupied portions of building.

1.8 CONDUCT OF OPERATIONS

- A. Contractor shall conduct his operations in conformance with rules and regulations promulgated by the Secretary of the Interior for the National Park Service, and applicable park rules and regulations prescribed by Park Superintendent.
- B. Work on Saturdays, Sundays, Federal holidays or at night may not be performed unless stated in the Work Restrictions below or without prior consent from the Contracting Officer. Submit requests 3 business days in advance of the work to the Contracting Officer for approval.
- C. No signs or advertisements (except those specified herein) shall be displayed on the construction site or within the park unless approved by the Contracting Officer.

1.9 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, except when otherwise indicated.
 - 1. Weekend Hours: With approval of the Contracting Officer.
 - 2. Early Morning Hours: Not permitted.
 - 3. Hours for noisy activities: 8 a.m. to 5 p.m.
- B. Existing Utilities
 - 1. Existing Utilities: Notify Contracting Officer and utility companies of proposed locations and times for excavation.
 - 2. Contractor shall be responsible for locating and preventing damage to known utilities. If damage occurs, repair utility at no additional expense to the Government.
 - 3. If damage occurs to an unknown utility, repair utility. An equitable adjustment will be made in accordance with the Changes clause of the contract.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than 3 business days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Contracting Officer's written permission.
 - 3. Hours and length of Utility Shutdowns: During regular work hours and up to a 4 hour duration.
- D. Nonsmoking Building/Tobacco Use/Vaping: Smoking is not permitted within building or within 25 feet of entrances, operable windows, or outdoor air intakes. Tobacco use and vaping is restricted to designated locations to be determined by the Contracting Officer.

1.10 SPECIAL CONSTRUCTION REQUIREMENTS

- A. Project Website: A project website administered by NPS will be used for purposes of managing communication and documents during construction stage.
 - 1. See Section 01 31 00 "Project Management and Coordination" for requirements on using Project Website.
- B. Equipment Decontamination Procedures: The Contractor shall incorporate decontamination procedures for all vehicles, trucks, and equipment used at the site to control and prohibit the transfer of noxious weeds and plants into the park environment or movement of contaminants into or out of the site. Vehicles and equipment will be inspected by Park Representative prior to entry into the park for mud, weeds, and other unwanted substances. Steam clean earth-moving equipment (including haul vehicles) of mud and weed seed. Subsequent entries of hauling vehicles will not require cleaning unless they have been to another work site. Notify Park Representative a minimum of 48 hours prior to entry of vehicles and equipment.

- C. Refuse Containers: Provide trash dumpsters with animal proof cover lids to contain construction debris. Maintain all food products and scented products in bear proof containers.
- D. Vehicle Operation and Fluids: Do not operate or park equipment outside construction limits or on topsoil areas, except as approved by Contracting Officer. Do not operate or store vehicles and equipment leaking oil, gas, or antifreeze within park boundaries. Do not drain oil, hydraulic fluids, antifreeze, or other chemicals onto ground within park boundaries. Completely contain diesel fuel at work site.
- E. Utility Crossing Support at Bridge: Contractor shall coordinate final utility crossing support on the Medea Creek Bridge in conformance with utility company requirements. A deferred design submittal shall be provided with shop drawings and calculations stamped and signed by the Contractor's design engineer. Design shall be by a structural or civil engineer licensed in the State of California.

1.11 SOILS INVESTIGATION REPORT

- A. The report "Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountains National Recreation Areas SAMO, Los Angeles County, California," prepared by Kleinfelder, updated August 30, 2021, is attached to the end of this section.
- B. In case of conflict between report and drawings or specifications, the drawings and specifications govern.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00



**GEOTECHNICAL INVESTIGATION REPORT
PROPOSED PARAMOUNT RANCH REBUILD
SANTA MONICA MOUNTAIN NATIONAL
RECREATION AREA SAMO
LOS ANGELES COUNTY, CALIFORNIA**

PROJECT NO. 20170255.001A

**June 25, 2021
Updated August 30, 2021**

Copyright 2021 Kleinfelder
All Rights Reserved

ONLY THE CLIENT OR ITS DESIGNATED REPRESENTATIVES MAY USE THIS DOCUMENT AND ONLY FOR THE SPECIFIC PROJECT FOR WHICH THIS REPORT WAS PREPARED.



June 25, 2021+
Updated August 30, 2021
Job No.: 20170255.001

Ms. Deborah Cooper
Architectural Resources Group
Pier 9, The Embarcadero, Suite 107
San Francisco, California 94111

SUBJECT: Geotechnical Investigation Report
Proposed Paramount Ranch Rebuild
Santa Monica Mountain National Recreation Area SAMO
Los Angeles County, California

Dear Ms. Cooper:

Kleinfelder is pleased to present the attached Geotechnical Investigation Report for the proposed Paramount Ranch Rebuild to be located in Los Angeles County, California. The report describes the study, findings, conclusions, and recommendations for use in project design and construction. Kleinfelder's services included investigation and exploration of the site, evaluating the subsurface conditions, and developing geotechnical engineering recommendations to aid in project design and construction as described in our proposal dated December 30, 2020.

It is Kleinfelder's professional opinion that the proposed site is geotechnically suitable for construction of the proposed project using conventional grading and shallow foundation systems. The primary geotechnical design and construction issues associated with the project is presence of disturbed soil from previous demolition activities and near surface soils with low to moderate expansion potential. The designer(s) and contractor(s) should be aware of the site subsurface conditions, as they will affect design and construction. Specific recommendations regarding the geotechnical aspects of project design and construction are presented in the following report.

Kleinfelder appreciates the opportunity to provide geotechnical engineering services to Joseph Chow and Associates and the National Park Service (NPS). We trust this information meets your current needs. If there are any questions concerning the information presented in this report, please contact this office at your convenience.

Sincerely,

KLEINFELDER, INC.

Adam AhTye, PE
Staff Engineer

Stephen P. Plauson, PE, GE
Principal Geotechnical Engineer

A Report Prepared for:

Architectural Resources Group
Pier 9, The Embarcadero, Suite 107
San Francisco, California 94111

**GEOTECHNICAL INVESTIGATION REPORT
PROPOSED PARAMOUNT RANCH REBUILD
SANTA MONICA MOUNTAIN NATIONAL RECREATION AREA SAMO
LOS ANGELES COUNTY, CALIFORNIA**

Kleinfelder Job No.: 20170255.001A

Prepared by:



Adam AhTye, PE
Staff Engineer



Stephen P. Plauson, PE, GE
Principal Geotechnical Engineer

KLEINFELDER, INC.
3731 W. Ashcroft Avenue
Fresno, California 93722
(559) 486-0750

June 25, 2021
Updated August 30, 2021

TABLE OF CONTENTS

CHAPTER		PAGE
1	INTRODUCTION.....	1
1.1	GENERAL.....	1
1.2	PROPOSED CONSTRUCTION.....	1
1.3	PURPOSE AND SCOPE OF SERVICES.....	2
2	FIELD EXPLORATION	4
2.1	FIELD EXPLORATION	4
2.2	FIELD and laboratory TESTS.....	4
2.2.1	Field Testing.....	4
2.2.2	Laboratory Tests	4
3	SITE CONDITIONS.....	6
3.1	SURFACE.....	6
3.2	FEMA FLOOD ZONE.....	6
3.3	EARTH MATERIALS	6
3.4	GROUNDWATER CONDITIONS.....	7
4	GEOLOGIC CONDITIONS.....	8
4.1	REGIONAL GEOLOGY.....	8
4.2	2018 IBC SEISMIC DESIGN CRITERIA	8
4.2.1	Site Class	8
4.2.2	Seismic Design Parameters	8
4.3	LIQUEFACTION	10
5	EARTHWORK.....	11
5.1	GENERAL.....	11
5.2	SITE PREPARATION	11
5.2.1	Demolition of Structures	11
5.2.2	Stripping.....	11
5.2.3	Disturbed Soil, Undocumented Fill and Subsurface Obstructions	12
5.2.4	Over-Excavation.....	12
5.2.5	Scarification and Compaction	13
5.3	ENGINEERED FILL	13
5.3.1	Materials.....	13
5.3.2	Compaction Criteria.....	14
5.3.3	Construction Considerations.....	15
5.4	TEMPORARY EXCAVATIONS	15
5.4.1	General	15
5.4.2	Excavations and Slopes	16
5.4.3	Construction Considerations.....	16
5.5	TRENCH BACKFILL	16
5.5.1	Materials.....	16
5.5.2	Compaction Criteria.....	17
6	DESIGN RECOMMENDATIONS.....	18
6.1	GENERAL.....	18
6.2	FOUNDATIONS.....	18
6.2.1	Allowable Vertical Bearing Pressures and Settlements.....	18

6.2.2	Lateral Resistance.....	19
6.2.3	Design and Construction Considerations.....	20
6.3	RETAINING STRUCTURES	20
6.4	CONCRETE SLABS-ON-GRADE	21
6.4.1	Subgrade Preparation	21
6.4.2	Capillary and Moisture/Vapor Break	22
6.4.3	Conventional Slab Design	23
6.4.4	Thickened Interior Concrete Slab at Partition Walls	23
6.5	CORROSION POTENTIAL	23
6.6	PAVEMENTS.....	24
6.6.1	Design R-value and Traffic Assumptions	24
6.6.2	Asphalt Concrete Pavement Design	24
6.6.3	Moisture Considerations.....	26
6.7	SITE DRAINAGE	26
7	ADDITIONAL SERVICES	28
7.1	PLANS AND SPECIFICATIONS REVIEW	28
7.2	CONSTRUCTION OBSERVATION AND TESTING.....	28
8	LIMITATIONS	29

FIGURES

EXPLORATION LOCATION PLAN AND VICINITY MAP	1
--	---

APPENDICES

LOG KEY	A-1/A-2
BORING LOGS	A-3/A-6
LABORATORY TEST SUMMARY REPORT	B-1
SIEVE ANALYSIS	B-2
RESISTANCE VALUE	B-3
DIRECT SHEAR	B-4
CORROSIVITY TESTING RESULTS	

1 INTRODUCTION

1.1 GENERAL

This report presents the results of a geotechnical investigation for the proposed rebuilding of Paramount Ranch that is located west of Paramount Ranch Road and Cornell Road in Los Angeles County, California. The purpose of the investigation was to explore and evaluate the subsurface conditions at the site and to develop geotechnical engineering recommendations to aid in project design and construction.

This report includes recommendations related to the geotechnical aspects of project design and construction. Conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the locations of the exploration and the provisions and requirements outlined in the “Additional Services” and “Limitations” Sections of this report. Recommendations presented herein should not be extrapolated to other areas or used for other projects without prior review.

1.2 PROPOSED CONSTRUCTION

Kleinfelder’s understanding of the project is based upon a review of the email request for the project, including project plans, a scope of services provided by the National Park Service (NPS) and an email correspondence with Architectural Resources Group and SOHA Engineering. It is understood that previous fires burned the structures in the Paramount Ranch backlot area located west of Madea Creek. Current project plans are intended to reconstruct the previously burned structures, which includes four single-story, wood-framed structures consisting of approximately a 1,200, 1,920, 2,000, and 5,760 square foot buildings and a 5,550 square foot covered pavilion. The structures are anticipated to be supported on conventional spread footings and concrete slab-on-grade floors. Maximum wall and column loads are anticipated to be less than 3 kips per foot and 30 kips; respectively. Appurtenant improvements are anticipated to include asphalt pavements, underground utilities, hardscape, and landscaping. The building areas were previously developed and grades established, therefore proposed cuts and fills are anticipated to be minimal, on the order of 1 to 2 feet to achieve pad grade and positive site drainage.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation was to explore the site subsurface conditions and develop recommendations and opinions to assist in project design and construction. To accomplish these purposes, Kleinfelder's scope of services includes the following:

- Review of existing geologic and geotechnical data for the site vicinity.
- Drilling and sampling of five soil borings to explore subsurface conditions and to obtain samples for laboratory testing.
- Laboratory testing of selected samples to assess pertinent geotechnical properties.
- Evaluation of the available data to develop conclusions and recommendations to guide geotechnical aspects of design and construction.
- Preparation of this report.

Environmental evaluations and analyses, including detailed review of possible contaminants in the foundation soils, are outside of our scope of services.

This report addresses the following items:

- A description of the proposed project, including a vicinity map showing the location of the site and a site plan showing the locations of the exploration points for this study
- A description of the site surface and subsurface conditions encountered during the field investigation, including boring logs
- A summary of the field exploration and laboratory testing program
- Ground motion parameters for use in structure design based on the 2018 IBC and ASCE 7-16
- Comments on liquefaction potential and liquefaction induced settlement
- Recommendations for site preparation and earthwork, including the use of on-site soils for engineered fill and recommended import fill specifications

- Recommendations for design of shallow foundations including the bearing capacity of foundation soil for sustained loading, total combined loading, and anticipated settlement
- Modulus of subgrade reaction for design of foundations as a beam on an elastic foundation
- Recommendations for resistance of lateral loads, including passive pressure and friction coefficient
- Recommendations to aid in the design of concrete slabs-on-grade, including a modulus of subgrade reaction
- Comments on the corrosion potential of on-site soils to buried metal and concrete
- Recommendations for asphalt concrete pavements based on a range of truck traffic indexes
- Comments on general site drainage

2 FIELD EXPLORATION

2.1 FIELD EXPLORATION

The field exploration was conducted on May 11, 2021 and consisted of drilling four (4) exploratory test borings and conducting a site reconnaissance by a staff engineer. The test borings were drilled with CME 75 truck-mounted drill rigs, using hollow stem drilling techniques. The borings were completed to depths of 16.5 and 51.5 feet below the existing ground surface (bgs). The approximate locations of the test borings are indicated on the Exploration Location Plan and Vicinity Map, Figure 1, located at the end of this report.

The soils encountered in the boring were visually classified in the field and a continuous log was recorded. Soil samples were collected from the test borings at selected depths by driving a 1.4-inch I.D. standard penetrometer into the undisturbed soil with a 140-pound automatic hammer free falling a distance of 30 inches. The sampler was driven 18 inches in accordance with ASTM D1586 test procedures and was used without liners. Resistance to sampler penetration was noted on the boring logs as the number of blows per foot over the last 12 inches of sampler penetration. The blow counts listed in the boring logs have not been corrected for the effects of overburden pressure, rod length, sampler size, or hammer efficiency.

2.2 FIELD AND LABORATORY TESTS

2.2.1 Field Testing

Penetration rates determined in general accordance with ASTM D1586 were used to aid in evaluating the consistency, compression, and strength characteristics of the foundation soils. Correlation to the penetration rates were also used in the engineering analyses.

2.2.2 Laboratory Tests

Kleinfelder performed laboratory tests on selected near surface samples to evaluate their physical characteristics. The following laboratory tests were used to aid in developing the design geotechnical parameters:

- Unit Weight (ASTM D2937)

- Moisture Content (ASTM D2216)
- Sieve Analysis (ASTM C136)
- Expansion Index (ASTM D4829)
- Direct Shear (ASTM D3080)
- pH and Minimum Resistivity (California Test Method No. 532)
- Soluble Sulfate Content (California Test Method No. 417)
- Soluble Chloride Content (California Test Method No. 422)
- Resistance Value (California Test Method No. 301)

3 SITE CONDITIONS

3.1 SURFACE

The existing project site consisted of vacant a land situated just west of the Madea Creek and was surrounded by vacant land and mature vegetation to the north, a church building to the south, and a building to the west of the site. The ground surface supported a moderate growth of annual grasses and weeds with no visible evidence of the previous Paramount Ranch structures. The general topography of the proposed building sites appeared to be relatively flat and at a similar elevation to the areas immediately surrounding the proposed building locations. The topography beyond the immediate project site consists of the Santa Monica Mountains ascending to the west and the site descends downward to the stream channel of Madea Creek to the east.

3.2 FEMA FLOOD ZONE

According to the Federal Emergency Management Act (FEMA), the project site lies within two flood designations (Map Number 06037C1507G dated April 4, 2018). Flood Zone X indicating areas of minimal flood hazard and Flood Zone X indicating areas of 0.2 percent annual chance flood hazard, areas of 1 percent annual chance flood with average depth less than one foot or with drainage areas of less than one square mile. The project civil designer should confirm if the flood designations are of concern for the civil design of the site grading and drainage of the site.

3.3 EARTH MATERIALS

The borings were performed within the location of the proposed structures. The following description provides a general summary of the subsurface conditions encountered during the field exploration and as further evaluated through the laboratory testing program. For a more thorough description of the actual conditions encountered at specific boring locations, refer to the boring logs presented in Appendix A. The soils were classified according to the Unified Soil Classification System (ASTM D2487).

The subsurface soils consist early Holocene aged alluvial deposits consisting of gravels, sands, and clay of flood plains. The general soil profile encountered by the subsurface exploration consisted primarily of sandy clay and clayey sand extending to the depth of exploration,

approximately 51.5 feet bgs with traces of gravel in the upper 3 feet. The granular soils had a relative consistency of medium dense to very dense and the fine-grained soils had a relative consistency of very stiff to hard.

3.4 GROUNDWATER CONDITIONS

Groundwater was not encountered within the depth of exploration, 51.5 feet bgs. Research utilizing the California Department of Water Resources (DWR) website indicate groundwater levels to be greater than 50 feet bgs. It is possible that groundwater conditions at the site could change at some time in the future due to variations in the water surface elevation in the adjacent Madea Creek, rainfall, groundwater withdrawal, construction activities, or other factors not apparent at the time of our field reconnaissance.

4 GEOLOGIC CONDITIONS

4.1 REGIONAL GEOLOGY

The project site and its vicinity are in an area traditionally characterized by low to moderate seismic activity. Faulting and seismic ground shaking is usually associated with known fault systems. The site is not located in an Alquist-Priolo Earthquake Fault Zone as established by the Alquist-Priolo Fault Zone Act (Section 2622 of Chapter 7.5, Division 2 of the California Public Resources Code).

Based on a review of published data and a current understanding of the geologic framework and tectonic setting of the proposed facility, there are no known faults which traverse through the local soils in or near the site. The primary source of seismic shaking is anticipated to be the Malibu Coast, which is located about 6 miles south of the project site.

4.2 2018 IBC SEISMIC DESIGN CRITERIA

4.2.1 Site Class

Based on information obtained from this investigation, published geologic literature and maps, and on our interpretation of the 2018 International Building Code (IBC) criteria, it is our opinion that the project site may be classified as Site Class D, Stiff Soil, according to Section 1613.3.2 of 2018 IBC and Table 20.3-1 of ASCE 7-16 (2016). Site Class D is defined as a profile consisting of stiff soil with a shear wave velocity between 600 feet per second and 1,200 feet per second, standard penetration test (SPT) blow counts (N-value) between 15 and 50 blows per foot, or undrained shear strength between 1,000 and 2,000 pounds per square foot in the top 100 feet.

4.2.2 Seismic Design Parameters

Approximate coordinates for the site are noted below.

- Latitude: 34.115702°N
- Longitude: -118.75658°W

This section provides seismic design parameters based on the 2018 IBC. For 2018 IBC based design, seismic design requirements are based on ASCE 7-16. The general seismic design parameters are obtained based on the site class, site coordinates, and the risk category of the building using the OSHPD seismic design maps website. Mapped spectral accelerations for 0.2 second and 1 second periods (S_S and S_1), associated soil amplification factors (F_a and F_v), and mapped peak ground acceleration (PGA) are presented in Table 5-1 below.

Since the mapped S_1 value is greater than 0.2g and the site is classified as Site Class D, per 2018 IBC, a site-specific ground motion hazard analysis is required unless Exception 2 is taken by the structural engineer, per Section 11.4.8 of ASCE 7-16. Should the project design team take the exception, a site-specific ground motion hazard analysis is not needed. As such, Kleinfelder is providing general procedure seismic design parameters consistent with Chapter 11 of ASCE 7-16, Supplement 1 of ASCE 7-16, and the 2018 IBC as follows.

TABLE 4.2-1
Ground Motion Parameters Based on 2019 CBC

Parameter	Value	ASCE 7-16 Reference
S_S	1.492 g	Fig 22-1
S_1	0.527 g	Fig 22-2
Site Class	D	Table 20.3-1
F_a	1.000	Table 11.4-1
F_v	NA ¹	Table 11.4-2, Supplement 1
PGA	0.623g	Fig 22-9
S_{MS}	1.492g	Eq. 11.4-1
S_{M1}	NA ¹	Eq. 11.4-2
S_{DS}	0.995 g	Eq. 11.4-3
S_{D1}	NA ¹	Eq. 11.4-4
F_{PGA}	1.100	Table 11.8-1
PGA_M	0.686g	Eq. 11.8-1
C_{RS}	0.925	Fig 22-18A
C_{R1}	0.920	Fig 22-19A
T_L	8 seconds	

¹NA = Not Applicable; Section 11.4.8 of ASCE 7-16 requires a site-specific ground motion hazard analysis be performed for Site Class D sites with S_1 greater than or equal to 0.2g unless exceptions are taken. If exceptions are taken, then a F_v value of 1.773 shall be used only to calculate the T_s value.

4.3 LIQUEFACTION

For liquefaction of soils due to ground shaking to occur, it is generally accepted that four conditions will exist:

- The subsurface soils are in a relatively loose state,
- The soils are saturated,
- The soils are granular, and
- Ground shaking is of sufficient intensity should occur to act as a triggering mechanism.

Saturated granular sediments can experience liquefaction if subject to seismically induced ground motion of sufficient intensity and duration. The absence of groundwater within the upper 50 feet of site would preclude the occurrence of liquefaction. Based on the ground shaking which may be expected at this site, the relative density and geologic age of the sediments, analysis utilizing Youd (2001) indicates liquefaction, seismically induced settlement, or bearing loss is considered unlikely, even if there should be a substantial increase in groundwater levels.

5 EARTHWORK

5.1 GENERAL

Based on the laboratory data, field exploration, and geotechnical analyses conducted by Kleinfelder for this study, it is geotechnically feasible to construct the proposed development, as currently envisioned. The proposed building and overall site improvements can be developed using conventional grading and foundation construction techniques.

The investigation has revealed a surface horizon of low to moderately expansive clayey sand soils. These soils expansive soils are susceptible to volume changes associated with changes in soil moisture content. The potential for future differential movement resulting from these soils can be reduced to normally tolerable levels by following the foundation and moisture conditioning and compaction recommendations presented in this report.

Recommendations regarding site grading are presented in subsequent sections of this report. All reference to relative compaction, maximum density, and optimum moisture is based on ASTM Test Method D1557.

5.2 SITE PREPARATION

5.2.1 Demolition of Structures

The site previously supported various structures, foundation systems (i.e., concrete slabs/footings), pavements, and associated underground utilities. All remaining foundation systems, associated underground utilities, and other unsuitable structures encountered during the site preparation should be entirely removed.

Following removal of any remaining foundations, utilities, buried structures, etc. all disturbed soils should be mitigated as described in Sections 5.2.3 and 5.2.4.

5.2.2 Stripping

At the time of the site reconnaissance, a light to moderate growth of seasonal vegetation was present on the site. It is likely the amount of surface vegetation will vary with time. Any surface

vegetation, miscellaneous surface obstructions, pavements etc. should be removed from the project area, prior to any site grading. Based on site observation, stripping of vegetation will likely involve the upper 1 to 2 inches of surface soil.

Surface strippings should not be incorporated into fill unless they can be sufficiently blended to result in an organic content less than 3% by weight (ASTM D2974). Stripped topsoil, with an organic content between 3% and 12% by weight, may be stockpiled and used as non-structural fill (i.e., landscaped areas). If used in landscape areas soil with an organic content between 3% and 12% should be placed within 2 feet of finished grade and at least 5 feet outside of building and pavement perimeters. Soil with an organic content greater than 12% by weight should be excluded from fill.

5.2.3 Disturbed Soil, Undocumented Fill and Subsurface Obstructions

Initial site grading should include a reasonable search to locate soil disturbed by previous activity, any undocumented fill soils, abandoned underground structures, or existing utilities that may exist within the area of construction. Any subsurface obstructions should be removed from the project area. Any areas or pockets of soft or loose soils, void spaces made by burrowing animals, undocumented fill, or other disturbed soil that are encountered, should be excavated to expose firm native material approved by a representative of the Geotechnical Engineer.

5.2.4 Over-Excavation

The demolition of previous structures, foundations, and pavements along with removal of existing utilities is anticipated to have disturbed the near surface soils within the project area, which could lead to non-uniform bearing conditions and differential settlement of the proposed site improvements. As such, if the proposed improvements (e.g., proposed fill placement and new structures and pavements) are to be located within the footprint of the existing structures, the disturbed areas should be overexcavated or cleared of loose soil as necessary. It is anticipated the depth of overexcavation to remove soils loosened by demolition may be on the order of 18 inches bgs. The over-excavation should extend beyond the perimeter of the improvements a minimum distance of 3 feet. The over-excavation is recommended to repair any near surface loose/disturbed soils. The undisturbed foundation soils are capable of supporting the proposed improvements, therefore, foundations that extend below the recompaction depth discussed in Sections 5.2.4 and 5.2.5 may derive bearing on firm,

undisturbed native soils approved by the geotechnical engineer without further over-excavation below the footing.

5.2.5 Scarification and Compaction

After stripping the site and performing necessary removals and required overexcavation, all areas to receive fill or to support proposed improvements should be scarified at least 8 inches below exposed subgrade elevation. The subgrade soil should be uniformly moisture conditioned to at, or above optimum moisture, proof rolled to detect soft or pliant areas, and compacted to the requirements for engineered fill (Section 5.4). Soft or pliant areas should be excavated to expose competent, stable, and undisturbed soil.

The expansive soil condition will necessitate moisture conditioning to a depth of 6 inches below footings and 18 inches below exterior concrete slabs-on-grade (refer to Sections 6.2 and 6.4). Therefore, additional over-excavation and scarification may be necessary to achieve the required moisture content below footings.

5.3 ENGINEERED FILL

5.3.1 Materials

All backfill soils should be nearly free of organics (less than 3% by weight per ASTM D 2974) or other deleterious debris and less than 3 inches in maximum dimension. Oversize particles (larger than 3 inches) should be screened from excavated on-site soil prior to use as engineered backfill.

Any imported fill materials to be used for engineered fill should be sampled and tested by the project Geotechnical Engineer prior to being transported to the site. Table 5.3-1 provides general criteria for imported soil.

**TABLE 5.3-1
SOIL MATERIALS TEST PROCEDURES**

<u>Gradation</u>		<u>Test Procedures</u>	
<u>Sieve Size</u>	<u>Percent Passing</u>	<u>ASTM¹</u>	<u>Caltrans²</u>
76 mm (3 inch)	100	C136	202
19 mm (¾ inch)	80 – 100	C136	202
No. 4	60 - 100	C136	202
No. 200	20 – 70	C136	202
<u>Plasticity</u>			
<u>Liquid Limit</u>	<u>Plasticity Index</u>		
< 40	< 25	D4318	204
<u>Soluble Sulfates</u>			
< 1500 ppm		-	417
<u>Soluble Chloride</u>			
<250 ppm		-	422
<u>Resistivity</u>			
>1000 ohm x cm		-	532
Notes:			
¹ American Society for Testing and Materials Standards (latest edition) ² State of California, Department of Transportation, Standard Test Methods (latest edition)			

5.3.2 Compaction Criteria

Soils used as engineered fill should be uniformly moisture conditioned to at least the percentages above optimum moisture indicated in Table 5.3-2, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to within the required range of relative compaction indicated in Table 5.3-2. Discing and/or blending may be required to uniformly moisture-condition soils used for engineered fill. The actual level of moisture conditioning and compaction will be based on the expansion potential and moisture density relationships determined during grading. The general intent is to bring the expansive material to about 80 to

85 percent saturation at the time of construction. Preliminary design with use of on-site soil should consider criteria for the EI range of 21 – 41 (PI between 9 and 15).

**TABLE 5.3-2
MOISTURE CONDITIONING AND COMPACTION**

Soils		Relative Compaction (min – max)	Minimum Moisture Conditioning (% Over Optimum)
PI	EI		
9 – 15	21 – 41	90-95%	+ 3%
16 – 25	41 – 80	88-92%	+ 4%
> 25	> 80	88-92%	+ 5%

5.3.3 Construction Considerations

Should site grading be performed during or subsequent to wet weather, near-surface site soils may be significantly above optimum moisture content. These conditions could hamper equipment maneuverability and efforts to compact site soils to the recommended compaction criteria. Disking to aerate, chemical treatment, replacement with drier material, stabilization with a geotextile fabric or grid, or other methods may be required to mitigate the effects of excessive soil moisture and facilitate earthwork operations. Any consideration of chemical treatment (e.g., lime) to facilitate construction would require additional soil chemistry evaluation and could affect landscape areas and some construction materials (e.g., aluminum).

If construction is performed during dry, hot or windy weather, it may be necessary to periodically apply surface watering to counter evaporative loss or re-establish moisture prior to constructing structures.

5.4 TEMPORARY EXCAVATIONS

5.4.1 General

All excavations must comply with applicable local, State, and Federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety generally is the responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. The information provided is a

service to the client. Under no circumstances should the information provided be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

5.4.2 Excavations and Slopes

The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, State, and/or Federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

All excavations should be constructed and maintained in conformance with current OSHA requirements (29 CFR Part 1926) for a Type C soil. If excavations encounter saturated soils, temporary excavations will have to be laid back or shored and the trench dewatered to maintain stability.

5.4.3 Construction Considerations

Heavy construction equipment, building materials, excavated soil, and vehicular traffic should be kept sufficiently away from the top of any excavation to prevent any unanticipated surcharging. If it is necessary to encroach upon the top of an excavation, Kleinfelder can provide comments on slope gradients or loads on shoring to address surcharging, if provided with the geometry. Shoring, bracing, or underpinning required for the project (if any), should be designed by a professional engineer registered in the State of California.

During wet weather, earthen berms or other methods should be used to prevent runoff water from entering all excavations. All runoff should be collected and disposed of outside the construction limits.

5.5 TRENCH BACKFILL

5.5.1 Materials

Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of soil compatible with design requirements for the specific types of pipes. It is recommended

the project designer or pipe supplier develop the material specifications based on planned pipe types, bedding conditions, and other factors beyond the scope of this study. Randomly excavated near surface soil will likely be Class III and IVA material (clayey sand/sandy clay) per ASTM D2321.

Trench zone backfill (i.e., material placed between the pipe zone backfill and finished subgrade) may consist of native soil which meets the requirements for engineered fill.

5.5.2 Compaction Criteria

All trench backfill should be placed and compacted in accordance with recommendations provided for engineered fill. Reduced compaction (85% minimum) could be specified for trench zone backfill in non-structural areas located a distance equal to the depth of the trench from any structures and appurtenant improvements. Mechanical compaction is recommended; ponding or jetting should not be used.

6 DESIGN RECOMMENDATIONS

6.1 GENERAL

The proposed building improvements may be supported by continuous reinforced and shallow isolated spread footings bearing on approved undisturbed native soil or properly engineered fill. The following recommendations are based on the assumption that the recommendations in Section 5, "Earthwork," have been Implemented. Specific comments regarding the geotechnical aspects of project design are presented in subsequent sections.

6.2 FOUNDATIONS

Based on the anticipated expansive nature of the foundation soils, it is recommended that footings be embedded at least 24 inches below the lowest adjacent grade. Footings should be reinforced with two #4 bars near the top and two #4 bars near the bottom (4 bars total). Foundation depths and reinforcement should also satisfy structural and constructability considerations. Clay subgrade soil within 6 inches of the bottom of footings and within footing sidewalls should have a moisture content of at least 3 percent above optimum, immediately prior to pouring foundation concrete.

These recommendations are based on engineering judgement and experience associated with expansive soil and is not based on any structural analysis. Any additional reinforcement for structural considerations should be provided by the structural engineer. The recommendations should be reviewed by project structural engineering or building designer and they should concur with the recommendations provided.

6.2.1 Allowable Vertical Bearing Pressures and Settlements

Generally two geotechnical issues determine the design bearing pressure for conventional spread footing foundations; (1) strength of the foundation soil and (2) tolerable settlement. For light loads, bearing may be dictated by code required minimum footing geometry or constructability considerations.

The available bearing capacity, based only on the shear strength of the soil, will be dependent upon the footing geometry. Presented in Table 6.2-1 are the expressions for the allowable

available bearing capacity (shear strength considered only) for static loading (D.L. + long term L.L.) and total combined loading (D.L. + L.L. + transient loading, such as wind or seismic).

**TABLE 6.2-1
AVAILABLE ALLOWABLE BEARING**

	Available Allowable Bearing (psf)
Static Loading	$870 B + 1,590D$
Total Combined Loading	$1,305 B + 2,385 D$
Unfactored Ultimate Bearing	$2,610 B + 4,765 D$
Note: B is footing width in feet and D is footing embedment depth in feet.	

The above expressions are appropriated for design using the Basic and Alternate Load Combinations in Section 1605.3 of the 2018 IBC. Analysis, based on methods by Schmertmann, determined the following estimated static settlement based on a range of assumed design bearing and estimated structural loads. Settlement is expected to occur rapidly with load application. The estimated settlements presented in Table 6.2-2 are based on the assumption that the sustained load of footings is equal to 80 percent of the total load.

**TABLE 6.2-2
ESTIMATED SETTLEMENT**

Footing Type	Loading (DL + LL)	Design Bearing (psf)	Estimated Settlement (inch)
Strip	3 kips/ft	3,000	Less than 0.25
Square	30 kips	3,000	0.30

The foundation soil is anticipated to have a low expansive potential. Therefore, foundation embedment and reinforcement should be consistent with structural or architectural considerations and the 2018 IBC. A modulus of subgrade reaction, K_p ($B_p = 1$ foot), of 400 pci can be used for undisturbed on-site soils or engineered fill. The subgrade modulus is applicable to consideration of static loads with deformations within an elastic range.

6.2.2 Lateral Resistance

Lateral loads applied to foundations can be resisted by a combination of passive lateral bearing and base friction. The allowable and ultimate passive pressures and frictional coefficients for the footings are presented in Table 6.2-3.

**TABLE 6.2-3
PASSIVE PRESSURES AND FRICTIONAL COEFFICIENTS**

	Allowable		Ultimate
	Static	Total Combined	
Frictional Coefficient	0.35	0.47	0.70
Passive Pressure (psf/ft of depth)	400	535	805
Lateral Translation Needed to Develop Passive Pressure	0.005 D	0.012 D	0.025 D

Note: D is the footing depth

Passive resistance should not be used within the top 12 inches of the footing unless abutted by hardscape. If the deflection resulting from the strain necessary to develop the passive pressure is beyond structural tolerance, additional passive pressure values could be provided based on tolerable deflection. The passive pressure and frictional resistance can be used in combination. The allowable values already incorporate a factor of safety and, as such, would be compared directly to the driving loads. If analytical approaches require the input of a safety factor, the ultimate values would be used.

6.2.3 Design and Construction Considerations

Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. All footing excavations should be observed by the project Geotechnical Engineer just prior to placing steel or concrete. The purpose of these observations is to check that the bearing soils actually encountered in the foundation excavations are similar to those assumed in analysis and to verify the recommendations contained herein are implemented during construction.

6.3 RETAINING STRUCTURES

The lateral earth pressure against retaining structures will be dependent upon the ability of the wall to deflect. Presented in Table 6.3-1 are the active, at-rest, and braced lateral earth pressures. The active pressure is applicable to walls able to translate 0.0005 radians at the top or bottom. The at-rest soil pressure is applicable to retaining structures that are fully fixed against both rotation and translation. Walls restrained from translation at the top and bottom,

but able to deflect 0.0005 radians between the restrained points should be designed for the braced lateral pressure.

**TABLE 6.3-1
LATERAL EARTH PRESSURES FOR ON-SITE SOIL**

Loading Conditions	Earth Pressures
Active Pressure (psf/ft of depth)	35
Braced Pressure (psf)	23 H
At-Rest Pressure (psf/ft of depth)	50

H in the expression represents the retained height in feet (measured from finished grade to bottom of footing). The above-recommended values consider saturated soil conditions; however, they do not include the lateral pressure due to hydrostatic forces. Therefore, wall backfill should be adequately drained.

Retaining wall foundation design can utilize the passive pressures and sliding resistance given in Table 6.2-3 and the bearing pressures given in Table 6.2-1. When utilizing the available allowable bearing pressures of Table 6.2-1, the value for static loading would represent the average bearing for the footing and the value for total combined loading would represent the allowable maximum toe pressure.

6.4 CONCRETE SLABS-ON-GRADE

6.4.1 Subgrade Preparation

Slabs-on-grade should be supported on recompacted soils or engineered fill placed as described in Section 5.3 of this report. Clay subgrade soil within 24 inches of pad grade should have a moisture content of at least the percentage above optimum as indicated in Table 5.3-2, immediately prior to pouring the slab or placing the vapor retarding membrane.

A moisture cut-off/containment system should be provided at the free edges (not adjacent to buildings or pavement curbing) of exterior concrete slabs. This cut-off could consist of a 10-mil PVC membrane draped vertically for a depth of 24 inches.

It will be necessary to maintain the moisture in conditioned subgrade, if the moisture conditioning is performed prior to the time of concrete placement. This could be achieved by

periodic watering to provide sufficient moisture to counter evaporative loss. The frequency of moisture application will vary based on ambient temperature, humidity and wind conditions.

6.4.2 Capillary and Moisture/Vapor Break

Considering the depth to ground water and the soil types, a capillary break (i.e. clean sand or gravel layer) is not necessary. Ground or sand bedding is not recommended beneath exterior slabs.

If the building contains components (flooring or equipment) which might be adversely affected by moisture or moisture vapor transmission through the floor slab, it is recommended that the slab subgrade be covered by a vapor retarding membrane, such as 10-mil polyolefin. If design should incorporate a gravel subgrade layer, the membrane should have a minimum thickness of 15 mil. As an added precaution, consideration could be given to extending the vapor retarding membrane down along the interior side of the footings to provide a more complete vapor barrier. The subgrade surface should be smooth and care should be exercised to avoid tearing, ripping, or otherwise puncturing the vapor retarding membrane. If the vapor retarding membrane becomes torn or disturbed, it should be removed and replaced or properly patched. It is recommended consideration be given to placing concrete directly on the vapor retarding membrane. If required by designers, the vapor retarding membrane could be covered with approximately 1 to 2 inches of saturated surface dry (SSD), relatively clean sand to protect it during construction. Concrete should not be placed if sand overlying the vapor barrier has been allowed to attain a moisture content greater than about 5% (due to precipitation or excessive moistening). Excessive water beneath interior floor slabs could result in future significant vapor transmission through the slab, adversely affecting moisture-sensitive floor coverings and the indoor environment.

It should be noted that, although the slab support discussed above is currently the industry standard, this system might not be completely effective in preventing floor slab moisture vapor transmission problems. This system will not necessarily assure that floor slab moisture transmission rates will meet floor-covering manufacturer standards and that indoor humidity levels will not inhibit mold growth. A qualified specialist(s) with knowledge of slab moisture protection systems, flooring design and other potential components that may be influenced by moisture, should address these post-construction conditions separately. The purpose of a geotechnical study is to address subgrade conditions only, and consequently, it does not evaluate future potential conditions.

6.4.3 Conventional Slab Design

To accommodate the potential for expansive soils, the minimum reinforcement of concrete floor slabs should consist of #3 bars at 24 inches on center in both principle directions or equivalent. The reinforcement is based on engineering judgement and experience with expansive soils, not on any structural analysis. The reinforcement assumes a nominal slab thickness of 4 to 5 inches. Slab thickness and reinforcement must also satisfy structural considerations.

A modulus of subgrade reaction, K_1 ($B_p = 1$ foot), of 330 pci may be used for elastic analysis of slabs on properly compacted native or similar soil.

Slab concrete should have good density, a low water/cement ratio, and proper curing to promote a low porosity. It is recommended the water/cement ratio not exceed 0.45 to 0.5 to minimize vapor transfer.

Consideration should be given to some form of reinforcement of exterior slabs to aid in crack control. Additionally, dowelling of exterior slabs to building foundations and at slab central joints or “cold” interfaces should be considered at any location where hazard or other problematic performance (such as door thresholds).

6.4.4 Thickened Interior Concrete Slab at Partition Walls

It is understood that the use of a thickened concrete slab is proposed along sections of the building pad in order to support a partition wall and portion of the ceiling. The loads due to the partition wall and ceiling are anticipated to be low, less than 250 psf. The thickened slab is capable of supporting these loads and would produce a settlement of less than 0.25-inch. The thickened concrete slab design should incorporate the above recommendations for subgrade preparation, vapor retarding membrane, and reinforcement.

6.5 CORROSION POTENTIAL

A soil sample obtained from the near surface of the site was tested to evaluate pH, minimum electrical resistivity, and soluble sulfate and chloride content.

The pH of the soil tested was 6.68 and the minimum electrical resistivity was 16,600 ohm-cm. These values are generally representative of an environment that is mildly to moderately corrosive to buried unprotected metals.

Test results suggest that a low level of soluble sulfates (77 ppm) and soluble chlorides (< 5 ppm) are present in on-site soils. Normal cement (Type II) and reinforcement cover should be adequate in foundation concrete that comes in contact with the foundation soils. Reinforcement cover need not be increased for concrete that comes in contact with the on-site soil.

Corrosion is dependent upon a complex variety of conditions, which are beyond the geotechnical practice. Consequently, a qualified corrosion engineer should be consulted if the owner desires more specific recommendations.

6.6 PAVEMENTS

6.6.1 Design R-value and Traffic Assumptions

The subgrade Resistance-value (R-value) for the on-site soil was evaluated in the laboratory on one (1) samples of the near surface soil within the proposed pavement areas. The tested soil had a measured R-value of 41 for on-site pavements. The laboratory testing conformed to Caltrans Test Method 301. Based on the tested values, an R-value of 41 is recommended for design purposes for on-site pavements.

Detailed vehicular load and frequency information is not available for the on-site pavements. Traffic on the site is anticipated to consist of parking and drives for automobiles and occasional trash collection, maintenance, and emergency truck traffic. Consequently, a range of pavement sections have been provided for the on-site pavements based on Traffic Indexes (T.I.'s) of 4.5, 5.0, 5.5, 6.0, 6.5, and 7.0. These traffic design assumptions should be reviewed for compatibility with the actual development, and revised pavement sections developed, as necessary.

6.6.2 Asphalt Concrete Pavement Design

Flexible pavement design recommendations have been developed based upon the California Department of Transportation (Caltrans) design procedures and an assumed design R-value of 41. The flexible asphalt concrete pavement sections associated with the assumed T.I.'s for on-site asphalt pavements are summarized in Table 6.6-1.

**TABLE 6.6-1
RECOMMENDED MINIMUM PAVEMENT SECTIONS
(R-VALUE of 41)**

Traffic Index	Asphalt Concrete (inches)	Aggregate Base – Class 2 (inches)
4.5	2.5	4.0
5.0	2.5	4.5
5.5	3.0	4.5
6.0	3.0	6.0
6.5	3.5	6.5
7.0	4.0	7.0

The design criteria assumes a 20-year design period and that normal maintenance (crack sealing, etc.) is performed. The traffic index is a measure of the volume of truck traffic that will be applied to a pavement section in the design life. The allowable average daily truck traffic (ADTT) for the assumed traffic indexes is presented in Table 6.6-2.

**TABLE 6.6-2
AVERAGE DAILY TRUCK TRAFFIC**

Traffic Index	2-Axle Vehicle	or	3-Axle Vehicle	or	5-Axle Vehicle
4.5	2.2		0.8		0.2
5.0	5.2		2.0		0.5
5.5	11.6		4.4		1.2
6.0	24.1		9.0		2.4
6.5	47.3		17.7		4.7
7.0	88.1		33.0		8.8

The flexible pavement should conform to, and be placed in accordance with, current Caltrans Standard Specifications. The aggregate base (Class 2) should comply with the specifications in Section 26. The aggregate base and upper 12 inches of subgrade should be compacted to a minimum of 95 percent relative compaction as determined by the ASTM D1557 or California Test Method 216 (dry weight determination) test procedures.

6.6.3 Moisture Considerations

The pavement design should consider both the vehicular loading, as well as the environmental factors. The vehicular loading will depend on the amount and type of traffic anticipated for the pavement design life. Environmental factors include the potential for moisture variations beneath the pavement structural section. It is recommended that all pavement areas conform to the following criteria:

- All trench backfill, including utility and sprinkler lines, should be properly placed and adequately compacted to provide a stable subgrade.
- Adequate drainage should be provided to prevent surface water from ponding and saturating the subgrade soil.
- A periodic maintenance program should be incorporated.
- All concrete curbs separating pavement and landscaped areas should extend to the subgrade.

6.7 SITE DRAINAGE

Providing and maintaining adequate site drainage to prevent entrapment and ponding of surface water and excessive moisture migration into subgrade soil is very important. Poor perimeter or surface drainage could cause reduced subgrade support. The site development should incorporate the basis for good drainage. This includes:

- Sufficient pad height to allow for proper drainage.
- Defined drainage gradients away from the structures to points of conveyance, such as drainage swales and/or area drains and discharge pipe.
- Roof downspouts connected to proper areas of discharge.

The maintenance personnel must maintain the established drainage by not blocking or obstructing gradients away from structures without providing some alternative drainage means (e.g. area drains and subsurface pipes). If planter areas are established near the structures, it is important to prevent surface run-off from entering the planter. Where planted areas are adjacent to the structures, care must be taken not to over irrigate and to maintain a leak-free

sprinkler piping system. Consideration should be given to use of low volume emitter irrigation systems for planters. Well-maintained low-volume emitter irrigation (drip system) is best suited for planters adjacent to structures. Watering practices must strive to promote a uniform moisture condition year around.

7 ADDITIONAL SERVICES

7.1 PLANS AND SPECIFICATIONS REVIEW

It is recommended Kleinfelder conduct a general review of final plans and specifications to evaluate that earthwork and foundation recommendations have been properly interpreted and implemented during design. In the event Kleinfelder is not retained to perform this recommended review, no responsibility for misinterpretation of the recommendations is assumed.

7.2 CONSTRUCTION OBSERVATION AND TESTING

It is recommended that all earthwork during construction be monitored by a representative from Kleinfelder, including site preparation, placement of all engineered fill and backfill, construction of subgrades, and all foundation excavations. The purpose of these services would be to provide Kleinfelder the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.


8 LIMITATIONS

Recommendations contained in this report are based on field observations and the subsurface exploration, laboratory tests, and present knowledge of the proposed construction. It is possible that soil conditions could vary beyond the point explored. If soil conditions are encountered during construction, which differ from those described herein, Kleinfelder should be notified immediately in order that a review may be made and any supplemental recommendations provided. If the scope of the proposed construction changes from that described in this report, the recommendations should also be reviewed.

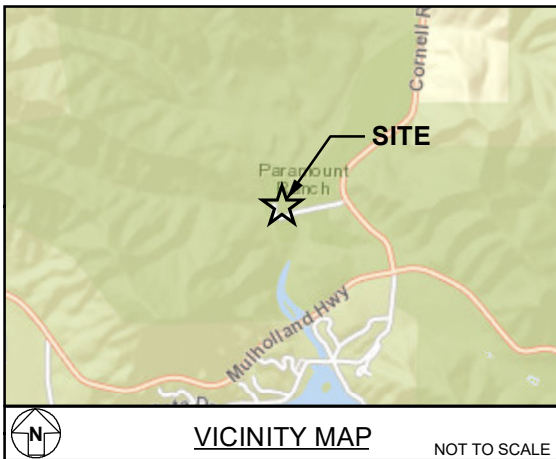
This report has been prepared in substantial accordance with the generally accepted geotechnical engineering practice as it exists at the time of the study. No warranty is expressed or implied. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by Kleinfelder during the construction phase in order to evaluate compliance with the recommendations.

This report is intended to be used by the National Park Service, Architectural Resources Group, and their designers, and regulatory agencies, and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any other party who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

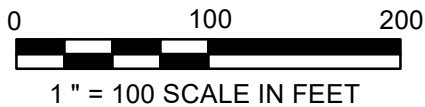



LEGEND	
	SOIL BORING

NOTE:
 BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS
 COMPILED BY ESRI PRODUCTS AND 2021 MICROSOFT CORPORATION.
 COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE CALIFORNIA V FIPS 0405



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



 <p>KLEINFELDER <i>Bright People. Right Solutions.</i></p>	PROJECT NO. 20170255 DRAWN BY: A. AhTye CHECKED BY: S. Plauson DATE: 6/24/2021 REVISED: -	EXPLORATION LOCATION PLAN AND VICINITY MAP	FIGURE 1
		PARAMOUNT RANCH REBUILD 2903 CORNELL ROAD AGOURA HILLS, CALIFORNIA	

SAMPLE/SAMPLER TYPE GRAPHICS



BULK SAMPLE

CALIFORNIA SAMPLER
(3 in. (76.2 mm.) outer diameter)

STANDARD PENETRATION SPLIT SPOON SAMPLER
(2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

WATER LEVEL (level where first observed)

WATER LEVEL (level after exploration completion)

WATER LEVEL (additional levels after exploration)

OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, i.e., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

GRAVELS (More than half of coarse fraction is larger than the #200 sieve)	CLEAN GRAVELS WITH <5% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		Cu < 4 and/or 1 > Cc > 3		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
	GRAVELS WITH 5% TO 12% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
		Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		Cu < 4 and/or 1 > Cc > 3		GP-GM	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
		Cu < 4 and/or 1 > Cc > 3		GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
	GRAVELS WITH > 12% FINES			GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		Cu < 6 and/or 1 > Cc > 3		SP	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
	SANDS WITH 5% TO 12% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
		Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		Cu < 6 and/or 1 > Cc > 3		SP-SM	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
		Cu < 6 and/or 1 > Cc > 3		SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
	SANDS WITH > 12% FINES			SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)			ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	SILTS AND CLAYS (Liquid Limit greater than 50)			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY



PROJECT NO.: 20170255

DRAWN BY:

CHECKED BY:

DATE:

REVISED: -

GRAPHICS KEY

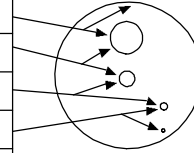
PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-1

GRAIN SIZE

DESCRIPTION	SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders	>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles	3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse 3/4 - 3 in. (19 - 76.2 mm.)	3/4 - 3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine #4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse #10 - #4	0.075 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium #40 - #10	0.017 - 0.075 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine #200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines	Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller

**SECONDARY CONSTITUENT**

	AMOUNT	
Term of Use	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N ₆₀ (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q _u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP < 0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP < 1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP < 2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP < 4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N ₆₀ (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.



PROJECT NO.: 20170255
 DRAWN BY:
 CHECKED BY:
 DATE:
 REVISED: -

SOIL DESCRIPTION KEY

PARAMOUNT RANCH REBUILD
 2903 CORNELL ROAD
 AGOURA HILLS, CALIFORNIA

FIGURE

A-2

Date Begin - End: 5/11/2021	Drilling Company: Gregg Drilling	BORING LOG B-1
Logged By: P. Rivas	Drill Crew: Jerry and Dave	
Hor.-Vert. Datum: WGS84	Drilling Equipment: Fraste	
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger	
Weather: Sunny/Warm	Bore Diameter: 6 in. O.D.	
Hammer Type - Drop: 140 lb. Auto - 30 in.		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Bare Earth and Grass	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Lithologic Description											
5		Clayey SAND with Gravel (SC): fine to coarse-grained, low to medium plasticity, brown, moist, dense medium dense		BC=14 47 26									Sample Disturbed pH= 6.68 Resistivity= 16600 Sulfates= 77 Chlorides= 4
				BC=19 22 23									
				BC=22 14 7									
10		Sandy Lean CLAY (CL): medium plasticity, reddish brown, moist, hard, fine sand		BC=10 25 30 PP=>4.5		28.1	93.6						
15		light brown, increased sand		BC=16 24 25 PP=>4.5				91	56				
		The boring was terminated at approximately 16.5 ft. below ground surface. The boring was backfilled with grout on May 11, 2021.				GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. <u>GENERAL NOTES:</u>							
20													
25													
30													



PROJECT NO.: 20170255
DRAWN BY: PR
CHECKED BY: SP
DATE:
REVISED: -

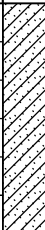



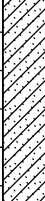

BORING LOG B-1

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-3

Date Begin - End: 5/11/2021	Drilling Company:	BORING LOG B-2
Logged By: P. Rivas	Drill Crew: Jerry and Dave	
Hor.-Vert. Datum: WGS84	Drilling Equipment: Fraste	
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger	
Weather: Sunny/Warm	Bore Diameter: 6 in. O.D.	
Hammer Type - Drop: 140 lb. Auto - 30 in.		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Bare Earth and Grass	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Lithologic Description											
5		Clayey SAND with Gravel (SC): low to medium plasticity, brown, moist, very dense, up to 3" gravel	 BC=11 26 50/4" PP=>4.5										Expansion Index= 28
		Sandy Lean CLAY (CL): medium plasticity, orange, moist, stiff	 BC=10 11 16					87	27				
10			 BC=21 50/3" PP=>4.5										
15		Clayey SAND (SC): fine to coarse-grained, gray, moist, very dense	 BC=50/5"										
20	The boring was terminated at approximately 16.5 ft. below ground surface. The boring was backfilled with grout on May 11, 2021.					GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES:							
25													
30													



PROJECT NO.: 20170255
DRAWN BY: PR
CHECKED BY: SP
DATE:
REVISED: -






BORING LOG B-2

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-4

Date Begin - End: 5/11/2021	Drilling Company:	BORING LOG B-3	
Logged By: P. Rivas	Drill Crew: Jerry and Dave		
Hor.-Vert. Datum: WGS84	Drilling Equipment: Fraste	Hammer Type - Drop: 140 lb. Auto - 30 in.	
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger		
Weather: Sunny/Warm	Bore Diameter: 6 in. O.D.		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Bare Earth and Grass	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Lithologic Description											
		Clayey SAND with Gravel (CL): fine to coarse-grained, low plasticity, brown, dense, fine to coarse angular gravel		BC=13 9 9									R-Value= 41
5				BC=10 12 8 PP=>4.5		18.5	84.0						
10		Sandy Lean CLAY (CL): medium plasticity, olive brown, hard, fine-grained sand											
		dark brown, decreased sand content		BC=7 12 15				100	85				
15				BC=15 27 37 PP=>4.5									
		The boring was terminated at approximately 16.5 ft. below ground surface. The boring was backfilled with grout on May 11, 2021.				<u>GROUNDWATER LEVEL INFORMATION:</u> Groundwater was not observed during drilling or after completion. <u>GENERAL NOTES:</u>							
20													
25													
30													



PROJECT NO.: 20170255
DRAWN BY: PR
CHECKED BY: SP
DATE:
REVISED: -

BORING LOG B-3

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-5

Date Begin - End: 5/11/2021	Drilling Company:	BORING LOG B-4
Logged By: P. Rivas	Drill Crew: Jerry and Dave	
Hor.-Vert. Datum: WGS84	Drilling Equipment: Fraste	
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger	
Weather: Sunny/Warm	Bore Diameter: 6 in. O.D.	
Hammer Type - Drop: 140 lb. Auto - 30 in.		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Bare Earth and Grass	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Lithologic Description											
		Sandy Lean CLAY with Gravels and Cobbles (CL): medium plasticity, brown, moist, fine to coarse-grained sand, fine and coarse angular gravels, cobbles up to 4 in.		BC=13 16 21									Sample disturbed
		Sandy Lean CLAY (CL): medium plasticity, brown, moist, hard, fine to medium-grained sand, trace fine gravel											
5		olive, fine-grained sand, no gravel		BC=10 9 9									
10		reddish brown, decreased sand content		BC=5 7 9									
15		Lean CLAY: medium plasticity, dark brown, moist, hard		BC=6 11 20									
20				BC=12 14 19									
25		sulfur odor		BC=9 28 48									
30				BC=19 30 36									



PROJECT NO.: 20170255
DRAWN BY: PR
CHECKED BY: SP
DATE:
REVISED: -

BORING LOG B-4

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-6

Date Begin - End: 5/11/2021	Drilling Company:	BORING LOG B-4	
Logged By: P. Rivas	Drill Crew: Jerry and Dave		
Hor.-Vert. Datum: WGS84	Drilling Equipment: Fraste	Hammer Type - Drop: 140 lb. Auto - 30 in.	
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger		
Weather: Sunny/Warm	Bore Diameter: 6 in. O.D.		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Bare Earth and Grass	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Lithologic Description											
		Lean CLAY: medium plasticity, dark brown, moist, hard dark brown and bluish gray	BC=15 43 50										
40		no odor	BC=20 27 49										
45			BC=50/6"										
50		Sandy Lean CLAY (CL): medium plasticity, brownish gray, hard, fine-grained sand	BC=31 32 48										
55		The boring was terminated at approximately 51.5 ft. below ground surface. The boring was backfilled with grout on May 11, 2021.				GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES:							
60													
65													



PROJECT NO.: 20170255
DRAWN BY: PR
CHECKED BY: SP
DATE:
REVISED: -

BORING LOG B-4

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

FIGURE

A-6

Exploration ID	Depth (ft.)	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
					Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	0.0	CLAYEY SAND (SC)									pH= 6.68 Resistivity= 16600 Sulfates= 77 Chlorides= 4
B-1	10.0	SANDY LEAN CLAY (CL)	28.1	93.6							
B-1	15.0	SANDY LEAN CLAY (CL)			100	91	56				
B-2	0.0 - 5.0	CLAYEY SAND (SC)									Expansion Index= 28
B-2	5.0	CLAYEY SAND (SC)			100	87	27				
B-3	0.0	CLAYEY SAND (SC)									R-Value= 41
B-3	5.0	SANDY LEAN CLAY (CL)	18.5	84.0							
B-3	10.0	SANDY LEAN CLAY (CL)			100	100	85				

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic



PROJECT NO.: 20170255

DRAWN BY:

CHECKED BY:

DATE:

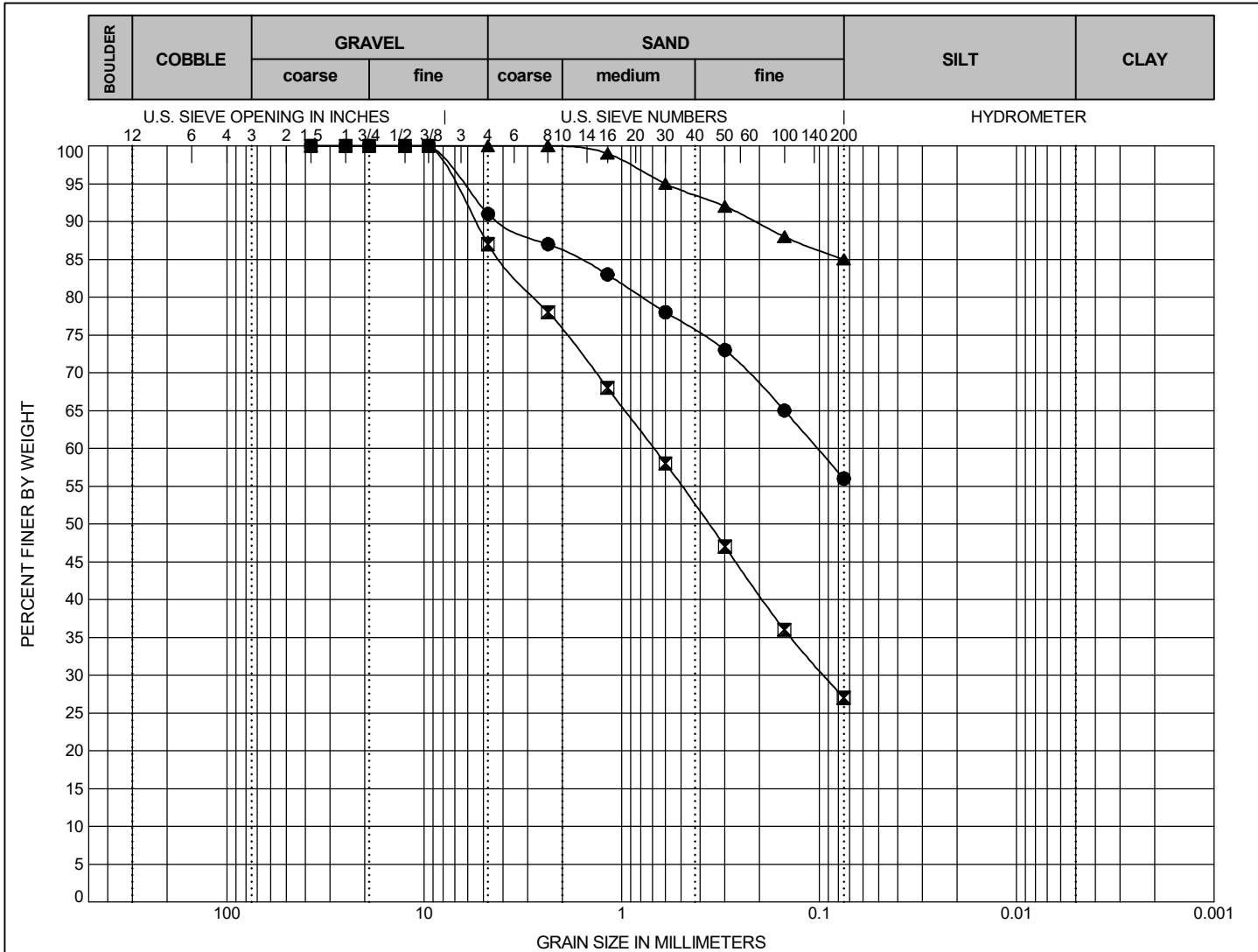
REVISED:

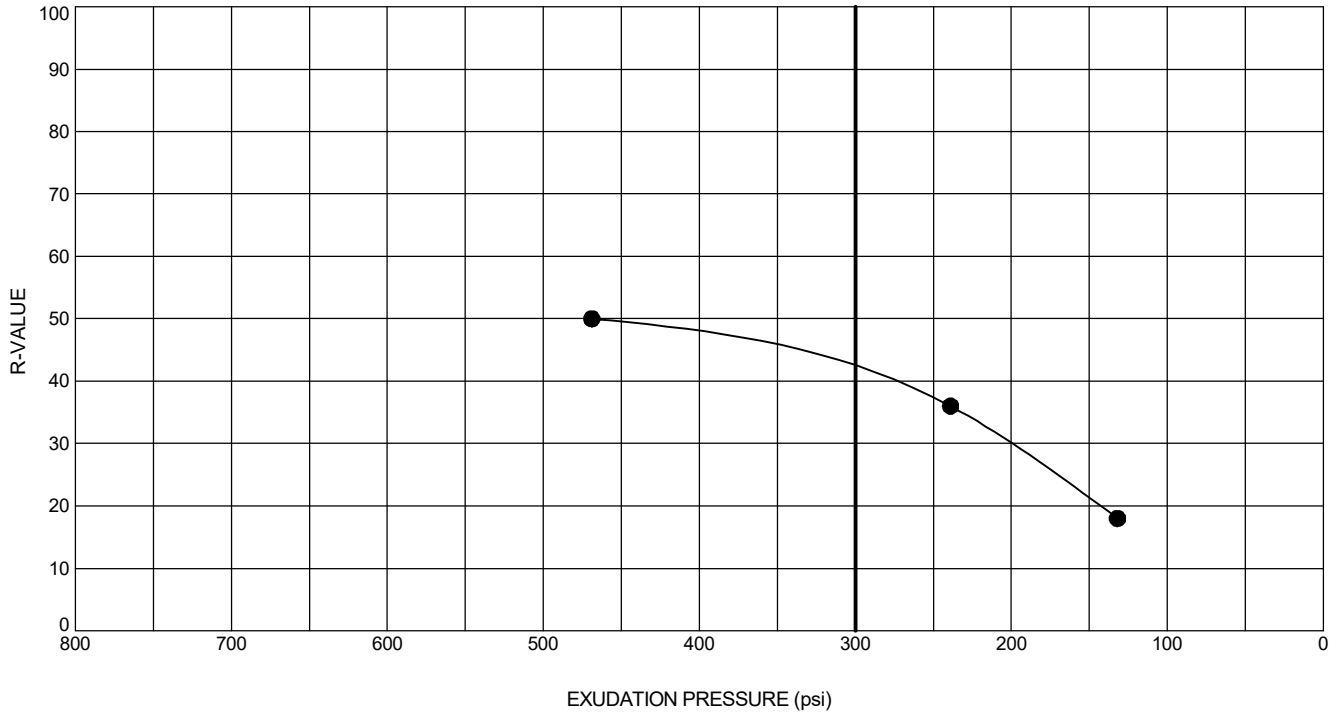
LABORATORY TEST RESULT SUMMARY

PARAMOUNT RANCH REBUILD
2903 CORNELL ROAD
AGOURA HILLS, CALIFORNIA

TABLE


B-1

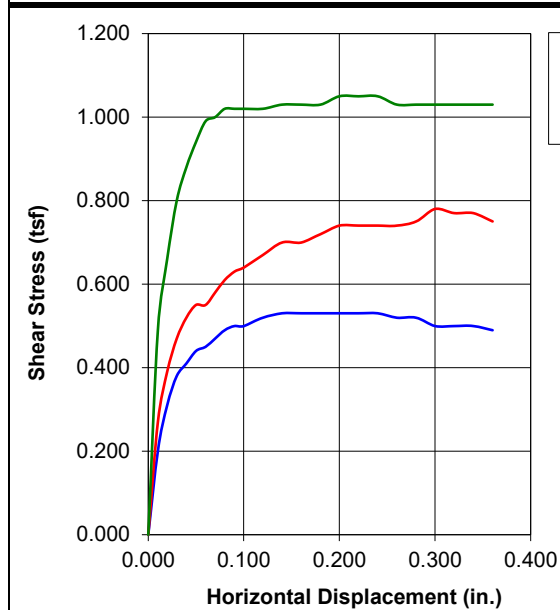
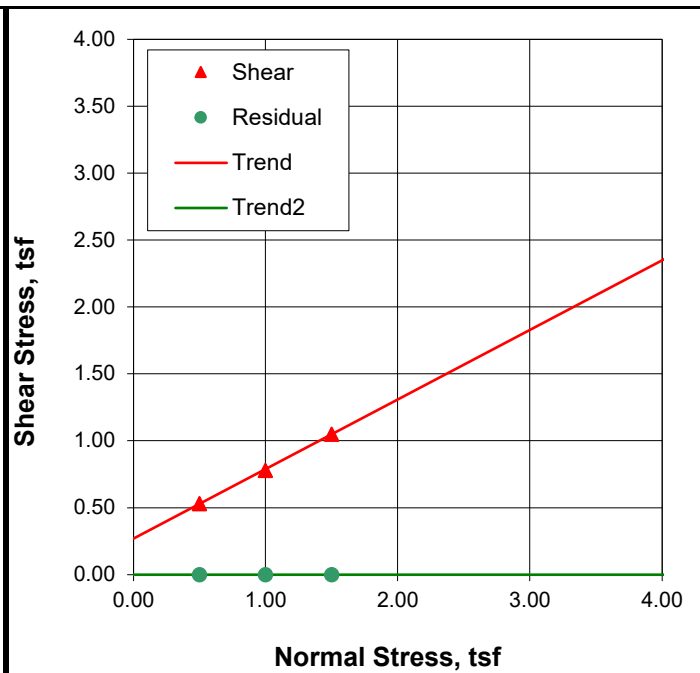
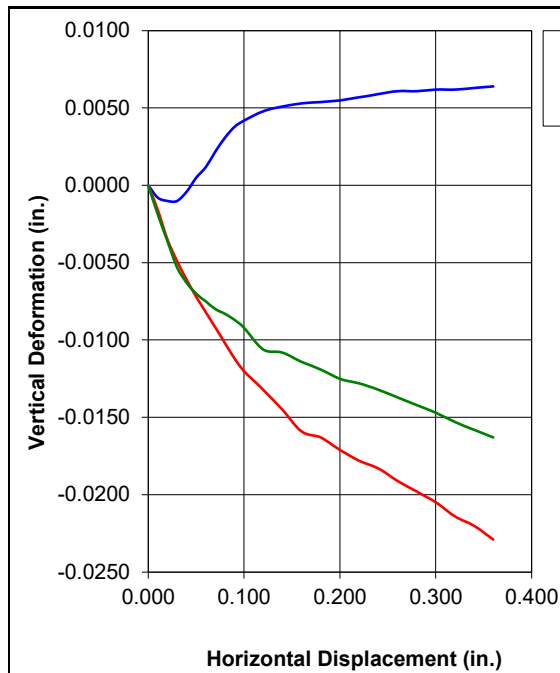




Exploration ID	Depth (ft.)	Sample Description			R-Value @ 300 psi Exudation Pressure
B-3	0 - 5	CLAYEY SAND (SC)			41
Specimen No.	Moisture at Time of Test (%)	Dry Unit Weight (pcf)	Expansion Pressure (psi)	Exudation Pressure (psi)	Corrected Resistance Value
1	16.5	108.4	0	239	36
2	17.9	107.0	0	132	18
3	15.5	112.9	0	469	50

Testing performed in general accordance with ASTM D2844.


	PROJECT NO.: 20170255	R-VALUE	TABLE
	DRAWN BY: PR CHECKED BY: SP DATE: REVISED: -	PARAMOUNT RANCH REBUILD 2903 CORNELL ROAD AGOURA HILLS, CALIFORNIA	B-3

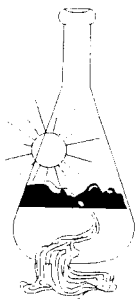


Specimen Number		1	2	3	4
Initial	Water Content, %	17.2	20.5	18.6	
	Dry Density, pcf	96.4	94.9	96.6	
	Void Ratio	0.747	0.776	0.744	
	Saturation, %	62.0	71.5	67.4	
	Diameter, in	2.42	2.42	2.42	
	Height, in	0.96	0.96	0.96	
At Test	Water Content, %	30.6	30.9	29.3	
	Dry Density, pcf	97.7	104.5	104.9	
	Void Ratio	0.747	0.776	0.744	
	Diameter, in	2.42	2.42	2.42	
	Height, in	0.96	0.96	0.96	
Maximum Shear Stress, tsf		0.53	0.78	1.05	
Residual Shear Stress, tsf		na	na	na	
Horizontal Displacement, in.		0.140	0.300	0.200	
Normal Stress, tsf		0.50	1.00	1.50	
Strain Rate, in./min.		0.002	0.002	0.002	

LL:	nm	PL:	nm	PI:	nm	G _s :	2.70	Assumed		c, tsf	φ, deg.	Tan φ
Test Conditions: Undisturbed / Inundated									Failure	0.3	27.5	0.52
Specimen 1: Olive Brown Sandy Lean CLAY									Residual	na	na	na
Specimen 2: Olive Brown Sandy Lean CLAY												
Specimen 3: Olive Brown Sandy Lean CLAY												

Boring:	B	Remarks: nm = not measured, na = not applicable										
Sample:	3	The determination of strength envelopes and the development of relationships to aid in interpreting and evaluating test results are beyond the scope of this test method. The user of this report retains the sole responsibility to evaluate and approve any interpreted values from the testing.										
Depth, ft:	0											
Test Date:	6/6/21											

 KLEINFELDER <i>Bright People. Right Solutions.</i> 9969 Horn Rd., Sacramento, CA 95827	PROJECT NO.: ENTRY BY: CHECKED BY: DATE:	20170255 A. Catanuso J. Slinkard 6/17/21	DIRECT SHEAR TEST ASTM D3080	TABLE B-4
			PARAMOUNT RANCH REBUILD 2903 CORNELL ROAD AGOURA HILLS, CALIFORNIA	



Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 06/16/2021
Date Submitted 06/10/2021

To: Adam Ahtye
Kleinfelder-Merced
121 Heron Way, Ste.D
Merced, CA 95340

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 20170255.001 SAMO Site ID : B 1 0-5 BULK.
Thank you for your business.

* For future reference to this analysis please use SUN # 85023-177272.

EVALUATION FOR SOIL CORROSION

Soil pH	6.68		
Minimum Resistivity	1.66	ohm-cm (x1000)	
Chloride	3.5 ppm	00.00035	%
Sulfate	77.2 ppm	00.00772	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

SECTION 01 26 01 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of administrative and procedural requirements for contract modifications.

1.2 DEFINITIONS AND ALLOWANCES

- A. Home Office Overhead: Costs incurred in support of all of a contractor's projects and not attributable to a specific job. The cost for home office overhead is only allowed as a percentage of all direct work excluding profit. The following items represent allowable home office overhead costs identified in Part 31 of the Federal Acquisition Regulation (FAR):

1. Rent
2. Utilities
3. Furnishings
4. Office equipment
5. Executive and management staff not exclusively assigned to the project
6. Support, accounting, and administrative staff
7. Preparation of cost proposals, estimating, and schedule analyses connected with Modifications
8. Estimating and preconstruction services
9. Mortgage costs
10. Real estate and corporate taxes
11. Automobile maintenance and travel costs for home office personnel
12. Home office insurances i.e. structure, automotive, umbrella, flood, etc.
13. Depreciation of equipment and other assets
14. Home office supplies (paper, staples, etc.)
15. Legal services
16. Accounting and data processing
17. Professional fees/registration

- B. General Conditions (Field Office Overhead): Management and administrative costs incurred on site for the designated project. Costs associated with preparation of modifications will not be allowed. Costs for these items are to be included only in the general conditions of the modification estimate. Only in the case of a contract time extension are additional general conditions included in modifications. The following items, if applicable, are considered allowable costs for calculating General Conditions:

1. Project Manager (PM), Assistant Project Manager
2. Superintendent, Assistant Superintendent
3. Quality Control, Safety Officer, Environmental Manager, etc.
4. Engineers
5. Travel, lodging, and per diem (as established by Federal Travel Regulations)
6. Scheduling

7. Field Office Trailers and associated temporary utilities
8. Field office supplies
 - a. Mailing and couriers
 - b. Reproduction costs
 - c. Storage
 - d. Phones
 - e. Computers
 - f. Copiers

9. Personal vehicles i.e. Superintendent Pickup trucks

C. General Requirements: Costs directly associated with the project and are necessary to perform the actual work of the modification. These costs shall be shown as direct costs in the estimate. The following items, if applicable, are considered allowable costs for calculating General Requirements:

1. Hoisting
2. Material handling
3. Temporary fencing
4. Port-a-lets
5. Trash removal, dumpsters
6. Barricades
7. Small tools
8. Safety supplies
9. Scaffolding
10. Daily cleaning
11. Traffic control
12. Temporary signage
13. Temporary heating and power

D. Personnel Costs: Costs included in the modification must only be for General Conditions staff and workers actually present and working on project site. Modification costs for salaried workers are only allowed within the structure of a 40-hour week and no overtime or holiday pay will be allowed.

1. Worker Hourly Rates are costs directly associated with the individual worker and consist of the following:
 - a. Base Rate: The hourly rate paid directly to the worker
 - b. Labor Burden: Employer payments of all applicable burdens; includes insurance and taxes the business must pay on behalf of the worker to government entities and educational forums, such as:
 - 1) Social Security
 - 2) Medicare
 - 3) Workers Compensation – Policy and company calculation to be made available.
 - 4) Federal Unemployment Tax Act (FUTA) - Cap Rate and percentage to be proportionally allocated over one year.
 - 5) State Unemployment Tax Act (SUTA) - Cap Rate and percentage to be proportionally allocated over one year.

- 6) Union agreement costs - Other costs required under an enforceable collective bargaining agreement.
- c. Fringe Benefits: Various non-wage compensations provided to employees such as:
 - 1) Health Care Insurance Premiums
 - 2) Cell Phone
 - 3) Clothing
 - 4) 401K and Pensions
 - 5) Vehicle allowances
 - 6) Gas allowance
 - 7) Life insurance premiums
 - 8) Disability insurance
 - 9) Other Fringe Benefits required under an enforceable collective bargaining agreement
- E. Bonuses or Deferred Compensation: No Bonus or Deferred Compensation will be allowed within any components of pricing including Home Office Overhead, General Conditions, General Requirements, Hourly Worker Rates, or the direct costs of work.
- F. General Liability Insurance: An insurance policy that protects Contractor from claims resulting from bodily injury or property damage to a third party. Include as a separate line item within all modification proposals and provide a current insurance quote upon request.
- G. Performance and Payment Bonds: A performance bond is a surety bond issued by an insurance company or bank to guarantee satisfactory completion of a project. The Payment Bond guarantees the Contractor will pay the labor and material costs incurred. Banks and Insurance companies charge a premium for individual project based on a sliding scale related to the size of the project. Include as a separate line item in modification proposals and provide current company bonding rates upon request.
- H. Builder's Risk Insurance: Covers the contractor's loss due to fire, high winds, or other natural forces. Not reimbursed by the National Park Service (NPS) and shall not be included in modification proposals.

1.3 MODIFICATION PROPOSAL PRICING REQUIREMENTS

A. General:

- 1. Proposal be received in the format and within the time frame specified in the Request for Proposal (RFP) letter. Costs or delays resulting from failure of contractor to submit within the time frame specified will not be compensable.
- 2. Proposal shall be detailed with itemized lists of equipment, materials, labor, production rates, overhead, profit, and bond markup for each item. Labor costs must be itemized by craft and hourly rate, including Fringe Benefits and Labor Burden. If the costs of Fringe Benefits and Labor Burden are not itemized, it is assumed they are included in the hourly rate shown, or contractor is not requesting reimbursement. Contractor may utilize the government provided [Contractor Estimate Form](#), or their own form, provided that it contains the same information and level of detail as the Government's form.

3. Requests for extensions of contract time as a result of change must be justified with a Time Impact Analysis (TIA). Refer to Section 01 32 16 "Construction Schedule", for time impact analysis requirements. TIA and associated costs shall be received with the proposal by the date shown within the Request for Proposal letter. Contractor's failure to submit within the specified time frame will be construed as the Contractor waiving right for additional time and no time extension will be allowed.
4. All supporting documentation used to justify the proposed modification will be made available to the Contracting Officer (CO) upon request.
5. Contractor shall review and approve all subcontractor/supplier pricing in detail for proper format, scope, production rates, and pricing prior to submission to NPS. All delay costs associated with not reviewing and approving subcontractor/supplier pricing will be borne by the Contractor.
6. All pricing and production rates within the estimate must be based on fair and reasonable pricing and cannot include built-in contingency.

B. Labor:

1. Contractor shall estimate cost of labor by itemizing each craft involved, indicating worker hourly rate (base rate + labor burden + fringe benefits) for each and itemizing hours required for each craft directly engaged in modification work. Any work proposed requiring overtime work or premium pay shall be itemized separately. Rates shall be in accordance with the Davis-Bacon Act as incorporated herein. Labor Burden may include payroll taxes, Social Security, unemployment insurances, workers compensation insurance, Federal Insurance Contributions Act (FICA), FUTA, and other direct costs resulting from Federal, State or local laws.
2. Itemize labor costs for equipment operators separate from equipment costs.
3. Labor cost for foremen shall only be costs for related work required for the modification.

C. Materials:

1. Estimated cost for materials shall include quotes from multiple sources. Material prices shall include applicable fees and credits, including but not limited to, sales tax, freight and delivery charges, and tax rebates.
2. No markup shall be applied to any material provided by NPS.

D. Equipment:

1. Equipment used for the project must be appropriately sized for work being performed.
2. Do not include costs for "miscellaneous tools and equipment", in your proposal for a replacement value of \$500 or less. Costs shown in excess of \$500 shall be broken out separately.
3. Regardless of ownership, rates to be used in determining equipment rental costs shall be the lowest cost from one of the following sources:
 - a. United States (U.S.) Army Corps of Engineers, Ownership and Operating Expense Schedule (use latest edition and applicable region)
 - b. Construction Blue Book
 - c. Local equipment rental rates, documented by actual invoice charges, or itemized vendor quotes.

4. Estimated equipment rates shall include operating costs of all fuel, oil, lubrication, supplies, small tools, necessary attachments, ground engaging components, tires and tracks, routine repairs and maintenance (cost of major repair and overhaul is not allowed per Federal Acquisition Regulation (FAR) 31.105(d)(2)), depreciation, storage, insurance, and all incidentals. Mobilization, if applicable, may be included for equipment solely used on the modification work but must be listed separately.
5. Estimate full rate for equipment only for duration that equipment will be utilized to accomplish work of the modification.
6. Standby unit rates used in accordance with paragraph 1.3, D, 2, above. If the U.S. Army Corp of Engineers is utilized then their standby rates prevail. If Bluebook or local equipment pricing is accepted, then 1/2 of equipment costs minus any operating costs, major repair and overhaul will be accepted.
7. If equipment is in standby mode due solely to a documented NPS delay, established standby rate shall apply from the first day of the delay.
8. Equipment not used and on job site for up to five consecutive days may be classified at standby rates, provided the equipment is or has been used solely to perform work on the modification and will be necessary to complete additional modification work. Equipment still on the jobsite but not in use after five consecutive days will not be considered in the modification pricing.
9. Requests for compensation for equipment stand by time must be justified, documented and itemized separately.
10. The estimated timeframe (daily, weekly, monthly) for use of the equipment must reflect the lowest cost to the Government.

E. Establishment and Application of Overhead and Profit Percentages:

1. Home Office Overhead and Profit (OH&P) shall be applied to direct costs only. Profit shall not be applied to overhead amounts; and overhead shall not be applied to profit. Home office overhead shall contain only allowable, allocable, and reasonable costs per the contract documents and FAR Part 31. Profit percentages are based on risk factors found in FAR Part 31 which have been applied to the specific type of work included in this project. Negotiated rates shall not exceed the following percentages for OH&P for contractor self-performed work:

Overhead.....	10%
Profit.....	5.00%
2. Total aggregate limit of markup (OH&P) for Contractor and Subcontractors on modification work shall not exceed 25%. The NPS will not be responsible for allocation of percentages between contractor and subcontractors at any tier.
3. If Contractors form a partnership, partnership may only receive home office overhead and profit in same amount as an individual Contractor (refer to paragraph 1.3,E,1 above). It is the responsibility of the partners to decide on division of revenue.
4. Combined Increases and Decreases: On proposals involving both increases and decreases in the Contract Price, overhead and profit mark-ups are required on net increases and deducted on net decreases.
5. At no time can profit be calculated on Overhead or itself, it must be calculated on direct costs of work only.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 012601

SECTION 01 27 00 – DEFINITION OF CONTRACT LINE ITEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section explains in general, what is and is not included in a contract line item, and limits or cut-off points where one item ends and another begins.
- B. If no contract line item exists for a portion of work, include costs in a related item.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF CONTRACT LINE ITEMS

- A. Contract Line Item Number 1, Base Bid, BARN BUILDING.
 - 1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for construction of the new Barn Building. Include all work from outside face of wall inwards.
 - 2. No separate measurement will be made.
 - 3. Payment will be made at the contract lump sum price.
- B. Contract Line Item Number 2, Base Bid, PAVILION BUILDING.
 - 1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for construction of the new Pavilion Building. Include all work from outside face of wall inwards.
 - 2. No separate measurement will be made.
 - 3. Payment will be made at the contract lump sum price.
- C. Contract Line Item Number 3, Base Bid, RESTROOM BUILDING.
 - 1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for construction of the new Restroom Building. Include all work from outside face of wall inwards.
 - 2. No separate measurement will be made.
 - 3. Payment will be made at the contract lump sum price.

D. Contract Line Item Number 4, Base Bid, SITE PREPARATION AND IMPROVEMENTS.

1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for site preparation and improvements outside of site utilities including all site demolition, grading, excavation, all site improvements including decomposed granite paving, accessible parking and planting.
2. No separate measurement will be made.
3. Payment will be made at the contract lump sum price.

E. Contract Line Item Number 5, Base Bid, SITE MECHANICAL UTILITIES.

1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for the construction of all utility infrastructure associated with water, sanitary sewer and storm sewer systems.
2. No separate measurement will be made.
3. Payment will be made at the contract lump sum price.

F. Contract Line Item Number 6, Base Bid, SITE ELECTRICAL UTILITIES.

1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for the construction of all utility infrastructure associated with electrical and telecommunication systems, including all excavation, bedding, backfill, surface restoration, and any necessary components, i.e., conduit, transformer pad, conductors past the meter, pull boxes, controls and incidentals, power connections and wireless access points dispersed on site, and site lighting not attached to buildings.
2. No separate measurement will be made.
3. Payment will be made at the contract lump sum price.

G. Contract Line Item No. 7: Base Bid, ELECTRICAL UTILITY SERVICE DESIGN AND UTILITY-PERFORMED INSTALLATION.

1. This bid item includes the design and construction provided by the power utility company for the new electrical service to Paramount Ranch, and includes, but is not limited to, the service design, the riser at the utility pole along Cornell Road, the new switch near the Longhorn Building, conductors from the utility pole up to the meter, providing and setting the transformer, and providing and setting the meter.
2. No separate measurement will be made.
3. Payment will be made to the Contractor for the actual payments made by the Contractor (without any markups) to Southern California Edison after written documentation of payment by the Contractor is presented. Payment for this CLIN shall be full compensation for all of the power utility administration, connection, and design fees, and materials, equipment and labor necessary to complete the construction work to be performed by the utility. The value shown in the Contract Price Schedule for CLIN 7 is an amount to be used by all offerors in their price proposals, but payment to the Contractor shall be based on actual payments by the Contractor to the utility companies, as indicated above.

H. Contract Line Item Number 8, Bid Option A, SMALL EVENT BUILDING.

1. This bid item includes, but is not limited to, furnishing materials, equipment and labor for construction of the new Small Event Building. Include all work from outside face of wall inwards.
2. No separate measurement will be made.
3. Payment will be made at the contract lump sum price.

END OF SECTION 01 27 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Definitions
 - 2. Construction Coordination
 - 3. Submittals
 - 4. Coordination Drawings
 - 5. Requests for Information (RFIs)
 - 6. NPS/DSC Project Website
 - 7. Project Meetings
 - 8. Environmental Coordination
 - 9. Permits
- B. Related Requirements:
 - 1. Section 01 32 16 "Construction Schedule" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 73 40 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
 - 4. Section 01 91 14 "Total Building Commissioning" for coordinating the work with Owner's Commissioning Authority.

1.2 DEFINITIONS

- A. [Agency with Jurisdiction](#)
- B. [Construction Permits – Contractor Provided](#)
- C. [Government Furnished Permits](#)

1.3 CONSTRUCTION COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.
 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of components, including mechanical and electrical.
 5. Properly plan construction operations to include permit requirements. Allow enough time to execute permit provisions to maintain work schedule, site visits, inspections, and reporting deadlines.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to:
1. Preparation of Contractor's Construction Schedule
 2. Preparation of the Schedule of Values
 3. Installation and removal of temporary facilities and controls
 4. Delivery and processing of submittals
 5. Progress meetings
 6. Permit requirements
 7. Pre-installation conferences
 8. Project closeout activities
 9. Commissioning activities

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of Contract Documents or standard printed data. Include following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Contracting Officer (CO) for resolution of such conflicts.
 - c. Indicate space requirements for routine maintenance and anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and controls.
 - e. Indicate required installation sequences.
 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 22 by 34 inches.

3. Number of Copies: Submit electronic copies of each submittal. Contracting Officer will return one copy.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Section

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural, structural, mechanical, plumbing, fire-protection, fire-alarm, and electrical elements. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
3. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
5. Mechanical and Plumbing Work:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
6. Electrical Work:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Fire-Protection System:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
8. Review: Contracting Officer will review coordination drawings to confirm Work is being coordinated; details of coordination are Contractor's responsibility. If Contracting Officer determines coordination drawings are not prepared in scope or detail, or are otherwise deficient, Contracting Officer will inform Contractor, who shall make changes and resubmit.
9. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 23 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2. File Submittal Format: Submit or post coordination drawing files using Portable Document Format (PDF) file format.
 3. Contracting Officer will furnish Contractor one set of digital data files (AutoCad.dwg) of Drawings for use in preparing coordination digital data files.
 - a. Contracting Officer makes no representations as to accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in AutoCad.dwg.
- D. Division 1 documents: The following items shall be submitted a minimum of one week prior to Preconstruction Conference. Contracting Officer will notify Contractor of tentative date for Pre-Construction Conference.
1. Letter designating Project Superintendent
 2. Construction Schedule
 3. A Comprehensive Schedule of Values
 4. Accident Prevention Plan
 5. A List of Subcontractors for this project
 6. Written statements from Subcontractors certifying compliance with applicable labor standard clauses.
 7. Certificates of Insurance or SF1413 for Contactor and all Subcontractors
 8. Waste Management Plan
 9. Quality Control Plan
 10. Temporary Storm Water Pollution Prevention Plan (SWPP or UPPP)
 11. Indoor Air Quality (IAQ) Management Plan
 12. Contractors Commissioning Plan
 13. List of Required Construction Permits. Include the following information for each permit:
 - a. Name of Permit
 - b. Agency(ies) with Jurisdiction issuing the permit
 - c. Information required from Government to complete permit application
- E. Provide items listed to Contracting Officer before Pre-Construction Conference. If all documents have not been received one week prior to scheduled Pre-Construction Conference date, conference may be cancelled, Notice to Proceed may not be issued, and Contracting Officer will consider other contractual remedies. Work shall not commence until written Notice to Proceed has been issued.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit an RFI utilizing form created on NPS/DSC management software-website.
1. Contracting Officer will not respond to RFIs submitted by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in the work.
- B. Content of RFI: Include detailed, legible description of item needing information or interpretation and the following:

1. RFI number, numbered sequentially
2. Date
3. RFI subject
4. Specification Section number and title and related paragraphs, as appropriate.
5. Drawing number and detail references, as appropriate.
6. Field dimensions and conditions, as appropriate.
7. Contractor's suggested resolution: If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.
8. Contractor's signature
9. Requested date for response
10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Form: Complete RFI Form on NPS/DSC Project Website as follows:

1. Enter general information at the top of the form.
2. Under the "Action" section at the bottom of the form, select "Question" then select "CMR" in drop-down of "Send to" box.
3. Enter details of question and attach related documents.
4. Select "Submit Form" at bottom of page.

D. Contracting Officer's Action: Contracting Officer will review each RFI, determine action required, and respond. Contracting Officer will determine critical nature of each RFI and issue response accordingly.

1. The following are not considered to be RFIs and will receive no action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in Contract Documents.
 - e. Requests for adjustments in Contract Time or Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Contracting Officer's action may include a request for additional information; time for response will date from time of receipt of additional information.
3. Contracting Officer's action on RFIs may result in need for a change to Contract Time or Contract Sum. All contract changes will be processed following terms and conditions of contract.

1.6 PROJECT WEB SITE

A. Use NPS/DSC management software website for communication throughout contract period on:

1. Project directory

2. Project correspondence
3. Meeting agendas and minutes
4. Contract modifications forms and logs
5. RFI form and processing
6. Task and issue management
7. Photo documentation
8. Baseline schedule, schedule updates and calendar management
9. Submittal form and processing
10. Payment coordination documentation
11. Drawing and specification document hosting, viewing, and updating
12. Online document collaboration
13. Reminder and tracking functions
14. Archiving functions
15. Notification of submittal and RFI statuses and current responsible party
16. Permits and addendums

- B. Some documents are not suitable to be shared using the NPS/DSC management software website. Documents containing Personal Identifying Information (PII) (i.e. certified payrolls) shall not be shared using NPS/DSC management software website and shall be coordinated with Project team as appropriate.
- C. Submit to Contracting Officer a list of employees who will need access to the website. Users will receive an invitation to register from Department of Interior (DOI). Once registered on DOI website, user will be given access to NPS/DSC management software website.
- D. All users will be required to have the following software packages:
 1. Google Chrome, current version.
 2. Adobe Acrobat Professional (Pro) version 10 or later.

1.7 PROJECT MEETINGS

- A. Preconstruction Conference: Before start of construction, Contracting Officer will arrange an on-site meeting with Contractor. Meeting agenda will include the following as a minimum:
 1. Roles & Responsibilities / Lines of Authority
 2. Park rules and regulations
 3. Jobsite Safety
 4. Resolution of comments on required Division 1 documents
 5. Coordination of Subcontractors
 6. Labor law application
 7. Modifications
 8. Payments to Contractor
 9. Payroll reports
 10. Contract time
 11. Liquidated damages
 12. Contractor Performance Evaluation
 13. Display of Hotline posters
 14. Notice to proceed
 15. Correspondence procedures

16. NPS/DSC Project website
17. Acceptance/rejection of work
18. Progress meetings
19. Submittal procedures
20. NPS Final Accessibility Inspection
21. Environmental requirements
22. Permit requirements
23. As-constructed drawings/operation and maintenance (O&M) manuals.
24. Saturday, Sunday, holiday and night work.
25. Reference materials
26. Value engineering
27. Schedule of Values

B. Progress Meetings: Contracting Officer will schedule weekly meetings with Contractor.

1. Attendees: In addition to Government Representatives, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented. Participants at meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Meeting agenda will include:
 - a. Approval of minutes of previous meetings
 - b. Submittal status
 - c. Review of off-site fabrication and delivery schedules.
 - d. Requests for information (RFI) and other issues.
 - e. Modifications
 - f. Work in progress and projected.
 - 1) Status of required inspections (Special Inspections, Accessibility, etc.)
 - g. Inspections of work in progress and projected (Special inspections, Accessibility, etc.)
 - h. Construction Schedule update (provide updated Critical Path Method (CPM)).
 - i. Status of Project Record Drawings and O&M manuals.
 - j. Other business relating to work.
 - k. Permit requirements

C. Preinstallation Conferences: Conduct at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend meeting. Advise Contracting Officer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for particular activity under consideration, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related RFIs
 - d. Related Change Orders

- e. Purchases
 - f. Deliveries
 - g. Submittals
 - h. Sustainable design requirements.
 - i. Review of mockups
 - j. Possible conflicts
 - k. Compatibility requirements
 - l. Time schedules
 - m. Weather limitations
 - n. Manufacturer's written instructions
 - o. Warranty requirements
 - p. Compatibility of materials
 - q. Acceptability of substrates
 - r. Temporary facilities and controls
 - s. Space and access limitations
 - t. Regulations of agency(ies) with jurisdiction
 - u. Testing and inspecting requirements
 - v. Installation procedures
 - w. Coordination with other work
 - x. Required performance results
 - y. Protection of adjacent work
 - z. Protection of construction and personnel
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene conference at earliest feasible date.

1.8 ENVIRONMENTAL COORDINATION

- A. Contractor's Environmental Manager: Designate on-site party responsible for overseeing Contractor's conformance to environmental goals for project and implementing procedures for environmental protection.
 1. Qualifications: Minimum 3 years Construction experience on projects of similar size and scope; with environmental procedures similar to this project; familiar with environmental regulations applicable to construction operations.
 2. Responsibilities: Responsibilities shall include:
 - a. Compliance with applicable Federal, State, and local environmental regulations, including maintaining required documentation.
 - b. Implementation of Waste Management Plan (WMP).
 - c. Implementation of Indoor Air Quality (IAQ) Management Plan.
 - d. Implementation of Storm Water Pollution Prevention Plan (SWPPP).
 - e. Present overview of environmental issues and summarize site specific procedures relating to management plans at Preconstruction conference.
 - f. Training for Contractor personnel in accordance with position requirements.

- g. Monitoring and documentation of environmental procedures.
- B. Perform project quality control in accordance with requirements specified in Related Sections, including:
 - 1. Quality Requirements
 - 2. Regulatory Requirements
 - 3. Indoor Air Quality (IAQ) Management
 - 4. Noise and Acoustics Management
 - 5. Temporary Storm Water Pollution Prevention Environmental Management
 - 6. Construction Waste Management
- C. Contractor's Environmental Training Program: Contractor shall provide environmental training for workers performing work on project site. Training shall include:
 - 1. Overview of environmental issues related to building industry.
 - 2. Overview of environmental issues related to Project.
 - 3. Review of site-specific procedures and management plans:
 - a. Construction Waste Management
 - b. Indoor Air Quality (IAQ) Management
 - c. Noise and Acoustics Management
 - d. Temporary Storm Water Pollution Prevention
 - 4. Pollution Prevention (P2) practices: Submit evidence of P2 training and participation in P2 programs.
 - 5. Compliance with environmental regulations: As specified in Regulatory Requirements. Submit Contractor 40 CFR (Code of Federal Regulations) employee training records upon request of Contracting Officer.
- D. Provide documentation for environmental procedures as specified herein and in accordance with approved Waste Management Plan, IAQ Management Plan, and Storm Water Pollution Prevention Plan.

1.9 PERMITS

- A. General:
 - 1. Permits and Responsibilities: Contractor shall, without additional expense to the Government, be responsible for obtaining necessary licenses and permits, and for complying with Federal, State and municipal laws, codes, and regulations applicable to the performance of the work. Contractor shall also be responsible for damages to persons or property that occur as a result of Contractor's fault or negligence; and for materials delivered and work performed until completion and acceptance of the work.
 - 2. For the purpose of this contract, Contractor will not be considered an agent of the Government. Contractor shall comply with appropriate Federal, State and local laws.
- B. Government Furnished Permits: During development of the project's design, permits listed below were negotiated and agreed to by the Government. Terms and provisions of these permits shall be adhered to for the duration specified in each permit.

1. A permit was acquired for Long-term Street Easement for utility repairs with Los Angeles County for Connell Road. The Agency(ies) with Jurisdiction for this permit is Los Angeles County Public Works Department.
- C. Potential Permits: Permits listed below were identified during the design process as likely to be required based on typical means and methods of construction. The list is provided to assist Contractor in determining which permits will be required for contract's chosen means and methods. The list shall not be considered complete; it is the Contractors' responsibility to determine means and methods and obtain required permits. Contractor shall obtain all permits required to legally conduct work.
1. Review permits issued, both government-provided and those obtained by Contractor. Ensure precautions have been taken to fully comply with permit provisions, including material, meetings, reporting and anything necessary for work to be accomplished on schedule. Edit list below accordingly.
 2. Electrical Utility Hookup – Southern California Edison
 3. Gas Utility Hookup - None
 4. Sewer Hookup – Las Virgenes Municipal Water District
 5. New Water Meter - Las Virgenes Municipal Water District
 6. Street Closure – Los Angeles County Public Works Department
 7. Stormwater Pollution Prevention Permit – Regional Water Quality Control Board
 8. Dust Control Permit – South Coast Air Quality Management District
 9. Hot Work Permit – SAMO Fire Marshal
 10. Excavation – USA DigAlert
- D. Coordination with Agency(ies) with Jurisdiction Issuing Permits
1. Coordination: Contact the Agency(ies) with Jurisdiction as needed and sufficiently in advance to avoid delaying work: Coordinate meetings, reporting requirements, inspections, and other requirements.
- E. Administrative Procedures:
1. Coordinate scheduling and timing of required administrative provisions of project permits with Agency(ies) with Jurisdiction, Construction Manager, and Park to avoid conflicts.
 2. Supply needed information to Agency(ies) with Jurisdiction issuing permits, pay fees required and provide material needed to comply with permit's conditions and provisions.
 3. Upload permits to NPS/DSC management software website when permits are obtained.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 16 – CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of Construction Schedule requirements including:
 - 1. Schedule of Values
 - 2. Construction Schedule Requirements.
 - 3. Construction Schedule Updates.
 - 4. Time Impact Analysis.
- B. Purpose: The Construction Schedule ensures adequate planning, coordination, scheduling, and reporting during execution of the work by the Contractor. It shall assist the Contractor and Contracting Officer (CO) in monitoring the progress of the work, evaluating proposed changes, and processing Contractor's monthly progress payments. It shall include the dates in the contract, phases, milestones, occupancies, holidays, weather consideration, a critical path, and the requirements of this section.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: Allocation of the Schedule of Values for completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by the Contracting Officer.
- C. Critical Path Method (CPM): Method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: Longest connected chain of interdependent activities through the network schedule that establishes minimum overall Project duration and contains no float.
- E. Float: Measure of leeway in starting and completing an activity.
 - 1. Float: Not for the exclusive use or benefit of the Government or Contractor but is jointly owned.
 - 2. Free Float: Amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total Float: Measure of leeway in starting or completing an activity without adversely affecting planned Project completion date.
- F. Resource Loading: Allocation of manpower and equipment necessary for completion of an activity as scheduled.
 - G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

1.3 SUBMITTALS

- A. Electronic Copies: Schedules and reports submitted shall be posted on the NPS/DSC management software website in native electronic file formats. The intent of the Government is to limit the number of printed reports to those determined by the project team as essential.
- B. Schedule of Values: After contract award and before Pre-Construction conference, submit schedule of dollar values based on Contract Price Schedule.
- C. Construction Baseline Schedule: After contract award and before Pre-Construction conference, submit electronically submit the baseline schedule, large enough to show entire schedule for entire construction period. Utilize Schedule of Values in preparation of Construction Baseline Schedule.
- D. Critical Path Method (CPM) Reports: Concurrent with CPM schedule, electronically submit each of the following computer-generated reports. For each activity, include activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of predecessor and successor tasks for activities sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updates: On or before 7th day preceding progress payment request date, submit estimates of percent completion of each schedule activity and necessary supporting data. Provide two paper copies.
- F. Construction Schedule Revisions and Time Impact Analysis: For each Construction Schedule revision, electronically submit a Time Impact Analysis. Incorporate a Fragmentary Network (Fragnet) into currently accepted Construction Schedule that demonstrating how Contractor proposes to incorporate a modification, change, delay, or Contractor request.

1.4 QUALITY ASSURANCE

- A. Contractor shall meet with Contracting Officer on day of the preconstruction conference to go over:
 1. Review software limitations, content and format for reports.

2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages, interim milestones, and Government occupancy/substantial completions.
4. Review delivery dates for Government-furnished products.
5. Review schedule for work of separate Government contracts.
6. Review time required for review of submittals and re-submittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review time required for obtaining and activating permits.
10. Review and finalize list of construction activities to be included in schedule.
11. Review baseline schedule comments, resolve issues and progress on incorporating them
12. Review procedures for updating schedule.
13. Discuss reporting requirements and establish protocol for naming and transmitting electronic schedules.

- B. Contractor's Schedule Representative: Before the preconstruction conference, designate an authorized representative to be responsible for preparing and maintaining the Construction Schedule. Submit resume outlining qualifications of Scheduler to Contracting Officer for acceptance. Scheduler shall have prepared and maintained at least 5 previous schedules of similar size and complexity similar to this Contract, demonstrating proficiency of using scheduling software. Authorized representative will be responsible for preparing the Baseline Schedule, required updates, revisions, Time Impact Analyses, and reports.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.
- B. Coordinate Construction Baseline Schedule with Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
1. In developing Construction Baseline Schedule, ensure Subcontractor's work at all tiers, and prime Contractor's work, is included and coordinated.
 2. Secure time commitments for performing critical elements of work from parties involved.
 3. Coordinate each construction activity in network with other activities and schedule in proper sequence.

PART 2 - PRODUCTS

2.1 SCHEDULE OF VALUES

- A. Breakdown each lump-sum item into component work activities used in the schedule for which progress payments may be requested. Work activities broken out within schedule of values shall be integrated into and made a logical part of the construction baseline schedule. Total costs for the component work activities shall equal contract price for that lump-sum item. Contracting Officer may request data to verify accuracy of dollar values. Include mobilization, general

condition costs, overhead and profit in the total dollar value of unit price items and in the component work activities for each lump-sum item. Do not include mobilization, general condition costs, overhead or profit as a separate item.

- B. Do not break down unit price items. Use only the contract price for unit price items.
- C. Total cost of all items shall equal the contract price. The Schedule of Values will form the basis for progress payments and the Construction Schedule.

2.2 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Construction Baseline Schedule: Prepare Construction Baseline Schedule using a computerized, cost and resource-based, time-scaled Critical Path Method network analysis diagram for the Work.
 - 1. Develop and finalize Construction Baseline Schedule so it can be accepted for use no later than 30 days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing work within applicable completion dates, regardless of Governments acceptance of schedule.
 - 2. Establish procedures for monitoring and updating Construction Baseline Schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
- B. Construction Baseline Schedule Preparation: Prepare a list of all activities required to complete the Work. Using preliminary Critical Path Method network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate estimated duration, sequence requirements, and relationship of each activity in relation to other activities.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the Critical Path Method schedule within the limitations of the Contract Time.
 - 4. Show sequence and interdependence of activities required for completion of work. Ensure work sequences are logical and Construction Baseline Schedule shows a coordinated plan of the work.
 - 5. Resource loading of each activity shall include personnel by labor category and equipment type and capacity proposed to complete the activity in duration shown.
 - 6. Consider seasonal weather conditions in planning and scheduling work influenced by high and low ambient temperatures, wind, or precipitation to ensure completion of work within contract time.
 - 7. Time Frame: Proposed duration assigned to each activity shall be Contractor's best estimate of time required to complete activity considering the scope and resources planned for activity.

- a. An early finish date may be shown but the late finish date shall be same date as last day of contract period. An early completion schedule shall contain:
 - 1) Insert an activity titled "Project Float" as a successor to last activity in early project completion schedule network.
 - 2) Add a milestone titled "Contract End Date" as a successor to the activity "Project Float".
 - 3) Add duration to the activity "Project Float" as required so the milestone "Contract End Date" equals the last day of Contract Period.
 - b. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
 - c. Contractor shall limit use of lead or lag duration's between schedule activities.
 - d. Project Calendars: Develop and incorporate the following calendars:
 - 1) Administrative Calendar: Include calendar based on a 7-day week to be used on activities based on calendar days. Apply this calendar to administrative tasks or other tasks not affected by non-working days (Federal Holidays, weather, etc.).
 - 2) Project Calendar: Include calendar based on planned work week for the project. Include Federal Holidays, weekends, and non-workdays indicated in contract documents. Apply this calendar to activities not anticipated to be affected by weather. Be clear when identifying number of work days in work week.
 - 3) Weather Calendar: Utilize Project Calendar and show anticipated normal downtime related to weather as non-working time. Weather days shall be based on data for local area from a reliable source like the National Oceanic and Atmospheric Administration (NOAA), National Park Service records, or source acceptable to Contracting Officer. Apply this calendar to activities anticipated to be affected by weather.
 - e. Activity Duration: Define so no activity is longer than 14 days, except for non-construction activities including mobilization, shop drawings and submittals, fabrication and delivery of materials and equipment.
 - f. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in the schedule. Procurement cycle activities can include submittals, approvals, purchasing, fabrication, and delivery.
 - 1) Timber and Steel Trusses.
 - g. Submittal Review Time: Include review and re-submittal times indicated. Coordinate submittal review times in Construction Baseline Schedule.
 - h. Startup and Testing Time: Include not less than 5 days for startup, testing and commissioning activities.
 - i. Substantial Completion: Allow time for Government administrative procedures necessary for certification of Substantial Completion. (For more information, refer to Specification 01 77 00 "Closeout Procedures.")
8. Constraints: Include constraints and work restrictions indicated in Contract Documents and as follows in schedule and show how the sequence of Work is affected.

- a. Work Restrictions: Show effect of the following on the schedule:
 - 1) Coordination with existing construction
 - 2) Uninterruptible services
 - 3) Partial occupancy before Substantial Completion
 - 4) Use of premises restrictions
 - 5) Provisions for future construction
 - 6) Seasonal variations
 - 7) Environmental control
 - 8) Permit provisions
 - b. Work Stages: Indicate important stages of construction for each major portion of the Work.
 - 1) Subcontract awards
 - 2) Submittals
 - 3) Purchases
 - 4) Mockups
 - 5) Fabrication
 - 6) Sample testing
 - 7) Deliveries
 - 8) Installation
 - 9) Tests and inspections
 - 10) Adjusting
 - 11) Curing
 - 12) Building flush-out.
 - 13) Building commissioning activities.
9. Milestones: Include milestones indicated in Contract Documents in schedule, including, but not limited to, Notice to Proceed, Substantial Completion and interim milestones requested by the Contracting Officer.

C. Joint Review, Revision, and Acceptance:

- 1. Within seven calendar days of receiving Contractor's proposed Construction Baseline Schedule, Contracting Officer shall review initial Construction Baseline Schedule.
- 2. Within seven calendar days after review, Contractor shall revise and resubmit Construction Baseline Schedule in accordance with comments presented from review.
- 3. In the event the Contractor fails to define any element of work, activity, or logic, and the Contracting Officer review does not detect this omission or error, such omission or error, when discovered by Contractor or Contracting Officer, shall be corrected by Contractor within seven calendar days and shall not affect contract period.
- 4. Upon acceptance of the Construction Baseline Schedule, Contracting Officer saves schedule as a baseline and updates on a monthly basis. Construction schedule update will be used to evaluate Contractor's monthly applications for payment based upon information developed at monthly Construction Schedule update meeting.

- D. Cost Correlation: In the heading of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of dates used to prepare payment requests.

1. Contractor shall assign cost to construction activities on Construction Baseline Schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Contracting Officer's approval, be assigned to fabrication and delivery activities. Costs shall be included for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable).
 2. Each activity cost shall reflect an accurate value based on the Contract Price Schedule.
 3. Total cost assigned to activities shall equal total Contract Price.
- E. Recovery Schedule: When periodic schedule update indicates Work is 14 or more calendar days behind current accepted schedule, a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule shall also be submitted. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery shall be accomplished.
- F. Computer Software: Prepare schedules using a program developed specifically to manage construction schedules.
1. Use Microsoft Project or Primavera.

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE UPDATES

- A. Progress Meeting Updates: Provide a 3 week look-ahead schedule, derived from the currently accepted schedule, before each weekly progress meeting. Utilize look-ahead schedule to facilitate and take notes on discussions held during progress meeting.
- B. Monthly Schedule Updates:
1. General: Update Construction Schedule on monthly basis to reflect construction progress and activities throughout entire contract period and until project substantial completion. The status date of each schedule update shall be the 7th day preceding the progress payment request date.
 2. Procedure: Contractor shall meet with Contracting Officer each month at Construction Schedule update meeting to review progress made through the status date of the Construction Schedule update, including dates activities were started or completed and percentage of work completed on each activity started or completed.
 3. Reports: Concurrent schedule revisions, prepare tabulated reports showing:
 - a. Identification of activities that have changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays
 - e. Changes in the critical path
 - f. Changes in total float or slack time
 - g. Changes in the Contract Time

4. Narrative: Report shall include a brief description of actual progress made during update period; actual and potential delaying activities; impediments to progress; issues related to inclement weather; progress toward established milestones and project float. Report shall include a brief description of work anticipated to be performed in the next month. Minor revisions to the schedule should be identified for evaluation and acceptance or rejection.
 5. As Work progresses, indicate Actual Completion percentage for each activity.
 6. If schedule update shows a late finish date after contract completion date, include:
 - a. Known delays
 - b. Actions to get back on schedule
 - c. Pending modifications
 - d. Impediments or constraints affecting progress
 7. Progress Payments: Monthly updating of the currently accepted Construction Schedule shall be an integral part of the process upon which progress payments will be made. If Contractor fails to provide schedule updates or revisions, a portion of the monthly payment may be retained until corrections have been made.
- C. Distribution: Distribute copies of accepted schedule to Contracting Officer, Contracting Officers Representative, Construction Management Representative, Subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to same parties and post in same locations. Delete parties from distribution when they have completed their assigned portion of the Work.
- D. Construction Schedule Revisions:
1. Required Revisions: If, as a result of the monthly schedule update, it appears the currently accepted Construction Schedule no longer represents actual prosecution and progress of the work, Contracting Officer will request, and Contractor shall submit, a revision to the Construction Schedule. Contractor may also request reasonable revisions to currently accepted Construction Schedule in event the Contractor's planning for the work is revised. If Contractor desires to make changes, Contractor shall notify Contracting Officer in writing, stating reason for proposed revision. Accepted revisions shall be incorporated into currently accepted Construction Schedule for next monthly schedule update.
 2. Procedure: If revision to currently accepted Construction Schedule is contemplated, Contractor or Contracting Officer shall advise the other in writing at least seven calendar days prior to next monthly schedule update meeting, describing revision and reasons for the revision. Government-requested revisions will be presented in writing to the Contractor, who shall respond in writing within seven calendar days.
 3. Reports: Concurrent with making revisions to schedule, prepare tabulated reports showing:
 - a. Identification of activities changed
 - b. Changes in early and late start dates
 - c. Changes in early and late finish dates
 - d. Changes in activity durations in workdays
 - e. Changes in critical path
 - f. Changes in total float or slack time

3.2 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS CHANGES DELAYS AND CONTRACTOR REQUESTS:

1. Requirements: When contract modifications or changes are initiated, delays experienced, or Contractor desires to revise currently accepted Construction Schedule, Contractor shall submit to Contracting Officer a written time impact analysis illustrating the influence of modification, change, delay, or Contractor request on contract time.
2. Time Extensions: Activity delays, resulting in a late completion date projection, shall not automatically mean an extension of contract time is warranted or due to Contractor. It is possible a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in absorbing a part of available total float that may exist within an activity chain of the Schedule, not causing any effect on contract time. Time extensions will be granted in accordance with terms of contract.
3. Extension of contract time will be granted only to the extent the equitable time adjustments to activity or activities affected by modification, change, or delay exceeds total (positive or zero) float available on a particular activity.
4. Procedure: Each time impact analysis shall be submitted within time period stated in a request for proposal, or time period designated under the clauses entitled Changes or Default. In cases where Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Contractor request does not require an extension of the contract time. Upon acceptance, time impact analysis shall be incorporated into currently accepted Construction Schedule at next monthly schedule update.
5. Contract Modifications: Prepare time-impact analysis using fragnets to demonstrate effect of proposed change on overall Construction Schedule for each proposed contract modification concurrent with submission.

END OF SECTION 01 32 16

SECTION 01 32 33 – PHOTO DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for:
 - 1. Existing condition images
 - 2. Periodic construction images
- B. See Section 01 77 00 "Closeout Procedures" for a complete listing of closeout documents.
- C. See Section 01 79 00 "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of National Park Service (NPS) personnel.

1.2 SUBMITTALS

- A. Construction Images: Submit images electronically within 7 days of taking the image. Include:
 - 1. Date, time and number (sequentially number all images) in filename.
 - 2. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 3. Submit digital images exactly as originally recorded in digital camera, without alteration, or modifications using image-editing software.
- B. Closeout: Submit complete set of digital image electronic files as a Project Record Document. Submit on Digital Video Disc (DVD).
 - 1. Provide index as separate file on Disc. List each image as a file name with number, date, and time. Include description and or vantage point image was taken.
 - 2. Submit images that have the same aspect ratio as the sensor, un-cropped.

PART 2 - PRODUCTS

2.1 FORMAT REQUIREMENTS

- A. Media: DVD-R Archival Gold
- B. Media Labels: Archival DVD labeling markers, archival labels, or direct print.
- C. Images: Provide sRGB (standard Red Green Blue) color images in JPEG (Joint Photographic Experts Group) format. Minimum sensor size of 8 megapixels, and at image resolution of not less than 3200 by 2400 and 300 dpi (dots per inch).

PART 3 - EXECUTION

3.1 CONSTRUCTION IMAGES

- A. General: Take digital images using the maximum range of depth of field, in-focus, to clearly show the Work. No blurry or out-of-focus areas accepted.
 - 1. Maintain index with each set of Construction images and identify the number, date, time, and description for each.
 - 2. Maintain one set of images accessible in field office at Project site available for reference.
- B. Existing Condition Images: Before commencement of excavation, take color digital images of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Flag excavation areas and construction limits before recording construction images.
 - 2. Take 24 separate images to show existing conditions adjacent to property before starting Work. Images should include, but are not limited to, project building locations, perimeter of work area, Medea Creek Bridge, lawn, existing set structures and utility corridors to Cornell Road.
- C. Periodic Construction Images: Take 12 color, digital weekly, with timing each month adjusted to coincide with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last images were taken.
- D. Additional Images: Contracting Officer may issue requests for additional images.
 - 1. Three days advance, where feasible.
 - 2. In emergency situations, take additional images within 24 hours of request.
 - 3. Additional images include, but are not limited to:
 - a. Immediate follow-up when on-site events result in construction damage or losses.
 - b. Fabrication locations away from Project site.
 - c. Substantial Completion of a major phase or component of Work.
 - d. Extra record images at time of final acceptance.

END OF SECTION 01 32 33

SECTION 01 33 23 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written, graphic information, and physical samples that require Government's responsive action.
- B. Informational Submittals: Written information that does not require Government's responsive action. Submittals may be rejected for not complying with requirements.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 GENERAL SUBMITTAL PROCEDURES

- A. General: Prepare and submit submittals required by individual Specification Sections and in some cases as requested in drawings. Types of submittals are indicated in individual specific sections.
 - 1. Contracting Officer (CO) reserves right to require submittals in addition to those called for in individual sections.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Review for legibility, accuracy, completeness, and compliance with Contract Documents.
 - 1. Coordinate submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of Work so processing will not be delayed because of need for concurrent review coordination.
 - a. Contracting Officer reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Submittal List: Submittal list is attached to the end of this Specification Section. The intent is to provide an overall summary of submittal requirements. The requirements of individual Specification Sections and terms and conditions of the Contract still apply regardless of what is shown on submittal list.
- D. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence when e-mail notification is received by Contracting Officer (or designee) indicating submittal has been posted on NPS management software website and is ready for review. When Contracting Officer has completed review, e-mail notification will be sent to Contractor indicating submittal has been processed. No extension of Contract Time will be authorized because of failure to transmit submittals in advance of Work to permit processing, including re-submittals.
 - 1. Action Submittals
 - a. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required.
 - b. Re-submittal Review: Allow 14 days for review of each re-submittal.
 - 2. Informational submittals
 - a. Review: Allow 14 days for review of each submittal.
- E. Approved Equals:
 - 1. For each item proposed as an "approved equal," submit supporting data, including:
 - a. Drawings and samples as appropriate.
 - b. Comparison of the characteristics of the proposed item with that specified.
 - c. Changes required in other elements of the work because of the substitution.
 - d. Name, address, and telephone number of vendor.
 - e. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.
 - 2. A request for approval constitutes a representation that Contractor:
 - a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.
 - b. Will provide the same warranties for the proposed item as for the item specified.
 - c. Has determined that the proposed item is compatible with interfacing items.
 - d. Will coordinate installation of an approved item and make changes required in other elements of the work because of the substitution.
 - e. Waives claims for additional expenses that may be incurred as a result of the substitution.
- F. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Transmittal Form (CM-16): All submittals shall be transmitted using National Park Service Transmittal Form (CM-16). The form can be downloaded from the DSC Workflows website's [Submittal Review](#) page and completed on the NPS/DSC management software website. No action will be taken on a submittal item unless accompanied by this Transmittal Form.
 - a. Complete the general information at the top of form.
 - b. Provide all required information based on submittal type
 - c. Attach all related documents.
 - d. Sign the Contractor section at bottom of the Transmittal Form (CM-16).
 2. Physical samples: Complete Transmittal Form (CM-16) on the NPS/DSC management software website as described above. Deliver physical sample to the Contracting Officer (or designee) on site for processing. All comments and actions will be documented on the Transmittal Form (CM-16) on the NPS/DSC management software website.
- G. Identification: Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use a sequential number (e.g. .001). Re-submittals shall include alphabetic suffix after another decimal point (e.g. .001.A).
- H. Re-submittals: Make re-submittals using same process used with initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in the title block on the Transmittal Form (CM-16) and clearly indicate extent of revision.
 3. Re-submit submittals until they are marked "Approved" or "Approved with notations".
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities.
- J. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved with notations". Ensure notations have been incorporated and, at a minimum, keep one copy of final approved submittal on site for use during construction.

1.4 CONTRACTOR'S USE OF CAD/BIM FILES

- A. General: At Contractor's written request, copies of CAD (Computer Aided Design)/BIM (Building Information Modeling) files will be provided to Contractor for Contractor's use in connection with Project, subject to:
1. Files provided as is; no format or other changes to files or changes to objects in the drawing will be done by the Government.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. Product Data: Collect information into a single submittal for each element of construction and

type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each submittal to show which products and options are applicable.
 3. As applicable, include:
 - a. Manufacturer's product specifications.
 - b. Manufacturer's installation instructions: When Contract Documents require compliance with manufacturer's printed instructions, provide one complete set of instructions to Contracting Officer and keep another complete set of instructions at the project site until substantial completion.
 - c. Manufacturer's catalog cuts: Submit only pertinent pages; mark each page of standard printed data to identify specific products proposed for use.
 - d. Wiring diagrams showing factory-installed wiring.
 - e. Printed performance curves.
 - f. Operational range diagrams.
 - g. Compliance with specified referenced standards.
 - h. Testing by recognized testing agency.
 4. Submit product data in PDF (portable document format) file format before or concurrent with samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of CAD/BIM Drawings is otherwise permitted.
1. Preparation: Fully illustrate requirements in Contract Documents. As applicable, include:
 - a. Dimensions
 - b. Identification of products
 - c. Fabrication and installation drawings
 - d. Roughing-in and setting diagrams
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring
 - f. Shopwork manufacturing instructions
 - g. Templates and patterns
 - h. Schedules
 - i. Notation of coordination requirements
 - j. Notation of dimensions established by field measurement
 - k. Relationship to adjoining construction clearly indicated
 - l. Seal and signature of professional engineer if specified
 - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring
 2. Submit shop drawings as PDF electronic file
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Complete and post the Transmittal Form (CM-16) on the NPS/DSC management software website for processing and documentation of action on submitted samples.
 3. Identification: Attach label on unexposed side of Samples that includes:
 - a. Generic description of Sample
 - b. Product name and name of manufacturer
 - c. Sample source
 - d. Submittal Number and title of appropriate Specification Section
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Contracting Officer will return with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit 5 sets of Samples. Contracting Officer will retain three Sample sets; Architect will retain one sample set; remainder will be returned. Retain Sample set as a Project Record Sample.
- D. Construction Materials: Contractor is encouraged to submit products made out of recycled or environmentally responsible material. Every effort will be made by National Park Service to approve these materials.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by individual Specification Sections.
1. Post informational submittals as PDF electronic files directly to the NPS management software website.
 2. Certificates and Certifications: Provide a notarized statement with signature of entity responsible for preparing certification. Certificates and certifications shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
 3. Informational submittals that do not comply with requirements specified in Contract Documents will be rejected and one copy will be returned.

- B. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- C. Contractors Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- D. Accident Prevention Plan: Comply with requirements specified in Section 01 35 23 "Safety Requirements."
- E. Schedule of Values: Comply with requirements specified in Section 01 32 16 "Construction Schedule."
- F. Waste Recycling Plan: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- G. Quality Control Plan: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- H. Storm Water Pollution Prevention Plan: Comply with requirements specified in Section 01 57 23 "Temporary Storm Water Pollution Prevention" and storm water permit requirements identified in Section 01 31 00 "Project Management and Coordination."
- I. Indoor Air Quality Management Plan: Comply with requirements specified in Section 01 57 19.11 "Indoor Air Quality Management."
- J. Qualification Data: Prepare written information demonstrating capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.
- L. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying Installer complies with Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- M. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying manufacturer complies with Contract Documents. Include evidence of manufacturing experience where required.
- N. Product Certificates: Prepare written statements on manufacturer's letterhead certifying product complies with Contract Documents.
- O. Material Certificates: Prepare written statements on manufacturer's letterhead certifying material complies with Contract Documents.
- P. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in Contract Documents.

- Q. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- S. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in Contract Documents.
- T. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- U. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in Contract Documents.
- V. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- W. Design Data: Prepare written and graphic information, including: performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- X. Manufacturer's Instructions: Prepare written or published information documenting manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- Y. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. As applicable, include:
1. Statement on condition of substrates and their acceptability for installation of product.
 2. Summary of installation procedures being followed, compliance with requirements and, if not, what corrective action was taken.
 3. Results of operational and other tests and a statement of whether observed performance complies with the requirements.
- Z. Permit Compliance Products: Prepare required information for compliance with permit provisions. Products include written notification of project startup, suspension, and completion of work; photo documentation of site conditions; reports; and drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of Contract and for compliance with Contract Documents. Note corrections and field dimensions.

3.2 CONTRACTING OFFICER'S ACTION

- A. General: Submittals will be disapproved without technical review if identification information is missing, not filled in, or if placed on back of submittal; an incorrect format of submittals is provided; transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Contractor's approval.
 - 1. Any work done or orders for materials or services placed before approval shall be at Contractor's own risk.
- B. Action Submittals: Contracting Officer will review each submittal, generate comments on corrections or modifications required, and indicate appropriate action on the Transmittal Form (CM-16). Submittal will be marked as defined below:
 - 1. APPROVED: Acceptable with no corrections.
 - 2. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. Comments are clear and no further review is required. Contractor shall address review comments when proceeding with the work.
 - 3. DISAPPROVED - RESUBMIT: Rejected as not in accordance with the contract or as requiring major corrections or clarifications. Contracting Officer will identify reasons for disapproval. Contractor shall revise and resubmit with changes clearly identified.
- C. Informational Submittals: Contracting Officer will review each submittal and will either accept or reject it.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

END OF SECTION 01 33 23

Submittal List with Review Estimate Template

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
01 11 00		Summary of Work		X					X								
	1.10E	Bridge utility crossing design															
01 31 00		Project Management and Coordination															
	1.4	Coordination Drawings							X								
		Coordination Digital Data Files							X								
		Division 1 Documents		X													
01 32 16		Construction Schedule															
	1.3	Schedule of Values		X													
		Construction Baseline Schedule		X													
		CPM Reports		X													
		Construction Schedule Updates		X													
		Construction Schedule Revisions and Time Impact Analysis		X													
	1.4	Scheduler Qualifications					X										
01 32 33		Photo Documentation															
	1.2	Construction Images					X										
13513		Archaeological Protection															
	1.3	Daily Work Schedule		X													
01 35 23		Safety Requirements															
	1.2	Accident Prevention Plan		X													
	3.4	Safety Meeting Minutes					X										
01 40 00		Quality Requirements															
	1.5	Quality Control Plan		X													
		Qualification Data					X										
		Contractor's Quality Control Daily Reports		X													
		Test Reports		X													
		Accessibility Inspection Report		X													
		Off-Site Inspection Reports		X													
		Copies of Permits, Licenses, and Certificates	X														
		Special Inspection Forms		X													
01 57 19		Indoor Air Quality															
	1.4	IAQ Management Plan		X													
		Product Data								X							
		Inspection and Test Reports		X													
01 67 00		Temporary Storm Water Pollution Prevention															
	1.3	SWPPP		X													
		Inspection Schedule					X										
		Erosion Control Products								X							
01 67 00		Product Requirements															
	1.3	Affirmative Procurement Reporting Form		X													
		Environmental Data				X											
		Material Safety Data Sheets				X											
		Chain of Custody	X														
01 73 40		Execution															
	1.2	Certificates		X													
		Landfill Receipts					X										
		Certified Surveys		X													
		Quantity Surveys		X													
		Land Surveyor Qualifications					X										
01 74 19		Construction Waste Management and Disposal															
	1.4	Waste Management Plan		X													
		Progress Documentation		X													
		Waste Reduction Calculations		X													
		Records of Donations		X													
		Records of Sales		X													
		Recycling and Processing Facility Records		X													
		Landfill and Incinerator Disposal Records		X													

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
		Qualification Data				X											
		Progress Payment Requirements		X													
		Closeout Submittals		X													
	1.5	Waste Management Coordinator Qualifications				X											
01 77 00		Closeout Procedures															
	1.3	Warranties				X											
		NPS Forms for Occupancy				X											
		Project Record Documents				X											
		Environmental Record Documents				X											
		Operating Instructions			X												
		Tools, Spare Parts				X											
		Keys, Keying Schedule				X											
		TAB Report		X													
01 78 23		Operation and Maintenance Data															
	1.2	Operation and Maintenance Manuals			X												
01 79 00		Demonstration and Training															
	1.2	Instruction Program				X											
		Demonstration and Training Video				X											
	1.3	Facilitator Qualifications				X											
		Instructor Qualifications				X											
01 91 14		Total Building Commissioning															
	1.6	Two-week Look Ahead Schedules		X													
		Certificates of Readiness	X														
		Contractor's Commissioning Representative Qualifications				X											
		Commissioning Plan		X													
		Pre functional Checklists		X													
		Owner's Project Requirements				X											
		Functional Performance Tests	X														
		List of Test Devices				X											
		Deficiency Report and Resolution Record		X													
		Closeout Documentation		X													
		Operation and Maintenance - Training Plan		X													
02 41 00		Selective Demolition															
	1.4	Site Plan for Protected Vegetation									X						
		Demolition Plan		X													
		Project Record Documents															
	1.5	Demolition Firm Qualifications				X											
03 20 00		Concrete Reinforcing															
	1.2	Product Data - Steel Reinforcing									X						
		Product Data - Bar Supports									X						
		Steel Reinforcement Shop Drawings								X							
		Construction Joint Layout								X							
	1.3	Material Test Reports			X												
03 30 00		Cast-in-Place Concrete															
	1.3	Product Data - Portland Cement									X						
		Product Data - Fly Ash									X						
		Product Data - Slag Cement									X						
		Product Data - Aggregates									X						
		Product Data - Admixtures									X						
		Product Data - Vapor Retarders									X						
		Product Data - Floor and Slab Treatments									X						
		Product Data - Curing Materials									X						
		Product Data - Repair Materials									X						
		Concrete Mix Design with Test Data									X						
	1.4	Qualification Data - Installer		X													
		Qualification Data - Ready-Mixed Concrete Manufacturer		X													
		Qualification Data - Testing Agency		X													
		Material Certifications - Cementitious Materials		X													

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
		Material Certifications - Admixtures	X														
		Material Certifications - Aggregates	X														
		Material Test Reports - Portland Cement	X														
		Material Test Reports - Fly Ash	X														
		Material Test Reports - Slag Cement	X														
		Test Reports	X														
		Inspection Reports	X														
05 12 00		Structural Steel Framing															
	1.4	Product Data - Structural-Steel Materials									X						
		Product Data - High Strength, Bolt-nut-washer Assemblies									X						
		Product Data - Anchor Rods									X						
		Product Data - Shop Primer									X						
		Product Data - Galvanized repair paint									X						
		Product Data - Shrinkage-resistant grout.									X						
		Shop and erection drawings								X							
		Welding Procedure Specifications									X						
	1.5	Qualification Data - Installer & Fabricator					X										
		Welding Certificates	X														
		Paint Compatibility Certificates	X														
		Mill Test Reports		X													
		Product Test Reports - Bolts, nuts, and washers		X													
06 10 00		Rough Carpentry															
	1.3.A	Product Data - Process and factory-fabricated product									X						
	1.4.A	Evaluation Reports - Wood-preserved treated wood		X													
		Evaluation Reports - Engineered Wood Products		X													
		Evaluation Reports - Power-driven fasteners		X													
		Evaluation Reports - Post-installed anchors		X													
		Evaluation Reports - Metal Framing Anchors		X													
06 13 00		Heavy Timber Construction															
	1.3	Product Data - Timber Connectors									X						
		Sustainable Design Submittals	X														
		Shop Drawings								X							
	1.4	Material Certificates - Timbers specified	X														
		Certificates of Inspection	X														
06 13 26		Timber Trusses															
	1.4	Qualification Information - Truss Manufacturer and Designer	X														
		Design Drawings & Calculations		X													
		Product Data - Bolts, screws, & other connectors									X						
		Sustainable Design Submittals	X														
		Design Drawings								X							
		Shop Drawings								X							
	1.5	Material Certificates - Members			X												
		Certificates of Inspection	X														
	1.6	Manufacture Qualifications				X											
		Design Engineer Qualifications				X											
06 16 00		Sheathing															
	1.2	Product Data - Plywood									X						
		Product Data - Machine Nails									X						
	1.3	Special Inspection Reports	X														
	1.4	Machine Nailing Demonstration Panel					X										
		Testing Agency Qualifications				X											
06 20 00		Finish Carpentry															
	1.5	Shop Drawings								X							
		Samples						X									
06 20 13		Exterior Finish Carpentry															
	1.3	Product Data									X						
		Material Certificates	X														
		Shop Drawings								X							

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
		Samples						X									
		Material Lists															
	1.5	Installer Qualifications					X										
07 21 00		Thermal Insulation															
	1.4	Product Data									X						
07 25 00		Weather Barriers															
	1.5	Product Data									X						
		Shop Drawings								X							
		Manufacturer's Installation Instruction									X						
07 41 13		Metal Roof Panels															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples						X									
		Test Reports	X														
		Warranty					X										
	1.5	Manufacturer's Qualification Statement					X										
		Installer's Qualification Statement					X										
07 42 13		Metal Wall Panels															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples						X									
		Manufacturer's Qualification Statement					X										
		Installer's Qualification Statement					X										
07 46 46		Fiber Cement Siding															
	1.4	Product Data									X						
		Maintenance Instructions									X						
	1.5	Installer's Qualification Statement					X										
07 62 00		Sheet Metal Flashing and Trim															
	1.4	Shop Drawings								X							
		Product Data									X						
	1.5	Fabricator and Installer Qualifications					X										
07 92 00		Joint Sealants															
	1.4	Product Data for Sealants									X						
		Color Cards for Selection									X						
		Warranty					X										
08 14 33		Solid Core Wood Doors with Wood Facings															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples						X									
		Certificates for QA Program					X										
	1.5	Manufacturer Qualifications					X										
		Installer Qualifications					X										
		Woodwork Quality Assurance Program					X										
08 31 00		Access Doors and Panels															
		Product Data									X						
		Shop Drawings								X							
08 52 00		Wood Windows															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples						X									
		Test Reports	X														
		Warranty					X										
	1.5	Manufacturer Qualifications					X										
		Installer Qualifications					X										
08 71 00		Door Hardware															
	1.2	Product Data									X						
		Hardware Schedule										X					
		Keying Schedukle											X				

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
		Product Test Reorts	X														
		Operating and Maintenance Manuals	X								X						
08 91 00.19		Fixed Louvers and Vents															
	1.4	Product Data									X						
		Shop Drawings								X							
		Test Reports	X														
		Certificate	X														
		Maintenance Data									X						
	1.5	Warranty					X										
09 21 16		Gypsum Board															
	1.4	Product Data									X						
	1.5	Installer Qualifications					X										
09 78 00		Interior Wall Paneling															
		Product Data									X						
		Shop Drawings								X							
		Samples							X								
		Manufacturer's Instructions									X						
		Maintenance Data									X						
		Maintenance Materials					X										
	1.3	Manufacturer's Qualification Statement					X										
		Installer's Qualification Statement					X										
09 91 13		Exterior Painting															
	1.5	Product Data									X						
		Samples							X								
		Certification	X														
		Maintenance Data									X						
		Maintenance Materials					X										
	1.6	Manufacturer Qualifications					X										
		Applicator Qualifications					X										
	1.7	Mock Up							X								
09 92 13		Interior Painting															
	1.5	Product Data									X						
		Samples							X								
		Certification	X														
		Maintenance Data									X						
		Maintenance Materials					X										
	1.6	Manufacturer Qualifications					X										
		Applicator Qualifications					X										
	1.7	Mock Up							X								
09 93 00		Staining and Transparent Finishes															
	1.5	Product Data									X						
		Samples							X								
		Certification	X														
		Maintenance Data									X						
		Maintenance Materials					X										
	1.6	Manufacturer Qualifications					X										
		Applicator Qualifications					X										
10 21 13 .19		Plastic Toilet Compartments															
	1.5	Product Data									X						
		Shop Drawings								X							
		Samples							X								
		Manufacturer's Installation Instructions									X						
10 21 13 .19		Toilet Accessories															
	1.5	Product Data									X						
		Manufacturer's Installation Instructions									X						
11 40 01		Custom Fabricated Foodservice Equipment															
		Product Data								X							
		Shop Drawings								X							

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
12 36 00		Countertops															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples							X								
		Test Reports	X														
		Manufacturer's Instructions									X						
		Maintenance Data									X						
	1.5	Installer's Qualification Statement					X										
21 00 00		Fire Suppression Basic Requirements															
	1.4	Product Data									X						
		Shop Drawings		X						X							
		Test Reports		X													
		Warranty					X										
		Installer Qualifications					X										
		Certificate	X														
		Maintenance Data			X												
		Calculations		X													
22 00 00		Plumbing Basic Requirements															
	1.4	Submittal		X													
	1.6	Warranty					X										
	1.7	Coordination Documents								X							
		Installer Qualifications					X										
22 05 19		Plumbing Devices															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Maintenance Data			X												
22 05 23		General Duty Valves and Piping															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Maintenance Data			X												
22 05 29		Hangers and Supports for Plumbing Piping and Equipment															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Maintenance Data			X												
22 05 29		Identification for Plumbing Piping															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Maintenance Data			X												
22 07 00		Plumbing Insulation															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Maintenance Data			X												
22 10 00		Plumbing Piping															
	1.4	Product Submittal									X						
		Shop drawing								X							
	1.6	Warranty					X										
	2.1	Manufacturer					X										
		Testing	X														
	3.5	Domestic water pping Sterilization	X														
22 30 00		Plumbing Equipment															
	1.4	Product Submittal									X						
	1.6	Warranty					X										
	2.1	Manufacturer					X										

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
22 40 00		Maintenance Data			X												
		Plumbing Fixtures															
	1.4	Product Submittal									X						
	1.6	Warranty				X											
	2.1	Manufacturer				X											
23 00 00		Maintenance Data			X												
		Heating, Ventilating and Air Conditioning (HVAC) Basic Requirements															
	1.4	Product Data									X						
		Shop Drawings							X								
		Samples					X										
		Test Reports		X													
		Warranty				X											
		Installer Qualifications				X											
		Certificate	X														
		Maintenance Data			X												
23 05 13		Common Motor Requirements for HVAC Equipment															
	1.4	Product Data									X						
	1.6	Warranty				X											
23 05 29		Hangers and Supports for HVAC Ductwork and Equipment															
	1.4	Product Data									X						
	1.6	Warranty				X											
23 05 53		Identification for HVAC Piping, Ductwork and Equipment															
	1.4	Product Data									X						
	1.5	Manufacturer's Qualifications				X											
	1.6	Warranty				X											
23 05 93		Testing, Adjusting, and Balancing for HVAC															
	1.4	Pre-Balance Report		X													
		Final Balance Report		X													
		Construct Documents Examination Report		X													
		Strategies and Procedures Plan		X													
		Certified TAB Report		X													
		Sample Report Forms		X													
		Test Instrument Calibration		X													
	1.5	Personal Qualifications				X											
		Balance Firm Qualifications				X											
	1.6	Warranty				X											
23 07 00		HVAC Insulation															
	1.4	Product Data									X						
		Material Test Reports		X													
		Manufacture's Installation Instructions			X												
		Warranty				X											
		Installer Qualifications				X											
		Certificate				X											
		Maintenance Data			X												
	1.6	Warranty				X											
		Commissioning of HVAC															
23 08 00	1.4	Certificates Of Readiness	X														
		Certificate Of Completion Of Installations, Prestart And Startup Ac	X														
		Control Drawing						X									
		Test Reports		X													
	1.6	Warranty				X											
23 09 33		Electric and Electronic Control System for HVAC								X							
	1.4	Operation and Maintenance Manual			X												
		Shop Drawings						X									
	1.6	Warranty				X											
23 21 13		HVAC Piping															
	1.4	Product Data									X						
		Shop Drawings							X								

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch												
SUBMITTAL			REQUIREMENTS (Indicate with X)							ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
		Warranty				X											
		Installer Qualifications				X											
23 31 00		HVAC Ducts and Casings															
	1.4	Product Data									X						
		Shop Drawings								X							
		Field Quality Control Reports		X													
	1.5	Installer Qualifications				X											
		Welder Qualifications				X											
	1.6	Warranty				X											
23 33 00		Air Duct Accessories															
	1.4	Product Data									X						
		Shop Drawings								X							
		Maintenance Data			X												
	1.5	Manufacturer Qualifications				X											
		Manufacture's Installation Instructions			X												
	1.6	Warranty				X											
23 34 00		HVAC Fans															
	1.4	Product Data									X						
		Maintenance Data			X												
	1.6	Warranty				X											
23 37 00		Air Outlets and Inlets															
	1.4	Product Data									X						
		Performance Data									X						
		Diffuser Schedule								X							
	1.6	Warranty				X											
23 40 00		HVAC Air Cleaning Devices															
	1.4	Product Data									X						
		Shop Drawings								X							
		Samples						X									
	1.6	Warranty				X											
26 00 00		Electrical Basic Requirements															
	1.4	Product Data								X							
26 05 09		Equipment Wiring															
	1.4	Product Data - Safety Switches									X						
26 05 19		Low-Voltage Electrical Power Conductors and Cables															
	1.4	Product Data Lugs and Pads									X						
		Product Data Wires/Cables									X						
		Product Data Connectors									X						
		Product Data Lugs									X						
	1.6	Warranty				X											
26 05 26		Grounding and Bonding For Electrical Systems															
	1.4	Product Data - Grounding electrode									X						
		Product Data - Connectors									X						
		Product Data - Coductors									X						
		Product Data - Ground Well									X						
		Product Data - Bus Bar									X						
		Warranty				X											
26 05 29		Hangers and Supports For Electrical Systems and Equipment															
	1.4	Product Data - Anchors, Threaded Rod and Fasteners									X						
		Product Data - Support Channel, Hangers and Supports									X						
	1.6	Warranty				X											
26 05 33		Raceways															
	2.1-2.8	Product Data - Conduit: RMC, PVC, EMT, FMC, LFMC									X						
		Product Data - Conduit fittings									X						
		Warranty															
26 05 34		Boxes															
	2.1	Product Data - Outlet boxes, Pull and junction boxes, weatherproof									X						
		Warranty									X						

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
26 05 43		Electrical Vaults and Underground Raceways															
	2.1	Product Data - Handholes															
		Product Data - Raceway															
		Warranty					X										
26 05 53		Identification for Electrical Systems															
	1.4	Product Data - Equipment Nameplates									X						
		Product Data - Device Labels									X						
		Product Data - Wire Markers									X						
		Product Data - Underground warning tape									X						
	1.6	Warranty					X										
26 05 73		Electrical Distribution System Studies															
	1.4	Test Report Power System Studies (short circuit, arc flash, overcurrent p		X													
	1.5	Quality Assurance					X										
	1.5	Installer Qualifications					X										
	1.6	Warranty					X										
26 08 05		Electrical Acceptance Testing															
	1.4	Test Report - Dry Type Transformers		X													
		Test Report - Low Voltage Circuit Breakers		X													
		Test Report - Switchboards		X													
		Test Report - Panelboards		X													
		Test Report - Grounding systems		X													
		Test Report - Cables		X													
	1.5	Quality Assurance					X										
	1.5	Installer Qualifications					X										
	1.6	Warranty					X										
26 08 10		Building Lighting Acceptance Testing															
	1.4	Test Report - Acceptance Testing Phase 1 - Documentation		X													
		Test Report - Acceptance Testing Phase 2 - Inspection and Testing		X													
		Test Report - Acceptance Testing Phase 3 - Certification		X													
	1.5	Quality Assurance					X										
	1.5	Installer Qualifications					X										
26 09 25		Digital Lighting Controls															
	1.4	Product Data - Lighting controls									X						
		Shop Drawings								X							
		Closeout submittals		X													
	1.5	Installer Qualifications					X										
		Certificate	X														
		Maintenance Data			X												
	1.6	Warranty					X										
26 24 16		Panelboards															
	1.4	Product Data - panel boards									X						
	1.6	Warranty					X										
26 27 26		Wiring Devices															
	1.4	Product Data - Wall Switches									X						
		Product Data - Receptacles									X						
		Product Data - Finish Plates									X						
		Product Data - Wall Dimmers									X						
		Product Data - Surface Covers									X						
	1.6	Warranty					X										
26 28 00		Overcurrent Protective Devices															
	1.4	Product Data - Fuses									X						
	1.4	Product Data - Circuit breakers									X						
	1.6	Warranty					X										
26 28 16		Enclosed Switches and Circuit Breakers															
	1.4	Product Data - Toggle Disconnect Switches									X						
		Product Data - Motor Starters									X						
	1.4	Product Data - Safety Switches									X						
		Product Data - Enclosed Circuit Breakers									X						

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE								
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)								
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)								
SUBMITTAL			REQUIREMENTS (Indicate with X)															
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT	
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER								
	1.6	Warranty				X												
26 43 00		Surge Protective Devices							X									
	1.4	Product Data - SPD							X									
	1.6	Warranty				X												
26 51 00		Lighting																
	1.4	Product Data - Luminaires, LED drivers, Lamps,							X									
		Product Data - Emergency LED power supplies							X									
		Product Data - Lighting Poles							X									
		Warranty				X												
27 00 00		Communications Basic Requirements																
	1.4	Product Data							X									
		Shop Drawings							X									
		Joint Restraints							X									
		Samples						X										
		Test Reports		X														
		Warranty				X												
		Installer Qualifications				X												
		Certificate	X															
		Maintenance Data			X													
27 05 28.28		Firestopping for Communications Systems																
	1.4	Product Data							X									
		Shop Drawings							X									
		Warranty				X												
		Installer Qualifications				X												
		Certificate	X															
		Maintenance Data			X													
27 05 43		Underground Ducts and Raceways for Communication Systems																
	1.4	Product Data							X									
		Shop Drawings							X									
		Maintenance Data			X													
27 11 00		Communication Equipment Rooms																
	1.4	Product Data							X									
		Shop Drawings							X									
27 13 00		Communications Backbone Cabling																
	1.4	Product Data							X									
		Shop Drawings							X									
		Test Reports		X														
		Warranty				X												
27 15 00		Communications Horizontal Cabling																
	1.4	Product Data							X									
		Shop Drawings							X									
		Test Reports		X														
		Warranty				X												
27 41 16		Integrated Audio-Video Systems and Equipment																
	1.4	Product Data							X									
		Shop Drawings							X									
		Test Reports		X														
		Warranty				X												
		Installer Qualifications				X												
		Certificate	X															
27 51 29		Emergency Responder Radio Coverage System (ERRCS)																
	1.4	Product Data							X									
		Shop Drawings							X									
		Test Reports		X														
		Warranty				X												
		Installer Qualifications				X												
		Certificate	X															
		Maintenance Data			X													

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
27 53 20		Cable Television Distribution System															
	1.4	Product Data									X						
		Shop Drawings								X							
		Test Reports		X													
		Warranty					X										
28 00 00		Electronic Safety and Security Basic Requirements															
	1.3	Product Data										X					
		Shop Drawings								X							
		Test Reports		X													
		Warranty					X										
		Installer Qualifications					X										
		Certificate	X														
		Maintenance Data															
28 08 01		Commissioning and Testing of Security System															
	1.4	Product Data										X					
		Shop Drawings								X							
		Test Reports		X													
		Warranty					X										
		Installer Qualifications					X										
		Certificate	X														
		Maintenance Data			X												
28 10 00		Access Control and Intrusion Detection															
	1.4	Product Data										X					
		Shop Drawings								X							
		Test Reports		X													
		Warranty		X													
		Installer Qualifications					X										
		Certificate	X														
		Maintenance Data			X												
28 23 00		Video Surveillance															
	1.4	Product Data										X					
		Shop Drawings								X							
		Test Reports		X													
		Warranty					X										
		Installer Qualifications					X										
		Certificate	X														
		Maintenance Data			X												
28 31 00		Fire Detection and Alarm															
	1.4	Product Data										X					
		Shop Drawings								X							
		Test Reports		X													
		Record of Completion					X										
		Operation and Maintenance Data			X												
		Warranty					X										
		Installer Qualifications					X										
		Battery Calculations		X													
		Voltage Drop Calculations		X													
		Designer Qualifications		X													
31 23 16		Structure Excavation															
	1.4	Engineered Fill Materials	X														
		Inspection and Compaction Testing Reports	X														
31 23 33		Utility Trenching And Backfilling															
	1.4	Product Data										X					
31 30 00		Earthwork And Grading															
	1.4	Product Data										X					
32 12 16		Asphalt Paving															

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:					303051					(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:					SAMO Rebuild Paramount Ranch					ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SUBMITTAL			REQUIREMENTS (Indicate with X)														
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
	1.4	Job Mix Design							X								
	1.4	Product Data							X								
32 13 13		Concrete Paving															
	1.4	Product Data							X								
		Test for Compressive Strength	X														
	1.5	Certification of Mix Design	X														
		Mock-up													X		
32 15 00		Aggregate Surfacing															
	1.5	Product Data							X								
		Samples						X									
		Test Reports	X														
	1.6	Installer Qualifications					X										
		Mock-up													X		
32 33 00		Site Furnishings															
	1.3	Product Data								X							
		Shop Drawings							X								
		Samples						X									
	1.4	Manufacturer's Qualification					X										
32 84 00		Planting Irrigation															
	1.4	Material List													X		
		Operation Manuals				X											
		Record Drawings					X										
		Controller Plan					X										
		Maintenance Material					X										
32 91 13		Soil Preparation															
	1.3	Product Data													X		
		Soil Test Reports	X														
32 93 00		Planting															
		Product Data													X		
		Samples						X									
32 98 13		Landscape Establishment															
	1.2	Schedule		X													
		Report of Chemicals Used		X													
		Application Instructions				X											
		Closeout Documentation					X										
33 14 16		Water Utilities For Potable And Non-Potable Systems															
	1.4	Product Data - Pipe and Fittings													X		
		Product Data - Valves													X		
		Product Data - Backflow Prevention Assembly													X		
		Product Data - Fire Hydrants													X		
		Product Data - Restraint Systems													X		
	1.4	Fire Shop Drawings								X							
	1.4	Hydrostatic Test Reports		X													
33 30 00		Sanitary Sewer															
	1.4	Product Data - Gravity Pipe and Fittings													X		
		Product Data - Flexible Couplings													X		
		Product Data - Cleanouts													X		
		Product Data - Maintenance Holes													X		
		Product Data - Cast-in-Place Concrete							X								
	3.5	Video Inspection														X	
33 40 00		Storm Drainage Utilities															
	1.4	Product Data - Gravity Pipe and Fittings													X		
		Product Data - Cleanouts													X		
		Product Data - Catch Basins and Junction Boxes													X		
		Product Data - Cast-in-Place Concrete													X		
		Shop Drawings								X							
	3.5	Testing		X													
		Video Inspection					X										

SUBMITTAL LIST										ACTION SUBMITTAL REVIEW ESTIMATE							
Park Acronym/Project Management Information System (PMIS) Number:						303051				(Complete this portion for Architect / Engineer (A/E) construction service task order negotiation.)							
Project Title:						SAMO Rebuild Paramount Ranch											
SUBMITTAL			REQUIREMENTS (Indicate with X)							ARCHITECT / ENGINEER REVIEW TIME (Indicate in whole or partial hours.)							
SPECIFICATION SECTION	PARAGRAPH NUMBER	DESCRIPTION	INFORMATIONAL				ACTION				ARCHITECT	CIVIL ENGINEER	STRUCTURAL ENGINEER	MECHANICAL ENGINEER	ELECTRICAL ENGINEER	PROJECT MANAGER COORDINATION	LANDSCAPE ARCHITECT
			CERTIFICATIONS OR LABORATORY TESTS	REPORTS OR CALCULATIONS OR PLAN	MANUFACTURER DATA AND INSTRUCTIONS	OTHER	SAMPLES	SHOP DRAWINGS	MANUFACTURER DATA AND INSTRUCTIONS	OTHER							
33 46 00		Subdrainage															
		Product Data - Perforated Pipe and Fittings									X						
		Product Data - Geotextile Fabric									X						
		Product Data - Drain Rock									X						
Total:										0	0	0	0	0	0	0	0

SECTION 01 35 13.22 – ARCHEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section consists of protecting archeological resources contained in soil deposits.

1.2 DEFINITIONS

- A. Archeological Resources: Archeological resources are physical evidences of past human activity, including evidences of effects of that activity on the environment. Archeological resources represent both prehistoric and historic time periods, found above and below ground and under water.
- B. Archeologically Sensitive Areas: Areas having potential to contain significant (National Register eligible) archeological resources. If National Register eligible or listed archeological resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with state historic preservation officer and, if necessary, associated American Indian tribes.
- C. Non-sensitive Areas: Areas with little potential of containing significant (National Register eligible) archeological resources.
- D. Archeological Monitor: Representative of Government designated to oversee construction activities that could disturb archeological resources.
- E. Archeological Resources Protection Act (ARPA) of 1979 (Public Law (P.L.) 96-95; 93 United States Statutes at Large (Stat.) 712): defines archeological resources as any material remains of past human life or activities that are of archeological interest and at least 100 years old; Section 4 of the statute describes the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archeological resource on Federal or Indian lands; the curatorial requirements of artifacts, and other materials excavated or removed.

1.3 SUBMITTALS

- A. Daily Work Schedule: Detail construction work in archeologically sensitive areas. Submit to Contracting Officer (CO) 30 days before start of ground disturbing site work.

1.4 QUALITY ASSURANCE

- A. At least one week before on-site work begins, Contractor shall meet with Contracting Officer and Archeological Monitor to discuss Daily Work Schedule, equipment, and special methods used in archeologically sensitive areas. Contractor shall ensure approved Daily Work Schedule is followed throughout construction.

PART 2 - PRODUCTS

2.1 DAILY WORK SCHEDULE

- A. Daily Work Schedule is required for work occurring within archeologically sensitive areas. Include all work that is to occur within the area and key the schedule to the drawings to include:
 - 1. Starting and ending dates of ground-disturbing construction.
 - 2. Locations of temporary facilities, such as barriers, field offices, staging areas, sanitary facilities, borrow pits, and haul and access roads.
 - 3. Types of construction, such as clearing, topsoil stripping, structure or trench excavation, landscaping, and post construction clean-up.
 - 4. Methods and equipment used for each type of construction.
 - 5. Plan for relocating work in the event of temporary work stoppages at each archeologically sensitive area

PART 3 - EXECUTION

3.1 BARRICADES

- A. Comply with requirements specified in Section 01 50 00 "Temporary Facilities and Controls."

3.2 ARCHEOLOGICAL INVESTIGATION BY NON-NPS PERSONNEL

- A. A permit is required for archeological investigations (e.g. excavation, shovel testing, coring, pedestrian survey, underwater archeology, rock art documentation, or other types of reconnaissance including archaeological monitoring of construction) carried out on parklands by non-National Park Service (NPS) personnel, unless carried out under a contract or a cooperative agreement specifically written for archeological investigations. Permits are issued under the Archaeological Resources Protection Act of 1979 (ARPA). The NPS does not issue a permit for archeological investigations carried out by NPS archeologists, or to archeologists working on NPS archeological projects under a contract or cooperative agreement.
- B. Applicants should submit a Permit Application (DI Form 1926 (Revision September 2004) Office of Management and Budget (OMB) Number (No.) 1024-0037, approved through 1/31/2008. Permit Application form is available, in PDF (portable document file) format, to the manager of the park in which they propose to work; or to the regional director, with a copy to the park manager.

3.3 OBSERVATION

- A. Archeological Monitor will observe ground-disturbing site work, including construction of temporary facilities, at archeologically sensitive areas, from a safe location mutually agreed on by Contractor and Monitor. As new ground is broken, Monitor will examine excavated materials, using construction layout centerline and perimeter staking as a reference point to record locations of findings.

3.4 DISCOVERY OF RESOURCES

- A. If Archeological Monitor discovers resources, immediate relocation of work to a non-sensitive area may be required for Monitor to identify and document resources and, if necessary, develop appropriate mitigation plan. While Archeological Monitor is documenting resources in sensitive areas, Contractor shall relocate work to non-sensitive areas where monitoring is not normally required.
- B. If resources are discovered while Archeological Monitor is absent, stop work immediately and report the discovery to the Contracting Officer.

3.5 WORK STOPPAGE

- A. Contractor shall plan, schedule, and execute work to prevent stoppages at one area from stopping all work at construction site.

END OF SECTION 01 35 13.22

SECTION 01 35 23 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes establishing an effective accident prevention program and providing a safe working environment for personnel and visitors.

1.2 SUBMITTALS

- A. Accident Prevention Plan (APP): Submit APP after contract award and before Pre-Construction conference. Contracting Officer (CO) will review proposed APP. If APP requires any revisions or corrections, Contractor shall resubmit Plan within 10 days. No progress payments will be made until the APP is accepted.

1.3 QUALITY ASSURANCE

- A. Comply with contract clauses "Accident Prevention" and "Permits and Responsibilities." In case of conflicts between Federal, State, and local safety and health requirements, the most stringent shall apply. Onsite equipment shall meet 29 CFR 1926 (Code of Federal Regulations) (Occupational Safety and Health Administration (OSHA)) requirements. Failure to comply with requirements of this section and related sections may result in suspension of work.
- B. Site Safety Supervisor:
 - 1. Designate authorized onsite representative for preparation and maintenance of the APP.
 - 2. Shall be responsible for:
 - a. Implementation and enforcement of the APP
 - b. Daily safety inspections
 - c. Conducting and documenting weekly and monthly safety meetings
 - d. Review of safety requirements at progress meetings
 - e. Compilation and maintenance of Safety Data Sheets (SDS) and safety reference materials
 - f. Tracking and resolution of safety violations
 - g. Site personnel and visitor compliance with site safety and health requirements and APP
 - h. Investigation and reporting of accidents and injuries
- C. Qualifications of Employees:
 - 1. Physically and able to perform their assigned duties in a safe manner.
 - 2. Do not allow employees whose ability or alertness is impaired because of prescription or illegal drug use, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury to perform work.

3. Provide operating instructions for equipment. Operators of vehicles, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, operating instructions, and be fully capable of operating such equipment. Retain copies of operator licenses and certifications onsite.

1.4 ACCIDENT REPORTING

- A. Reportable Accidents: Defined as: death, occupational disease, and/or traumatic injury to employees or the public; fires; and/or property damage by accident in excess of \$100.
 1. Notify Contracting Officer immediately in the event of a reportable accident.
 2. Fill out and forward an Accident/Property Damage Report Form (CM-22) to Contracting Officer within 7 days of a reportable accident. Obtain form from Contracting Officer.

1.5 RESOURCES

- A. COVID-19 (Coronavirus Disease 2019) information provided below is not intended to provide a complete analysis of requirements for Contractor and is provided as a courtesy.
 1. [Coronavirus.gov](https://www.cdc.gov/coronavirus/2019-ncov/index.html)
 2. Occupational Safety and Health Administration (United States Department of Labor) - [COVID-19](https://www.osha-slc.gov/covid-19/)
 3. Center for Disease Control (CDC)
 - a. [Get the Facts About Coronavirus](https://www.cdc.gov/media/releases/2020/s0407-covid-19-facts.html)
 - b. [What Construction Workers Need to Know about COVID-19](https://www.dhs.gov/what-construction-workers-need-know-about-covid-19)
 4. Federal Emergency Management Agency (FEMA) - [Coronavirus \(COVID-19\) Response](https://www.fema.gov/emergency-preparedness-response-recovery/coronavirus-covid-19-response)
 5. National Park Service (NPS) - [NPS Public Health Update](https://www.nps.gov/plan-your-visit/health-safety/nps-public-health-update)

PART 2 - PRODUCTS

2.1 ACCIDENT PREVENTION PLAN (APP)

- A. APP shall be written to comply with OSHA and project requirements (generic plan is not acceptable) including but not limited to:
 1. Name and qualifications of supervisor responsible to carry out program.
 2. Weekly and monthly safety meetings shall be documented with topics and attendees.
 3. First aid and rescue procedures.
 4. Job Hazard Analysis (JHA) for each major phase. List of hazards associated and methods proposed to provide for property protection and safety of the public, National Park Service personnel, and Contractor's employees. Include initial and continuing training.
 5. Planning for possible emergency situations, as detailed in Article 1.2. Such planning shall take nature of construction, site conditions, and degree of exposure of persons and property into consideration.
 6. Infectious Disease Preparedness:
 - a. Contractors are responsible for their employees' safety and the safety of job site visitors during the performance of this contract. We encourage Contractors to follow

guidance from the Department of Labor (DOL), Occupational Safety and Health Administration (OSHA), the Centers for Disease Control and Prevention (CDC), and all other applicable local, city, and state mandates. We encourage Contractors to develop policies for infection prevention and an Infectious Disease Preparedness and Response Plan.

- b. To the extent appropriate, Contractors should include the protective health and safety measures they intend to implement in any accident prevention or safety submittals required under this contract. These plans should contain preventive measures the Contractor intends to follow while performing work on government property as well as responsive and corrective actions to be taken if an employee exhibits symptoms or tests positive for contagion.
- c. Upon contract award, Contractors should communicate with Contracting Officer regarding Contractor decisions and actions to protect the health and safety of workers for the duration of contract performance under which pandemic conditions exist.

2.2 FIRST AID FACILITIES

- A. Provide adequate facilities for number of employees and appropriate to construction hazards.

2.3 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

- A. Selection shall conform to OSHA Subpart E.

PART 3 - EXECUTION

3.1 DAILY SAFETY INSPECTIONS

- A. Conduct daily safety inspections and maintain daily safety reports which include:
 - 1. Area/operation inspected
 - 2. Date of inspection
 - 3. Identified hazards
 - 4. Corrective actions taken

3.2 EMERGENCY INSTRUCTIONS

- A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at work site.

3.3 FIRE AND LIFE SAFETY

- A. Comply with requirements of National Fire Protection Association (NFPA) 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).

3.4 HAZARDOUS MATERIALS

- A. Hazardous materials: Explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.
- B. Store hazardous materials in accordance with manufacturer's and OSHA Subpart D requirements. Maintain Safety Data Sheets (SDS) for each chemical readily available on site.
 - 1. Immediately report spills of hazardous materials to the Park.
 - 2. Maintain a spill emergency response kit.
 - 3. Train employees how to respond to a spill and use emergency response kit.

3.5 PROTECTIVE EQUIPMENT

- A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair personal items as appropriate before issuing to another individual.

3.6 SAFETY MEETINGS

- A. As a minimum, conduct one weekly 15-minute "toolbox" safety meeting conducted by a foreman or supervisor and attended by construction personnel at worksite. Topics shall coincide with work scheduled for following week. Document and submit meeting minutes to Contracting Officer within one day after meeting.
- B. Conduct monthly safety meetings for personnel, contractors, and subcontractors performing work on the site. Notify Contracting Officer of meeting dates and times. Meetings shall be used to: review effectiveness of Contractor's safety effort; resolve current health and safety problems; provide a forum for planning safe construction activities, and for updating Accident Prevention Plan. Contracting Officers Representative will attend meetings and enter results of meetings into the daily log.

3.7 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

- A. A hard hat use area shall be designated by Contractor. Hard hat area shall be posted by Contractor in a manner satisfactory to Contracting Officer.
- B. It is Contractor's responsibility to require persons working on or visiting site to wear hard hats and PPE in good repair at all times. As a minimum, maintain six hard hats and other APP required equipment.

3.8 TRAINING

- A. First Aid: Provide training to personnel to ensure prompt and efficient first aid.
- B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage.

END OF SECTION 01 35 23

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements. Quality of work shall be responsibility of the Contractor.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with Contract Document requirements.
- C. See Divisions 2 through 49 Sections for specific test and inspection requirements. All testing and inspection is the responsibility of the Contractor.

1.2 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the work to evaluate actual products incorporated into the work and completed construction comply with requirements.
- C. Mockups: Full-size physical assemblies constructed on-site. Mockups are constructed from selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Approved mockups establish the standard by which the Work will be judged, unless otherwise indicated.
- D. Preconstruction Testing: Tests and inspections performed specifically for project before products and materials are incorporated into work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections performed by a Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or a testing agency qualified to conduct product testing, to establish product performance and compliance with industry standards.
- F. Source Quality Control Testing: Tests and inspections performed at the source, i.e., plant, mill, factory, or shop.

- G. Field Quality Control Testing: Tests and inspections performed on-site for installation of work and for completed work.
- H. Testing Agency or Laboratory: Entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.

1.3 CONFLICTING REQUIREMENTS

- A. Reference Standards: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer before proceeding.
- B. Minimum Quality Levels: Quality level shown or specified shall be minimum provided or performed. Actual installation may comply exactly with minimum quality specified, or it may exceed minimum within reasonable limits. To comply with requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Contracting Officer before proceeding.

1.4 SUBMITTALS

- A. Quality Control Plan:
 - 1. After contract award and before Pre-Construction conference, submit a written Contractor Quality Control (CQC) plan.
 - 2. If plan requires revisions or corrections, Contractor shall resubmit plan within 10 days.
 - 3. Government reserves the right to require changes in plan during contract period as necessary to obtain the quality specified.
 - 4. No change in the approved plan may be made without written concurrence by Contracting Officer.
- B. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in form of a recent report on inspection of testing agency by a recognized authority.
- C. Contractor Quality Control (CQC) Daily Reports: Submit showing inspections and tests on first workday following date covered by report. Quality Control Supervisor shall utilize [DSC Forms](#).
 - 1. Review Construction Management Representative (CMR) Daily report if applicable and reconcile any differences prior to posting.

D. Test Reports

1. Test reports shall be completed by person performing test.
2. Submit Daily Test Information Sheets with Quality Control Daily Reports.
3. Submit failing test results and proposed remedial actions within four hours of noted deficiency.
4. Submit three copies of complete test results no later than one calendar day after test was performed.

E. Accessibility Inspection Report:

1. Fill out applicable sections of the Accessibility Inspection Report and attach to Contractor Quality Control Daily Report.
2. Utilize attached Accessibility Inspection form to document compliance with Architectural Barriers Act Accessibility Standards (ABAAS).
3. Inspect at various stages of construction as needed to ensure finished product meets standards.
4. Submit report no later than one calendar day after inspection was performed.

F. Off-Site Inspection Reports: Submit prior to shipment.

G. If Contractor Quality Control plan and Quality Control Daily Reports are not submitted as specified, Contracting Officer may retain payments until such time plan(s) is/are accepted and implemented, or may retain payments for work completed on days with no Quality Control Daily Reports.

H. Permits, Licenses, and Certificates: For National Park Service (NPS) records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Contractors Quality Control Staff:

1. Contractor's Quality Control Supervisor shall be assigned no other duties.
2. Contractor's designated Quality Control Supervisor shall be on the project site whenever contract work is in progress.
3. Contractor's job supervisory staff may be used to assist Quality Control Supervisor supplemented, as necessary, by additional certified testing technicians.

C. Installer Qualifications: Firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent indicated for Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: Firm experienced in manufacturing products or systems similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- E. Fabricator Qualifications: Firm experienced in producing products similar to those indicated for Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- F. Professional Engineer Qualifications: Professional engineer legally qualified to practice in jurisdiction where Project is located and is experienced in providing engineering services of kind indicated (including Structural Tests and Special Inspections (STSI)). Engineering services are defined as those performed for installations of system, assembly, or products similar to those indicated for Project in material, design, and extent.
- G. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing Work.
- H. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), a National Voluntary Laboratory Accreditation Program (NVLAP), or an independent agency with experience and capability to conduct testing and inspecting indicated, according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by Contract, is acceptable to Contracting Officer.
 - 1. Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7 (Code of Federal Regulations).
 - 2. National Voluntary Laboratory Accreditation Program (NVLAP): Testing agency accredited according to National Institute of Standards and Technology's (NIST) National Voluntary Laboratory Accreditation Program.
 - 3. Measuring devices, laboratory equipment, and instruments shall be calibrated at established intervals against certified standards in accordance with NIST requirements. Measuring and testing devices shall be made available for use by Government for verification tests.
- I. Factory-Authorized Service Representative Qualifications: Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products similar in material, design, and extent to those indicated for Project.
- J. Mockups: Before installing portions of work requiring mockups, build mockups for each form of construction and finish required to comply with following requirements, using materials indicated for completed work:
 - 1. Build mockups in location and of size indicated; if not indicated, as directed by Contracting Officer.
 - 2. Notify Contracting Officer 14 days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate proposed range of aesthetic effects and workmanship.
 - 4. Obtain Contracting Officer's approval of mockups before starting work, fabrication, or construction.
 - 5. Maintain mockups in an undisturbed condition as a standard for judging the completed work.
 - 6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

- A. Contractor is responsible for testing and inspections, including Structural Tests and Special Inspections (STSI), as identified in attached STSI. Inspect and test work as needed to ensure quality of materials, workmanship, construction, finish, and functional performance are in compliance with applicable specifications, drawings, and those required by the Building Code.
 - 1. Engage qualified testing agency to perform quality-control services.
 - 2. Submit appropriate report for each quality-control service.
 - 3. Testing and inspecting requested by Contractor and not required by Contract Documents are Contractor's responsibility.
 - 4. Contracting Officer may designate test locations.
- B. Manufacturer's Field Services: Where indicated, engage factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction of replaced work that failed to comply with Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with NPS and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Contracting Officer and Contractor promptly of irregularities or deficiencies observed in work during performance of services.
 - 2. Determine location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections, State in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit 3 copies of certified written report of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of Work.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide:
 - 1. Access to Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for material mixes that require control by testing agency.
 - 7. Security and protection for samples and testing and inspecting equipment at Project site.

- F. Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with minimum delay and to avoid removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 QUALITY CONTROL PLAN

- A. Quality Control Plan shall include:
 - 1. List of personnel responsible for quality control and assigned duties. Include each person's qualifications. Include alternate(s) and qualifications.
 - 2. Copy of letter of direction to Contractor's Quality Control Supervisor(s) outlining assigned duties and authorities designated by principal or owner.
 - 3. Names, qualifications / accreditations, and descriptions of laboratories to perform sampling and testing, and samples of proposed report forms from laboratories.
 - 4. Methods of performing, documenting, and enforcing quality control of work including Contractor report forms and acknowledgment of NPS forms.
 - 5. Methods of monitoring and controlling environmental pollution and contamination as required by regulations and laws.
 - 6. Specific discussion regarding mockups, off-site visits, receiving inspections, manufacturers representation, startup requirements, and other aspects of performance specific to Project.
 - 7. Provisions for substantial completion(s) and final inspection(s) per Contract.

PART 3 - EXECUTION

3.1 OFF-SITE CONTROL

- A. Items fabricated or assembled off-site shall be inspected for quality control at place of fabrication.

3.2 ON-SITE CONTROL

- A. Notification:
 - 1. Notify Contracting Officer at least 48 hours in advance of preparatory phase meeting.
 - 2. Notify Contracting Officer at least 24 hours in advance of initial and follow-up phases.
- B. Preparatory Phase: Perform before beginning each feature of work.
 - 1. Review control submittal requirements with personnel directly responsible for quality assurance and quantity control of the work. As a minimum, Contractor's Quality Control Supervisor and foreman responsible for feature of work shall be in attendance.
 - 2. Review applicable specifications sections and drawings related to feature of work.

3. Ensure copies of referenced standards related to sampling, testing, and execution for feature of work are available on site.
4. Ensure provisions have been made for field control testing.
5. Examine work area to ensure preliminary work has been completed.
6. Verify field dimensions and advise Contracting Officer of discrepancies with contract documents.
7. Ensure necessary equipment and materials are at project site and they comply with approved shop drawings and submittals.
8. Document preparatory phase activities and discussions on Contractor's Quality Control Daily Report.

C. Initial Phase:

1. As soon as work begins, inspect and test representative portion of particular feature of work for quality of workmanship.
2. Review control testing procedures to ensure compliance with contract requirements.
3. Document initial phase activities and discussions on Contractor's Quality Control Daily Report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

D. Follow-Up Phase: Inspect and test as work progresses to ensure compliance with contract requirements until completion of work.

E. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be required on same feature of work for following reasons:

1. Quality of on-going work is unacceptable.
2. Changes in quality control staff, on-site production supervision, or work crew.
3. Work on particular feature of work is resumed after substantial period of inactivity.

3.3 DOCUMENTATION

- A. Maintain Quality Control Daily Reports, Daily Test Report Information Sheets, and Accessibility Inspection Reports of quality control activities and tests. (Download from DSC Workflows website > Forms/Templates/Samples/Guidelines page > [Construction Forms](#) section.)
- B. Quality Control Daily Reports shall not be substituted for other written reports required under clauses of contract, such as Disputes, Differing Site Conditions, or Changes.

3.4 ENFORCEMENT

- A. Contractor shall stop work on any item or feature pending satisfactory correction of deficiency noted by quality control staff or Contracting Officer.

3.5 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams as invisible as possible.
 2. Comply with Contract Document requirements for Section 01 73 29 "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 ENVIRONMENTAL DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.
- B. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.
 - 1. Biobased content: Amount of biobased carbon in the material or product as a percentage of weight (mass) of total organic carbon in the material or product.
- C. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.
- D. Deconstruction: Disassembly of buildings for purpose of recovering materials.
- E. DFE (Design for the Environment): A technique that includes elements of resource conservation and pollution prevention as applied in various product sectors. A technique that incorporates approaches which are part of product (or assembly) concept, need and design. Considerations involve material selection, material and energy efficiency, reuse, maintainability and design for disassembly and recyclability. Refer to International Organization for Standardization (ISO) Guide 64 for additional clarification.
- F. Environmentally preferable products: Products and services that have a lesser or reduced effect on the environment in comparison to conventional products and services. Refer to EPA's Final Guidance on [Environmentally Preferable Purchasing Program](#).
- G. Non-Renewable Resource: A resource that exists in a fixed amount that cannot be replenished on a human time scale. Non-renewable resources have potential for renewal only by geological, physical, and chemical processes taking place over of millions of years. Examples include iron ore, coal, and oil.
- H. Perpetual Resource: A resource that is virtually inexhaustible on a human time scale. Examples include solar energy, tidal energy, and wind energy.
- I. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent Federal Trade Commission (FTC) Guide for Use of Environmental Marketing Claims.

- J. Renewable Resource: A resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource. A renewable resource can be exhausted if improperly managed. However, a renewable resource can last indefinitely with proper stewardship. Examples include trees in forests, grasses in grasslands, and fertile soil.

1.2 QUALITY ASSURANCE

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where compliance with two or more standards is specified, and standards may establish different or conflicting requirements for minimum quantities or quality levels, comply with most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Contracting Officer (CO) for decision before proceeding.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents to the extent referenced. Such standards are made a part of Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities found in Section 01 42 00 Sources for Reference Publications, [Unified Facilities Guide Specifications](#) (UFGS) (accessible via [Masters](#) website > Downloads section > click on UFGS Master (WBDG Website). Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

XX EXAMPLE Association (The)
 www.EXAMPLE.org

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in following list. Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. icc-es.org	(800) 423-6587 (562) 699-0543

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in following list. Names, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABA & ABAAS United States Access Board	Architectural Barriers Act (ABA) Architectural Barriers Act Accessibility Standards (ABAAS) www.access-board.gov
CoE	Army Corps of Engineers www.usace.army.mil
CPSC	Consumer Product Safety Commission www.cpsc.gov
DOC	Department of Commerce www.commerce.gov
DOD	Department of Defense www.defense.gov
DOJ	Department of Justice www.justice.gov
DOE	Department of Energy www.energy.gov
EPA	Environmental Protection Agency www.epa.gov
FAA	Federal Aviation Administration www.faa.gov

FCC	Federal Communications Commission www.fcc.gov
FDA	Food and Drug Administration www.fda.gov
GSA	General Services Administration www.gsa.gov
HUD	Department of Housing and Urban Development www.hud.gov
LBL	Lawrence Berkeley National Laboratory www.lbl.gov
NCHRP	National Cooperative Highway Research Program (See TRB (Transportation Resource Board))
NIST	National Institute of Standards and Technology www.nist.gov
OSHA	Occupational Safety & Health Administration www.osha.gov
PHS	U.S. Department of Health and Human Services www.hhs.gov
RUS	Rural Utilities Service (See USDA (Department of Agriculture))
SD	State Department www.state.gov
TRB	Transportation Research Board www.nationalacademies.org/trb/transportation-research-board
USDA	Department of Agriculture www.usda.gov
USP	U.S. Pharmacopeia www.usp.org
USPS	Postal Service www.usps.com

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in following list. Names, telephone numbers, and websites are subject to change and are believed to be accurate and up-to-date as of date of Contract Documents.

ABAAS	Architectural Barriers Act Accessibility Standards www.access-board.gov
CFR	Code of Federal Regulations Available from Government Printing Office www.govinfo.gov/app/collection/cfr
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
DSCC	Defense Supply Center Columbus (See FS (Federal Specification))
FED-STD	Federal Standard (See FS (Federal Specification))
FS	Federal Specification Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/ Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences www.nibs.org
FTMS	Federal Test Method Standard (See FS (Federal Specification))
MIL	(See MILSPEC (Military Specification and Standards))
MIL-STD	(See MILSPEC (Military Specification and Standards))
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point www.dsp.dla.mil/Specs-Standards/
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-aba-standards/ufas <i>(UFAS is only for housing projects per Fair Housing Act. See also the Fair Housing Act Design Manual, www.huduser.gov/portal/publications/destech/fairhousing)</i>

1.5 ENVIRONMENTAL REFERENCE STANDARDS

A. American Forest and Paper Association:

1. Sustainable Forestry Initiative

B. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):

- ASHRAE 52.2, *Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size*
 - ASHRAE 55, *Thermal Environmental Conditions for Human Occupancy*
 - ASHRAE 62.1, *Ventilation for Acceptable Indoor Air Quality*
 - ASHRAE/IESNA 90.1, *Energy Standard for Buildings, Except Low-Rise Residential Buildings*
- C. American Association of State Highway and Transportation Officials (AASHTO):
- M288 Geotextile Specification for Highway Applications
 - MP009-06 Standard Specification for Compost for Erosion/Sediment Control (Filter Berms and Filter Socks)
 - MP010-03 Standard Specification for Compost for Erosion/Sediment Control (Compost Blankets)
- D. American Society for Testing and Materials International (ASTM):
- A478 Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
 - A580/A580M Standard Specification for Stainless Steel Wire
 - A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
 - C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
 - C128 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
 - C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - C1319 Standard Specification for Concrete Grid Paving Units
 - C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - C1371 Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
 - C1386 Standard Specification for Precast Autoclaved AERATED Concrete (PAAC) Wall Construction Units
 - C1483 Standard Specification for Exterior Solar Radiation Control Coatings on Buildings
 - C1549 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
 - C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces
 - C289 Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
 - C311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
 - C33 Standard Specification for Concrete Aggregates
 - C593 Standard Specification for Fly Ash and Other Pozzolans for Use With Lime
 - C595 Standard Specification for Blended Hydraulic Cements
 - C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

- C67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- C739 Standard Specification for Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
- C936 Standard Specification for Interlocking Concrete Paver Units
- C989 Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
- D1435 Standard Practice for Outdoor Weathering of Plastics
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 foot pound force per cubic foot (ft-lbf/ft³) (2,700 kilonewton meter per cubic meter (kN-m/m³))
- D1972 Standard Practice for Generic Marking of Plastic Products
- D198 Standard Test Methods of Static Tests of Lumber in Structural Sizes
- D2103 Standard Specification for Polyethylene Film and Sheeting
- D217 Standard Test Methods for Cone Penetration of Lubricating Grease
- D2369 Standard Test Method for Volatile Content of Coatings
- D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
- D3792 Standard Test Method for Water Content of Coatings by Direct Injection Into a Gas Chromatograph
- D3864 Standard Guide for Continual On-Line Monitoring Systems for Water Analysis
- D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4017 Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method
- D4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
- D4444 Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters
- D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- D4552 Standard Practice for Classifying Hot-Mix Recycling Agents
- D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- D4716 Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Product
- D4840 Standard Guide for Sampling Chain-of-Custody Procedures
- D4887 Standard Test Method for Preparation of Viscosity Blends for Hot Recycled Bituminous Materials
- D5106 Standard Specification for Steel Slag Aggregates for Bituminous Paving Mixtures
- D5116 Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products
- D5199 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
- D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- D5268 Standard Specification for Topsoil Used for Landscaping Purposes
- D5359 Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
- D5505 Standard Practice for Classifying Emulsified Recycling Agents
- D5509 Standard Practice for Exposing Plastics to a Simulated Compost Environment

- D5512 Standard Practice for Exposing Plastics to a Simulated Compost Environment Using an Externally Heated Reactor
- D5539 Standard Specification for Seed Starter Mix
- D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations
- D5603 Standard Classification for Rubber Compounding Materials—Recycled Vulcanizate Particulate Rubber
- D5663 Standard Guide for Validating Recycled Content in Packaging Paper and Paperboard
- D5759 Standard Guide for Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
- D5792 Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
- D5834 Standard Guide for Source Reduction Reuse, Recycling, and Disposal of Solid and Corrugated Fiberboard (Cardboard)
- D5851 Standard Guide for Planning and Implementing a Water Monitoring Program
- D5852 Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method
- D6002 Standard Guide for Assessing the Compostability of Environmentally Degradable Plastics
- D6006 Standard Guide for Assessing Biodegradability of Hydraulic Fluid
- D6007 Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber
- D6046 Standard Classification of Hydraulic Fluids for Environmental Impact
- D6081 Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation
- D6108 Standard Test Method for Compressive Properties of Plastic Lumber and Shapes
- D6109 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber
- D6112 Standard Test Methods for Compressive and Flexural creep and Creep-Rupture of Plastic Lumber and Shapes
- D6117 Standard Test Methods for Mechanical Fasteners In Plastic Lumber and Shapes
- D6155 Standard Specification for Nontraditional Coarse Aggregates for Bituminous Paving Mixtures
- D6245 Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
- D6261 Standard Specification for Extruded and Compression Molded Basic Shapes Made from Thermoplastic Polyester (TPES)
- D6262 Standard Specification for Extruded, Compression Molded, and Injection Molded Basic Shapes of Poly(aryl ether ketone) (PAEK)
- D6270 Standard Practice for Use of Scrap Tires in Civil Engineering Applications
- D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers
- D6330 Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using Small Environmental Chambers Under Defined Test Conditions
- D6345 Standard Guide for Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air
- D6400 Standard Specification for Compostable Plastics

- D6435 Standard Test Method for Shear Properties of Plastic Lumber and Plastic Lumber Shapes
- D6629 Standard Guide for Selection of Methods for Estimating Soil Loss by Erosion
- D6662 Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards
- D6712 Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes
- D6886 Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography
- D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
- D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))
- D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
- E1021 Standard Test Methods for Measuring Spectral Response of Photovoltaic Cells
- E1038 Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls
- E1039 Standard Test Method for Calibration of Silicon Non-Concentrator Photovoltaic Primary Reference Cells Under Global Irradiation
- E1040 Standard Specification for Physical Characteristics of Nonconcentrator Terrestrial Photovoltaic Reference Cells
- E1105 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
- E1171 Standard Test Method for Photovoltaic Modules in Cyclic Temperature and Humidity Environments
- E1333 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Under Defined Test Conditions Using a Large Chamber
- E1362 Standard Test Method for Calibration of Non-Concentrator Photovoltaic Secondary Reference Cells
- E1433 Standard Guide for Selection of Standards on Environmental Acoustics
- E1462 Standard Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules
- E1596 Standard Test Methods for Solar Radiation Weathering of Photovoltaic Modules
- E1597 Standard Test Method for Saltwater Pressure Immersion and Temperature Testing of Photovoltaic Modules for Marine Environments
- E1609 Standard Guide for Development and Implementation of a Pollution Prevention Program
- E1686 Standard Guide for Selection of Environmental Noise Measurements and Criteria
- E1690 Standard Test Method for Determination of Ethanol Extractives in Biomass
- E1721 Standard Test Method for Determination of Acid-Insoluble Residue in Biomass
- E1755 Standard Test Method for Ash in Biomass
- E1758 Standard Test Method for Determination of Carbohydrates in Biomass by High Performance Liquid Chromatography
- E1780 Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source
- E1799 Standard Practice for Visual Inspections of Photovoltaic Modules

- E1802 Standard Test Methods for Wet Insulation Integrity Testing of Photovoltaic Modules
- E1821 Standard Test Method for Determination of Carbohydrates in Biomass by Gas Chromatography
- E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
- E1830 Standard Test Methods for Determining Mechanical Integrity of Photovoltaic Modules
- E1861 Standard Guide for Use of Coal Combustion By-Products in Structural Fills
- E1918 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- E1971 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
- E1980 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- E1991 Standard Guide for Environmental Life Cycle Assessment of Building Materials/Products
- E2047 Standard Test Method for Wet Insulation Integrity Testing of Photovoltaic Arrays
- E2114 Standard Terminology for Sustainability Relative to the Performance of Buildings
- E2128 Standard Guide for Evaluating Water Leakage of Building Walls
- E2129 Standard Practice for Data Collection for Sustainability Assessment of Building Products
- E2397 Standard Practice for Determination of Dead Loads and Live Loads associated with Green Roof Systems
- E2398 Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems
- E2399 Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems
- E2400 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems
- E241 Standard Guide for Limiting Water-Induced Damage to Buildings
- E2432 Standard Guide for General Principles of Sustainability Relative to Buildings
- E408 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- E413 Standard Classification for Rating Sound Insulation
- E477 Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers
- E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
- E683 Standard Practice for Installation and Service of Solar Space Heating Systems for One- and Two-Family Dwellings
- E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- E781 Standard Practice for Evaluating Absorptive Solar Receiver Materials When Exposed to Conditions Simulating Stagnation in Solar Collectors With Cover Plates
- E782 Standard Practice for Exposure of Cover Materials for Solar Collectors to Natural Weathering Under Conditions Simulating Operational Mode
- E823 Standard Practice for Nonoperational Exposure and Inspection of a Solar Collector
- E881 Standard Practice for Exposure of Solar Collector Cover Materials to Natural Weathering Under Conditions Simulating Stagnation Mode

- E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - E903 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
 - E948 Standard Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight
 - F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - F2034 Standard Specification for Sheet Linoleum Floor Covering
 - F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- E. Bat Conservation International:
- Bat Approved Bat Houses
- F. Carpet and Rug Institute
- Green Label & Green Label Plus Testing Programs, carpet-rug.org/testing/green-label-plus
- G. Center for Resource Solutions
- Green-e program
- H. Environmental Protection Agency (EPA):
- Comprehensive Procurement Guidelines
 - ENERGY STAR
 - Environmentally Preferable Purchasing Program Final Guidance
 - GreenScapes program
 - Heat Island Initiative
 - Indoor Air Quality Building Education and Assessment Model (I-BEAM)
 - National Environmental Performance Track
 - Pollution Prevention (P2)
 - Product Stewardship Program
 - Significant New Alternatives Policy (SNAP) Program
- I. Federal Trade Commission:
- Guide for the Use of Environmental Marketing Claims
- J. Forest Stewardship Council:
- Chain-Of-Custody
 - Forest Management
- K. Green Building Initiative (GBI):
- Green Globes - US
- L. Green Seal:
- GC-03 Anti-Corrosive Paints
 - GC-12 Occupancy Sensors
 - GC-13 Split-Ductless Air-Source Heat Pumps
 - GS-05 Compact Fluorescent Lamps

- GS-11 Paints
 - GS-13 Windows
 - GS-14 Window Films
 - GS-31 Electric Chillers
 - GS-32 Photovoltaic Modules
 - GS-36 Commercial Adhesives
 - GS-37 Industrial & Institutional Cleaners
- M. International Iron and Steel Institute:
- CO2 Breakthrough Program
- N. International Organization of Standardization:
- Guide 64; Guide for Inclusion of Environmental Aspects in Product Standards
 - 9660 Information processing -- Volume and file structure of CD-ROM for information interchange
 - 14001 Environmental management systems – Specification with guidance for use
 - 14004 Environmental Management Systems – General Guidelines on Principles, Systems and Supporting Techniques
 - 14020 Environmental labels and declarations – General principles
 - 14024 Environmental labels and declarations – Type I environmental labelling - Principles and procedures
 - 14040 Environmental management – Life cycle assessment – Principles and framework
- O. National Association of Home Builders:
- Advanced Framing Techniques: Optimum Value Engineering
- P. National Institute of Building Sciences:
- MOIST program for transfer of heat and moisture
 - Whole Building Design Guide
- Q. National Institute of Standards and Technology:
- BEES (Building for Environmental and Economic Sustainability) Lifecycle Decision Support Tool
- R. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
- IAQ Guidelines for Occupied Buildings Under Construction
- S. Southcoast Air Quality Management District:
- 1168 Adhesive And Sealant Applications
- T. US Composting Council:
- Seal of Testing Assurance Program
- U. US Department of Agriculture:
- Biobased Products – Definitions and Descriptions
- V. US Green Building Council:
- LEED™ 2009 Green Building Rating System
 - LEED™ v4 (version 4) Green Building Rating System

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Contracting Officer (CO), permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in Contract Sum as required.
- B. Water Service: Nonpotable water is available from existing water system east of Medea Creek from A hydrant southwest of the existing restroom building that can be used to fill trucks or trailers without metering and without payment of use charges.
- C. Electric Power Service: Electric power from existing system is not available for use.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with National Electrical Contractors Association (NECA), National Electrical Manufacturers Association (NEMA), and Underwriter Laboratories (UL) standards and regulations for temporary electric service. Install service to comply with National Fire Protection Association (NFPA) 70.
- B. Environmental Protection: Provide environmental protection as required by agency(ies) with jurisdiction and as indicated in Contract Documents. Coordinate with requirements of the following:
 - 1. Regulatory Requirements
 - 2. Indoor Air Quality (IAQ) Management
 - 3. Noise and Acoustics Management
 - 4. Environmental Management
 - 5. Construction Waste Management
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States (U.S.) Architectural & Transportation Barriers Compliance Board's Architectural Barriers Act Accessibility Standard (ABAAS) Accessibility Guidelines.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary materials may be new or used, but must be adequate in capacity for required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- B. Portable Chain-Link Fencing: Minimum 2 inch (50 millimeters), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 millimeters) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 millimeters) OD line posts and 2-7/8 inch (73 millimeters) OD corner and pull posts, with 1-5/8 inch (42 millimeters) OD top and bottom rails. Provide concrete bases for supporting posts.
- C. Safety Barrier Fence: Orange plastic fence, minimum height, 4 feet.
- D. Barrier Tape: Yellow tape Imprinted with "CAUTION: CONSTRUCTION AREA," manufactured by Reef Industries, Inc., Houston, Texas, or approved equal.
- E. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."
- F. Gypsum Board: Minimum 1/2 inch (12.7 millimeters) thick by 48 inches (1219 millimeters) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- H. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25-millimeter) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- I. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 millimeters).

2.2 TEMPORARY FACILITIES

- A. Field Office: The NPS will provide office space for the Contractor's use at the Longhorn Building, Paramount Ranch, 2903 Cornell Road, Agoura Hills, CA.
- B. Storage and Fabrication Sheds: Temporary weather tight sheds or other covered facilities for storage of materials subject to weather damage. Number and size of structures shall be subject to Contracting Officer's approval.

- C. Toilets: Sufficiently lighted and ventilated toilet facilities in weatherproof, sight proof, handicap accessible, sturdy enclosures with privacy locks.

- 1. Provide separate toilet facilities for men and women.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating, Ventilation, and Air Conditioning (HVAC) Equipment: Unless Contracting Officer authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to agency(ies) with jurisdiction, and marked for intended use.
- C. Direct Digital Control (DDC) Internet Connection: Furnish, install and maintain a high-speed connection (Digital Subscriber Line (DSL) or similar) between the project's DDC system and the internet through a Contractor furnished internet service provider. Contractor is responsible for maintenance of this connection and costs associated with internet service provider through warranty period of this contract. Upon completion of warranty period, service shall be transferable to the Government at which time future costs for connection will no longer be the responsibility of Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, NPS, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Acquire necessary permits.
- B. Storm Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

- C. Non-potable water for construction is not available within the park boundaries. Contractor shall furnish non-potable water from a source outside park boundary. Nonpotable water is available is available at Paramount Ranch, 2903 Cornell Road, Agoura Hills, CA to fill trucks or trailers.
- D. Potable water is not available on site. Furnish cool, potable water for construction personnel in locations convenient to work stations.
- E. Sanitary Facilities: Provide temporary toilets, and wash facilities for use by construction personnel.
 - 1. Place in approved locations secluded from public observation and convenient to work stations. Relocate as work progress requires.
 - 2. Maintain and clean toilet facilities at least weekly.
 - 3. Completely remove sanitary facilities on completion of work.
- F. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. Use of permanent heating system will not be allowed without written authorization from Contracting Officer. When the permanent heating system is approved for use as temporary heating, pay costs until final acceptance. Permanent heating system shall be sufficiently complete, including controls, to permit safe operation
 - 2. Provide and maintain adequate approved facilities, as required for safety and construction requirements, during the work. Provide ample clearance around stoves, heaters, chimney and vent connections to prevent ignition of combustible material
 - 3. Install and maintain temporary filters when air handing equipment is used for temporary heating [and cooling]. Install new filters before final acceptance in addition to any extra sets of filters required. Clean coils as determined by Contracting Officer.
 - 4. Warranties for equipment used for temporary heating shall start on date of Final Acceptance.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead, unless otherwise indicated.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

- J. Telephone Service: No telephone service is available on site for Contractor's use. Make arrangements with Telephone Company and pay costs.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:

- 1. Provide incombustible construction for shops, and sheds located within construction area or within 50 feet of building lines. Comply with NFPA 241.
- 2. Maintain support facilities until near Substantial Completion. Remove structures, equipment, and furnishings, and terminate services after punch list is 100 percent completed or when directed by Contracting Officer. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Contracting Officer.

- B. Traffic Controls: Erect and maintain barricades, lights, danger signals, and warning signs in accordance with Manual on Uniform Traffic Control Devices (MUTCD), Part IV, latest edition.

- 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
- 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- 3. Illuminate barricades and obstructions at night; keep safety lights burning from sunset to sunrise.
- 4. Adequately barricade and post open cuts in or adjacent to thoroughfares.
- 5. Protect pedestrian traffic by guardrails or fences.
- 6. When pedestrian traffic is detoured onto a roadway, provide temporary walkways with protection as required at ends and overhead. For walkways, use lumber running parallel to direction of traffic movement and provide ramps at changes of elevation.
- 7. Cover pipes, hoses, and power lines crossing sidewalks and walkways with troughs using beveled edge boards.
- 8. Install Barrier Tape where directed by Contracting Officer. Keep a minimum of two rolls on site.

- C. Parking: Use existing parking areas designated by the Contracting Officer for construction personnel.

- D. Dewatering Facilities and Drains: Comply with requirements of the agency(ies) with jurisdiction. Maintain Project site, excavations, and construction free of water.

- 1. Dispose of rainwater in lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

- E. Project Identification and Temporary Signs: Provide Project identification and other signs. Fence, barricade, or otherwise block off the immediate work area to prevent unauthorized entry.

- 1. Provide temporary, directional signs for construction personnel and visitors.
- 2. Maintain and touchup signs so they are legible at all times.
- 3. Erect and maintain sufficient detour signs at road closures and along detour routes.

- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of agency(ies) with jurisdiction.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Cleaning of Equipment: Contractor shall ensure prior to moving on to Project Area, equipment, is free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds. Ensure equipment has been pressure washed and is free of exotic species. Equipment shall be considered free of soil, seeds, and other debris when visual inspection does not disclose such material. Disassembly of equipment components or specialized inspection tools are not required.
- C. Temporary Erosion and Sedimentation Control: Refer to Section 01 57 23 "Temporary Storm Water Pollution Prevention".
- D. Tree and Plant Protection: Refer to Section 01 11 00 "Summary of Work".
- E. Pest Control: Follow NPS requirements to minimize attraction and harboring of rodents, roaches, and other pests and perform extermination and control procedures at regular intervals so Project will be free of pests and residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install chain link fencing to prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Locate vehicular gates to avoid interference with traffic on public thoroughfares.
 - 3. Locate pedestrian entrance gates as required to provide controlled personnel entry.
 - 4. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Contracting Officer with one set of keys.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of Manual on Uniform Traffic Control Devices (MUTCD), part IV, 2003 edition for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Responsible Person: Capable and qualified person shall be placed in charge of fire protection. Responsibilities shall include locating and maintaining fire protective equipment and establishing and maintaining safe torch cutting and welding procedures.
2. Tobacco Use, Smoking, and Vaping: Smoking within buildings or temporary storage sheds is prohibited.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of NPS. Check with Park; many require "burn permits" for welding.
4. Develop and supervise overall fire-prevention and -protection program for personnel at Project Site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
5. Provide temporary standpipes and hoses for fire protection. Hang hoses with warning sign stating hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
6. Hazard Control: Take necessary precautions to prevent fire during construction. Do not store flammable or combustible liquids in buildings. Provide adequate ventilation during use of volatile or noxious substances.
7. Spark Arresters: Equip gasoline or diesel powered equipment used during periods of potential fire hazards or in potential forest and grass fire locations with spark arresters approved by United States Department of Agriculture (USDA) Forest Service.
 - a. Written determinations of periods and areas of potential fire hazard will be issued by Contracting Officer.
8. Buildings: Furnish a minimum of one extinguisher for each 1,500 square feet of area or major fraction thereof.
 - a. Travel distance from any work station to nearest extinguisher shall not exceed 75 feet.
9. Vehicles and Equipment: Provide one extinguisher on each vehicle or piece of equipment.
10. Service and Refueling Areas: Locate areas a minimum of 50 feet from buildings. Shut down equipment before refueling.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on 24-hour basis where required to achieve indicated results and avoid possibility of damage.

- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. NPS reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-in size, and 12 inches above the ground for trees larger than 4-inch size.
- B. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction as indicated on Drawings.
- C. Existing Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reason for pruning.
 - 4. Description of pruning to be performed.
 - 5. Description of maintenance following pruning.
- C. Qualification Data: For arborist and tree service firm.
- D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- F. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Preinstallation Conference: Conduct conference at Project site.
 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Enforcing requirements for protection zones.
 - c. Arborist's responsibilities.
 - d. Field quality control.

1.5 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 1. Storage of construction materials, debris, or excavated material.
 2. Moving or parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 - 1. Type: Ground or shredded bark
 - 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 - 3. Color: Natural.
- B. Protection-Zone Fencing: Fencing fixed in position and as described in 3.3 below.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain. This refers to all trees that are larger than 4" DBH with their canopy dripline or visible surface roots inside or within 5'-0" of the Limit of Work boundary, or as otherwise indicated on the plans. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
 - 1. Apply 3-inch average thickness of organic mulch, or as shown in Drawings. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin, in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to drives, or other vehicular circulation.

1. Install fencing as shown in Drawings.
 2. Posts: Use posts with above-grade T-shaped support system where feasible. Where necessary due to slopes, set or drive posts into ground one-third the total height of the fence (without concrete footings). Where a post needs to be located on existing paving or concrete to remain, provide T-shaped support system or other appropriate means of post support acceptable to Landscape Architect and Owner.
- B. Maintain protection zones free of weeds and trash.
- C. Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Landscape Architect and remove when construction operations are complete and equipment has been removed from the site.
1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.



3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312219 "Landscape Grading" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Cut ends: Do not paint cut root ends.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 312219 "Landscape Grading".
- B. Root Pruning at Edge of Protection Zone if excavation is required: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches 
1. Prune to remove only  broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning where indicated.
 - b. Specialty Pruning: Palm where indicated.
- B. Unless otherwise directed by arborist and acceptable to Landscape Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.

- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.
 - 1. Submit details of proposed root cutting, pruning and tree, shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Perform repairs or treat damaged trunks, branches, and roots according to arborist's written instructions within 24 hours.
 - 4. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
 - 5. Plant and maintain new vegetation as specified in Section 329300 "Planting."

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 01 57 19.11 – INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for Indoor Air Quality (IAQ) management during construction operations.
 - a. Control of emissions during construction.
 - b. Moisture control during construction.
2. Procedures for testing baseline IAQ. Baseline IAQ requirements, specify maximum indoor pollutant concentrations for acceptance of the facility.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
1. Hazardous materials include pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- D. Indoor Air Quality (IAQ): Composition and characteristics of air in an enclosed space that affect occupants of that space. Indoor air quality of a space refers to relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including impact on thermal comfort such as air temperature, relative humidity and air speed.
- E. Interior final finishes: Materials and products exposed to interior occupied spaces; including flooring, wall covering, finish carpentry, and ceilings.
- F. Packaged dry products: Materials and products installed in dry form delivered in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

- G. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and materials which require curing.

1.3 QUALITY ASSURANCE

- A. Inspection and Testing Lab Qualifications: Minimum of 5 years of experience in performing types of testing specified herein.

1.4 SUBMITTALS

- A. Indoor Air Quality (IAQ) Management Plan: After award and before Pre-construction conference, prepare and submit IAQ Management Plan, including:

1. Procedures for control of emissions during construction.
 - a. Identify schedule for application of interior finishes: Identify each interior finish that generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors. Indicate air handling zone, sequence of application, and curing times.
 - b. Identify potential sources of odor and dust.
 - c. Identify construction activities likely to produce odor or dust.
 - d. Identify areas of project potentially affected, especially occupied areas.
 - e. Evaluate potential problems by severity and describe methods of control.
 - f. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent Heating HVAC systems, types of filters and schedule for replacement of filters.
 - g. Describe cleaning and dust control procedures.
 - h. Describe coordination with commissioning procedures.
2. Procedures for moisture control during construction.
 - a. Identify porous materials and absorptive materials.
 - b. Identify schedule for inspection of stored and installed porous and absorptive materials.
3. Revise and resubmit Plan as required by Contracting Officer (CO).
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

- B. Product Data:

1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
2. Material Safety Data Sheets (MSDS): Submit MSDSs for inclusion in Operation and Maintenance Manual for:
 - a. Adhesives
 - b. Caulking and sealants
 - c. Insulating materials

- d. Fireproofing and firestopping
- e. Paint
- f. Lubricants
- g. Cleaning products

C. Inspection and Test Reports:

- 1. Moisture control inspections
- 2. Moisture content testing
- 3. Moisture penetration testing
- 4. Microbial Growth testing

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

- A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- B. HVAC Protection:
 - 1. Seal return registers during construction operations.
 - 2. Provide temporary exhaust during construction operations.
 - 3. To greatest extent possible, isolate and/or shut down return side of HVAC system during construction. When ventilation system must be operational during construction activities, provide temporary filters at air inlets (returns) and at locations for filters prescribed in the design.
 - 4. Contractor shall bear cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- C. Source Control: Provide low and zero VOC materials as specified.
- D. Pathway Interruption: Isolate areas of work to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.
- E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.
- F. Temporary Ventilation: For materials/products that generally require ventilation for off gassing, provide an ACH (air changes per hour) of 1.5 or more and as follows:
 - 1. Provide minimum 48-hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees Fahrenheit minimum to 90-degree Fahrenheit maximum continuously during ventilation period. Do not ventilate within limits of Work unless otherwise approved by Contracting Officer.

2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.
 3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction. Coordinate with work of Division 23 (15), Heating Ventilating and Air Conditioning (HVAC).
- G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.
- H. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cubic feet. of outdoor air per square feet of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and relative humidity no higher than 60%.
1. Obtain Contracting Officers concurrence that construction is complete enough before beginning flush-out.
 2. If additional construction involving materials that produce particulates or any of specified contaminants is conducted during or after flush-out, then flush-out process must be restarted.
 3. Install new HVAC filtration media in locations identified to have permanent filtration in contract documents after completion of flush-out and before occupancy or further testing.

3.2 IAQ MANAGEMENT - MOISTURE CONTROL

- A. Housekeeping:
1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
 2. Verify installed materials and products are dry prior to sealing and weatherproofing building envelope.
 3. Store interior absorptive materials only after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
1. Examine materials for dampness as they arrive. If acceptable to Contracting Officer, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
 2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
 3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect weekly, after each rain event.
 - a. If stored or installed absorptive materials become wet, notify Contracting Officer. Inspect for damage. If acceptable to the Contracting Officer, dry completely prior to closing in assemblies; otherwise, remove (in accordance with the Waste Management Plan) and replace with new materials.
 4. Site drainage: Verify final grades of site work and landscaping drain surface water and ground water away from building.

5. Weatherproofing: Inspect moisture control materials as they are being installed. Include:
 - a. Air barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is sealed completely.
 - b. Flashing: Verify correct shingling of flashing for roof, walls, windows, doors, and other penetrations.
 - c. Vapor Barrier: Verify vapor barrier is installed in accordance with Contract documents.
 - d. Insulation layer: Verify insulation is installed without voids.
 - e. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair.
6. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
7. HVAC: Inspect HVAC system as specified in Section on Commissioning. And, inspect HVAC to verify:
 - a. ductwork and return plenums are air sealed;
 - b. duct insulation is installed and sealed; and

C. Schedule:

1. Schedule work such that absorptive materials, such as porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at earliest possible time.

D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.

1. Concrete: Moisture test as per one or more of the following; unless otherwise indicated, acceptable upper limits for concrete are < 4% top inch; < 85% headspace relative humidity (RH); <3 pounds per 1000 square feet per day:
 - a. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
 - b. ASTM F1869 Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - c. ASTM F2170 Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes]
2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are less than 20% at center of piece; less than 15% at surface.

E. Testing for Moisture Penetration:

1. Windows: Test as per ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference; unless otherwise indicated, acceptable upper limits are no leakage for 15 minutes.
2. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are no leakage for 15 minutes.
3. Exterior Walls:
 - a. Air tightness of the enclosure test: ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or ASTM E1827 Standard Test Methods for Determining Air tightness of Buildings Using an Orifice Blower Door; acceptable upper limits are 0.25 CFM/sf or less at 50 Pascal's.
 - b. Water Leakage: Review as per ASTM E2128 Standard Guide for Evaluating Water Leakage of Building Walls.

END OF SECTION 01 57 19.11

SECTION 01 57 19.12 – NOISE AND ACCOUSTICS MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Special requirements for noise and acoustics management during construction operations.

1.2 DEFINITIONS

- A. Ambient noise level: The total noise associated with a given environment, being usually a composite of normal or existing sounds from all sources near and far, excluding the noise source at issue.
- B. Daytime: The hours from 7 A.M. to 9 P.M. on weekdays and 9 A.M. to 9 P.M. on weekends and holidays.
- C. Nighttime: All non-daytime hours.
- D. Property line: The real or imaginary line along the ground surface and its vertical extension, which separates real property owned or controlled by one person from contiguous real property owned or controlled by another person or from any public right-of-way or from any public space.
- E. Receiving noise area: Any real property where people live or work and where noise is heard, excluding the project or source area.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 NOISE MANGEMENT

- A. Noise Control: Perform construction operations to minimize noise. Perform noise-producing work in less sensitive hours of the day or week as directed by the Contracting Officer CO).
- B. Repetitive and/or intermittent, high-level noise: Permitted only during Daytime.
1. Do not exceed the following dB(A) limitations at 50 feet:

<u>Sound Level in dB(A)</u>	<u>Time Duration of Impact Noise</u>
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

2. Maximum permissible construction equipment noise levels at 50 feet:

<u>EARTHMOVING</u>	<u>dB(A)</u>	<u>MATERIALS HANDLING</u>	<u>dB(A)</u>
Front Loaders	75	Concrete Mixers	75
Backhoes	75	Concrete Pumps	75
Dozers	75	Cranes	75
Tractors	75	Derricks Impact	75
Scrapers	80	Pile Drivers	95
Graders	75	Jack Hammers	75
Trucks	75	Rock Drills	80
Pavers, Stationary	80	Pneumatic Tools	80
Pumps	75	Saws	75
Generators	75	Vibrators	75
Compressors	75		

C. Ambient Noise:

1. Maximum noise levels (dB (decibel)) for receiving noise area at property line shall be as follows:
 - a. Residential receiving area
 - Daytime: 65 dB
 - Nighttime: 45 dB
 - b. Commercial/Industrial receiving area
 - Daytime: 67 dB
 - Nighttime: 65 dB
 - c. In the event the existing local ambient noise level exceeds the maximum allowable receiving noise level (dB), the receiving noise level maximum for construction operations shall be adjusted as follows:
 - d. Residential receiving area: Maximum 3 additional dB above the local ambient as measured at property line.
 - e. Commercial/Industrial receiving area: Maximum 5 additional dB above the local ambient as measured at the property line.

3.2 FIELD QUALITY CONTROL

- A. Assess potential effects of construction noise on adjacent neighbors and facility occupants in accordance with ASTM E1686 and as follows:
 1. Ambient noise measurement: Measure at property line at a height of at least four (4) feet above the immediate surrounding surface. Average the ambient noise level over a period of at least 15 minutes.
 2. Ambient noise measurement at urban sites: Conduct during morning peak traffic hour between 7 A.M. and 9 A.M. and afternoon peak traffic hour between 4 P.M. and 6 P.M. In addition, conduct a 24-hour measurement at the proposed project site to document the noise pattern throughout the day. Adjust and weight for seasonal and climatic variations.

- B. Monitor noise produced from construction operations in accordance with ASTM E1780.

END OF SECTION 01 57 19.12

SECTION 01 57 23 - TEMPORARY STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Federal Regulations for controlling discharges of pollutants (including chemicals, erodible material, and trash) from municipal separate storm sewer systems, construction sites, and industrial activities, were brought under the National Pollution Discharge Elimination System (NPDES) permit process by amendments to the Clean Water Act (CWA), and promulgation of federal stormwater regulations issued by the United States Environmental Protection Agency (USEPA). The USEPA uses amount of ground disturbance as a measure of a project potential to generate pollution from erosion. NPDES Phase I regulates discharges from construction sites that disturb 5 acres or more. NPDES Phase II regulations expand existing General Permit requirements under Phase I to include/regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity. Construction disturbances 1 acre and above typically require a formal NPDES permit and a formal Stormwater Pollution Prevention Plan (SWPPP) must be submitted to Agency(ies) with Jurisdiction for review and approval.
- B. Work of this section consists of implementing measures to Temporary Storm Water Pollution during construction activities through compliance with the NPDES permit program.
- C. The Construction Documents include generalized erosion and sediment control Storm Water Pollution Control Drawings for bidding purposes only. The Contractor's QSD will be required to update all Storm Water Pollution Control Drawings in accordance with actual site conditions and the QSD developed SWPPP.

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- B. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of the environment for aesthetic, cultural, or historical purposes.
- C. The State of California Construction General Permit Order 2009-0009-DWQ regulates the discharge from construction sites that disturb 1 acre or more.
- D. National Pollution Discharge Elimination System (NPDES) Phase I: Regulates discharges from construction sites that disturb 5 acres or more.
- E. NPDES Phase II: Regulations expand existing General Permit requirements under Phase I to include and regulate discharges from construction sites that disturb land equal to or greater than one (1) acre and less than 5 acres, known as Small Construction Activity.
- F. Storm Water Pollution Prevention Plan (SWPPP): Developed and implemented stormwater management measures to protect surface water from pollutants during construction activities

disturbing an acre or more in compliance with federal, state, and local requirements for permit approval under NPDES program.

1.3 SUBMITTALS

- A. After contract award and before pre-construction conference, prepare and submit:
 - 1. A SWPPP showing SWPPP satisfies Federal and State NPDES permit requirements.
- B. Inspection Schedule: Submit schedule for inspection and monitoring of storm water pollution prevention measures.
- C. Erosion Control Products: Submit manufacturer's product information and installation recommendations for silt fence, filter fabric, erosion control blanket, straw bales, and other materials proposed for use on this project.

1.4 QUALITY ASSURANCE

- A. Contractor shall prepare and submit a plan to Contracting Officer (CO) for review and concurrence.
- B. Orientation Meeting: Contractor shall arrange and conduct an Erosion and Sediment Control meeting/briefing to inform parties, scheduled to be on-site during project, of measures to be implemented for proper erosion and sediment control (may be included as part of Pre-Construction Meeting).
 - 1. Installation of silt fences, storm drain protection, and other forms of erosion and sediment control shall not begin until after this meeting has occurred.
- C. Pollution Prevention and Erosion Control Manager: Contractor shall designate Pollution Prevention and Erosion Control Manager responsible for implementation, inspection, maintenance, and amendments to approved plan.
 - 1. Pollution Prevention and Erosion Control Manager shall be familiar with temporary storm water pollution prevention procedures and Best Management Practices and ensure emergency procedures and plan are updated as needed and available for inspection.
 - 2. When changes in approved plan are required, Pollution Prevention and Erosion Control Manager shall prepare and certify an amendment and submit to Contracting Officer for review and concurrence.

PART 2 - PRODUCTS

2.1 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

- A. Provide SWPPP which satisfies Federal and State NPDES permit requirements and includes:
 - 1. Site description.

2. Identification and contract information for Pollution Prevention and Erosion Control Manager.
3. Expected sequencing of operations and construction schedule.
4. Weather monitoring procedure.
5. Descriptions and details Best Management Practices for of pollution prevention and erosion controls, including dust control.
6. Pollution prevention and erosion control plans.
7. Controls for other potential onsite storm water pollutants.
8. Applicable specifications.
9. Maintenance and inspection procedures and forms.
10. Description of potential non-storm water discharges at site.
11. Notice of Intent (NOI) form.
12. Notice of Termination (NOT) form.
13. Contractor and Sub-contractor Certification forms.
14. Other record keeping forms and procedures.
15. Housekeeping Best Management Practices, including vehicle wash-down areas, protection of equipment storage and maintenance areas, and sweeping of roadways related to hauling activities.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

- A. Protection of Natural Resources: Comply with applicable regulations and these specifications. Preserve natural resources within project boundaries and outside limits of work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Contracting Officer.
- B. Construction Zone: Arrange construction activities to minimize pollution (i.e., erosion, trash, etc.) to maximum practical extent.
 1. Clearing, excavation, and grading shall be limited to those areas of project site necessary for construction. Minimize area exposed and unprotected.
 2. Clearly mark and delineate limits of work activities.
 3. Equipment shall not be allowed to operate outside limits of work or to disturb existing vegetation.
 4. Excavation and grading shall be completed during dry season to maximum extent possible.
 5. Material shall be stored away from locations where water is present to greatest extent practicable.

3.2 REGULATORY REQUIREMENTS

- A. Permits: Contractor shall obtain required NPDES permits resulting in no impacts to scheduled work. Contractor shall account for possibility of significant lead time in scheduling and executing work.
 1. Implement requirements of NPDES permit for erosion control due to storm water runoff during construction.

2. Implement good housekeeping practices, inspections and record keeping.
 3. Prior to construction, Contractor and Subcontractors shall sign certifications (included in the plan) that they understand requirements of NPDES permit.
 4. Subcontractors shall comply with requirements of NPDES under supervision of Contractor.
 5. Accepted plan shall comply with terms and conditions of EPA permit.
- B. Notice of Intent (NOI): Contractor shall file a Notice of Intent and formal SWPPP as required to the Agency(ies) with Jurisdiction.
- C. Notice of Termination (NOT): After Substantial Completion of Work, file a Notice of Termination (NOT) with the Agency(ies) with Jurisdiction.
- D. Contracting Officer Notification: Contractor shall notify Contracting Officer in writing and by telephone of these events:
1. Erosion and sediment control meeting/briefing.
 2. Following installation of required sediment control structures.
 3. Prior to removal of or modification to sediment control structures.
 4. Prior to removal of sediment control structures.

3.3 TEMPORARY STORM WATER POLLUTION PREVENTION PLAN

- A. Review and Acceptance: Contractor and Contracting Officer will jointly review draft Plan and agree to needed revisions. Contractor shall incorporate revisions, sign, and submit final Plan to Contracting Officer. Final Plan will be the document enforced on the project.
1. Accepted Plan will describe and ensure implementation of practices to be used to reduce pollutants in storm water discharges.
 2. Contractor shall maintain current copy of Plan and associated records and forms at jobsite throughout duration of project.
 3. Plan shall be available for public inspection and inspection and use of Contracting Officer.
 4. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.
- B. Implementation: Implement Plan as required throughout construction period and maintain erosion control elements in proper working order.
1. Do not perform clearing and grubbing or earthwork until Plan has been implemented.
- C. SWPPP (including inspection forms) and data used to complete the NOI shall be provided to Contracting Officer after Substantial Completion of project.

3.4 SITE INSPECTIONS AND PLAN REVISIONS

- A. Inspections: Contractor and Contracting Officer will perform a weekly inspection onsite.

1. Inspection shall include disturbed areas not completely stabilized, areas used for storage of materials, locations where vehicles enter or exit site, and other erosion and sediment controls included in the Plan.
 2. Inspections shall be documented.
 3. Inspection forms shall be retained onsite in Plan notebook throughout construction period.
- B. Plan Revisions: It may be necessary to revise Plan during construction to make necessary improvements, revisions, or to respond to unforeseen conditions noted during construction or site inspections.
1. Plan shall specify mechanism whereby revisions may be proposed by Contractor or Contracting Officer.
 2. Contractor and Contracting Officer will jointly review each revision to Plan before changes incorporated and implemented. Contractor will then provide revised copy of Plan to Contracting Officer.
 3. Accepted modifications will be implemented within 7 calendar days following date of inspection when deficiencies or necessary corrections are first noted.
- C. Negligence: Provide additional temporary erosion and pollution controls made necessary by Contractor's errors or negligence at no additional cost to Government.

3.5 HOUSEKEEPING AND SITE MANAGEMENT

- A. Store materials onsite in conformance to Federal, state, local, and manufacturer's regulations and specifications. Use Best Management Practices to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.
- B. Manage solid waste in conformance to Federal, state, and local regulations. Best Management Practices should be used to minimize risk of materials coming into contact with environmental conditions (i.e. water and wind) that could disperse them.
- C. Include a spill prevention and control plan with provisions placed in SWPPP.
- D. Manage hazardous waste (including contaminated soil) in conformance to Federal, state, local and NPS regulations and guidelines.

3.6 EROSION CONTROL MEASURES

- A. Erosion control measures shall consist of Best Management Practices for storm water discharges, including silt fencing, barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms.
- B. Berms and excelsior drainage filters shall be used to form sediment traps and control run-on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and staging areas.
- C. Erosion control measures shall be used to contain only direct precipitation in construction zone. Contained water shall be allowed to percolate into ground or drain slowly through drainage filter sediment traps.

- D. Earthen sediment traps or holding ponds shall not be used unless accepted by Contracting Officer.
- E. Reduce runoff velocity and direct surface runoff around and away from fuel containment, storage, and borrow areas.
- F. Divert surface runoff around and away from cut and fill slopes.
- G. Place drainage filters around catch basins to create sediment traps to control run-off from construction area.
- H. Excess water used for dust control shall be contained within demolition areas by erosion control measures.
- I. Contractor shall prevent deposition of materials onto paved areas. Contractor shall inspect paved areas for deposited materials weekly and remove materials immediately.
- J. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion as described in approved SWPPP.
- K. Before work begins, sufficient equipment shall be available on site to assure operation and adequacy of erosion control system can be maintained.

3.7 MAINTENANCE OF TEMPORARY FACILITIES

- A. Ensure erosion and sediment control structures remain effective throughout excavation and grading operations. Relocate structures as necessary.
- B. Inspect control structures after each significant rainfall. Promptly repair breaches which occur.
- C. Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

3.8 REPORTING

- A. If a discharge occurs or if project receives written notice or order from regulatory agency, Contractor shall immediately notify Contracting Officer and shall file written report to Agency(ies) with Jurisdiction within 7 days of discharge event, notice, or order. Corrective measures shall be implemented immediately following discharge, notice, or order. The report to the Agency(ies) with Jurisdiction shall contain:
 - 1. Date, time, location, nature of operation, and type of discharge, including cause or nature of notice or order.
 - 2. Best Management Practices deployed before discharge event, or prior to receiving notice or order.
 - 3. Date of deployment and type of Best Management Practices deployed after discharge event, or after receiving notice or order, including additional Best Management Practices installed or planned to reduce or prevent re-occurrence.
 - 4. An implementation and maintenance schedule for affected Best Management Practices.

3.9 SEDIMENT DISPOSAL

- A. Sediment excavated from temporary sediment control structures shall be disposed on site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.
- B. Contractor shall place sediment removed from traps and other structures where it will not enter a storm drain or watercourse and where it will not immediately reenter the basin.

3.10 REMOVAL OF TEMPORARY STORM WATER POLLUTION CONTROL MEASURES

- A. Temporary control measures shall be removed with permission of Contracting Officer within 20 working days after final acceptance of project, and/or once grading is complete and slopes have stabilized.

END OF SECTION 01 57 23

SECTION 01 67 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and environmental requirements.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, current as of date of Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a product substitution, to have indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Definitions pertaining to sustainable development: As defined in ASTM E2114.
- D. Biobased Materials: As defined in Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, "biobased" means a "commercial or industrial product (other than food or feed) composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials." Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000.
 - 1. Biobased content: Amount of biobased carbon in material or product as a percentage of weight (mass) of total organic carbon in material or product.

- E. Chain-of-Custody: Process whereby a product or material is maintained under physical possession or control during its entire life cycle.
- F. Environmentally preferable products: Products and services with lesser or reduced effect on the environment in comparison to conventional products and services. Refer to Environmental Protection Agency's (EPA) Final Guidance on [Environmentally Preferable Purchasing](#) for more information.
- G. Stewardship: Responsible use and management of resources in support of sustainability.
- H. Sustainability: Maintenance of ecosystem components and functions for future generations.
 - 1. Recycled Content Materials: Products containing pre-consumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with International Organization for Standardization (ISO) 140001 Standard for the Use of Environmental Marketing Claims.
 - 2. Rapidly Renewable Material: Material made from plants typically harvested within a ten-year cycle.
 - 3. Regional Materials: Materials manufactured and extracted, harvested, or recovered within a radius of 500 miles from Project location.

1.3 SUBMITTALS

- A. Record Submittals as specified in – Sustainable Design Close-Out Documentation, submit:
 - 1. Affirmative Procurement Reporting Form. Submit on form in Appendix A of this Section, or similar form as approved by Contracting Officer (CO).
 - 2. Submit environmental data in accordance with Table 1 of ASTM E2129 for these products:
 - a. Finish Carpentry
 - b. Building Insulation
 - c. Roofing
 - d. Joint Sealers
 - e. Wood & Plastic Doors
 - f. Windows
 - g. Gypsum Board
 - h. Tile
 - i. Wall Coverings
 - j. Paints & Coatings
 - k. Toilet Compartments
 - l. Plumbing fixtures and equipment.
 - m. HVAC equipment
 - n. Lighting equipment
 - 3. Material Safety Data Sheets (MSDS): For each product required by OSHA to have a MSDS, submit an MSDS. MSDS shall be prepared within the previous five years. Include information for MSDS Sections 1 to 16 in accordance with ANSI Z400.1 and as follows:
 - a. Section 1: Chemical Product and Company Identification
 - b. Section 2: Composition/Information on Ingredients

- c. Section 3: Hazards Identification
 - d. Section 4: First Aid Measures
 - e. Section 5: Fire Fighting Measures
 - f. Section 6: Accidental Release Measures
 - g. Section 7: Handling and Storage
 - h. Section 8: Exposure Controls/Person Protection
 - i. Section 9: Physical and Chemical Properties
 - j. Section 10: Stability and Reactivity Data
 - k. Section 11: Toxicological Information. Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects. Provide written description of the process used in evaluating chemical hazards relative to preparation of the MSDS.
 - l. Section 12: Ecological Information. Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in event of accidental release.
 - m. Section 13: Disposal Considerations. Include data regarding proper disposal of the chemical. Include information regarding recycling and reuse. Indicate whether or not product is considered to be "hazardous waste" according to United States EPA Hazardous Waste Regulations 40 CFR 261 (Code of Federal Regulations).
 - n. Section 14: Transportation Information. Identify hazard class for shipping.
 - o. Section 15: Regulatory Information. Identify federal, state, and local regulations applicable to the material.
 - p. Section 16: Other Information. Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts. Identify the date MSDS was prepared.
4. Chain of Custody: Submit chain-of-custody documentation for sustainable forestry for these products:
- a. Rough Carpentry
 - b. Finish Carpentry
 - c. Wood Doors
 - d. Windows

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in undamaged condition; in manufacturer's original sealed container or other packaging system; complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with Contract Documents. Ensure products are undamaged and properly protected.
5. Obtain materials in biodegradable or recyclable/reusable packaging which uses minimum amount of packaging possible.

C. Storage:

1. Allow for inspection and measurement of quantity or counting of units.
2. Store materials in manner to not endanger Project structure.
3. Store products subject to damage by the elements, under cover in weather tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Store loose granular materials in well-drained area on solid surfaces to prevent mixing with foreign matter.

1.6 PACKAGING

- A. Where Contractor has option to provide one of listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.
- B. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
- C. Provide minimum 45 percent post-consumer recycled content and minimum 100 percent recovered fiber content of industrial paperboard in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.
- D. Provide minimum 10 percent post-consumer recycled content and minimum 10 percent recovered fiber content of carrier board in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.
- E. Provide minimum 5 percent post-consumer recycled content and minimum 5 percent recovered fiber content of brown papers (e.g., wrapping papers and bags) in accordance with EPA's Comprehensive Procurement Guidelines and ASTM D5663.

1.7 ENVIRONMENTALLY PREFERABLE PRODUCTS

- A. Provide environmentally preferable products to greatest extent possible.

1. To greatest extent possible, provide products and materials with a lesser or reduced effect on the environment considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the product.
2. Eliminate use of ozone depleting compounds during and after construction where alternative environmentally preferable products are available, consistent with either Montreal Protocol and Title VI or Clean Air Act Amendments of 1990, or equivalent overall air quality benefits that take into account life cycle impacts.
3. Use products meeting or exceeding EPA's recycled content recommendations for EPA-designated products. Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of total value of the materials in project.

1.8 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for product specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare written document containing appropriate terms and identification, ready for execution. Submit draft for approval before final execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with Specifications, prepare written document using appropriate form properly executed.
 3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products to comply with Contract Documents, undamaged and, unless otherwise indicated, new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types produced and used successfully in similar situations on other projects.
3. Government reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
4. Where products are accompanied by term "as selected," Contracting Officer will make selection.
5. Where products are accompanied by term "match sample," sample to be matched is Governments.
6. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name single product and manufacturer, provide named product that complies with requirements or approved equal.
2. Manufacturer/Source: Where Specifications name single manufacturer or source, provide product by named manufacturer or source that complies with requirements or approved equal.
3. Products: Where Specifications include list of names of both products and manufacturers, provide one of the products listed that complies with requirements or approved equal.
4. Manufacturers: Where Specifications include list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements or approved equal.
5. Available Products: Where Specifications include list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide specified product, system, or approved equal.
8. Basis-of-Design Product: Where Specifications name product and include a list of manufacturers, provide specified product or a comparable product by one of the other named manufacturers, or approved equal. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select product that complies with requirements and matches Architect's sample. Contracting Officers decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

- a. Standard Range: Where Specifications include phrase "standard range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
- b. Full Range: Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, Contracting Officer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

PART 3 - EXECUTION

3.1 PROTECTION AFTER INSTALLATION

- A. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01 67 00

AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

Project Name: _____ Project Number: _____
 Contractor Name: _____ License Number: _____
 Contractor Address: _____

Product	Total \$ value provided	Total \$ value with recycled content Pre- consumer	Total \$ value with recycled content Post- consumer	Total \$ value with biobased content	Exempted indicate 1,2,3,4	Comments
Hydraulic Mulch (paper based)						
Hydraulic Mulch (wood based)						
Compost						
Parking Stops (Concrete w/ fly ash, slag cement or low cement content)						
Parking Stops (Plastic/Rubber)						
Patio Blocks/Rubber						
Patio Blocks/Plastic						
Playground Surfaces						
Concrete with fly ash						
Concrete with slag cement						
Concrete with low cement content						
Plastic lumber						
Building Insulation						
Rock Wool						
Fiber glass						
Cellulose						
Perlite Comp Board						
Plastic Rigid Foam						
Glass Fiber Reinforced Foam						
Phenolic Rigid Foam						
Ceramic tile						
Resilient flooring						
Floor Tiles/Rubber						
Floor Tiles/Plastic						
Running Tracks						
Carpet (PET)						
Paint						

Reprocessed Latex Paint White & Light Colors						
Reprocessed Latex Dark Colors						
Consolidated Latex Paint						
Toilet/Shower partitions (plastic or steel)						
Other						

CERTIFICATION

I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content.

The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1. The product does not meet appropriate performance standards.
2. The product is not available within a reasonable time frame.
3. The product is not available competitively (from two or more sources).
4. The product is only available at an unreasonable price (compared with a comparable non-recycled content product.)

Signature: _____ Date: _____

END OF
AFFIRMATIVE PROCUREMENT REPORTING FORM
Recycled Content Materials & Biobased Content Materials

SECTION 01 73 40 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general procedural requirements governing execution of Work including:

1. Coordination with utility service providers
2. Construction layout
3. Field engineering and surveying
4. General installation of products
5. Progress cleaning
6. Starting and adjusting
7. Protection of installed construction
8. Correction of the Work

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit 2 copies signed by land surveyor.
- D. Quantity Surveys: Submit 2 copies showing quantities of work performed and actual construction completed in place.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: Professional land surveyor legally qualified to practice in jurisdiction where Project is located and-is experienced in providing land-surveying services of kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed.

1. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 2. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existence and location of underground utilities and other construction affecting Work.
1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 COORDINATION WITH UTILITY SERVICE PROVIDERS

- A. Coordination with Utility Service Providers: Contact following Utility Service providers, sufficiently in advance to avoid delaying the work, to coordinate Contractor's portion of Work, testing requirements, inspections, **etc.**
1. Electrical: Service Contact: Contact Morgan Strunk, Southern California Edison, (805) 494-7052 to coordinate Electrical service requirements.
 - a. Construction Contractor Responsibilities: Contractor is responsible for contracting with Southern California Edison to extend new service to the new buildings per design prepared by Southern California Edison for the project.
 2. Water and Wastewater Service Contact: Contact Las Virgenes Municipal Water District Technical Services, (818) 251-2100 to coordinate Water and wastewater service requirements.
 - a. Construction Contractor Responsibilities: Contractor is responsible for coordination with the utility and installation of water and sewer lines to serve the new buildings.
 3. Telecom Contact: Contact Mike Maki, IT Specialist, National Park Service, Santa Monica Mountains National Recreation Area, 401 W Hillcrest Dr., Thousand Oaks, CA 91360, (805) 370-2323 to coordinate Telecom requirements.

- a. Construction Contractor Responsibilities: You are responsible for extending infrastructure from NPS Longhorn Building to the new buildings.

3.3 PREPARATION

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

3.4 CONSTRUCTION LAYOUT

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

3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning Work. Preserve and protect permanent benchmarks and control points during construction operations. Controls destroyed by Contractor will be replaced by Contractor at their expense.
 - 1. Existing Monuments: All benchmarks, land corners, and triangulation points, established by other surveys, existing within construction area shall be preserved. If existing monuments interfere with Work, secure written permission before removing them.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with NPS requirements for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.6 INSTALLATION

- A. General: Locate Work and components of Work accurately in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions for best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Contracting Officer.
 2. Allow for building movement, thermal expansion, and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors to be embedded in concrete or masonry. Deliver to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials not considered hazardous.
- J. Quantity surveys: Shall be conducted, and data derived from these surveys shall be used in computing quantities of work performed and actual construction completed and in place.
1. Contractor shall conduct original and final surveys and surveys for any periods for which progress payments are requested. These surveys shall be conducted under direction of a representative of the Contracting Officer, unless Contracting Officer waives requirement in a specific instance. Government shall make such computations as are necessary to determine quantities of work performed or finally in place. Contractor shall make computations based on surveys for any periods for which progress payments are requested.
 2. Promptly upon completing a survey, Contractor shall furnish originals of field notes and other records relating to survey or layout of Work to Contracting Officer. Contractor shall retain copies of all such material furnished to Contracting Officer.

3.7 PROGRESS CLEANING

- A. General: Clean Project site, work areas, and common areas daily. Coordinate progress cleaning for joint-use areas where more than one Installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in National Fire Protection Association (NFPA) 241 for removal of combustible waste materials and debris.
 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to level of cleanliness necessary for proper execution of Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of Work, broom-clean or vacuum entire work area, as appropriate.
 3. Contractor shall provide progress cleaning that minimizes sources of food, water, and harborage available to pests.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials not hazardous to health or property and will not damage exposed surfaces.
1. Utilize non-toxic cleaning materials and methods.
 - a. Comply with Green Seal Standard (GS) 37 for general purpose cleaning and bathroom cleaning.
 - b. Use natural cleaning materials where feasible. Natural cleaning materials include:
 - 1) Abrasive cleaners: substitute 1/2 lemon dipped in borax.
 - 2) Ammonia: substitute vinegar, salt and water mixture, or baking soda and water.
 - 3) Disinfectants: substitute 1/2 cup borax in gallon water.
 - 4) Drain cleaners: substitute 1/4 cup baking soda and 1/4 cup vinegar in boiling water.
 - 5) Upholstery cleaners: substitute dry cornstarch.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. Clean and protect construction in progress and adjoining materials already in place during handling and installation. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations so that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or deleterious exposure during construction period.
- K. Final Cleaning: At completion of Work, remove remaining waste materials, rubbish, tools, equipment, machinery and surplus materials. Clean exposed surfaces and leave Project clean and ready for occupancy.
1. Provide final cleaning in accordance with ASTM E1971.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 29 "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to specified condition.
- C. Remove and replace damaged surfaces exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 40

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Solid Waste: Garbage, debris, sludge, or other discharged material (except hazardous waste) including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.
- D. Debris: Non-hazardous solid waste generated during construction, demolition, or renovation of a structure which exceeds 2.5 inch (60 millimeter) particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders). A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if mixture is comprised primarily of debris by volume, based on visual inspection.
- E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- F. Environmental Pollution and Damage: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.
- G. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- H. Hazardous Materials: Material regulated as a hazardous material in accordance with 49 CFR 173 (Code of Federal Regulations), requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have potential to meet the definition of Hazardous Waste in accordance with 40 CFR 261.

- I. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- J. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

1.3 PERFORMANCE REQUIREMENTS

- A. Salvage /Recycle Requirements: Develop waste management plan resulting in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work. The following waste categories, at a minimum, shall be diverted from a landfill:
 - 1. Land clearing debris (chipped debris can be used on site for mulch or erosion control)
 - 2. Clean dimensional wood, palettes
 - 3. Plywood, OSB (oriented strand board), and particle board
 - 4. Concrete (can be ground and used for fill on site)
 - 5. Asphaltic concrete (can be ground and used for fill on site)
 - 6. Cardboard, paper, packaging, newsprint
 - 7. Metals (from banding, stud trim, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze)
 - 8. Gypsum drywall - unpainted
 - 9. Non-hazardous paint and paint cans
 - 10. Beverage containers: Aluminum, glass, and plastic containers
 - 11. Insulation
 - 12. Ceiling grid and tiles
 - 13. Ductwork
 - 14. Wiring
 - 15. Other mixed construction and demolition waste as appropriate.
- B. If waste materials encountered during deconstruction/demolition or construction phase are found to contain lead, asbestos, polychlorinated biphenyls (PCBs), (such as fluorescent lamp ballasts), or other harmful substances, they are to be handled and removed in accordance with local, state, and federal laws and requirements concerning hazardous waste.
- C. Salvage/Recycle Requirements: Government goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible.

1.4 SUBMITTALS

- A. Waste Management Plan: After award of contract and prior to scheduled Pre-Construction Conference, Contractor shall submit a draft Waste Management Plan to Contracting Officer for approval. Submit 3 copies of plan. Revise and resubmit Plan as required by Contracting Officer. Approval of Contractor's Plan will not relieve Contractor of responsibility for compliance with applicable environmental regulations.
- B. Progress Documentation: Supplemental to Waste Management Plan, document solid waste disposal, diversion, and cost/revenue analysis and submit completed worksheet on a monthly basis. See Project Waste Management Plan Worksheet Sample, attached to the end of the Division 1 Specifications, and report totals to date for column headings.

- C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator.
- I. Progress payment requirements:
 - 1. With each Application for payment, submit an updated Project Waste Management Plan worksheet for solid waste disposal and diversion.
 - 2. With each Application for Payment, submit manifests, weight tickets, receipts, and invoices specifically identifying the Project and waste material.
- J. Closeout Submittals
 - 1. With Closeout Submittals, submit a summary of a Project Waste Management Plan worksheet for solid waste disposal and diversion.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with record of successful waste management coordination of projects with similar requirements.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Meeting: Conduct separate meeting or cover in Pre-Construction Conference and comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

PART 2 - PRODUCTS

2.1 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification and waste reduction work plan. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Salvaged Materials for Reuse: For materials salvaged and reused in Project, describe methods for preparing salvaged materials before incorporation into the Work.
 2. Salvaged Materials for Sale: For materials sold to individuals and organizations, include list of names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials donated to individuals and organizations, include list of names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include:
 1. Landfill tip fees per ton.
 2. If diverted, tip fee savings from landfill diversion.
 3. Costs of recycling, salvage, or reuse.
 4. Revenue from recycling, salvage, or reuse.
 5. Total cost or savings from diversion. (Calculate by using tip fee savings and subtracting costs of recycling or adding revenue from recycling.)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Contracting Officer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during entire duration of Contract.
- B. Waste Management Coordinator: Engage waste management coordinator responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Contractor shall establish contacts with local recycling and reuse companies to set up lines of responsibility. Contractor shall be responsible for coordination in terms of identifying materials, pickup schedules, and standard quality for recycled materials.
- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- F. Separation facilities:
 - 1. Contractor shall designate and Contracting Officer shall approve specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
 - 2. Place waste and recycling bins near each other, and close to point of waste generation but out of traffic pattern.
 - 3. Keep recycling and waste bin areas neat, clean, and clearly marked in order to avoid co-mingling of materials.
 - 4. Protect bins during non-working hours from off-site contamination.
 - 5. Check garbage dumpsters periodically for recyclables being thrown away and undocumented materials that could be recycled.
- G. Materials handling procedures: Material to be recycled shall be protected from contamination and shall be handled, stored, and transported in a manner that meets requirements set by designated facilities for acceptance. Establish defined area for operations of each trade, especially woodcutting so off-cuts are kept in one area and can be sorted by dimension for future reuse.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.

- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include:

1. American Industrial Services, Inc., 5626 Cherry Ave., Long Beach, CA 90805, (562) 272-8060.
2. American Reclamation, 4560 Doran St., Los Angeles, CA 90039, (888) 999-9330.
3. California Waste Services, 621 West 152nd St., Gardena, CA 90247, (310) 538-5998.
4. City Terrace Recycling, 1525 Fishburn Ave., Los Angeles, CA 90063, (323) 780-7150.
5. Construction & Demolition Recycling, 9309 Rayo Ave., South Gate, CA 90280, (323) 357-6900.
6. Cordova Construction Services, 12506 Montague St., Pacoima 91331, (818) 896-0509.
7. Crown Recycling Services, LLC., 9189 DeGarmo Ave., Sun Valley, CA 91352, (818) 504-1478.
8. Direct Disposal, 3720 Noakes St., Los Angeles, CA 90023, (323) 262-1604.
9. Downtown Diversion, 2424 East Olympic Blvd., Los Angeles, CA 90021, (213) 612-5005.
10. East Valley Diversion, 11616 Sheldon St., Sun Valley, CA 91352, (818) 252-0019.
11. Simi Valley Landfill and Recycling Center, 2801 Madera Rd., Simi Valley, CA 93065, (805) 579-7267.

- A. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Government and Contractor.

- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off ground and protect from weather.
5. Remove recyclable waste off Government property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

- A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4 inch.

- B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

- C. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust not containing painted or treated wood.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose in landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials to accumulate on-site.
 - 2. Remove and transport debris in manner preventing spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials allowed only at designated areas on Government property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport waste materials off Government property and legally dispose of them.

END OF SECTION 01 74 19

Project Waste Management Plan Worksheet Sample

National Park Service (NPS) - Denver Service Center (DSC) | 10-13-21

	A	B	C	D	E	F	G	H	I	J
Material	Quantity Recycled (in tons)	Quantity Salvaged or Reused (in tons)	A + B = Total Quantity Diverted from Landfill	Quantity to Landfill (in tons)	C + D = Total Quantity Generated (in tons)	Tip Fee/Ton at Landfill	C x F = Tip Fee Savings resulting from Landfill Diversion	Cost of Recycling (R), Salvage (S), or Reuse (Re) (Specify R, S, or Re)	Revenue from Recycling (R), Salvage (S), or Reuse (Re) (Specify R, S, or Re)	G - H + I = Total Cost (-) or Savings (+) from Diversion
Asphalt/Concrete										
Brick/Masonry/Tile										
Building Materials (doors, windows, fixtures, shingles, lumber, insulation, sheet goods, etc.)										
Carpet										
Carpet Padding, Foam Only										
Cardboard										
Ceiling Tile										
Drywall										
Glass										
Scrap Metal Aluminum										
Copper										
Steel										
Unpainted Wood & Pallets										
Yard Trimmings, Brush, Trees, Stumps, etc.										
Garbage/Trash										
Other										
Column Totals										
	Total Quantity Recycled	Total Quantity Reused or Salvaged	Total Quantity Diverted from Landfill	Total Quantity to Landfill	Total Quantity Generated		Tip Fee Savings from Diversion	Total Cost of Recycling, Salvage, or Reuse	Revenue from Recycling, Salvage, or Reuse	Total Cost (-) or Savings (+) from Diversion

Percentage Diverted = _____ (C divided by E from Column Totals). Should meet 60% diversion goal.

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including:
 - 1. Project Record Drawings
 - 2. Closeout Submittals
 - 3. Substantial Completion and Final Inspection
 - 4. Permit Closure and Transfer
 - 5. Final Acceptance of the Work
 - 6. Warranties

1.2 PROJECT RECORD DRAWINGS

- A. Maintain one complete full-size set of contract drawings and one full-size set of vendor-supplied drawings. Clearly mark changes, deletions, and additions using National Park Service (NPS) drafting standards to show actual construction conditions. Show additions in red, deletions in green and special instructions in blue.
- B. Keep record drawings current. Make record drawings available to Contracting Officer (CO) for inspection at the time of monthly progress payment requests. If project record drawings are not current, Contracting Officer may retain an appropriate amount of progress payment.
- C. Submit complete record drawings on completion of total project. Include shop drawings, sketches, and additional drawings to be included in final set, with clear instructions showing the location of these drawings.

1.3 CLOSEOUT SUBMITTALS

- A. A list of closeout requirements has been attached at the end of the Division 1 Specifications for your convenience. The intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list. Submit the following before requesting final inspection:
 - 1. Specific warranties, guarantees, workmanship bonds, final certifications, and similar documents.
 - 2. NPS required forms for occupancy, Fire Sprinkler/Alarm acceptance, and other similar forms or certificates.
 - 3. Project Record Documents, operation and maintenance manuals, final completion construction digital images recorded on CD-R (compact disc-recordable) or DVD-R (digital video disc-recordable) with index and descriptions, and similar final record information.

4. Environmental Record Documents: As specified in the following Divisions:
 - a. IAQ Management Plan: As specified in Section 01 57 19.11 Indoor Air Quality (IAQ) Management.
 - b. Product Data for filtration media: As specified in Section 01 57 19.11 Indoor Air Quality (IAQ) Management.
 - c. Moisture Control inspections and reports: As specified in Section 01 57 19.11 Indoor Air Quality (IAQ) Management.
 - d. Material Safety Data Sheet (MSDS) Data: As specified in Section 01 67 00 Product Requirements.
 - e. Affirmative Procurement Reporting Form: As specified in Section 01 67 00 Product Requirements.
 - f. Environmental Product Data: As specified in Section 01 67 00 Product Requirements.
 - g. Life-Cycle Assessment (LCA) Data: As specified in Section 01 67 00 Product Requirements.
 - h. Chain-of-Custody Data: As specified in Section 01 67 00 Product Requirements.
 - i. Final Summary of Solid Waste Disposal and Diversion: As specified in Section 01 74 19 Construction Waste Management and Disposal.
 - j. Commissioning Report: As specified in Section 01 91 14 Total Building Commissioning.
5. Posted Operating Instructions: As specified in individual sections. Furnish operating instructions attached to or posted adjacent to equipment. Include wiring diagrams, control diagrams, control sequence, start-up, adjustment, operation, lubrication, shut-down, safety precautions, procedures in the event of equipment failure, and other items of instruction recommended by manufacturer.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Contracting Officer. Label with manufacturer's name and model number where applicable.
 - a. Special Tools: One set of special tools required to operate, adjust, dismantle, or repair equipment. Special tools are those not normally found in possession of mechanics or maintenance personnel.
7. Keys and Keying Schedule: Submit keys including duplicates. Wire keys for each lock securely together. Tag and plainly mark with lock number, equipment identification, or panel or switch number, and indicate location, building, and room name or number.
8. Make final changeover of permanent locks and deliver keys to Contracting Officer. Advise Park personnel of changeover in security provisions.
9. Approved pre-functional checklists and functional performance testing reports from commissioning documentation.
 - a. Equipment start-up requires coordination with commissioning process. Refer to Section 01 91 14 Total Building Commissioning. Equipment shall not be "temporarily" started for commissioning.
10. Test and balance report.
11. Terminate and remove temporary facilities, mockups, construction tools, and similar elements from Project site, complete final cleaning requirements, including touchup painting.
12. Touch up and repair and restore marred exposed finishes to eliminate visual defects.

13. Instruct NPS personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videos.

1.4 FINAL INSPECTION, SUBSTANTIAL COMPLETION AND ACCEPTANCE PROCEDURES

- A. Request final inspection in writing when project or designated portion of project is substantially complete. Contracting Officer will proceed with inspection within 10 days of receipt of written request or will advise Contractor of items that prevent project from being substantially complete.
- B. If work is determined substantially complete, following final inspection, Contracting Officer will prepare Punch List and issue a Letter of Substantial Completion.
- C. If work is not determined substantially complete following final inspection, Contracting Officer will notify Contractor in writing. Contractor shall request new final inspection after completing work. Re-inspection costs may be charged against Contractor in accordance with Inspection of Construction contract clause.
- D. Contractor shall complete Punch List within 30 calendar days, documented weather permitting.
 1. Prior to requesting final inspection:
 - a. Complete commissioning requirements of Section<Insert Specification section.>, unless approved in writing by Contracting Officer.
- E. If Contractor completes items of work on Punch List and contractually required items, Contracting Officer will issue Letter of final acceptance of work.
- F. If Contractor fails to complete work within the time frame, Contracting Officer may correct work with an appropriate reduction in contract price or charge for re-inspection costs in accordance with Inspection of Construction contract clause.

1.5 PERMIT CLOSURE AND TRANSFER

- A. When work covered by the permits is complete, create list of tasks required to close or transfer permits to Park. Submit to Contracting Officer for approval.
- B. After substantial completion and Punch List completion, permits shall be closed and documented by Agency(ies) with Jurisdiction for the permit.
- C. If responsibility for permits is to be transferred to Park, Park shall be informed of permit provisions completed and responsibilities transferring to Park staff.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Contracting Officer for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.

- B. Organize warranty documents into an orderly sequence based on table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide typed description of product or installation, including name of product and name, address, and telephone number of Installer.
 - 3. Identify each binder on front and spine with typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF (portable document format) file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. See Division 1 Specification Section "Execution" for information on cleaning agents.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Conduct final cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.

- e. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of stains, films, and foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and vision-obscuring materials. Replace chipped or broken glass and transparent materials. Polish mirrors and glass.
 - i. Remove labels that are not permanent.
 - j. Touch up, repair, and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" (Underwriters Laboratories) and similar labels, including mechanical and electrical nameplates.
 - k. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Replace parts subject to unusual operating conditions.
 - m. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out and noticeably dimmed bulbs, and defective or noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage experienced, licensed exterminator to make a final inspection and rid project of rodents, insects, and other pests. Provide Government with report.
- D. Waste Disposal: Comply with requirements of Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including:
 - 1. Manuals, general
 - 2. Emergency manuals
 - 3. Operation manuals for systems, subsystems, and equipment
 - 4. Maintenance manuals for care and maintenance of products, materials, finishes, systems and equipment.
- B. See Divisions 2 through 49 Sections for additional operation and maintenance manual requirements for Work in those Sections.

1.2 SUBMITTALS

- A. Manual: Submit one electronic copy of each manual in draft form at least 15 days before final inspection. Contracting Officer (CO) will return copy or edit version with comments within 15 days of receipt.
- B. Format: Submit operations and maintenance manuals in following format:
 - 1. PDF (portable document format) electronic file. Assemble each manual into composite electronically indexed file. Submit on digital media acceptable to Contracting Officer.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. Correct or modify each manual to comply with Contracting Officers comments. Submit 4 copies of each corrected manual within 15 days of receipt of Contracting Officers comments.

1.3 QUALITY ASSURANCE

- A. Coordinate with Section 01 91 14 "Total Building Commissioning." Commissioning Agent shall review Operation and Maintenance Manuals for commissioned systems.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system. Manual shall contain title page, table of contents, and manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include:
 - 1. Project Title
 - 2. Location
 - 3. Park
 - 4. Contract Number
 - 5. Prime Contractors Name and Address
 - 6. Date of Substantial Completion
 - 7. Binder Volume Number
- C. Table of Contents: List each product included in manual, identified by product name, indexed to content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. Assemble instructions for subsystems, equipment, and components of one system into a single binder if needed.
 - 1. Binders: White, commercial quality, hard back, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold **8-1/2 by 11 inch** paper; with clear plastic window sleeve on front and spine to hold label describing contents and pockets inside covers to hold folded oversize sheets.
 - a. Cover Sheet: Identify binders on front and spine, with project title, location, park, contract number, prime contractor's name and address, date of substantial completion, and binder volume number. Insert cover sheet into clear plastic view pocket on front of binder. Insert sheet into clear plastic view pocket on spine with title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2. Data: Fill binders to no more than 75 percent of capacity. Punch holes shall not obscure any data. When contents of a single tabbed section cover more than one item, provide colored paper sheets to separate the data for each item.
 - a. Manufacturers' Data: Provide originals for color or copyrighted data. Black and white data may be originals or clean, good quality reproductions. No copies produced by facsimile transmission and sheets with stamps, such as submittal approval stamps. Include only sheets that apply to items installed; cross out inapplicable data.
 - b. Vendor Furnished As-Built Drawings: Maximum 24 inch by 36 inch sheets with minimum character or lettering size of 1/8 inch. Reduced-size reproductions may be provided instead of full-size drawings if reproductions are clear and legible. If

- reduced-size drawings are used, identify as "REDUCED SIZE" and provide graphic scales, if applicable.
 - c. Custom Data: Data supplemented by drawings and schematics necessary to describe systems adequately.
 - d. Equipment Data Sheet: Data, using form at end of this section.
 - e. Schedules: Schedules reflecting final, as-installed conditions.
 - f. Poorly reproduced or illegible data will be rejected.
3. Dividers: Divider sheets with Mylar reinforced edges and pre-printed numbered tabs aligned with numbers and title lines on index sheet. Include typed list of products and major components of equipment included in section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into separate section for type of emergency, emergency instructions, and emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, water leak, power failure, water outage, and equipment failure.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of National Park Service (NPS) operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION AND MAINTENANCE MANUALS

- A. Operation Requirements
 1. Content: In addition to requirements in Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
 2. Descriptions: Include:

- a. Product name and model number
 - b. Manufacturer's name
 - c. Equipment identification with serial number of each component
 - d. Equipment function
 - e. Operating characteristics
 - f. Limiting conditions
 - g. Performance curves
 - h. Engineering data and tests
 - i. Complete nomenclature and number of replacement parts
3. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
 4. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
 5. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

B. Maintenance Requirements for Systems and Equipment

1. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, and equipment data sheets as described below.
2. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
3. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
4. Maintenance Procedures: Test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, detailing essential maintenance and environmental procedures.
5. Maintenance and Service Schedules: Service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
6. Spare Parts List and Source Information: Lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
7. Warranties and Bonds: Copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include:
 - 1. Product name and model number
 - 2. Manufacturer's name
 - 3. Color, pattern, and texture
 - 4. Material and chemical composition
 - 5. Reordering information for specially manufactured products
- D. Environmental Requirements
 - 1. Identify environmentally preferable products incorporated into Project. Include: product model; manufacturer's name, address, phone, and website; and local technical representative.
 - a. Verify plastic products to be incorporated into Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.
 - 1) Type 1: Polyethylene Terephthalate (PET, PETE)
 - 2) Type 2: High Density Polyethylene (HDPE)
 - 3) Type 3: Vinyl (Polyvinyl Chloride or PVC)
 - 4) Type 4: Low Density Polyethylene (LDPE)
 - 5) Type 5: Polypropylene (PP)
 - 6) Type 6: Polystyrene (PS)
 - 7) Type 7: Other. Use of this code indicates that package in question is made with a resin other than the six listed above or is made of more than one resin listed above and used in a multi-layer combination.
 - b. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971 and approved Integrated Pest Management (IPM) plan.
 - 1) Include potential environmental impacts of recommended maintenance procedures and materials.
 - 2) Include potential indoor air quality impacts of recommended maintenance procedures and materials.
 - 3) Where proposed maintenance procedures incorporate composting of plastics, assess potential effect of each type of plastic to be included in composting process in accordance with ASTM D5509 or ASTM D6002

- c. Material Safety Data Sheets (MSDS): Include MSDSs as specified.
- 2. Develop environmental management programs for facility as follows:
 - a. Waste management program: Develop in accordance with ASTM E1609. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.
 - b. Indoor Air Quality (IAQ) management program: Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of VOCs (volatile organic compounds) in indoor air in accordance with ASTM D6345.
 - c. Water management program: Develop water monitoring program for surface and ground water on project site in accordance with ASTM D5851 and consistent with water management program utilized during construction operations.
- E. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following and items detailing essential maintenance procedures:

1. Test and inspection instructions
 2. Troubleshooting guide
 3. Precautions against improper maintenance
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions
 5. Aligning, adjusting, and checking instructions
 6. Demonstration and training video recording
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that affect validity of warranties or bonds.
1. Include procedures and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 GENERAL

- A. At start of project, begin accumulating operation and maintenance data and initiate index. Install and index data in binders within 30 days after delivery of items. As custom written data and test results are produced, add to operation and maintenance data file.
- B. List of Operation and Maintenance requirements has been attached at end of the Division 1 Specifications for your convenience. Intent is to provide an overall summary of requirements and not a comprehensive list. Terms and conditions of the contract require satisfaction of requirements of individual specification sections regardless of what is shown on the list.
- C. Keep operation and maintenance data current. Make operation and maintenance binders available to Contracting Officer for inspection at time of monthly progress payment requests. If operation and maintenance binders are not current, Contracting Officer may retain an appropriate amount of the progress payment.

3.2 MANUAL PREPARATION

- A. Manual Types

1. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and by NPS operating personnel for types of emergencies indicated.
2. Product Maintenance Manual: Assemble complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into Work.
3. Operation and Maintenance Manuals: Assemble complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

B. Manual Contents: Including:

1. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark sheet to identify product or component incorporated into Work. If data include more than one item in a tabular format, identify each item using appropriate references from Contract Documents. Identify data applicable to Work and delete references to information not applicable.
2. Custom Written Data: For data not in manufacturer's standard literature, provide text, drawings, and schematics specifically applicable to installed systems. Include step-by-step descriptions of operating procedures; identification of individual components and their functions; descriptions of how system components relate to one another and operate together to accomplish a common process or function; and sequence of operation for system control circuits. For seasonally operated systems, provide start-up and shutdown instructions.
3. Equipment Data Sheets: For each item of equipment included in operation and maintenance data, provide Equipment Data Sheet using form at the end of this section. For equipment consisting of a driven machine and a driver (for example, a pump and a motor), equipment data shall cover both the driven machine and the driver. For similar type equipment (for example, multiple exhaust fans of the same model and type), provide a single equipment data sheet with an attached schedule listing individual equipment items.
4. Vendor Furnished As-Built Drawings: Provide for each electrical and each mechanical control system.
 - a. For each control system, provide control circuit schematic drawings. Identify each wire and terminal block number. Show terminal numbers on control devices. Show control wires and devices remote from control panel.
 - b. For each control panel, provide general arrangement drawing showing location of each control component and terminal block on the panel front and interior. Include materials list of panel-mounted control components as well as field-installed control components remote from the panel, identifying components, manufacturer, model number, and initial set points or sensing ranges of devices where applicable.
 - c. For packaged equipment systems, provide general arrangement drawings showing interrelationships of the various items of equipment and components.
 - d. In addition to control wiring schematic, provide power wiring schematic drawing showing power flow to each motor. Identify each power conductor. Show over-current protection and motor starting devices.

C. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

EQUIPMENT DATA SHEET	
Equipment Item: _____ Designation: _____ Function: _____ Location: _____ Project: _____ Model Number: _____ Serial Number: _____	
Manufacturer Address and Phone:	Supplier Address and Phone:
Preventive Maintenance Tasks:	
Nameplate Data:	
Spare Parts Furnished and Other Information:	

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing National Park Service (NPS) personnel, including:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment, including environmental considerations.
 - 3. Demonstration and training video.
- B. See Divisions 2 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 GENERAL REQUIREMENTS

- A. List of System Demonstration and Training requirements has been attached at end of Division 1 Specifications for your convenience. Intent is to provide overall summary of requirements and not a comprehensive list. Terms and conditions of contract still require satisfaction of requirements of individual specification sections regardless of what is shown on list.

1.3 SUBMITTALS

- A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. For each training session, Contractor shall submit for approval a proposed outline of subjects to be covered. Training shall not be conducted until outline is approved.
- B. Demonstration and Training Video: Submit 2 copies of each DVD (digital video disc) for training sessions within 7 days of end of each training module.
 - 1. Label each DVD with date of demonstration or training, instructor's name, and provide an index of contents. Index shall list start and end time of each subject covered during training session. Sequence of training subjects shall follow sequence listed in approved training outline or as actually conducted.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: Firm or individual experienced in training or educating maintenance personnel in training program similar in content and extent for this Project, and whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: Factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Contracting Officer (CO).

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and:
 - 1. Environmental Topics
 - a. Overview of environmental issues related to building industry.
 - b. Overview of environmental issues related to Project.
 - c. Review of site-specific procedures and management plans implemented during construction:
 - 1) Regulatory Requirements
 - 2) Indoor Air Quality (IAQ) Management
 - 3) Noise and Acoustics Management
 - 4) Environmental Management
 - 5) Construction Waste Management
 - d. Review of site-specific procedures and management plans to be implemented during operation and maintenance.
 - 1) Include review of environmentally related aspects of Operations and Maintenance Manual.
 - 2) Integrated Pest Management (IPM)
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include description of specific skills and knowledge that participant is expected to master. For each module, include instruction for:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
 - 2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
 - 3. Emergencies: Instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
 - 4. Operations: Startup, break-in, control, and safety procedures; stopping and normal

- shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
- 5. Adjustments: Alignments and checking, noise, vibration, economy, and efficiency adjustments.
- 6. Troubleshooting: Diagnostic instructions and test and inspection procedures.
- 7. Maintenance: Inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
- 8. Repairs: Diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

- A. Facilitator: Engage qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Contracting Officer for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct NPS personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with NPS through Contracting Officer with at least seven days advance notice.
 - 2. Conduct training sessions after equipment or system has been accepted and turned over to Government. Coordinate with commissioning requirements.
 - 3. Coordinate with Integrated pest management requirements. Refer to specifications section and approved IPM plan.
 - 4. Individual sections specify duration of training required. If no duration is listed, provide training of sufficient duration to adequately cover subjects.

3.2 DEMONSTRATION AND TRAINING VIDEO

- A. General: Engage qualified commercial photographer to record demonstration and training video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of training module, record each chart containing learning objective and lesson outline.
- B. Video Format: Digital Video Disc (DVD).
- C. Video Recording: Record sessions with high resolution equipment. Instructor's voice shall be clearly audible and understandable on DVD. Utilize supplemental microphone worn by instructor.

- D. Narration: Describe scenes on video by audio narration by microphone while video is recorded, or dubbing audio narration off-site after video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1. DVDs with poor video or audio quality will be rejected and training recorded again.

END OF SECTION 01 79 00

SECTION 01 91 14 – TOTAL BUILDING COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. Construction checklists, including, but not limited to, installation checks, startup, and performance tests.
6. Commissioning tests.
7. Adjusting, verifying, and documenting identified systems and assemblies.

Work included under this section includes a complete and thorough investigation of equipment and systems indicated in Part 3 of section. In order to ensure proper installation and operation of components and systems. Contractor shall perform commissioning as described herein to accomplish the tasks, and goals of commissioning. Systems to be evaluated include but are not limited to:

8. HVAC (Heating, Ventilation, and Air Conditioning) components and equipment.
9. Lighting Control System.
10. Building Envelope (walls, roof, windows, infiltration, etc.)
11. Life Safety Systems (Fire Alarm & Suppression)
12. Electrical Systems.
13. Access Control/ Security Systems
14. Lightning Protection

B. Building commissioning activities and documentation are described in the following reference material: United States Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED™) rating program, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guideline 0-2005, The Commissioning Process, and National Institute of Building Sciences (NIBS) Guidelines.

C. National Park Service (NPS) personnel, Green Consultant, and Architect/Engineer, are not responsible for construction means, methods, job safety, or management function related to commissioning on job site.

D. Related Sections:

1. 01 31 00 - Project Management and Coordination
2. 01 33 23 - Submittal Procedures
3. 01 40 00 - Quality Requirements
4. 01 57 19.11 - Indoor Air Quality (IAQ) Management
5. 01 57 19.12 - Noise and Acoustics Management

6. 01 77 00 - Closeout Procedures
7. 01 78 23 - Operation and Maintenance Data
8. 01 79 00 - Demonstration and Training
9. 01 81 13 - Sustainable Design Requirements

1.2 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity.
- B. Basis-of-Design Document: Document prepared by Designer that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Total Building Commissioning (TBC): Quality-focused process for verifying and documenting that facility, systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. Requirements specified here are limited to construction phase commissioning activities.
- D. Construction Checklist: Form used by Contractor to verify appropriate components are on site, ready for installation, correctly installed and functional.
- E. Contractor's Commissioning Representative (CCxR): Contractor's designated individual to coordinate, manage, and execute commissioning processes of the contracting organizations.
- F. Commissioning Plan (CCxP): Plan that provides structure, schedule and coordination planning for commissioning process proposed specifically for this project. CCxP includes Personnel, activities, and a description of Infrastructure, and list of instruments and logging devices that will be used during Commissioning.
- G. Deficiency: Condition in the installation or function of a component, piece of equipment or system not in compliance with Contract Documents, does not perform properly or is not complying with Basis of Design.
- H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional performance testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The CCxR develops the sequentially written functional test procedure forms, and oversees and documents the actual testing, which is performed by the installing contractor or vendor. The CCxR creates worksheets from these forms which include procedures required to accommodate actual equipment, means and methods used in the project. Functional Performance Tests are performed after pre-functional checklists and startup is complete.

- I. Manual Test: Using hand-held instruments, control system readouts or direct observation to verify performance (contrasted to analyzing electronically monitored data taken over time to make the "observation").
- J. Monitoring: Recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.
- K. Owner's Project Requirements: Document originated by Designer that details functional requirements of project and expectations of use and operation, including project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. Document is updated, with input from Contracting Officer (CO) as required as project is finished.
- L. Pre-functional Checklist: List of items to inspect and elementary component tests to conduct to verify proper installation of equipment. Pre-functional checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels ok, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring voltage imbalance on a three-phase pump motor of a chiller system). Pre-functional" refers to "before" functional testing. Pre-functional checklists augment and are combined with the equipment manufacturer's start-up checklist.
- M. Seasonal Performance Tests: Functional Performance Tests deferred until system(s) will experience seasonal conditions closer to their design conditions.
- N. Systems Manual: System focused composite document that includes operational manual, maintenance manual, and additional information of use to Government during Occupancy and Operation Phase.

1.3 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action.
 - 1. CCxR (Contractor's Commissioning Representative): CCxR shall be approved by Contracting Officer and satisfy as many of the following requirements as possible:
 - a. Certified in Commissioning by nationally accredited organization (i.e. Associated Air Balance Council (AABC), Association of Energy Engineers (AEE), Building Commissioning Association (BCA), and National Environmental Balancing Bureau (NEBB))
 - b. Acted as principal Commissioning Authority where total building commissioning approach (including building envelope) was used for at least three projects of comparable size, type, and scope.
 - c. Technical training in Mechanical, Electrical, and/or fire protection engineering.
 - d. Past commissioning experience.
 - e. Knowledge of national codes.
 - f. Leadership in Energy and Environmental Design (LEED) Accredited Professional.
 - g. Experience in energy-efficient design and control strategy optimization.

- h. Specific experience with specialty systems relative to particular facility type (i.e. Federal blast and progressive collapse requirements, security systems, etc.).
2. Contractor Quality Control (CQC) Supervisor
3. Other Representatives may include Project superintendents, installers, suppliers, and specialists.

B. Members Appointed by Contracting Officer:

1. Representatives of facility user and operation and maintenance personnel.
2. Architect and engineering design professionals.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf to participate in and perform commissioning process activities including:

1. Perform commissioning tests, as required by technical specifications. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Record and resolve commissioning issues.
3. Attend commissioning team meetings held on weekly basis or more frequently as needed to complete commissioning related construction activities.
4. Integrate and coordinate commissioning process activities with overall project schedule.
5. Review Construction Checklist attached at end of specification section.
6. Complete electronic construction checklists as contract work is completed and provide to Contracting Officer on a weekly basis.
7. Complete commissioning process test procedures.
8. Provide maintenance orientation and inspection for systems, assemblies, equipment, and components based on contract requirements.
9. Provide Commissioning Plan and documentation for final commissioning documentation.
10. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for complete range of testing for required test period.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information:

1. Review of systems manual, submittals, documents, and other commissioning reports
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase
3. Commissioning Plan including Process activities and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for systems, assemblies, equipment, and components to be verified and tested
4. Certificate of readiness certifying systems, subsystems, equipment, and associated controls are ready for testing
5. Test and inspection reports and certificates
6. Corrective action documents
7. Testing, adjusting, and balancing reports

1.6 SUBMITTALS

- A. Two-week look-ahead schedules: Schedule showing the next two weeks of commissioning related construction activity to include completion dates for each element of commissioning documentation for each major system or subsystem as identified in 1.1.B.
- B. Certificates of readiness.
- C. Contractor's Commissioning Representative Qualifications.
- D. Commissioning Plan: Submit within 30 calendar days of authorization to proceed.
 - 1. Update as necessary during the work to reflect progress on components and systems.
- E. Pre functional checklists.
- F. Owner's project requirements.
- G. Functional performance test forms: Submit minimum 30 calendar days prior to testing
- H. List of test instrumentation, equipment, and monitoring devices. Include:
 - 1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
 - 2. Brief description of intended use.
 - 3. Calibration record showing:
 - a. Calibration agency, including name and contact information
 - b. Last date of calibration
 - c. Range of values for which calibration is valid
 - d. Certification of accuracy
 - e. National Institute of Standards and Technology (NIST) traceability certification for calibration equipment.
 - f. Due date of the next calibration.
- I. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation. Document results from start-up/pre-functional checklists, functional performance testing, and short-term diagnostic monitoring. Include details of components or systems found to be non-compliant with drawings and specifications. Identify adjustments and alterations required to correct system operation and identify who is responsible for making corrective changes.
 - 1. Update as necessary during work to reflect progress on components and systems. Submit updated versions monthly.
- J. Closeout Documentation
 - 1. Closeout documents for commissioned equipment and systems shall be submitted prior to functional performance testing. These include:
 - a. Record Documents and Drawings
 - b. Start-up certificates for commissioned equipment with start-up requirements

- c. Systems Manual
 - d. Include TAB, startup, and Control System check-out reports.
 - e. Other documents required by individual Specification sections.
- 2. Operation and Maintenance (O&M) Submittals (refer to requirements of technical specifications):
 - a. Training plan: Include for each training session:
 - 1) Dates, start and finish times, and locations
 - 2) Outline of the information to be presented
 - 3) Names and qualifications of presenters
 - 4) List of texts and materials required to support training

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Instrumentation shall:

- 1. Be of sufficient quality and accuracy to test and measure system performance within tolerances required to determine adequate performance.
- 2. Be calibrated on manufacturer's recommended intervals calibration tags permanently affixed to instrument being used.
- 3. Be maintained in good repair and operation condition throughout duration of use on this project.

B. Standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by Contractor for equipment being tested.

C. Required commissioning equipment (sensors, transducers, data loggers, etc.) not integral to the systems or equipment installed shall be provided by Contractors Commissioning Representative and shall not become property of the Government.

2.2 PRE-FUNCTIONAL CHECKLIST:

A. Prepare pre functional checklists for equipment and systems to be commissioned.

B. Pre-functional checklists shall be complementary to Commissioning Plan and Commissioning Schedule.

- 2.3 FUNCTIONAL TEST PROCEDURE FORMS: Prepare functional test procedure forms for each piece of equipment and each system to be commissioned.
- 2.4 FUNCTIONAL PERFORMANCE WORKSHEETS:
- A. Prepare Functional Performance worksheets, consisting of test procedures and expected results of testing.
- 2.5 REPORT FORMAT AND ORGANIZATION
- A. General Format and Organization:
1. Bind report in three-ring binders.
 2. Label front cover and spine of each binder with report title, volume number, project name, Contractor's name, and date of report.
 3. Record report on compact disk.
 4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.
- B. Commissioning Report:
1. Include table of contents and an index to each test.
 2. Include major tabs for each Specification Section.
 3. Include minor tabs for each test.
 4. Within each minor tab, include:
 - a. Test specification.
 - b. Pre-startup reports.
 - c. Approved test procedures.
 - d. Test data forms, completed and signed.
 - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

- 3.1 COMMISSIONING PROCESS
- A. Following activities outline general commissioning tasks (requiring development, execution, etc.) and order in which they occur. Specific Commissioning requirements are found in technical specification Section(s) 23 08 00 and 28 08 01.
1. Commissioning Scoping Meeting
 2. Finalize Owner's Project Requirements
 3. Commissioning Plan
 4. Prepare pre-functional checklists.

5. Prepare functional performance worksheets.
6. Perform Start-Up/Pre-Functional Checks in accordance with manufacturer's recommendations and pre-functional checklists.
7. Functional Performance Testing in accordance with functional performance worksheets
8. Deficiency Report and Resolution Record
9. Operation and Maintenance Documentation
10. Operations and Maintenance Training
11. Deferred Testing

3.2 TOTAL BUILDING COMMISSIONING (TBC) REQUIREMENTS

- A. TBC during construction, acceptance, and warranty phases is intended to achieve following specific objectives:
1. Verify that systems and equipment meet Owner's Project Requirements.
 2. Verify equipment is what was submitted and approved.
 3. Verify and document equipment is installed and started per manufacturer's recommendations, industry accepted minimum standards, and Contract Documents.
 4. Verify and document equipment and systems receive complete operational checkout by installing contractors.
 5. Verify and document equipment capacity and system efficiency.
 6. Verify performance of building envelope. Document testing and conformance to Contract Documents.
 7. Verify completeness of operations and maintenance materials.
 8. Ensure Governments operating personnel are adequately trained on operation and maintenance of building equipment.

3.3 COMMISSIONING SCOPING MEETING

- A. Commissioning Scoping Meeting:
1. Schedule, coordinate, and facilitate a scoping meeting.
 2. Review each building system to be commissioned, including intended operation, commissioning requirements, and completion and start-up schedules.
 3. Establish scope of work, tasks, schedules, deliverables, and responsibilities for implementation of Commissioning Plan.
 4. Attendance: Commissioning Team members.

3.4 COMMISSIONING PLAN

- A. Commissioning Plan: Develop commissioning plan to identify how commissioning activities will be integrated into general construction and trade activities. Commissioning plan shall identify how commissioning responsibilities are distributed. Intent of plan is to evoke questions, expose issues, and resolve issues with input from entire commissioning team early in construction.
1. Identify who will be responsible for producing various procedures, reports, Contracting Officer notifications and forms.

2. Include commissioning tasks and activities in overall project schedule. Tag individual activities so they can be filtered at later date.
3. List and describe each test/acceptance procedure, including acceptance criteria.

3.5 START-UP/PRE-FUNCTIONAL CHECKLISTS

- A. Start-Up/Pre-Functional Checklists: Complete pre-functional checklists prior to start up. Checklist shall help verify that systems are complete and operational, so functional performance testing can be scheduled.
 1. Verify equipment installed is what was approved on Submittal.
 2. Manufacturer's start-up checklists and other technical documentation guidelines may be used as basis for pre-functional checklists.

3.6 FUNCTIONAL PERFORMANCE TESTING

- A. Functional Performance Testing: Test procedures fully describe system configuration and steps required for each test.
 1. Test Methods: Functional performance testing and verification may be achieved by direct manipulation of system inputs (i.e. heating or cooling sensors), manipulation of system inputs with building automation system (i.e. software override of sensor inputs), trend logs of system inputs and outputs using building automation system, or short-term monitoring of system inputs and outputs using standalone data loggers. A combination of methods may be required to completely test complete sequence of operations. CCxR shall determine which method or combination of methods is most appropriate.
 2. Setup: Each test procedure shall be performed under conditions that simulate normal operating conditions as closely as possible. Where equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met, functional performance test procedures shall demonstrate actual performance of safety shutoffs in real or closely simulated conditions of failure.
 3. Sampling: Multiple identical pieces of non-life-safety or non-critical equipment may be functionally tested using a sampling strategy. If, after three attempts at testing the specified sample percentage, failures are still present, remaining units shall be tested at Contractors' expense.
- B. Prepare functional performance test procedure forms to accommodate actual installed equipment and systems.
- C. Coordinate, execute, and record results of functional performance testing.
 1. Coordinate retesting as necessary until satisfactory performance is verified.
 2. Verify intended operation of individual components and system interactions under various conditions and modes of operation.

3.7 DEFICIENCY REPORT AND RESOLUTION RECORD

- A. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation.
- B. Non-Conformance. Non-conformance and deficiencies observed shall be addressed immediately. Notify responsible parties and provide recommended actions to correct deficiencies.
 - 1. Corrections of minor deficiencies identified may be made during tests at discretion of CCxR. In such cases the deficiency and resolution shall be documented on procedure form.
 - 2. For identified deficiencies:
 - a. If no dispute on deficiency and responsibility to correct it:
 - 1) CCxR documents deficiency and adjustments or alterations required to correct it. Contractor corrects deficiency and notifies CCxR that equipment is ready to be retested.
 - 2) CCxR reschedules test and test is repeated until satisfactory performance is achieved.
 - b. If there is a dispute about a deficiency or who is responsible:
 - 1) Deficiency is documented CCxR on non-compliance form.
 - 2) Resolutions are made at lowest management level possible. Additional parties are brought into discussions as needed. Contractor shall have responsibility for resolving construction deficiencies. If a design revision is deemed necessary and approved by Contracting Officer, Architect/Engineer (A/E) shall have responsibility for providing design revision. CCxR documents resolution process.
 - 3) Once interpretation and resolution have been decided, appropriate party corrects deficiency and notifies CCxR that equipment is ready to be retested. CCxR reschedules test and test is repeated until satisfactory performance is achieved.
 - 3. Cost of Retesting: Costs for retesting shall be charged to Contractor.

3.8 OPERATIONS AND MAINTENANCE TRAINING

- A. Training: Develop Training Plan. Coordinate and execute training programs with CxA.
 - 1. Stress and enhance importance of system interactions, troubleshooting, and long-term preventive maintenance and operation programs.

3.9 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If test cannot be completed due to building structure, required occupancy condition, or other deficiency, functional testing may be delayed upon recommendation of CCxR and approval of Contracting Officer. These tests are conducted in same manner as the seasonal tests, as soon as possible.

B. Seasonal Testing

1. Schedule, coordinate, execute, and document additional testing for seasonal variation in operations and control strategies during appropriate season to verify performance of HVAC system and controls. Complete testing during warranty period to fully test sequences of operation.
2. Update O&M manuals and Project Record Drawings as necessary due to testing.

3.10 EQUIPMENT & SYSTEM SCHEDULE

- A. Commissioned Equipment and Systems List: Following is a list of systems and equipment to be commissioned organized by system. It includes the percentage of each category that will undergo testing. The intent is to provide an overall summary of commissioned equipment and systems, and not a comprehensive list. Refer to applicable specification sections for more information.

COMMISSIONED EQUIPMENT AND SYSTEMS LIST			
SYSTEM	EQUIPMENT	CC (Commissioning Coordinator)	FPT (Functional Performance Test)
Mechanical	Supply Fans, Exhaust Fans and Ceiling Fans		
Electrical	Distribution panels, Panelboards, Inverters, OCPD, Surge Protection Devices, Power Meters, Receptacles, Fuse and Non-fused Disconnect, and Disconnect Switches		
Lighting Controls	Sensors, timeclock, switches		
Plumbing	Water heater, circulating pump, thermostatic valve, cold/hot water distribution		
Fire Protection	Valves, pipe pressure tests, flow switches, bells, drains, backflow preventers		
Fire Alarm	Control panels, devices, and appliances.		

END OF SECTION 01 91 14

Closeout and Operation & Maintenance (O&M) Requirements Template

National Park Service (NPS) - Denver Service Center (DSC) | 1-27-21

Topic	Specification Section	Requirement	Submittal Date	Completed	Received by Park
Project Record Drawings	01 77 00	Final Project Record Drawings.			
	01 91 00	Record Drawings.			
	02 41 00	Record Drawings.			
	21 00 00	Record Drawings.			
	26 00 00	Include copy of approved submittal data along with submittal review letters received from Contracting Officer.			
	22 00 00	Division 22 Specifications: Record Drawings, see individual sections for any special requirements.			
	23 00 00	Division 23 Specifications: Record Drawings, see individual sections for any special requirements.			
	27 00 00	Division 27 Specifications: Record Drawings, see individual sections for any special requirements.			
	28 00 00	Division 28 Specification: Record Drawings including CAD drawings, see individual sections for any special requirements.			
	32 84 00	Record Drawings and Controller Plan.			
	33 14 16	Record Drawings.			
	33 30 00	Record Drawings.			
	33 40 00	Record Drawings.			
	33 46 00	Record Drawings.			
System Demonstration and Training	01 77 00	Submit demonstration and training video.			
	01 79 00	Develop instruction program and training modules.			
	01 91 00	Schedule demonstration and training.			
	21 00 00	Demonstrate equipment furnished and installed or connected functions in manner required.			
	23 00 00	Provide training of operating personal.			
	26 00 00	Instruction on proper operation of equipment and systems.			
	28 31 00	Provide personnel instruction per Div 283100 specs, section 3.1, O.			
Tools Spare Parts Equipment	21 13 00	Provide suitable wrenches for each sprinkler type and metal storage cabinet in fire riser room.			
Extra Stock	09 78 00	Maintenance materials.			
	09 91 13	Maintenance materials.			
	09 92 13	Maintenance materials.			
	09 93 00	Maintenance materials.			
	21 13 00	Provide extra sprinklers in a spare sprinkler cabinet per code.			
	23 34 00	Extra filter, one set of each type and size.			
	32 84 00	Maintenance materials.			
Reports	01 74 19	Construction Waste Management closeout submittals.			
	21 00 00	Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.			
	26 00 00	Include commissioning reports.Include copy of startup and test reports specific to each piece of equipment.			
	23 05 48	Provide seismic calculation and vibration isolation calculation.			
	23 05 93	Provide TAB report.			
	23 08 00	Provide test report.			
	28 31 00	Provide Program Data File.			
	28 31 00	Provide Record of Completion.			
	28 31 00	Provide Test Reports.			
	22 10 00	Provide water test report.			
Keys & Keying Schedule	28 31 00	Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.			
O&M Data Warranties	07 41 13	Warranty.			
	07 46 46	Maintenance data.			
	07 92 00	Warranty.			
	08 52 00	Warranty.			
	08 91 00	Maintenance data.			
	08 91 00	Warranty.			
	09 78 00	Maintenance data.			
	09 91 13	Maintenance data.			
	09 92 13	Maintenance data.			
	09 93 00	Maintenance data.			
	12 36 00	Maintenance data.			
	21 00 00	Division 21 Sections: Operation and Maintenance Manuals.			
	22 30 00	Equipment warranty.			
	22 30 00	Operation and Maintenance Manuals.			
	23 00 00	Division 23 Sections: Operation and Maintenance Manuals.			
	23 00 00	Warranties: HVAC Basic Requirements and individual Division 23,HVAC Sections. Include product certificates of warranties and guarantees.			
	26 00 00	Warranties: Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections. Include product certificates of warranties and guarantees.			
	26 00 00	Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.			
	27 00 00	Cable Manufacturer's Warranty.			
	28 31 00	System Components, Initiating Devices and Notification Appliances' Installation Sheets.			
	28 31 00	Manufacturer's Installation, Operation and Maintenance Manual.			
	28 31 00	One year warranty agreement including parts and labor. Warranty period begins upon date of completion.			
	28 31 00	Catalog Cut Sheets.			
	32 33 00	Maintenance data.			
	32 84 00	Manuals.			
	32 98 00	Landscape establishment manual.			

SECTION 02 41 00 - SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.
- C. Abandonment in place of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

- A. Section 01 11 00 - Summary of Work: Limitations on Contractor's use of site and premises.
- B. Section 01 11 00 - Summary of Work: Sequencing and staging requirements.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 015723 - Temporary Storm Water Pollution Prevention.
- E. Section 01 73 40 - Execution: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Site Plan: Showing:
 - 1. Vegetation to be protected.
- C. Demolition Plan: Submit demolition plan for removal of existing site utilities required to install new utilities.

- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 SCOPE

- A. Remove utilities and other site features as noted in drawings to facilitate new work.
- B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill on the drawings or in other sections.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Provide, erect, and maintain temporary barriers and security devices.
 - 2. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 3. Do not close or obstruct roadways or sidewalks without permit.
 - 4. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Protect existing structures and other elements that are not to be removed.
- C. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- D. If hazardous materials are discovered during removal operations, stop work and notify Contracting Officer; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- E. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.3 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. See Section 01 11 00 - Summary of Work for limitations on utility outages and required notifications.
- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Contracting Officer before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
- C. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction damaged during removal work.
 - 4. Patch as specified for patching new work.

3.5 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.2 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.

- b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

- A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
- C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.

2. Exposed Concrete: Symmetrically align joints and form ties in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 1. Provide and secure units to support screed strips
 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 1. Determine sizes and locations from trades providing such items.
 2. Obtain written approval of Contracting Officer prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Contracting Officer.
 3. Place joints perpendicular to main reinforcement.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

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

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of grade beams, footings, pedestals, retaining walls, curbs, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Contracting Officer.

3.4 SHORING AND RESHORING INSTALLATION

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

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a special inspector to perform inspections and prepare test reports.
- B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

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

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- E. Recycled Content: Provide reinforcing steel with a minimum recycled content of 80 percent (pre-consumer plus post-consumer). See Sustainability Requirements section 01 81 13.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 1. Do not cut or puncture vapor retarder.
 2. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318 and as indicated.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Stagger splices in accordance with ACI 318.
 - 2. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Contracting Officer.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified testing and inspecting agency to perform inspections and prepare reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION 03 20 00

PART 4 -

SAMO - 303051

03 20 00 - 4
CONCRETE REINFORCING

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
6. Vapor retarders.
7. Floor and slab treatments.
8. Curing materials.
9. Repair materials.

- B. Design Mixtures: For each concrete mixture, include historical or trial batch test data in accordance with ACI 301 for qualifying concrete mixes on the basis of strength. Historical or

trial batch test data is not required for lean concrete. For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Target slump.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Contracting Officer.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Aggregates.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.

D. Test Reports.

E. Inspection Reports.

1.5 QUALITY ASSURANCE

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

Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for field testing and inspection indicated.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

- B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type II/V.
2. Fly Ash: ASTM C618, Class F with maximum loss on ignition of 1 percent.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Recycled Content: Concrete mixes shall include fly ash and ground granulated blast furnace slag to replace a minimum of 30 percent of the total cementitious materials. See Sustainability Requirements section 01 81 13.

- C. Normal-Weight Aggregates: ASTM C33/C33M Class 1N crushed or uncrushed rock, coarse aggregate. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.

2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.4 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Euco Diamond Hard or equal.
 2. At stained concrete, sealer shall be compatible with the stain system.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
1. Color:
 - a. Ambient Temperature Below 50 deg F: Black.
 - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
 - c. Ambient Temperature Above 85 deg F: White.
- C. Curing Paper: Eight-feet- wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
1. Do not use curing compounds that will interfere with subsequent stains or finishes.

2.6 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 2. Slag Cement: 50 percent by mass.
 - 3. Total of Fly Ash and Slag Cement: 50 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.8 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, tie beams, & curbs.
 - 1. Exposure Class: ACI 318 F0 ; S0 ; W0 ; C0.
 - 2. Minimum Compressive Strength: 3000 psi at 28 days.
 - 3. Maximum w/cm: 0.40.
 - 4. Target Slump: As needed for placeability. .
- B. Class B: Normal-weight concrete used for interior slabs-on-ground.
 - 1. Exposure Class: ACI 318 F0 ; S0 ; W0 ; C0.
 - 2. Minimum Compressive Strength: 3000 psi at 28 days.
 - 3. Maximum w/cm: 0.45.
 - 4. Target Slump: as needed for placeability.
 - 5. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.

5. Terminate vapor retarder at the top of floor slabs, grade beams, sealing entire perimeter to floor slabs, grade beams, foundation walls.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Contracting Officer.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 4. Locate joints for grade beams at third points of spans.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one fourth of concrete thickness as follows:
 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Contracting Officer and testing and inspection agencies 24 hours prior to commencement of concrete placement.

- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Contracting Officer in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Scream slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

- 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

- a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class D.
 - e. Apply to concrete surfaces not exposed to public view.
- 2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch .
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class B.
 - e. Locations: Apply to concrete to receive a grout-cleaned (sacked) finish.
- 3. Grout-Cleaned Rubbed (Sacked) Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.
 - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.

B. Related Unformed Surfaces:

- 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
- 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish:
 - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
- C. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs on Ground:
 - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch .

3.9 FLINSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

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

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases as indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations. Use evaporation retarder as needed.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Cure formed concrete surfaces.
 - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 - 3. If forms remain during curing period, moist cure after loosening forms.
 - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
 - 1. Begin curing immediately after finishing concrete.
 - 2. Interior and Exterior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with

sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

- a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
- a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
- 1) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive No Other Treatment – Curing Compound:
- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.

3.11 TOLERANCES

- A. Conform to ACI 117.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 28 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month.
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 1. Repair and patch defective areas when approved by Contracting Officer.
 2. Remove and replace concrete that cannot be repaired and patched to Contracting Officer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

- a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by the Contracting Officer.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.02 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.

- e. Cure in same manner as adjacent concrete.
- 8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Contracting Officer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Contracting Officer's approval.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency shall immediately report to Contracting Officer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Contracting Officer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.

- 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
1. Anchor rods and bolts installed in concrete.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 100 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C1064/C1064M:

- a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure five 6-inch by 12-inch or seven 4-inch by 8-inch cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one laboratory-cured specimens at seven days and two (for 6x12 cylinders) and three (for 4x8 cylinders) at 28 days. Retain the remaining specimens until the concrete is accepted.
 - b. A 28- day compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
9. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Contracting Officer.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from all concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

PART 4 -

SAMO - 303051

03 30 00 - 20
CAST-IN-PLACE CONCRETE

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. See Section 09 91 13 and Section 09 91 23 for painting requirements.

1.2 DEFINITIONS

- A. Structural Steel: Steel shapes, plates, and bars used for structural purposes such as columns, beams, and trusses.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Shop primer.
6. Galvanized repair paint.
7. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
 1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer & Fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
 1. Alternately a qualified fabricator with minimum of 10 years experience that can demonstrate, by project records, quality control manual, and personnel qualifications, equivalence with AISC Category BU.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
 1. A.1. Alternately a qualified erector with a minimum of 10 years of experience that can demonstrate, by project records, quality control manual, and personnel qualifications, equivalence with AISC Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
1. ANSI/AISC 303.
 2. ANSI/AISC 360.
 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
1. Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles: ASTM A36/A36M or where noted ASTM A572/A572M, Grade 50.
- C. Plate and Bar: ASTM A36/A36M, or where noted ASTM A572/A572M, Grade 50.
- D. Structural Steel Tubing: ASTM A 500, Grade B.
- E. Steel Pipe: ASTM A53, Grade 50.
- F. Welding Electrodes: Comply with AWS requirements.
- G. Recycled Content: Structural steel materials shall contain a minimum of 85% recycled materials (post-consumer and pre-consumer). See Sustainability Requirements section 01 81 13.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
- C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
 - 1. Nuts: ASTM A563 hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- B. Threaded Rods: ASTM A36/A36M.
 - 1. Nuts: ASTM A63 hex carbon steel.
 - 2. Washers: ASTM A36/A36M carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 PRIMER

- A. Steel Primer:
 - 1. Comply with Sections 09 91 13 and 09 91 23.
 - 2. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel: Section 09 91 13 Exterior Painting.
 - 1. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Mark and match-mark materials for field assembly.
 - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces to be field welded.
 - 2. Galvanized surfaces.

- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching. Coordinate with Section 09 91 13 Exterior Painting.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency Engage a qualified testing agency to perform shop tests and inspections.
 - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AISC 360 Chapter M.
 - a. Perform UT as required by AISC 360 Chapter M, based on type of welded joint and thickness of material.
 - 4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- D. Splice members only where indicated.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Cleaning and touchup painting are specified in Section 09 90 00 "Painting and Coating".

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AISC 360, Chapter M.

END OF SECTION 05 12 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Free-standing railings at steps, ramps, and drinking fountains.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 09 21 16 - Gypsum Board: Placement of backing plates in stud wall construction.
- C. Section 09 91 13 - Exterior Painting: Paint finish.

1.3 REFERENCE STANDARDS

- A. ABAAS - Architectural Barriers Act Accessibility Standards, 2015.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
- H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

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

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.
- D. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.
- C. Fabricator Qualifications:
 - 1. A company specializing in manufacturing products specified in this section, with not less than five years of experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
 - 2. For anchorage to stud walls, provide backing plates, for bolting anchors.
 - 3. Posts: Provide adjustable flanged brackets.

- G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 - 1. Ease exposed edges to a small uniform radius.

2.2 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by continuous welds.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ABAAS Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

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

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking and nailers.

B. Related Requirements:

1. Section 06 13 00 "Heavy Timber Construction."
2. Section 06 16 00 "Sheathing" for floor and wall sheathing.
3. Section 06 13 26 "Timber Trusses" for wood trusses made from dimension lumber or timber.

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. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Engineered wood products.
 3. Power-driven fasteners.

4. Post-installed anchors.
5. Metal framing anchors.

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, GENERAL

- A. Regional Materials: Manufacture the following wood products within 500 miles of Project site.
 1. Dimension lumber.
 2. Laminated-veneer lumber.
 3. Parallel-strand lumber.
 4. Rim boards.
- B. Certified Wood: Certify the following wood products "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-00 and FSC STD-40-004.
 1. Dimension lumber.
 2. Laminated-veneer lumber.
 3. Parallel-strand lumber.
 4. Rim boards.
- C. Lumber: 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, 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. Dress lumber, S4S, unless otherwise indicated.
- D. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- E. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by

rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPB U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 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, mark end or back of each piece.
- 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.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
 - 1. Application: All interior partitions.
 - 2. Species:
 - a. Douglas fir-larch; WCLIB or WWPA
- B. Load-Bearing Partitions: No. 2 grade.
 - 1. Application: Exterior walls and interior load-bearing partitions.
 - 2. Species:
 - a. Douglas fir-larch; WCLIB or WWPA.
- C. Ceiling Joists: Construction or No. 2 grade.

1. Species:
 - a. Douglas fir-larch; WCLIB or WHPA.
- D. Joists, Rafters, and Other Framing Not Listed Above: No. 1 grade.
 1. Species:
 - a. Douglas fir-larch; WCLIB or WHPA.
- E. Exposed Framing Indicated to Receive a Stained or Natural Finish: 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: As indicated above for load-bearing construction of same type.

2.4 ENGINEERED WOOD PRODUCTS

- A. Composite Wood Products: Verify products are made without added urea formaldehyde.
- B. Composite Wood Products: Verify products 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. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- D. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - a. Weyerhaeuser Company.
 2. Extreme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal-depth members.
 3. Modulus of Elasticity, Edgewise: 1,900,000 psi.
- E. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - a. Weyerhaeuser Company.

2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
3. Modulus of Elasticity, Edgewise: 2,200,000 psi.

2.5 MISCELLANEOUS LUMBER

- A. General: 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.
- B. Dimension Lumber Items: Construction or No. 2.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction.
 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Simpson Strong-Tie Co., Inc.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified

independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [Type 304] [Type 316].
 - 1. Use for exterior locations and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. 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.
- H. 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.
- I. Comply with AWP A 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.
- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 2. ICC-ES evaluation report for fastener.
- K. Use steel common nails unless otherwise indicated. 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.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with indicated fastener patterns where applicable.
 2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
- 3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS
- A. Install where indicated and where required for screeding or 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 items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 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.
- B. Rafters: Notch to fit exterior wall plates and fasten as indicated. Double rafters to form headers and trimmers at openings in roof framing unless detailed otherwise. Where rafters abut at ridge, place directly opposite each other and fasten as indicated.

3.4 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.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 13 00 - HEAVY TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing using timbers.
2. Custom fabricated connectors.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for dimension lumber items associated with heavy timber framing.

1.2 DEFINITIONS

A. Timbers: Lumber of 5 inches nominal or greater in least dimension.

B. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For.

1. For timber connectors. Include installation instructions.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings:

1. For heavy timber framing. Show layout, dimensions of each member, and details of connections.
2. For custom fabricated steel connectors.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For timbers 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.
- B. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS, GENERAL

- A. Certified Wood: Certify wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-001 and FSC STD-40-004.

2.2 TIMBER

- A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.
 1. Factory mark each item of timber with grade stamp of grading agency.
 2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.
- B. Timber Species and Grade: Douglas fir-larch; No. 1, NLGA, WCLIB, or WWPA.
- C. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.
- D. Dressing: Provide dressed timber (S4S) unless otherwise indicated.

2.3 TIMBER CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Simpson Strong-Tie Co., Inc.
- B. Custom fabricated connectors: Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
 - 2. Round steel bars complying with ASTM A575, Grade M 1020.
 - 3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
- C. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness, unless indicated to be galvanized.
- D. Where indicated Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.4 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.5 FABRICATION

- A. Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.
- B. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- C. Predrill for fasteners and assembly of units.
- D. Coat crosscuts with end sealer.
- E. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Erect heavy timber framing true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - 1. Install horizontal and sloping members with crown edge up, and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports with metal strap ties if not continuous.
 - 2. Handle and temporarily support heavy timber framing to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- C. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.
 - 1. Predrill for fasteners using timber connectors as templates.
 - 2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - 3. Coat crosscuts with end sealer.
 - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. Install timber connectors as indicated.
 - 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 - 2. Install bolts with orientation as indicated or, if not indicated, as directed by Contracting Officer.

3.2 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Contracting Officer.

END OF SECTION 06 13 00

SECTION 06 13 26 - TIMBER TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design, fabrication, and installation of timber trusses.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for dimension lumber used in timber trusses, and used with timber trusses as bracing or part of the roof framing.
2. Section 06 13 00 "Heavy Timber Construction" for timber used in timber trusses.

1.2 REFERENCES

A. Comply with the applicable provisions of the following:

1. International Building Code, 2021 (IBC).
2. American Wood Council, "National Design Specification for Wood Construction" (NDS)
3. Timber Frame Engineering Council, "Design Guide for Timber Roof Trusses" (TFEC-4)

1.3 DEFINITIONS

A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Truss manufacturer and designer qualification information.

B. Design drawings and calculations.

C. Product Data: For.

1. Bolts, screws, and other connectors.

D. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer

- E. Design Drawings: Include entire roof framing system with the trusses. Show layout, dimensions of each member, and details of connections
- F. Shop Drawings: For timber trusses. Show layout, dimensions of each member, and details of connections.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. For any lumber or timber specified by the truss designer 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.
- B. Certificates of Inspection: Issued by lumber-grading agency for exposed members not marked with grade stamp.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall be a specialty manufacturer with expertise in design and construction of enhanced-appearance wood timber trusses.
 - 2. Manufacturer must be certified for chain of custody by an FSC-accredited certification body.
- B. Design Engineer Qualifications: A registered civil or structural engineer with a minimum of 10 years of experience in design and detailing of wood timber trusses.

1.7 STRUCTURAL PERFORMANCE

- A. Design trusses to support the unfactored loads indicated.
- B. Trusses shall match the profile and general member layout indicated. Actual number of bays may be modified in accordance with the design.
- C. Minimum member sizes are indicated. Trusses may use spaced double members for top and bottom chords, with single web members, or full size timbers.
- D. Camber trusses 1 inch.
- E. Connections may utilize any structurally verifiable system, including but not limited to:
 - 1. Bolted side plates.
 - 2. Kerfed (knife) plates with bolts
 - 3. Bolts and split ring connectors.
 - 4. Joinery techniques with tension bolts.
- F. Coordinate connection geometry at heel with the requirements indicated for anchorage to the wall/column framing.

1.8 APPEARANCE

- A. Trusses are exposed and must be designed and fabricated to present a consistent, neat appearance.
- B. Exposed bolts shall be arranged symmetrically, with any washer plates oriented consistently.
- C. Bolt heads and nuts may be at the surface or countersunk.
- D. Exposed plates shall have corners clipped and edges eased, and shall be primed and painted black in accordance with Section 09 90 00 Painting.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Trusses shall be fabricated and shipped full length.
- B. Schedule delivery to avoid extended on-site storage and to avoid delaying the Work.
- C. Trusses shall be wrapped and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS, GENERAL

- A. Certified Wood: Certify wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-001 and FSC STD-40-004.

2.2 LUMBER AND TIMBER

- A. Lumber and timber shall comply with the requirements of Section 06 10 00 and Section 06 13 00.
 - 1. Factory mark each item of lumber and timber with grade stamp of grading agency except that for exposed members indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.
- B. Timber Species and Grade: Douglas fir-larch; No. 1, NLGA, WCLIB, or WWPA, or as required by the design.
- C. Moisture Content: Provide lumber and timber with 19 percent maximum moisture content at time of dressing.
 - 1. Members shall be at no more than 15 percent moisture content at the time of fabrication and assembly.
- D. Dressing: Provide dressed lumber and timber (S4S) unless otherwise indicated.

2.3 CONNECTORS

- A. Materials: Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M or where required by the design ASTM A572, Grade 50.
 - 2. Round steel bars complying with ASTM A575, Grade M 1020.
- B. Fasteners:
 - 1. General: Provide steel fasteners in accordance with the approved design.
 - 2. Bolts, nuts, washers and lag screws shall be hot-dipped galvanized in accordance with ASTM A153.
- C. Finish steel connection assemblies rust-inhibitive primer, 2-mil dry film thickness, unless indicated to be hot-dipped galvanized.

2.4 SEALER

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.5 FABRICATION

- A. Fabricate to the tolerances necessary to erect on the supports indicated.
- B. Provide for full strength splicing as needed to allow for shipping and erection.
- C. Notches and butted joints shall be carefully constructed for full bearing without visible gaps.
- D. Bolt and screw holes in steel shall be drilled or punched 1/16-inch greater in diameter than the nominal diameter of the bolt or screw shank. Grind surface smooth.
- E. Bolt holes in wood shall be 1/16-inch greater in diameter than the nominal diameter of the bolt.
- F. Predrill for lag screws.
- G. Welding shall conform to AWS D1.1. Remove any visible signs of welding from fabricated steel elements.
- H. Surface finish shall be equivalent to that produced by machine sanding with No. 120 grit sandpaper. Restore cut or planed exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks..
- I. Coat crosscuts with end sealer.

- J. Seal Coat: After fabricating and surfacing each wood member, apply a saturation coat of penetrating sealer on surfaces prior to assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Erect trusses true and plumb. Provide temporary shoring and bracing to maintain stability until permanent supporting members are in place.
 - 1. Secure trusses to wall/column supports as indicated.
 - 2. Handle and temporarily support to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

3.2 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection and roof framing as directed by the Contracting Officer.

END OF SECTION 06 13 26

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

B. Related Requirements:

1. Section 06 10 00 Rough Carpentry and Section 06 13 00 Heavy Timber Construction for framing with lumber and timber.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Plywood.
2. Machine nails.

1.3 INFORMATIONAL SUBMITTALS

A. Special Inspection reports.

1.4 QUALITY ASSURANCE

A. Machine nailing demonstration panel:

1. Machine nailing shall be subject to successful completion of a demonstration panel to show that, using the equipment, nails, and personnel proposed for the production work, nails can be accurately placed and not over-driven.
2. The panel shall be a minimum of 10 feet by 10 feet.
3. If more than 10% of the nails are oversunk more than 1/32 inch below the surface of the plywood, machine nailing will not be permitted.

B. Testing Agency Qualifications:

1. The testing and inspection agency performing wood special inspection shall be under the supervision of a registered engineer. The inspector shall be qualified for inspection of wood framing by experience or training, relevant to the type of inspection. The registered engineer in charge of the testing and inspection agency shall issue a statement that the inspector is qualified for inspection of wood framing and provide qualification back-up data for review by the Contracting Officer..

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet 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. Certified Wood: Certify the following wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-00 and FSC STD-40-004.
 - 1. Plywood.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exposure 1, Structural I sheathing.
 - 1. Span Rating: Not less than 32/16.
 - 2. Nominal Thickness: Not less than 1/2 inch.

2.3 ROOF SHEATHING

- A. Plywood Sheathing: Exposure 1, Structural I sheathing.
 - 1. Span Rating: Not less than 48/24.
 - 2. Nominal Thickness: as indicated.
 - 3. 5-ply minimum.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

1. Nails for machine nailing shall have the same shank diameter as the specified nail, and shall have full-size nail heads.
2. Nails for machine nailing shall have a current valid evaluation report, and shall have means of determining the nail type, diameter, and length after driving, such as embossed marks or color coating.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. 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. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Wall and Roof Sheathing:
 - a. Nail to wood framing. Edge nails shall be spaced 3/8 inch from edge of panel. See Quality Assurance article for machine nailing.

- b. Space panels 1/8 inch apart at edges and ends.
- c. Nail heads shall be flush with the surface of the sheathing. Overdriven nails will be rejected.

C. Block edges as indicated.

3.3 SPECIAL INSPECTION

- A. The Contractor's testing and inspection agency shall inspect the following:
 - 1. Plywood nailing.
 - 2. Structural connections and framing clips

END OF SECTION 06 16 00

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items.
- B. Wood door frames.
- C. Wood casings and moldings.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 074646 - Fiber-Cement Siding for fiber-cement exterior trim and battens.
- C. Section 08 14 16 - Solid Core Doors with Decorative Wood Facings.
- D. Section 08 52 00 - Wood Windows.
- E. Section 09 91 13 - Exterior Painting: Painting of finish carpentry items.
- F. Section 09 91 23 - Interior Painting: Painting of finish carpentry items.
- G. Section 09 93 00 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- D. PS 20 - American Softwood Lumber Standard; 2020.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal procedures for project procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Samples: Submit two samples of wood trim and panel materials 12 inches long illustrating wood grain and each type of specified finish.

1.6 MOCK-UPS

- A. Provide mock-up of wood paneling at the Small Event Building, 8 feet long by full wall height.
- B. See Section 01 40 00 - Quality Requirements for additional requirements.
- C. Locate where directed by Contracting Officer.
- D. Mock-up may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect from moisture damage.
- B. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Exterior Woodwork Items:
 - 1. Fascias: Softwood to match framing, rough sawn, prepare for paint finish.
 - 2. Soffits and Trim: See Section 074646 - Fiber-Cement Siding for material.
 - 3. Door and Window Frames: Western red cedar, Grade A, for transparent finish.
- D. Interior Woodwork Items:
 - 1. Casings: Western red cedar, Grade A, for transparent finish.
 - 2. Board Paneling: Clear fir; rough sawn, prepare for paint finish.

2.2 WOOD-BASED COMPONENTS

- A. Provide sustainably harvested wood, certified or labeled as specified in Section 01 67 00 - Product Requirements.
- B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 67 00 - Product Requirements.

2.3 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; conceal prior to paint finish.
- C. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.

2.4 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking: Softwood lumber.
- C. Primer: Alkyd primer sealer.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

2.5 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.6 SHOP FINISHING

- A. Sand work smooth, except where rough sawn wood is noted. Set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Prime paint surfaces in contact with cementitious materials.
- D. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.3 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.4 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 91 13 and 09 91 23.

3.5 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes site carpentry work complete, as shown and as specified and includes wood work for fences, gates, and other landscape elements as defined and detailed in the drawings.

1.2 REFERENCES

- A. IBC - International Building Code
- B. NFPA - National Forest Products Association, National, Design Specifications
- C. ALSC - USDA American Lumber Standards Committee
- D. WCLI - West Coast Lumber Inspection Bureau, Standard Grading and Dressing Rules
- E. WWPA - Western Wood Products Association, Grading Rules for Western Lumber
- F. RIS - Redwood Inspection Service, Standard Specifications for Grades of California Redwood Lumber
- G. Section 018113 – Sustainable Design Requirements.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's current catalogue cuts and specifications for the following items:
 - 1. Redwood Lumber Product Data, indicating grade and kiln dried certification
 - 2. Fasteners
 - 3. Wood Sealer and Preservatives
- B. Material Certificates:
 - 1. 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.
- C. Shop Drawings:
 - 1. Enlarged plans, elevations and sections for the following site elements.
 - a. Fences
 - b. Gates
 - 2. Shop Drawing shall incorporate all elements as shown in the drawings, and shop drawings shall include structural calculation to determine size if not provided by the project's structural engineer. Shops shall also include all hardware (for gates and fences), all connections between wood and metal elements, wood sizes, materials, grades, finishes, required fasteners, and any misc. materials required for the fabrication.

3. Coordinated Gates and fence requirements with other specifications sections
4. Shop drawings shall be to scale and clearly labeled and dimensioned.
5. Drawings shall include site context as needed to ensure coordination and connection to other site elements. Refer to drawings.
6. Coordinate shop drawing with the project structural engineer's drawings.

D. Samples: Four 4 of each stain applied to specified wood.

E. Materials List: Indicate type of member, location, grade, specie, size, length and quantity.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage:

1. Store all lumber in neat stacks at the site. Stack all lumber so that it may be readily inspected.
2. Pile structural timber neatly on skids above ground to prevent twisting and affording proper ventilation and drainage.
3. Protect from termites, decay, rain and excessive sun.

B. Handling:

1. Handle lumber in a manner that will avoid injury or breakage.
2. Handle treated timber with rope slings. Do not use cant hooks, peaveys, or other sharp instruments in handling treated timber. Undue injury in handling will be cause for rejection.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of site gates and fences shall be provided by a specialty gate and fence sub-contractor. The sub-contractor shall have a min. of 5 years' experience in building and installing decorative gate and fences similar to the design details shown in the drawings.

B. Gate and fence panel shall be shop fabricated when possible.

C. Forest Certification: Provide wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.6 PROJECT/SITE CONDITIONS

A. Existing Conditions: For protection of existing plants to remain in regards to excavation needed to install fence footings, see Division 31, Section "Landscape Grading".

1.7 SEQUENCING AND SCHEDULING

A. General: Verify and obtain location and size of rough openings, bracing and blocking required to accommodate the work of other sections into the carpentry work.

B. Layout: Furnish layouts for foundation bolts and framing anchors in concrete.

- C. Adjustments: Determine foundation adjustments required in framing to obtain required levels and alignments.
- D. Submittals Review:
 - 1. Materials lists, shop drawings and layout drawings for quality, quantity, size and location of materials furnished in other sections.
 - 2. Shop drawings and layout drawings to coordinate cutting, notching and boring holes for piping, wiring and other items attached to or concealed in the carpentry work.

PART 2 - PRODUCTS

2.1 LUMBER

- A. General:
 - 1. Use only lumber conforming to grades and dress sizes permitted within the applicable grading rules.
 - 2. Lumber shall be new, uniformly sized and S4S unless otherwise noted on the Drawings.
 - 3. Mark each piece of lumber for use in structural framing with the grade and trade mark of a lumber grading organization.
 - 4. Use preservatives conforming to UBC.
- B. Fences and Gates:
 - 1. Redwood, Grade B all heart or better, S4S.

2.2 ACCESSORIES

- A. General:
 - 1. All metal fastenings and accessories shall be type 316 stainless steel unless otherwise noted.
 - 2. Fabricate and/or supply accessories to the details shown on the Drawings and as accepted. Size and type to suit application as accepted.
- B. Brackets, Hangers and Framing Clips: Simpson Co., 866 252-8606 or Teco Products.
- C. Concrete Footings: See Division 3, Section "Site Concrete" if available, or Division 32, Section "Landscape Concrete".
- D. Steel or Other Structural Members: Refer to Structural engineer's requirements.
- E. Gate latch and hardware, as per Drawings and manufacturer's specifications and guidelines.

2.3 FINISHES: Except as otherwise noted on the drawings or specified.

- A. Water repellant, fungus and mildew resistant penetrating stain that is resistant to Ultra Violet (UV) light.
 - 1. Color: Clear .
 - 2. Product: Thompson's Water Seal, Signature Series Clear Wood Protector
 - 3. Wood Preparation prior to Sealers Application:

4. Adhere to coating manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 PREPARATION

- A. Applying Preservatives:
 1. General: Apply preservative to all wood to be in contact with ground or cementitious materials.
 2. Moisture Content: Do not apply preservative to wood with a moisture content exceeding 25 percent as tested.
 3. Initial Application: Apply an approved wood preservative by brush or total immersion, to thoroughly coat and soak the wood. Do not assemble any part of the wood structure prior to application of preservatives where they are required.
 4. Additional Application: When any framing, cutting, or boring of treated timber is performed after treatment, thoroughly swab all cuts, dips, and holes with the same preservative specified for initial application.
- B. Concrete Footings: Install per Drawings. See Division 3, Section "Site Concrete", if available or Division 32, Section "Landscape Concrete".

3.3 INSTALLATION

- A. Cutting and Fitting:
 1. Cutting: Accurately cut and frame all lumber to a close fit, with even bearing over all contact surfaces.
 2. Fitting: Form all joints square and tight unless otherwise shown. Do not use shims when making joints.
- B. Screws and Bolts:
 1. Screws:
 - a. Drill holes for screws and lag screws same diameter as inner shank bolt size minus depth of thread .
 - b. Unless noted otherwise, countersink screws until heads are flush with finish surface.
 2. Bolts:
 - a. Pre-drill holes for countersunk bolts with a bit 1/16 in. larger than the accompanying washer, and to a depth which allows bolt head to be secured flush with finish surface.
 - b. Where bolts are not countersunk, bore hole to accept bolt only. Tighten bolt and washer flush to finish surface without compressing wood.
 3. All fasteners shall be type 316 stainless steel unless otherwise noted.
- C. Washers:
 1. Cut Washers: Fit all bolts 5/8 in. in diameter or less with cut washers.
 2. Cast Washers: Fit all bolts and lag screws over 5/8 in. in diameter with stainless steel washers, unless otherwise shown on the Drawings.

3.4 FINISHING

- A. Edge Treatment: Edges of seat decks, benches, handrails, planter caps and other exposed or leading corners are to be eased.
- B. Surfaces: All bench and seat deck tops and handrails are to be sanded smooth before application of finish coats.

3.5 ADJUSTING: Turn up and make tight all nuts, bolts, and lag screws at time of installation and again at the completion of the work, to ensure that shrinkage has been overcome and fastenings are tight.

3.6 FIELD QUALITY CONTROL

- A. Workmanship: Workmanship shall be first class throughout, and free of hammer marks, dents or other disfiguration. Unless otherwise specified, lumber shall not show saw marks.
- B. Fences: At time of installation of fence siding or decking, check every fourth to fifth board for plumbness or correct diagonal angle as noted on Drawings.

3.7 APPLICATION OF PROTECTION FINISH

- A. Preparation: Pre-Clean wood surface in accordance with Manufacturers written instructions prior to application of brightener.
- B. Apply in accordance with manufacturer's written instructions.
- C. Do not apply protecting finish to wood that has become wet, allow wood to air dry for two days before application of protecting finish to.
 - 1. Do not apply protecting finish to green wood until the Contracting Officer has determined that the wood has Air dried to a minimum of 23 plus or minus .5 . The Contracting Officer to provide a minimum of 4 wood moisture readings that average a minimum of 22.5 moisture content before application of protecting finish. Document and submit test results for record purposes.
 - 2. Apply finish to all sides and ends of the deck boards before installation.
- D. Apply Penetrating Finish to the following wood elements in accordance with the Manufacturer's written requirements, 2 coats minimum to deck wood elements and as follows:
 - 1. Wood Deck, all exposed surfaces and expose ends and sides.
 - 2. Apply second coat to exposed surface after installation.
 - 3. Protect in-place for 48 hours after second application of penetrating sealer.

3.8 ADJUSTING AND CLEANING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged woodwork if repairs are not approved by Architect.

3.9 PROTECTION

- A. Provide temporary protection around elements to avoid construction damage to finalized work.
- B. Any damaged or stained wood, due to construction, shall be removed and replaced at no cost to the owner.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Board insulation over roof sheathing and at exterior wall behind fiber cement siding wall finish.
- B. Thermal and acoustical batt insulation in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

- A. Section 01 18 13 - Sustainability Requirements.
- B. Section 06 10 00 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

1.3 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2017, with Editorial Revision (2018).
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2020.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.
- F. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum; 2021.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations for each product type and accessory.

- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.5 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Insulation in Wood Framed Walls: Batt insulation with no vapor retarder.
- B. Insulation in Wood Framed Ceiling Structure: Batt insulation with no vapor retarder.
- C. Insulation Above Perforated Metal Panels: Batt insulation with no vapor retarder.
- D. Insulation Over Roof Deck: Polyisocyanurate board.

2.2 MATERIAL REQUIREMENTS

- A. Recycled Content: Provide rigid insulation products made with average recycled content such that preconsumer recycled content is not less than 20 percent.
- B. Recycled Content: Provide products made from fiberglass batts with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 30 percent.

2.3 FOAM BOARD INSULATION MATERIALS

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type V: Faced with 5/8 inch minimum plywood on one major surface of core foam and glass fiber reinforced cellulosic felt or uncoated or coated polymer-bonded glass fiber mat facer on other major surface of core foam.
 - 1) Compressive Strength: 16 psi, minimum.
 - 2) Thermal Resistance, R-value: At 1-1/2 inch thick; 6.2, minimum, at 75 degrees F.
 - 3) For use at roof assemblies.
 - 2. Board Size: 48 inch by 96 inch.
 - 3. Board Thickness: 3.5 inches excluding plywood facing.
 - 4. Board Edges: Square.
 - 5. Products:
 - a. Basis-of-Design: Hunter Panels; H-Shield NB.

- b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type I: Faced with aluminum foil on both major surfaces of core foam.
 - 1) Class 2 - Glass fiber reinforced or non-reinforced core foam.
 - 2) Compressive Strength: 16 psi, minimum.
 - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
 - 4) For use at wall assemblies.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Board Thickness: 0.5 inch.
 - 5. Board Edges: Square.
 - 6. Products:
 - a. Basis-of-Design: Johns Manville; AP Foil-Faced.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.

2.4 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Formaldehyde Content: Zero.
 - 5. Facing: Unfaced.
 - 6. Products:
 - a. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Insulation for Sound Attenuation: ASTM C665; "Sound Attenuation Batts"; Type I preformed glass fiber batts conforming to the following:
 - 1. Batt Width: Maximum width as required for application.
 - 2. Thickness: Full depth of stud space.
 - 3. Facing: Unfaced.
 - 4. Flame Spread Rating: Less than 10, as tested in accordance with ASTM E84.
 - 5. Smoke Developed: Less than 10, as tested in accordance with ASTM E84.
 - 6. Overall Sound Transmission: STC 50.
 - 7. Minimum density of 6 lb/cu ft (96 kg/cu m), thermal resistivity of 4.5 deg F x h x sq ft/Btu x in. at 75 deg F (31.2 K x m/W at 24 deg C).

2.5 ACCESSORIES

- A. Flashing Tape: Special reinforced film with high performance adhesive.
 - 1. Application: Window and door opening flashing tape.
 - 2. Width: As required for application.
 - 3. Products:
 - a. Protecto Wrap Company; Protecto BT20XL Butyl: www.protectowrap.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Apply adhesive to back of boards:
 - 1. Three continuous beads per board length.
- B. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Place 6 inches wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames, and tape seal in place to ensure continuity of vapor retarder and air seal.

3.3 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

- A. Installation of board insulation over steep slope roof structure or roof sheathing, see Section 06 10 00.

3.4 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.5 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Weather barriers.

1.2 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.3 DEFINITIONS

- A. Weather Barriers: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

1.4 REFERENCE STANDARDS

- A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2018.
- B. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2020.

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.6 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

- A. Weather-Resistive Barrier: Provide on exterior walls under exterior cladding.
 - 1. Tyvek Commercial Wrap
 - 2. Or approved equal.

2.2 ACCESSORIES

- A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
 - 1. Width: 6 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.2 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Weather-Resistive Barriers: Install continuous weather resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
- C. Mechanically Fastened Exterior Sheets:
 - 1. Install sheets shingle-fashion to shed water, with seams aligned horizontal.
 - 2. Overlap seams as recommended by manufacturer, 6 inches, minimum.

3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
4. Install water-resistive barrier over jamb flashings.
5. Install head flashings under water-resistive barrier.
6. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

D. Openings and Penetrations in Exterior Water-Resistive Barriers:

1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Do not cover installed water-resistive barriers until required inspections have been completed.
- C. Take digital photographs of each portion of installation prior to covering up weather barriers.

3.5 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Architectural roofing system of preformed steel panels.
- B. Underlayment.

1.2 RELATED REQUIREMENTS

- A. Section 01 81 13 - Sustainability Requirements.
- B. Section 06 10 00 - Rough Carpentry: Roof sheathing.
- C. Section 07 21 00 - Building Insulation: Rigid roof insulation.
- D. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.
- E. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.3 REFERENCE STANDARDS

- A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.
- B. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).
- C. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
 - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
 - 1. Show work to be field-fabricated or field-assembled.

- D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
- E. Test Reports: Indicate compliance of metal roofing system to specified requirements.
- F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.7 FIELD CONDITIONS

- A. Do not install metal roof panels and underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.8 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.2 MANUFACTURERS

- A. Architectural Metal Roof Panels:
 - 1. Basis-of-Design: Western States Metal Roofing; A606-4.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.3 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Architectural Metal Panels: Factory-formed panels with weathered steel finish.
 - 1. Steel Panels:
 - a. Steel panels with finish complying with ASTM A606.
 - b. Steel Thickness: Minimum 22 gauge, 0.0299 inch.
 - 2. Profile: Corrugated with 7/8 inch ribs and 2.67 inch rib pitch.
 - 3. Texture: Smooth.
 - 4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
 - 5. Width: Maximum panel coverage of 24 inches.

2.4 ATTACHMENT SYSTEM

- A. Exposed System: Provide manufacturer's recommended stainless steel fasteners engineered to meet performance requirements and equipped with appropriate sealant separators to provide weathertight connections that will accommodate anticipated thermal movement.

2.5 FABRICATION

- A. Panels: Provide factory fabricated panels and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.6 ACCESSORIES

- A. Miscellaneous Sheet Metal Items: Provide trim of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of closed-cell synthetic rubber, neoprene, or PVC.
- C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
 2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
- D. Underlayment for Wood Substrate: Grace Ultra or approved equal.
1. Heat resistance: Formulated to withstand temperatures up to 300 degrees.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

3.2 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.
- B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
1. Install roofing system with exposed fasteners prefinished to match panels.
 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, trim, caps, rib closures, and ridge closures.
- C. Install roofing underlayment on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

- D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
 - 1. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.4 CLEANING

- A. See Section 01 77 00 - Closeout Procedures for additional requirements.
- B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 42 13 - METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufactured metal panels for exterior wall panels, interior wall panels, and interior ceiling panels.

1.2 RELATED REQUIREMENTS

- A. Section 01 81 13 - Sustainability Requirements.
- B. Section 06 10 00 - Rough Carpentry: Wall panel substrate.
- C. Section 07 21 00 - Building Insulation.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier under wall panels.
- E. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- F. Section 09 21 16 - Gypsum Board: Wall panel substrate.

1.3 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data - Walls and Ceilings: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical characteristics of components shown on shop drawings.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions and recommendations.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, perforations, and methods of anchorage.
- D. Samples: Submit two samples of each wall and ceiling panel, 12 inches by 24 inches in size illustrating finish, color, and texture.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 67 00 - Product Requirements for additional provisions.
2. Extra Interior Wall Panels Only: Quantity equal to 5% of total installed of each type, store where directed.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of experience.
- B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum five years of experience.

1.6 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct mock-up, 10 feet long by 10 feet wide, for each type of wall and ceiling panel product, include wall or ceiling panel, attachments to building frame, sealants and seals, and related insulation in mock-up.
- C. Locate as directed by Contracting Officer.
- D. Mock-up may remain as part of work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.8 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion for degradation in panel finish.

PART 2 PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.2 MANUFACTURERS

- A. Metal Wall and Ceiling Panels - Exposed Fasteners:
 - 1. Basis-of-Design: Western States Metal Roofing.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.3 METAL PANEL MATERIALS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels, interior wall panels, and interior ceiling panels.
 - 2. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
 - 3. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
 - 4. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
 - 5. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
 - 6. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.
 - 7. Provide continuity of water-resistive barrier seal at building enclosure elements; see Section 07 25 00.
- B. Exterior Wall Panels:
 - 1. Profile: Vertical, corrugated with 7/8 inch ribs and 2.67 inch rib pitch.
 - 2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch minimum thickness.
 - 3. Panel Width: 39 inches.
 - 4. Finish: A606-4 (Corten).
- C. Interior Wall Panels:
 - 1. Profile: Vertical, corrugated with 7/8 inch ribs and 2.67 inch rib pitch.
 - 2. Material: Precoated steel sheet, 24 gauge, 0.024 inch minimum thickness.
 - 3. Panel Width: 39 inch.
 - 4. Color and Finish: Type 1; Reclaimed Metal Rust, panel manufacturer's standard polyvinyl fluoride (PVDF).
 - 5. Color, Finish and Perforations: Type 1A; Reclaimed Metal Rust, panel manufacturer' standard polyvinyl fluoride ((PVDF); perforated to 30% openness, 1/16 inch diameter holes at 1/8 inch diagonal spacing.

- D. Interior Ceiling Panels:
 - 1. Profile: Vertical, corrugated with 7/8 inch ribs and 2.67 inch rib pitch.
 - 2. Material: Precoated steel sheet, 24 gauge, 0.024 inch minimum thickness.
 - 3. Panel Width: 39 inch.
 - 4. Color and Finish, Type 1; Reclaimed Metal Rust, panel manufacturer's standard polyvinyl fluoride (PVDF).
 - 5. Color, Finish and Perforations: Type 1A; Reclaimed Metal Rust, panel manufacturer's standard polyvinyl fluoride ((PVDF); perforated to 30% openness, 1/16 inch diameter holes at 1/8 inch diagonal spacing.
 - 6. Color and Finish, Type 2: Galv-Ten Robust, panel manufacturer's standard polyvinyl fluoride (PVDF).
- E. Internal and External Corners: Same material, thickness, and finish as exterior and interior sheets; manufacturer's standard profiles; shop cut and factory mitered to required angles.
- F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- G. Anchors: Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building framing members are ready to receive panels.
- B. Verify that water-resistive barrier has been installed over substrate completely and correctly; see Section 07 25 00.

3.2 PREPARATION

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.3 INSTALLATION

- A. Install panels on walls and ceilings in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Locate joints over supports.
- E. Lap panel ends minimum 2 inches.
- F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber-cement siding.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Siding substrate.
- B. Section 07 25 00 - Weather Barriers: Water-resistive barrier under siding.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.3 REFERENCE STANDARDS

- A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2016).

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Installer's Qualification Statement.
- D. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum five years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.7 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Simulated cedar grain.
 - 3. Length: 12 ft, nominal.
 - 4. Width (Height): 5-1/4 inches.
 - 5. Thickness: 5/16 inch, nominal.
 - 6. Finish: Factory applied primer.
 - 7. Warranty: 50 year limited; transferable.
 - 8. Products:
 - a. Basis-of-Design: James Hardie Building Products, Inc; HardiePlank Lap Siding, Select Cedarmill, 4" exposure: www.jameshardie.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Texture: Simulated cedar grain.
 - 2. Length (Height): 120 inches, nominal.
 - 3. Width: 48 inches.
 - 4. Thickness: 5/16 inch, nominal.
 - 5. Finish: Factory applied primer.
 - 6. Color: As indicated on drawings.
 - 7. Warranty: 50 year limited; transferable.
 - 8. Products:
 - a. Basis-of-Design: James Hardie Building Products, Inc; HardiePanel, Select Cedarmill: www.jameshardie.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- C. Trim and Battens: Trim made of cement and cellulose fiber formed under high pressure with integral surface texture.
 - 1. Texture:
 - a. Simulated wood grain at battens and corner boards.
 - b. Smooth at window and door trim and casings.
 - 2. Length: 12 foot, nominal
 - 3. Width: 2 1/2 inches and 5 1/2 inches, nominal.

4. Thickness: 3/4 inch, nominal.
5. Finish: Factory applied primer.
6. Color: As indicated on drawings.
7. Products:
 - a. Basis-of-Design: James Hardie Building Products, Inc; [HardieTrim, 4/4 Rustic and Rustic Grain Batten Boards. Select Cedarmill and Smooth]: www.jameshardie.com/#sl
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 ACCESSORIES

- A. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inch, minimum.
- B. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- C. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Install Sheet Metal Flashing:
 1. Above door and window trim and casings.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 2. Use trim details indicated on drawings.
 3. Touch up field cut edges before installing.
 4. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.

- C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- E. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.
- F. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- G. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

3.4 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, sheet metal roofing, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking for batten seams.
- C. Section 074113 - Metal Roof Panels.
- D. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
- E. Section 09 91 13 - Exterior Painting.

1.3 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- B. ASTM B32 - Standard Specification for Solder Metal; 2020.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sheet Metal Flashing and Trim Manufacturers:
 - 1. Fairview Architectural LLC: www.fairview-na.com/#sle.
 - 2. OMG Roofing Products: www.omgroofing.com/#sle.
 - 3. Tamlyn: www.tamlyn.com/#sle.
 - 4. Or approved equal..
 - 5. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, 0.0239 inch thick base metal.

2.3 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.4 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.
- F. Solder: ASTM B32; Sn50 (50/50) type.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Match color of adjacent roof components.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.

- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for field inspection requirements.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 01 81 13 - Sustainability Requirements.
- B. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with water-resistive barriers.
- C. Section 074113 - Metal Roof Panels.
- D. Section 074646 - Fiber Cement Siding.
- E. Section 08 14 16 - Solid Core Wood Doors with Decorative Wood Facings
- F. Section 08 52 00 - Wood Windows.

1.3 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.
- B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.
- F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
- G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 8. Certification by manufacturer indicating that product complies with specification requirements.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Samples for Verification: Where custom sealant color is specified, obtain directions from Contracting Officer and submit physical samples for verification of color of each required sealant.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience.

1.6 WARRANTY

- A. See Section 01 77 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: www.usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Or approved equal.
 - 6. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: www.usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Or approved equal.
 - 6. Substitutions: See Section 01 67 00 - Product Requirements.

2.3 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - 3. Do not seal the following types of joints.
 - a. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - b. Joints where installation of sealant is specified in another section.

- B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
 - 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
 - 3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 2. Floor Joints in Wet Areas: Self-leveling polyurethane "traffic-grade" sealant suitable for continuous liquid immersion.
 - 3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; to match fixture color.
 - 4. Narrow Control Joints in Interior Concrete Slabs: Self-leveling polyurethane sealant.
 - 5. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

2.4 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. For manufactured items, including but not limited to fiber cement siding, metal roofing and windows, use manufacturer recommended sealants.

2.5 NONSAG JOINT SEALANTS

- A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: To match fixtures.
 - 2. Manufacturers:
 - a. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Manufacturers:
 - a. Master Builders Solutions; MasterSeal NP1: www.master-builders-solutions.com/en-us/#sle.
 - b. Sika Corporation; Sikaflex-2c NS: www.usa.sika.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
 - d. Or approved equal.
 - e. Substitutions: See Section 01 67 00 - Product Requirements.

- C. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
 - 1. Movement Capability: Plus and minus 35 percent, minimum.
 - 2. Color: Match adjacent finished surfaces.
 - 3. Manufacturers:
 - a. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- D. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.
 - 1. Manufacturers:
 - a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.

2.6 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To match adjacent surfaces.
 - 3. Manufacturers:
 - a. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: Match adjacent surfaces.
 - 3. Service Temperature Range: Minus 40 to 180 degrees F.
 - 4. Manufacturers:
 - a. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
 - b. Or approved equal.
 - c. Substitutions: See Section 01 67 00 - Product Requirements.

2.7 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 - 2. Manufacturers:

- a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod):
www.adfastcorp.com/#sle.
 - b. Nomaco, Inc; HBR: www.nomaco.com/#sle.
 - c. Or approved equal.
 - d. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.

- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.4 FIELD QUALITY CONTROL

- A. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 14 16 - SOLID CORE DOORS WITH DECORATIVE WOOD FACINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Custom solid core wood doors with decorative wood facings including wood tongue and groove boards with simulated sitches, rails and battens, and cement fiber planks; non-rated; swinging and sliding operation.

1.2 RELATED REQUIREMENTS

- A. Section 06 20 00 - Finish Carpentry: Wood door frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 09 91 23 - Interior Painting: Field finishing of cement fiber doors.
- D. Section 09 91 13 - Exterior Painting: Field finishing of cement fiber doors.
- E. Section 09 93 00 - Staining and Transparent Finishing: Field finishing of wood doors.

1.3 REFERENCE STANDARDS

- A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.
- B. AWI (QCP) - Quality Certification Program; Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- E. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: For each type of door. Indicate door core materials and construction, and species for decorative facings.

- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 2. Include certification program label.
- D. Samples: Submit two samples of door construction for each type of door, 12 by 12 inches in size representing top corner of door. If multiple door types have same corner configuration only one set of samples is required for that configuration.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Warranty, executed in Owner's name.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in custom manufacturing the products specified in this section, with not less than ten years of experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than five years of experience.
- C. Woodwork Quality Assurance Program:
 - 1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; www.awiqcp.org/#sle.
 - 2. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by quality assurance program.
 - 4. Provide designated labels on installed products as required by quality assurance program.
 - 5. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.7 WARRANTY

- A. See Section 01 77 00 - Closeout Submittals for additional warranty requirements.
- B. Include coverage for delamination of facings, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Solid Core Wood Doors with Decorative Wood Facings:
 - 1. Custom manufacturer that participates in the specified certification program.

2.2 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Decorative Wood Faced Doors: 5-ply unless otherwise indicated.
- B. Exterior Doors: Solid core construction and water repellant treated.
 - 1. Thickness: 1-3/4 inches minimum.
 - 2. Facing: Wood for field transparent finishing.
 - 3. Facing: Cement fiber for field finishing.

2.3 DOOR FACINGS

- A. Decorative Wood Facing for Transparent Finish: Western Red Clear, Grade C and Better Clear.
 - 1. See Drawings for configuration of wood facing elements.
- B. Cement fiber facing for Painted Finish: Refer to Section 07 46 46 for Fiber Cement Siding product information.
 - 1. See Drawings for configuration of cement fiber facing elements.
- C. Facing Adhesive: Type I - waterproof.

2.4 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- C. Provide edge clearances in accordance with the quality standard specified.

2.5 ACCESSORIES

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch off bottom edges.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

3.3 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall mounted access units.

1.2 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame from single source manufacturer.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units in Wet Areas:
 - 1. Size: 12 by 12 inches.
 - 2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 3. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

2.2 WALL MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group, Inc. - JL Industries; Access Panels: www.activarcpg.com/#sle.
 - 2. Babcock-Davis; Access Doors: www.babcockdavis.com/#sle.
 - 3. Larsen's Manufacturing Co.: www.larsensmfg.com
 - 4. Or approved equal.
 - 5. Substitutions: See Section 01 67 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 52 00 - WOOD WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Factory fabricated wood windows.
- B. Glazing.
- C. Operating hardware.

1.2 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 09 93 00 - Staining and Transparent Finishing: Site finishing wood surfaces.

1.3 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.
- B. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).
- C. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.
- D. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.

- B. Product Data: Show component dimensions, anchorage and fasteners, glass, and internal drainage details.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.
- D. Submit two samples 12 by 12 inches in size illustrating window frame section, mullion section, glazing, and glazing materials.
- E. Submit two samples of each type of operating hardware.
- F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than ten years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and after installation of sealants.

1.9 WARRANTY

- A. See Section 01 77 00 - Closeout Procedures for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Wood Windows:
 - 1. Basis-of-Design: Kolbe & Kolbe Millwork Co., Inc.; Heritage Series, Crank Out Awning and Old World Classic Single Hung .
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 WOOD WINDOWS

- A. Wood Windows: Wood frame and sash, factory fabricated and assembled.
 - 1. Exterior Finish: Unfinished, for transparent finish.
 - 2. Interior Finish: Same as exterior.
 - 3. Configuration: As indicated on drawings.
 - 4. Window Product Types: AP - Awning, hopper, projected window and FW - Fixed window, in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 5. Factory glazed; dry glazing method.
 - 6. Wood Species: Fir, preservative treated using treatment type suitable for required finish.
 - 7. Frame and Sash Members: Mortise and tenon joints. Glue and steel pin joints to hairline fit, weather tight.

2.3 COMPONENTS

- A. Glazing: Single glazed, clear, uncoated, tempered, with glass thicknesses as recommended by manufacturer for specified wind conditions and meeting Wildland Urban Interface code requirements.
 - 1. Safety Glass: ASTM C1048, fully tempered with horizontal tempering, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1.
- B. Mullions: Full divided lites, 7/8", ovolo profile.
- C. Sills: Wood, with 1 inch nominal thickness; sloped for positive drainage; fits under sash and projects at least 1 inch beyond exterior face of wall; single piece full width of opening.
- D. Operable Sash Weatherstripping: Resilient PVC; permanently resilient, profiled to effect weather seal.
- E. Fasteners: Stainless steel.
- F. Sealant and Backing Materials: See Section 07 92 00 of types as indicated.
- G. Flashing: Provide related flashings, with necessary anchors and attachment devices.
- H. Sealant for Setting Sills, Stools, Aprons, and Sill Flashing: Non-curing butyl type.

2.4 PERFORMANCE REQUIREMENTS

- A. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 requirements for the specific window type in accordance with the following:
 - 1. Performance Class (PC): R.

2.5 HARDWARE

- A. Sash lock: Lever handle with cam lock.
- B. Window Opening Control Devices (WOCD): Provide operable window sash hardware that limits openings to only allow passage of 4 inch diameter rigid sphere or less, and are easily releasable to fully open without use of keys, tools, or special knowledge.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify wall openings and adjoining water-resistive barrier materials are ready to receive wood windows; see Section 07 25 00.

3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Install sills, stools, aprons, and casings.
- E. Set sill members and sill flashing in continuous bead of sealant.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install operating hardware.
- H. Finish exterior surfaces with transparent materials; see Section 09 93 00.
- I. Finish interior surfaces with transparent materials; see Section 09 93 00.

3.3 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inch per 3 ft non-cumulative or 1/8 inch per 10 ft, whichever is less.

3.4 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.5 CLEANING

- A. Remove protective material from factory finished surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.
 - 4. UL 305 - Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Proof of Compliance: (California located Projects): Provide a list of product(s) containing chemicals known to cause cancer or reproductive toxicity as defined by the Office of Environmental Health Hazard Assessment (OEHHA) under Proposition 65 (CA Code of Regulations, Title 27, Section 27001). The list includes the specific chemical(s), if the chemical will be exposed to consumers, the means of warning, and an illustration of the label.

- E. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual overhead door closer bodies.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 1. Manufacturers:
 - a. Pemko (PE).
- B. Hidden Sliding Door System: Provide sliding barn door system that is concealed behind the door for soft open and close applications. System shall support openings with up to a 176 pound panel capacity, shall meet ADA push force requirements and shall have nylon wheels and steel ball bearings for smooth operation.
 1. Manufacturers:
 - a. Hafele (HF) - Slido Design.
 - b. Pemko (PE) - Hide Slide.
 - c. No Substitution.

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Door Controls International (DC).

- c. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 - 1. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood (RO).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Manufacturers:
 - a. Rockwood (RO).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Manufacturer's Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.
4. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide temporary keyed construction cores.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 14 million cycles or greater.
2. Where specified, provide status indicators with highly reflective color and wording for "locked/unlocked" or "vacant/occupied" with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1" x 0.6" with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.
3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.

B. Multi-Point Locksets: ANSI/BHMA A156.37, Certified Products Directory (CPD) listed vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - MP9800 Series.
- b. Sargent Manufacturing (SA) - 7000 Series.

2.6 AUXILIARY LOCKS

- A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13 Grade 1 Certified Products Directory (CPD) listed large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

- 1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML2000 Series.
- b. Sargent Manufacturing (SA) - 8200 Series.

- B. Behavioral Health, Cylindrical: ANSI/BHMA A156.2, Series 4000, Operational and Security Grade 1 Certified Products Directory (CPD) listed cylindrical locks that exceed 3,100 in-lb with no entry; lock to maintain egress functionality in compliance with BHMA certification requirements. Locksets shall be listed for low, medium and high risk areas in the NYS-OMH Patient Safety Standard. Latch retraction with preload shall exceed 100 lb. while maintaining ANSI/BHMA requirements for operation in warped doors. Locksets shall be provided standard with Torx® fasteners and with optional lead-lining and antimicrobial coating as specified in Hardware Sets.

- 1. Manufacturers:

- a. Corbin Russwin (RU) - CLX3300 BHSS Series.
- b. Sargent Manufacturing (SA) - 10X BHW Series.
- c. No Substitution.

2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- 2. Strikes for Bored Locks and Latches: BHMA A156.2.
- 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.

4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:
 - a. Norton Rixson (NO) - 7500 Series.
 - b. Sargent Manufacturing (SA) - 351 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Burns Manufacturing (BU).
 - b. Hiawatha, Inc. (HI).
 - c. Rockwood (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).

- b. Rockwood (RO).
- c. Sargent Manufacturing (SA).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).
 - 2. Reese Enterprises, Inc. (RE).

2.13 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and

reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
1. Quantities listed are for each pair of doors, or for each single door.
 2. The supplier is responsible for handing and sizing all products.
 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. OT - Other
2. MK - McKinney
3. PE - Pemko
4. RO - Rockwood
5. SA - SARGENT
6. RF - Rixson
7. NO - Norton

Hardware Sets

Set: 1.0

Doors: 101A, 101B, 101C, 101D, 101G, 101H, 101J, 101K

8	Disc Bearing Strap Hinge	1047 x 18" Richards-Wilcox	BLK	OT
1	Surface Vert Rod Exit	LC 9710 306 Less Pull SPAR	BSP	SA
1	Surface Vert Rod Exit, Exit Only	9710 EO SPAR	BSP	SA
1	Cylinder	per facility standard		OT
2	Curved Iron Pull	Signature Hardware Sadler Rustic 10-1/4" Length		OT
2	Surface Closer	PR7500	BSP	NO
2	Kick Plate	K1050 10" high CSK BEV	BSP	RO
2	Door Stop	466-RKW	Black	RO
1	Gasketing	290DS		PE
1	Rain Guard	346D		PE
2	Sweep	315DN		PE

1	Astragal	18041DNB		PE
2	Latch Guard Cover	BFRC12	BSP	RO

Set: 2.0

Doors: 401A

8	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	US10B	MK
1	Surface Vert Rod Exit	LC 9706 ETL SPAR	US10B	SA
1	Surface Vert Rod Exit	9710 ETL SPAR	US10B	SA
1	Cylinder	per facility standard		OT
2	Surface Closer	PR7500	690	NO
2	Kick Plate	K1050 10" high CSK BEV	US10B	RO
1	Door Stop	466-RKW	Black	RO
1	Gasketing	290DS		PE
1	Rain Guard	346D		PE
1	Sweep	315DN		PE
1	Astragal	18041DNB		PE
1	Latch Guard Cover	BFRC12	US10B	RO

Set: 3.0

Doors: 204

3	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1	Rim Exit Device, Storeroom	LC 9804 ETL SPAR	BSP	SA
1	Cylinder	per facility standard		OT
1	Surface Closer	PR7500	BSP	NO
1	Kick Plate	K1050 10" high CSK BEV	BSP	RO
1	Door Stop	466-RKW	Black	RO
1	Gasketing	290DS		PE
1	Rain Guard	346D		PE
1	Sweep	315DN		PE

Set: 4.0

Doors: 401B

4	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	US10B	MK
1	Rim Exit Device, Storeroom	LC 9804 ETL SPAR	US10B	SA
1	Cylinder	per facility standard		OT
1	Surface Closer	PR7500	690	NO
1	Kick Plate	K1050 10" high CSK BEV	US10B	RO
1	Door Stop	466-RKW	Black	RO

1	Gasketing	290DS	PE
1	Rain Guard	346D	PE
1	Sweep	315DN	PE

Set: 5.0

Doors: 205

6	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1	Flush Bolt	2945	BSP	RO
1	Dust Proof Strike	570	BSP	RO
1	Storeroom/Closet Lock	LC 8204 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surface Closer	PR7500	BSP	NO
2	Door Stop	466-RKW	Black	RO
1	Gasketing	290DS		PE
1	Rain Guard	346D		PE
2	Sweep	315DN		PE
1	Astragal	357BSP		PE

Set: 6.0

Doors: 304

8	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1	Flush Bolt	2945	BSP	RO
1	Dust Proof Strike	570	BSP	RO
1	Classroom Deadlock	LC 8203	BSP	SA
1	Cylinder	per facility standard		OT
4	Curved Iron Pull	Signature Hardware Sadler Rustic 10-1/4" Length		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surface Closer	PR7500	BSP	NO
2	Door Stop	466-RKW	Black	RO
1	Gasketing	290DS		PE
1	Rain Guard	346D		PE
2	Sweep	315DN		PE
1	Astragal	357BSP		PE

Set: 7.0

Doors: 101L, 101M

10 Hinges	Surelock McGill	OT
1 Note	Balance of Hardware by Door Manufacturer	OT

Set: 8.0

Doors: 103, 107B, 303

3 Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1 Classroom Lock	LC 8237 LE1P	BSP	SA
1 Cylinder	per facility standard		OT
1 Surface Closer	PR7500	BSP	NO
1 Kick Plate	K1050 10" high CSK BEV	BSP	RO
1 Door Stop	466-RKW	Black	RO
1 Gasketing	290DS		PE
1 Rain Guard	346D		PE
1 Sweep	315DN		PE

Set: 9.0

Doors: 207

3 Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1 Privacy Lock	LB V20 8265 LE1P	BSP	SA
1 Surface Closer	CPS7500	BSP	NO
1 Kick Plate	K1050 10" high CSK BEV	BSP	RO
1 Gasketing	290DS		PE
1 Rain Guard	346D		PE
1 Sweep	315DN		PE

Set: 10.0

Doors: 201, 202

3 Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1 Classroom Lock	LC 8237 LE1P	BSP	SA
1 Cylinder	per facility standard		OT
1 Surface Closer	PR7500	BSP	NO
1 Kick Plate	K1050 10" high CSK BEV	BSP	RO
1 Door Stop	466-RKW	Black	RO
1 Gasketing	290DS		PE
1 Rain Guard	346D		PE
1 Sweep	315DN		PE

Set: 11.0

Doors: 101F

6	Disc Bearing Strap Hinge	1047 x 18" Richards-Wilcox	BLK	OT
1	Flush Bolt	557	BSP	RO
1	Storeroom/Closet Lock	LC 8204 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surf Overhead Hold Open	10-326	BSP	RF
1	Astragal	357BSP		PE
2	Silencer	609		RO

Set: 12.0

Doors: 401C, 401D

6	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	US10B	MK
1	Flush Bolt	557	US10B	RO
1	Storeroom/Closet Lock	LC 8204 LE1P	US10B	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surf Overhead Hold Open	10-326	BSP	RF
1	Astragal	357BSP		PE
2	Silencer	609		RO

Set: 13.0

Doors: 301B

6	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1	Flush Bolt	2905	BSP	RO
1	Storeroom/Closet Lock	LC 8204 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surface Closer	CPS7500	BSP	NO
2	Kick Plate	K1050 10" high CSK BEV	BSP	RO
1	Astragal	357BSP		PE
2	Silencer	609		RO

Set: 14.0

Doors: 108, 206, 308

3	Hinge, Full Mortise, Hvy Wt	T4A3786	BSP	MK
---	-----------------------------	---------	-----	----

1	Storeroom/Closet Lock	LC 8204 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Surface Closer	7500	BSP	NO
1	Kick Plate	K1050 10" high CSK BEV	BSP	RO
1	Wall Stop	406	BSP	RO
3	Silencer	609		RO

Set: 15.0

Doors: 101E

6	Disc Bearing Strap Hinge	1047 x 18" Richards-Wilcox	BLK	OT
1	Flush Bolt	2905	BSP	RO
1	Classroom Lock	LC 8237 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surface Closer	PR7500	BSP	NO
2	Kick Plate	K1050 10" high CSK BEV	BSP	RO
2	Wall Stop	406	BSP	RO
1	Astragal	357BSP		PE
2	Silencer	609		RO

Set: 15.5

Doors: 301A

6	Hinge, Full Mortise, Hvy Wt	T4A3786 NRP	BSP	MK
1	Flush Bolt	2905	BSP	RO
1	Classroom Lock	LC 8237 LE1P	BSP	SA
1	Cylinder	per facility standard		OT
1	Coordinator	2600 series x MB as required	Black	RO
2	Surface Closer	PR7500	BSP	NO
2	Kick Plate	K1050 10" high CSK BEV	BSP	RO
2	Wall Stop	406	BSP	RO
1	Astragal	357BSP		PE
2	Silencer	609		RO

Set: 16.0

Doors: 105, 106, 306, 307

3	Hinge, Full Mortise, Hvy Wt	T4A3786	BSP	MK
1	Classroom Lock	LC 8237 LE1P	BSP	SA
1	Cylinder	per facility standard		OT

1	Surface Closer	7500	BSP	NO
1	Kick Plate	K1050 10" high CSK BEV	BSP	RO
1	Kick Plate	K1050 6" high CSK BEV	BSP	RO
1	Wall Stop	406	BSP	RO
3	Silencer	609		RO

Set: 17.0

Doors: 107A, 203A, 203B, 305

1	Sidewall Brkt w/ Hanger	Crown Industrial No 8 w/ brackets	BLK	OT
1	Curved Iron Pull	Signature Hardware Sadler Rustic 10-1/4" Length		OT
1	Note	Balance of Hardware by Door Manufacturer		OT

Set: 18.0

Doors: 402

1	Sliding Door Hardw	Crown Industrial	BLK	OT
1	Note	Balance of Hardware by Door Manufacturer		OT

END OF SECTION 08 71 00

SECTION 08 91 00 - LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Louvers, frames, and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 09 91 13 - Exterior Painting: Field painting.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.
- E. ASTM E2886 / E2886M-20 - Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement.

1.4 SUBMITTALS

- A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- C. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.5 WARRANTY

- A. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
 - 1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
 - 2. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
 - 3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
 - 4. Ember and Flame Resistance: Louvers to meet ASTM E2886.
- B. Stationary Louvers: Horizontal blade, extruded aluminum construction.
 - 1. Blades: Straight.
 - 2. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
 - 3. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
 - 4. Aluminum Finish: Superior performing organic coatings; finish welded units after fabrication.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.3 FINISHES

- A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
 - 1. Manufacturers:
 - a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
 - b. Sherwin-Williams Company; Fluoropon: www.coil.sherwin.com/#sle.
 - c. Or approved equal.
 - d. Substitutions: See Section 01 67 00 - Product Requirements.

2.4 ACCESSORIES

- A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- B. Fasteners and Anchors: Stainless steel.
- C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Set sill members and sill flashing in continuous bead of sealant.
- D. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Secure louver frames in openings with concealed fasteners.
- F. Coordinate with installation of mechanical ductwork.

3.3 ADJUSTING

- A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.4 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

END OF SECTION

SECTION 08 91 19 - FIXED LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed formed-metal louvers, frames, and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

1.4 SUBMITTALS

- A. Product Data: For each type of product describing design characteristics, maximum recommended air velocity, design free area, materials, and finishes
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Product Test Reports: Independent agency reports showing compliance with specified performance criteria.
- D. Sample warranties.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: As indicated on drawings.
- C. Wildland Fire Performance Requirements: Vents shall be designed and approved to prevent flame or ember penetration into the structure where indicate to meet ASTM E2886.

2.2 FIXED FORMED-METAL LOUVERS

- A. Horizontal Drainable-Blade Louver: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
 - 1. Louver Depth: 4 inches.
 - 2. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, not less than 0.052 inch for frames and 0.040 inch for blades.
 - 3. Mullion Type: Exposed.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
 - b. Point of Beginning Water Penetration: Not less than 800 fpm.
 - c. Air Performance: Not more than 0.15-inch wg static pressure drop at 900-fpm free-area velocity.
 - 5. Provide dampers where indicated in Architectural and Mechanical Drawings.

2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Insect screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Galvanized-Steel Louvers:
 - 1. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

2.4 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 GALVANIZED-STEEL SHEET FINISHES

- A. Finish louvers after assembly, for factory-finishing or field finishing.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780/A780M.
- C. Treat prepared metal mill phosphatized pretreatment for field painting, rinse and seal surfaces with manufacturer's standard clear acrylic coating on both sides
- D. Factory Finish: Baked-enamel or powder-coat. Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: Paint colors to match adjacent wall finishes and gloss is to match other exterior painted metal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

- A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer, remove damaged units and replace with new units.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gypsum wallboard.
- B. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 01 81 13 - Sustainability Requirements.
- B. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.
- C. Section 07 21 00 - Building Insulation: Thermal and acoustic insulation.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

1.3 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2020.
- E. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- F. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- G. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- H. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
- I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

- J. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

1.4 SUBMITTALS

- A. See Section 133323 - Submittal Procedures for project procedures.
- B. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

PART 2 PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. Recycled Content: Provide gypsum board products with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 50 percent.
- B. VOC Content: Adhesives and sealants applied on-site on the interior of the building and products used on the interior of the building shall comply with VOC limits as specified in Section 018113 - Sustainable Design Requirements.
 - 1. Use materials that have the lowest possible VOC content in units of g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. Basis-of-Design: USG Corporation; www.usg.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - 4. Paper-Faced Products:
 - a. USG Corporation; USG Sheetrock Brand EcoSmart Panels Firecode X: www.usg.com/#sle.
 - 5. Moisture and Mold Resistant Paper Faced Products:

- a. USG Corporation; USG Sheetrock Brand EcoSmart Panels Mold Tough Firecode X:
www.usg.com/#sle.
- C. Impact Resistant Wallboard:
 - 1. Application: High-traffic areas indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Type: Fire-resistance-rated Type X, UL or WH listed.
 - 4. Thickness: 5/8 inch.
 - 5. Edges: Tapered.
 - 6. Glass Mat Faced Products:
 - a. USG Corporation; USG Sheetrock Brand Glass-Mat Panels Mold Tough VHI Firecode X:
www.usg.com/#sle.

2.3 GYPSUM WALLBOARD ACCESSORIES

- A. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 - 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) Shreetrock Brand DuraA-Bead.
- B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Joint Compound: Drying type, vinyl-based, ready-mixed.
- C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

3.3 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.

3.4 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.5 TOLERANCES

END OF SECTION

SECTION 09 78 00 - INTERIOR WALL PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Decorative fiberglass reinforced plastic (FRP) wall paneling.
- B. Accessories.

1.2 SUBMITTALS

- A. See Section 133323 - Submittal Procedures for project procedures.
- B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include attachment recommendations and any anchorage devices specific to project substrate types.
- C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
 - 1. Scale of Drawing Elevations: 1/4 inch to 1 foot, minimum.
- D. Samples: Submit samples, 24 by 24 inches in size, indicating finish, surface design and color range for each type of panel.
- E. Manufacturer's Instructions: Provide manufacturer's installation instructions.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Maintenance Data: Include recommended instructions, methods, and materials for cleaning FRP panels.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Panels: Quantity equal to 5 percent of total installed.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
- B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of documented experience.

1.4 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct one mock-up, 12 feet long by nine feet high of wall paneling of each type, illustrating joints and trim.
- C. Locate where directed.
- D. Mock-ups may remain as part of the work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.
- C. Packaging Waste Management: See Section 01 74 19.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Decorative Fiberglass Reinforced Plastic (FRP) Wall Paneling:
 - 1. Basis-of-Design: Crane Composites, Inc; Designs Series, Forest Collection: www.cranecomposites.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

- A. Surface Burning Classification: Provide wall paneling assemblies meeting a minimum Class B when tested in accordance with ASTM E84.

2.3 DECORATIVE FRP WALL PANELING

- A. Type: Digitally-printed pattern images with manufacturer's standard scratch-resistant, UV-resistant protective coating.
 - 1. Panel Size: 4 by 10 feet.
 - 2. Panel Thickness: 0.075 inch.
 - 3. Pattern: Sabine.
 - 4. Material: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - a. Scratch Resistance: Barcol hardness score of 25 minimum, when tested in accordance with ASTM D2583.

- b. Impact Strength: Minimum of 5 ft lb force per inch, when tested in accordance with ASTM D256.
 - c. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 5. Panel Manufacturing Tolerances:
 - a. Width and Length: 1/8 inch variation in panel lengths up to and including 10 feet.
 - b. Squareness: Not more than 1/8 inch out of square in any direction.
- B. Accessories:
 - 1. Trim:
 - a. Material: PVC.
 - b. Color/Finish: To match panel.
 - 2. Products:
 - a. Crane Composites Inc.; Silhouette Trim.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
- C. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.
- G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
- H. Remove excess sealant after paneling is installed and prior to curing.

3.3 CLEANING

- A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.4 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.

3.5 PROTECTION

- A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting.
- B. Section 09 93 00 - Staining and Transparent Finishing. Wood substrates.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 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 D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. 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 (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Submit samples in sheen specified.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 67 00 - Product Requirements for additional provisions.
 - 2. Extra Paint and Finish Materials: 2 gallons of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.7 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Exterior Paint Finish:
 - 1. Provide panel, [8] feet long by [8] feet wide, illustrating paint color, texture, and finish for typical exterior finish on fiber cement siding, and wood and fiber cement siding at eaves.
 - 2. Locate [where directed by Contracting Officer's Representative].
 - 3. Mock-up may remain as part of the work.
- C. Semi-Transparent Stain for Concrete Floors: Cast concrete panel of stained concrete to demonstrate typical joints, scoring pattern, surface finish, texture, tolerances, stain color, and standard of workmanship.
 - 1. Build panel approximately 10 square feet in the location indicated by the Contracting Officer.
 - 2. Stain panel to demonstrate color, including range of color tones and patterning.
 - 3. Provide mockup simultaneous to exterior paint mockup.

1.8 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 paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:

1. Basis-of-Design: Sherwin-Williams Company: www.sherwin-williams.com/#sle.
2. Or approved equal.
3. Substitutions: See Section 01 67 00 - Product Requirements.

C. Primer Sealers: Same manufacturer as top coats.

D. Concrete Stains and Sealers:

1. Basis-of-Design: Sika USA: www.usa.sika.com/#sle.
2. Or approved equal.
3. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, 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 paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified: where sheen is not specified, sheen will be selected by the Contracting Office from the Manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.

1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to Owner.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding, primed wood, and primed metal, and excluding doors and windows.

1. Two top coats and one coat primer.

2. Top Coat(s): Exterior Latex.
 - a. Products:
 - 1) Sherwin-Williams Loxon Self-Cleaning Acrylic Exterior, Flat. (MPI #10)
- B. Paint E-TR-C - Transparent Finish on Concrete Floors:
 1. 1 coat stain.
 2. Stain: Semi-Transparent Stain for Concrete Floors.
 - a. Products:
 - 1) Sika USA Lithochrome Chemstain Classic.
 - 2) _____.
 3. Sealer: Water Based Sealer for Concrete Floors; MPI #99.
 - a. Products:
 - 1) Sika USA Scoffield Cureseal-W.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Water Based Primer for Galvanized Metal; MPI #134.
 - a. Products:
 - 1) Sherwin-Williams DTM Primer/Finish (MPI #134)
 2. Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin-Williams DTM Primer/Finish (MPI #107)
 3. Latex Primer for Exterior Wood; MPI #6.
 - a. Products:
 - 1) Sherwin-Williams Exterior Latex Primer, B42W8041. (MPI #6)

2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints 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 effect proper application.

- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Fiber Cement Siding: 12 percent.
 - 2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 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 for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- G. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Galvanized Surfaces:
- I. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- J. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, to match face panels.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 93 00 - Staining and Transparent Finishing: Wood substrates.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 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 D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. 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 (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Submit samples in sheen specified.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 67 00 - Product Requirements for additional provisions.
 - 2. Extra Paint and Finish Materials: 2 gallons of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.7 MOCK-UP

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish for typical wood paneling, and at gypsum board for each gloss level.
- C. Locate where directed by Contracting Officer.
- D. Mock-up may remain as part of the work.

1.8 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 paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

- B. Paints:
 - 1. Basis-of-Design: Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Concrete Stains and Sealers:
 - 1. Basis-of-Design: Sika USA: www.usa.sika.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, 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 paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by the Contracting Officer from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel, and excluding doors and windows.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel. (MPI #139), for all location outside of restrooms, catering kitchens and storage rooms.
 - 2) Sherwin-Williams ProMar 200 HP Series, Semi-Gloss. (MPI #141), for restrooms, catering kitchens and storage rooms.
- B. Paint I-TR-C - Transparent Finish on Concrete Floors.
 - 1. 1 coat stain.
 - 2. Stain: Semi-Transparent Stain for Concrete Floors.
 - a. Products:
 - 1) Sika USA Lithochrome Chemstain Classic.
 - 3. Sealer: Water Based Sealer for Concrete Floors.
 - a. Products:
 - 1) Sika USA Scoffield Cureseal-W.

2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Interior Latex Primer Sealer; MPI #50.
 - a. Products:
 - 1) Sherwin-Williams Multi-Purpose Interior/Exterior Latex Primer/Sealer (MPI # 50).
 - 2. Interior Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Sherwin-Williams DTM Primer/Finish (MPI #107).
 - 3. Interior Water Based Primer for Galvanized Metal; MPI #134.
 - a. Products:
 - 1) Sherwin-Williams DTM Primer/Finish (MPI #134)

2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately 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. Test shop-applied primer for compatibility with subsequent cover materials.
- E. 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. Gypsum Wallboard: 12 percent.
 - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 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. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer. Protect from corrosion until coated.
- I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of stains and transparent finishes.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting: Stains and transparent finishes for concrete substrates.
- B. Section 09 91 23 - Interior Painting: Stains and transparent finishes for concrete substrates.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 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 D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. 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. MPI product number (e.g. MPI #33).

3. Manufacturer's installation instructions.
 4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, 12 by 24 inches in size.
 - D. Certification: By manufacturer that stains and transparent finishes comply with VOC limits specified.
 - E. 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.
 - F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 67 00 - Product Requirements for additional provisions.
 2. Extra Stain and Transparent Finish Materials: 2 gallons 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.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum ten years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.7 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 and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8 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. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide finishes used in any individual system from the same manufacturer; no exceptions.
- B. Stains:
 - 1. Basis-of-Design: Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.

2.2 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. Volatile Organic Compound (VOC) Content:
 - 1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected by Contracting Officer's Representative from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Allow for one color for each system.

2.3 EXTERIOR AND INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

- A. Finish on Wood - Doors and Windows:

SAMO - 303051

09 93 00 - 3
STAINING AND
TRANSPARENT FINISHING

1. Two coat(s) stain.
2. Stain: Exterior Semi-Transparent Stain for Wood, Water Based; MPI #156.
 - a. Products:
 - 1) Sherwin-Williams WoodScapes Polyurethane Semi-Transparent Stain.

2.4 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

3.1 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 effect proper application.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 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 hardware 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.

3.3 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. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- F. Reinstall items removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SAMO - 303051

09 93 00 - 6
STAINING AND
TRANSPARENT FINISHING

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Room identification, exit door, and occupant load signs.
- B. Interior directional and informational signs.

1.2 RELATED REQUIREMENTS

- A. Section 26 51 00 - Interior Lighting: Exit signs required by code.

1.3 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
- D. Samples: Submit two samples, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.

PART 2 PRODUCTS

2.1 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ABA Accessibility Guidelines.
- B. Room and Door Signs: Provide signs where indicated on the Drawings.
 - 1. Sign Type: Flat signs with applied character panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Size: As indicated on the Drawings.
 - 5. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and room numbers and braille.
- C. Exit, Occupant Load, and Assistive Listening Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Sizes: As indicated on drawings.

2.2 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Wall Mounting of One-Sided Signs: Concealed screws.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Clear.
 - 4. Character Color: Contrasting color.

2.3 MATERIALS

- A. Interior Signage: Cast acrylic sheet, transparent, clear, semi-matte or non-glare, 0.125-inch thick, frameless signs, color TBD.
- B. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
 - 1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
- C. Metallic Laminate: Aluminum foil laminated top phenolic core.
 - 1. Acceptable Manufacturers:
 - a. Formica, DecoMetal.
 - b. Lamin-Art, a Wilsonart Company.
 - c. Accepted equivalent.
 - 2. Grade: GP40
 - 3. Thickness: .0040-inch (1.0mm)

4. Color: To be selected by Contracting Officer from manufacturer's full line of standard colors.
- D. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ABAAS requirements. Text shall be accompanied by Grade 2 Raster Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
 1. Raised-Copy Thickness: Minimum of 1/32 inch (0.8 mm).
 2. Characters: Width-to-height ratio of between 60 percent and 110 percent measured by the width of the uppercase letter "O" and height of the uppercase letter "I"; and a stroke width-to-height ratio of 15 percent maximum measured by the width and height of the uppercase letter "I".
 3. Braille Layout:
 - a. Dots: 1/10-inch oc in each cell.
 - b. Dot Spacing: 1/5-inch between cells as measured from the second column of dots in the first cell.
 - c. Dot Height: Minimum 1/40-inch above the background.
- E. Colored Coatings for Acrylic Sheet: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for application intended.

2.4 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ABAAS.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid surface toilet compartments.
- B. Solid surface urinal screens.

1.2 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- B. Section 10 28 00 - Toilet Accessories.

1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

- A. See Section 13323 Submittal Procedures for project procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.
- D. Color Samples: Submit manufacturer's color chips for initial selection.
- E. Partition Panel Samples: Submit samples of partition panels, 6 inch by 6 inch in size illustrating panel finish, color, sheen, and edge and corner treatment.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Solid Surface Toilet Compartments:
 - 1. Basis-of-Design: Bobrick Washroom Equipment, Inc.: Sierra Series, www.bobrick.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: Section 01 67 00 - Product Requirements.

2.2 PLASTIC TOILET COMPARTMENTS

- A. Solid Surface Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of acrylic polymer resin, mineral filler, and pigment, tested in accordance with ASTM E84; floor-mounted headrail-braced.
 - 1. Color: Desert Beige, #SC-02..
 - 2. Doors:
 - a. Thickness: 3/4 inch.
 - b. Width: As indicated in drawings, 24 inch minimum,
 - c. Width for Handicapped Use: 36 inch, out-swinging.
 - d. Height: 58 inch.
 - 3. Panels:
 - a. Thickness: 1/2 inch.
 - b. Height: 58 inch.
 - c. Depth: As indicated on drawings.
 - 4. Pilasters:
 - a. Thickness: 3/4 inch.
 - b. Width: As required to fit space; minimum 3 inch.
 - 5. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.3 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
- B. Head Rails: Extruded aluminum, anti-grip profile.
 - 1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- E. Hinges: Stainless steel, manufacturer's standard finish.
 - 1. Continuous-type hinge, self closing.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.

2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
 3. Provide door pulls meeting accessibility requirements at accessible and ambulatory toilet compartments on both sides of door near latch.
- G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Electric hand dryers.
- D. Diaper changing stations.

1.2 RELATED REQUIREMENTS

- A. Section 10 21 13.19 - Plastic Toilet Compartments.
- B. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.3 REFERENCE STANDARDS

- A. ABA Standards - Architectural Barriers Act (ABA) Standards, 2015.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2017).
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
- H. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

- J. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

- A. See Section 01 33 23 - Submittal Procedures for project procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Commercial Toilet Accessories:
 - 1. Basis-of-Design: Bobrick Washroom Equipment, Inc.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- B. Under-Lavatory Pipe Supply Covers:
 - 1. Basis of Design: Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- C. Electric Hand Dryers:
 - 1. Basis-of-Design: Dyson .
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- D. Diaper Changing Stations:
 - 1. Koala Kare Products: www.koalabear.com/#sle.
 - 2. Or approved equal.
 - 3. Substitutions: See Section 01 67 00 - Product Requirements.
- E. Provide products of each category type by single manufacturer.

2.2 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.4 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Double jumbo roll, surface mounted enclosure type, stainless steel.
 - 1. Products:
 - a. Bobrick Washroom Equipment, Inc; B-2892.
 - 2. Provide 1 per toilet stall.
- B. Waste Receptacle: Semi-recessed, stainless steel, seamless lower door for access to container, with tumbler lock, reinforced panel full height of door, continuously welded bottom pan and seamless exposed flanges.
 - 1. Liner: Removable seamless stainless steel receptacle.
 - 2. Minimum capacity: 12 gallons.
 - 3. Products:
 - a. Bobrick Washroom Equipment, Inc.; B-43644.
- C. Automated Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with container concealed below deck; chrome-plated brass with bright polished finish; chrome-plated deck escutcheon.
 - 1. Minimum Capacity: 27 ounces.
 - 2. Power: AC power adapter.
 - 3. Products:
 - a. Bobrick Washroom Equipment, Inc.: B-824.
 - 4. Provide 1 dispenser at each sink.
- D. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
 - 1. Size: 24"x36".
 - 2. Frame: Angle frame shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 3. Products:
 - a. Bobrick Washroom Equipment, Inc.; B-2908 2436.

4. Provide 1 mirror at each sink.
- E. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
1. Minimum capacity: 250 seat covers.
 2. Products:
 - a. Bobrick Washroom Equipment, Inc.; B-4221.
 3. Provide 1 dispenser per toilet stall.
- F. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings. Provide grab bars meeting ABAAS in each accessible stall, ambulatory stall, and family restrooms.
 - e. Products:
 - 1) Bobrick Washroom Equipment, Inc.; B-5806 Series.
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products:
 - a. Bobrick Washroom Equipment, Inc.; B-254.
 2. Provide 1 unit per stall in Women's Rooms and Family Restroom.

2.5 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Under-Lavatory Pipe and Supply Covers:
1. Insulate exposed supply and drainage piping, including hot and cold supplies, under lavatories or sinks to comply with ABA Standards.
 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
 3. Construction: 1/8 inch flexible PVC.
 - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - b. Comply with ASTM C1822, type indicated.
 4. Color: As selected from manufacturer's standard range.
 5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
 6. Products:
 - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.

2.6 ELECTRIC HAND DRYERS

- A. Electric Hand Dryers: Traditional fan-in-case type, with downward fixed nozzle.
1. Operation: Automatic, sensor-operated on and off.
 2. Mounting: Surface mounted.
 3. Cover: Stainless steel with brushed finish.

- a. Tamper-resistant screw attachment of cover to mounting plate.
- 4. Electric Hand Dryer Products:
 - a. Dyson Airblade V.

2.7 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Stainless steel.
 - 2. Mounting: Surface.
 - 3. Products:
 - a. Koala Kare Products; KB310-SSWM.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations and as indicated on drawings.

3.4 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 09 91 23 - Interior Painting: Field paint finish.

1.3 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.5 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Temperature range: Minus 40 degrees F to ____ degrees F.

2.2 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
 - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- C. Fire Rated Cabinet Construction: One-hour fire rated.
 - 1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
- D. Cabinet Configuration: Recessed type.
 - 1. Size to accommodate accessories.
 - 2. Trimless type.
 - 3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- F. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- H. Fabrication: Weld, fill, and grind components smooth.
- I. Finish of Cabinet Exterior Trim and Door: Primed for field paint finish.
- J. Finish of Cabinet Interior: Primed for field paint finish..

2.3 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: _____.

- C. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, ____ inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Paint cabinets to match color of adjacent wall surface per Section 09 91 23 - Painting.

END OF SECTION

SECTION 11 40 00 - FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Foodservice equipment.
- B. Connections to utilities.

1.2 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between equipment and adjacent walls, floors, and ceilings.
- B. Section 11 40 01 - Custom Fabricated Foodservice Equipment.
- C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- B. NSF 2 - Food Equipment; 2019.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Contracting Officer's name and registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products clear of floor in a manner to prevent damage.

- B. Coordinate size of access and route to place of installation.

1.6 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Foodservice Equipment:
 - 1. Traulsen; www.traulsen.com
 - 2. Manitowoc; www.manitowocice.com
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for utility requirements.
- B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to local authorities having jurisdiction as suitable for the purpose specified and indicated.

2.3 EQUIPMENT

- A. Equipment, General
 - 1. Equipment Eligible for Energy Star Rating: Provide Energy Star Rated equipment
- B. Refrigerators:
 - 1. Basis of Design: Traulsen G-Series solid door, 2 section, reach in units.
- C. Ice Machines:
 - 1. Basis of Design: Manitowoc Indigo NXT Series iT0500 ice machine with Bin D570.
 - a. Features: Programmable ice production, regular cube, and corrosion resistant exterior.
- D. Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.4 MATERIALS

- A. Stainless Steel Sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

- B. Finish Hardware: Manufacturer's standard.
- C. Service Outlet Covers and Escutcheons: Stainless Steel.

2.5 FINISHES

- A. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify ventilation outlets, service connections, and supports are correct and in required location.
- B. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install items in accordance with manufacturers' instructions.
- B. Insulate to prevent electrolysis between dissimilar metals.

3.3 ADJUSTING

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
- B. Remove and replace equipment creating excessive noise or vibration.

3.4 CLEANING

- A. Remove masking or protective covering from stainless steel and other finished surfaces.
- B. Wash and clean equipment.
- C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

END OF SECTION

SECTION 11 40 01 - CUSTOM FABRICATED FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Custom fabricated stainless steel units, including:
 - 1. Food preparation tables.

1.2 REFERENCE STANDARDS

- A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.
- B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017.
- E. NSF 2 - Food Equipment; 2019.
- F. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

1.3 SUBMITTALS

- A. Shop Drawings: Submit floor plans, elevations, cross-sections, and construction details for fabricated units specified, including:
 - 1. Layout and anchorage of equipment and accessories, including clearances for maintenance and operation and required electrical or plumbing connections.
 - 2. Size, type, and location of equipment drain lines and floor drains.
 - 3. Special conditions, including required slab depressions, cores, wall openings, blockouts, ceiling pockets, access panels, and above ceiling hanger assemblies.
 - 4. Wiring, piping, and schematic diagrams.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver fixed equipment that is not to be integrated into structure until after completion of finished ceilings, floor and walls, painting, and lighting.
- B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: 18-8 percent chromium-nickel composition, minimum; alloy Type 302, 304, or 316; No. 4 - Brushed finish on exposed surfaces.
 - 1. Sheets: ASTM A240/A240M or ASTM A666.
 - 2. Tubing: ASTM A269/A269M or ASTM A270/A270M; of true roundness with seams and welds ground smooth.
 - 3. Bars: ASTM A276/A276M.
- B. Sound Deadening Material: Bituminous paint or other water resistant mastic.
- C. Bolts, Screws, and Rivets: Stainless steel; do not use on exposed surfaces unless specifically indicated or unavoidable.
 - 1. Bolt and Screw Caps: Provide lock washer and chromium-plated brass/bronze acorn nut to cap visible or exposed threads on inside of fixtures.
- D. Anchoring Devices: Stainless steel, of type appropriate for use; provide seismic anchorage as specified in SMACNA (KVS).

2.2 CUSTOM FABRICATED UNITS - GENERAL REQUIREMENTS

- A. See drawings for dimensions and configurations; ensure proper fit by taking field measurements prior to fabrication.
- B. Provide fully shop assembled units complying with SMACNA (KVS) and NSF 2 and stainless steel components, unless otherwise indicated.
 - 1. Where details are referenced as "SMACNA" details, refer to SMACNA (KVS).
 - 2. Stainless Steel Sheet: For surfaces up to 12 feet in length provide one continuous sheet without joints or welds, including back and end splashes.
 - 3. Joints: Provide welded joints unless specifically indicated or not possible; do not solder or braze stainless steel; do not use bolts, screws, or other fasteners on work surfaces, food contact surfaces, or wet surfaces.
 - 4. Drainage of Surfaces: Provide distinct pitch of top surfaces toward waste or drain outlets while maintaining level tops of rolled and marine edges and back and end splashes.
 - 5. Drainage of Equipment: Provide drain piping as indicated; where compartments or pans are intended to hold liquids or catch drips and no drain piping is indicated, provide drain fitting and gravity draining piping terminating over nearest floor drain.
 - 6. Where cut-outs are indicated for equipment to be set into countertop, provide cut-out in top and back of case body, maintaining continuous counter front; size to fit equipment with sanitary joint.
 - 7. Shop prepare openings for plumbing fixtures, fittings, and other service components.
 - 8. Sound Deadening: Apply sound deadening material to accessible internal surfaces of metal work and underside of metal counters and sinks.
- C. Countertops: Stainless steel, 14 gauge, 0.0747 inch thick, minimum; with underbracing as recommended by 1, and bullnose edges and 45-degree back and end splashes, unless otherwise indicated.

- D. Counter Edges: Provide finished edge on all open sides; close open ends down to bottom edge of turn down; if not otherwise indicated provide turned down edges.
 - 1. Turned Down Edges: 1-1/2 inch turn down at 90 degrees, with 1/2 inch return at 30 degree angle.
- E. Back and End Splashes: Provide wherever tops abut walls or other vertical surfaces; close open ends from top to bottom of turned down top edge.
 - 1. Where indicated and where required for concealment of plumbing, make horizontal dimension of back and end splashes at least 2-1/2 inches from face of wall.
 - 2. Wall Clips: 4 inch long 14 gauge, stainless steel "zee" clips; anchored to wall at 36 inches on center.
- F. Legs: Stainless steel tubing, 1-5/8 inches outside diameter; fit legs with set-screw fastened sockets and adjustable feet as specified.
 - 1. Legs Over 12 inches Long: 14 gauge, 0.065 inch, minimum, wall thickness.
 - 2. Weld leg sockets to continuous channel or angle or gusset plates; provide stainless steel triangular pad where leg gussets are welded to frame.
 - 3. Legs may be bolted to table tops using studs welded to bottom of top.
 - 4. Where vibration or oscillation is anticipated anchor in floor with 1/4 inch stainless steel pins.
 - 5. Unless otherwise indicated provide legs for all units.
- G. Shelves: Stainless steel.
 - 1. Undercounter Shelves: 16 gauge, 0.0598 inch thick.
 - 2. Provide one undercounter shelf full length of 3'-0" high units.

2.3 FABRICATION

- A. Joints, Bends, and Edges: Make each joint close fitting, especially butt and contact joints.
 - 1. Make brake bends free of open-texture or orange peel appearance.
 - 2. Make sheared edges free of burrs, projections, and fins.
 - 3. Neatly finish mitered and bullnosed corners with under edge of material ground to uniform condition, without overlapping materials or cracks.
- B. Welding: Make each welded joint smooth, ductile, and watertight, without gaps, holes, or discoloration or marring of surface adjacent to welds.
 - 1. Welding:
 - a. Stainless Steel: Comply with AWS D1.6/D1.6M.
 - 2. Use welding processes and filler metal compatible with material being welded. Do not use carbon arc welding on surfaces that will be exposed to view in finished work.
 - 3. Grind exposed welds flush with adjacent material; finish and polish to match adjacent surface.
 - a. Avoid excessive heating of metal and metal discoloration.
 - b. When grinding, use iron-free abrasives, wheels, and belts that have not been used on carbon-steel.
 - c. Remove pits, runs, sputter, cracks, low spots, voids, buckles, and other imperfections.
 - d. Remove grain of rough grinding by several successively finer polishings until specified finish is attained.

4. When welding sheet, penetrate entire thickness for entire length of joint; make joints flat, continuous and homogeneous with sheet metal without reliance on straps under seams, filling with solder, or spot welding.
5. When stainless steel is joined to dissimilar materials, use stainless steel for fastening devices and welding material.
6. Protection Against Corrosion: Eliminate possibility of corrosion wherever welding occurs on stainless steel, and minimize possibility of carbide precipitation in welding bolts and screws.
7. When welding galvanized steel, thoroughly clean and repair damaged galvanizing and coat welds with polyurethane coating.
8. Where bolts or screws are welded to underside of tops or trim, finish and undepress the exposed side of welds.
9. Coat welds and discolorations that are not exposed to view in finished work with metallic-based paint to prevent the possibility of progressive corrosion of joints, unless welds are ground and polished smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify correct locations of utility connections, floor drains, ventilation connections, and supports.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.3 INSTALLATION

- A. Install in accordance with fabricator's instructions and recommendations, plumb and level and in proper locations, ready for utility connections.
- B. Lay out work in advance to prevent damage to building, piping, wiring, or equipment; cut, fit, and patch where necessary; coordinate work with others.
- C. Do not cut or fit units in the field; if adjustments are necessary due to inadequate field measurement prior to fabrication, take unit back to shop and perform modifications there.
- D. Do not field weld unless absolutely necessary; weld and grind field joints in accordance with specified fabrication procedures.

- E. Securely anchor and attach non-mobile or adjustable-leg equipment to walls, floors, or bases with stainless steel bolts.
- F. Follow SMACNA (SRM) seismic restraint recommendations for project location.

3.4 CLEANING

- A. Remove masking or protective covering from stainless steel and other finished surfaces.
- B. Clean equipment to condition suitable for food preparation use.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SAMO - 303051

11 40 01 - 6
CUSTOM FABRICATED
FOODSERVICE EQUIPMENT

SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall-hung counters and vanity tops.

1.2 RELATED REQUIREMENTS

- A. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.3 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material; 2013.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- E. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII; 2016.
- F. PS 1 - Structural Plywood; 2009.

1.4 SUBMITTALS

- A. See Section 0133323 - Submittal Procedures for project procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.

- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
 - 1. Flat Sheet Thickness: 1 1/8" inch, minimum.
 - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Basis-of-Design: DuPont (E. I. du Pont de Nemours and Company); Corian Quartz: www.corianquartz.com/#sle .
 - 2) Or approved equal
 - 3) Substitutions: See Section 01 67 00 - Product Requirements.
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
 - c. Finish on Exposed Surfaces: Polished.
 - d. Color and Pattern: Dove Grey..
 - 3. Other Components Thickness: 3/4 inch, minimum.
 - 4. Exposed Edge Treatment: Expose edge of 1 1/8" slab thickness; with edge profile as indicated on drawings.

5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.
7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.2 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, white.

2.3 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install vanities in accordance with manufacturer's instructions and approved shop drawings
- B. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 00 00 - FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 21 00 00, Fire Suppression Basic Requirements applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of fire protection systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including and Division 01, General Requirements, Drawings, Addenda, and Contracting Officer Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.
 - 4. Approved or approved equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted Item.

1.2 RELATED SECTIONS

- A. Content of Section applies to Division 21, Fire Suppression Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement
 - e. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per and Division 01, General Requirements, individual Division 21, Fire Suppression Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. CA Title 24 Part 6 California Energy Code
 - 8. IFC - International Fire Code
 - 9. NFPA 101 Life Safety Code
 - 10. NPS Reference Manual 58.
 - 11. CA Title 24 Part 8 California State Historic Building
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 4. ANSI - American National Standards Institute
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASCE-7 Minimum Design Loads for Buildings and Other Structures
 - 7. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 8. ASHRAE Guideline 0, the Commissioning Process
 - 9. ASME - American Society of Mechanical Engineers
 - 10. ASPE - American Society of Plumbing Engineers

11. ASSE - American Society of Sanitary Engineering
12. ASTM - ASTM International
13. AWWA - American Water Works Association
14. CFR - Code of Federal Regulations
15. EPA - Environmental Protection Agency
16. ETL - Electrical Testing Laboratories
17. FCC - Federal Communications Commission
18. FM - FM Global
19. FM Global - FM Global Approval Guide
20. IAPMO - International Association of Plumbing and Mechanical Officials
21. ICC - International Code Council
22. IEC - International Electrotechnical Commission
23. ICC-ESR - International Code Council Evaluation Service Reports
24. HI - Hydraulic Institute Standards
25. ISO - International Organization for Standardization
26. MSS - Manufacturers Standardization Society
27. NEC - National Electric Code
28. NEMA - National Electrical Manufacturers Association
29. NFPA - National Fire Protection Association:
 - a. NFPA 13 - Standard for the Installation of Sprinkler Systems
 - b. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
 - c. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 - d. NFPA 70 - National Electrical Code
 - e. NFPA 72 - National Fire Alarm and Signaling Code
30. NRCA - National Roofing Contractors Association

- 31. NSF - National Sanitation Foundation
- 32. OSHA - Occupational Safety and Health Administration
- 33. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
- 34. TIMA - Thermal Insulation Manufacturers Association
- 35. UL - Underwriters Laboratories Inc.

D. See Division 21, Fire Suppression individual Sections for additional references.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
- D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Contracting Officer on all transmissions/submissions.
- E. Submit shop drawings, calculations and product data sheets as one complete stand-alone package to Contracting Officer's insurance underwriter.
- F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.
- G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - 1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove

extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.

2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.
 3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 4. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
 5. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.
- H. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead Item; Bear costs of additional reviews at Contracting Officer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- I. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.
- J. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.
- L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- M. Substitutions and Variation from Basis of Design:
1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if

included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equal", a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.

N. Shop Drawings:

1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.
2. Shop Drawings and hydraulics calculations, sway brace calculations, trapeze hanger calculations, and the like, to be prepared under the direct supervision and control of a Contracting Officer competent to do such work and licensed in the state of California. Drawings and calculations to bear the seal and wet signature of the Contracting Officer.
3. Provide Shop Drawings which indicate information required by NFPA 13. Include room names and fire sprinkler occupancy hazard classifications.
4. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.
5. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.
6. Utilizing the Structural backgrounds, provide Shop Drawings illustrating locations and types of hangers and sway braces.
7. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.
8. Provide Shop Drawings illustrating each type of branchline restraint and sway brace, including length of sway brace member, sway brace fittings, minimum and maximum angles from vertical of sway brace member, method of attachment to structure, size,

length and embedment of attachment to structure and size and type of structural member to which sway brace will be attached. Number each type of restraint and sway brace. Indicate on Drawings locations of each type of numbered restraint and sway brace.

9. Provide details for any hanger, attachment, or sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the engineered product manufacturer.
10. Provide Shop Drawings illustrating information for Sprinkler System General Information Sign.
11. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.
12. When required, provide Coordination Drawings.
13. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
14. Provide details of hanger, sway bracing and branch line restraint attachments to structure and to piping. Include details on the size and load capacities of fasteners. Provide verification of the structural capacity to withstand seismic load.
15. Provide sway bracing calculations on drawings showing horizontal seismic design load and requirements, with indication of zone of influence for each bracing location.
16. Provide a schedule of sway bracing type, size, and design criteria, including length, angle from vertical, and load capacities.
17. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.
18. Provide details of flexible sprinkler hose fitting per manufacturer's schedule of equivalent feet used in hydraulic calculations, showing device length, maximum number of 90-degree bends and expected radius of bends.
19. Provide a schedule of signage to be installed at each flexible sprinkler hose fitting.
20. On the drawings, provide a list of number, model, temperature, sprinkler Identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list."
21. Spare sprinkler head cabinet size indicating the number of spare sprinkler head to be contained therein.

O. Samples: Provide samples when requested by individual Sections.

P. Resubmission Requirements:

1. Make any corrections or change in submittals when required. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.
2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".

Q. Operation and Maintenance Manuals/Contracting Officer's Instructions:

1. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or Item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - a. Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.
 - b. Include Warranty per and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Sections.
 - c. Catalog description of each Item of equipment actually installed on job.
 - d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:
 - 1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection , lubrication or service, describing and scheduling performance of maintenance.
 - 2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e. F-5 etc.
 - e. Include product certificates of warranties and guarantees.
 - f. Include Record Drawings,
 - g. Include copy of water supply flow test used as basis for hydraulic calculations.
 - h. Include hydraulic calculations and sway brace calculations.

- i. Include Contractor's Material and Test Certificates for Aboveground Piping/Underground Piping.
 - j. Include a copy of NFPA 25.
 - k. Include a copy of valve charts and whether normally open or normally closed.
 - l. Include a copy of drain, auxiliary, and low point drains charts.
 - m. Include a copy of the list to be included in the spare sprinkler head box.
 - n. Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - o. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e. belts, motors, lubricants, and filters.
 - p. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
 - q. Include copy of startup and test reports specific to each piece of equipment.
 - r. Contracting Officer will return incomplete documentation without review. Contracting Officer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Contracting Officer's hourly rates.
- 2. Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".
 - 3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

R. Record Drawings:

- 1. Maintain at site at least one set of Drawings for recording "As-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical

Item. Include items changed by field orders, supplemental instructions, and constructed conditions.

2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
3. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
4. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.
5. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.
6. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic and sway brace and the like calculations.

1. Hydraulic Calculations:

- a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.
- b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed "by hand" or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by Contracting Officer.
- c. Provide one or more hydraulic calculations for each hydraulically most remote area.
- d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.
- e. For grid systems, either provide "peaked" hydraulic calculations, or provide two additional sets of hydraulic calculations for each hydraulically most remote area.
- f. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.
- g. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.

- h. When flexible sprinkler hose fittings are added to an existing system, provide hydraulic calculations verifying the design flow rate will be achieved."
 - i. For Future Tenant Improvement Spaces: Include in hydraulic calculations friction loss allowances for future installation of flexible sprinkler head connectors so that flexible connectors may be installed in the future without revisions to the overhead system.
2. Sway Brace Calculations:
- a. Sway brace calculations utilizing a proprietary computer calculation program only used for the sway brace components supported by that manufacturer. For example, only "manufacturer X" sway brace components, and not those of another manufacturer, may be calculated on a "manufacturer X" sway brace computer calculation program.
 - b. Provide seismic calculations for any sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the I-joist manufacturer.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every Item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer in writing before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

- F. Provide products that are UL listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Provisions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, fire alarm, plumbing, cable trays, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, electrical, fire alarm ceiling suspension and tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling and finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by and/or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades onto master coordination documents.
- B. Prepare Drawings as follows:
 - 1. Provide drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
 - 3. Indicate fire protection system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 - 4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible Item. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings, architectural reflected ceiling drawings and HVAC equipment, ductwork and piping. Drawings to indicate proposed and identified structural members to which hangers and sway braces will be attached as shown on structural drawings.

5. Incorporate Addenda Item and change orders.
 6. Provide additional coordination as requested by other trades.
- C. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
 - D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
 - E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers and bracing materials.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, FM, ICC-ES, and CSFM approved for their intended fire protection function or have adequate approval or be acceptable by State, County, and City authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with and Division 01, General Requirements for this project relating to hazardous materials.
 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in , Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Install equipment requiring access (i.e. drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts and the like) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 - 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
 - 2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Contracting Officer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

- G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Contracting Officer of discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 21, Fire Suppression Sections.
- B. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to lateral seismic forces as determined by building code and NFPA 13 calculations, whichever is more demanding.
- C. See Structural Drawings for seismic design criteria for sway bracing and seismic restraint.
- D. Earthquake resistant designs for Fire Protection (Division 21) equipment and distribution, i.e. fire sprinkler systems, fire standpipe systems, fire pumps, fire pump controllers, fire tanks, clean agent fire suppression systems, etc. to conform to regulations of Contracting Officer.
- E. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by Contracting Officer.
- F. Provide stamped Shop Drawings from licensed Contracting Officer of seismic bracing and seismic movement assemblies for piping, equipment, tanks, pumps controllers and the like. Submit shop drawings along with equipment submittals.
- G. Provide stamped Shop Drawings from licensed Contracting Officer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

- H. Provide details of flexible drops for sprinklers in conformance with Building Code and ASCE 7 requirements of ceilings. Coordinate with Architectural and Structural Drawings and Specifications.
- I. Piping: Per NFPA 13, ASCE-7 and local requirements.
- J. Equipment:
 - 1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA, ASCE 7 and local requirements.
 - 2. Provide means to prohibit excessive motion of fire protection equipment during an earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground piping installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.
 - 4. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.
 - 5. When mains or branchlines are to be permanently concealed by construction or insulation systems.
 - 6. When fire suppression systems, or portions of, are being tested and ready for inspection by Contracting Officer.
- C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Contracting Officer at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.
- D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:
 - a. Cutting and patching of plaster or partitions.
 - b. Cutting and patching of finished ceilings.
2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Contracting Officer.
3. When masonry to concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.
4. Locate concealed utilities to eliminate possible service interruption or damage.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.
6. Proposed floor cutting/core drilling/sleeve locations to be approved by Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
7. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost to Contracting Officer.

3.6 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:
 - 1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand and model numbers on site inside building or protected from weather, sun, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 - 2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 - 3. Protect bright finished shafts, bearing housings and similar Item until in service.

3.7 DEMONSTRATION

- A. Confirm Demonstration requirements in and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Maintenance Staff as specified in Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.
- D. Prior to acceptance of work and during time designated by Contracting Officer, provide necessary qualified personnel to operate system for a period of two hours.

- E. Instruct the Contracting Officer in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.
- F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Contracting Officer that equipment is furnished and installed or connected under provisions of these Specifications.

3.8 CLEANING

- A. Confirm Cleaning requirements in and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.
- C. Sprinklers may not be cleaned except for vacuuming in a manner in which no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.9 INSTALLATION

- A. Confirm Installation requirements in and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.
- B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:
 - 1. Ferrous Metal: After completion of fire protection work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.

2. After acceptance by Contracting Officer, in a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Contracting Officer.
3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
4. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Contracting Officer.
5. Covers: Covers such as vault covers and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

- A. Confirm requirements in and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document and Commissioning Reports
 - h. Letter of Conformance

3.12 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

- B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning Item at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.
- C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Contracting Officer. Remove cracked or dented Item and replace with new Item.
- D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.

3.13 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize fire protection equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.15 CONNECTIONS TO EXISTING

- A. Prior to connection of piping to existing piping or utilities, field verify existing conditions and exact sizes and locations of existing piping. Provide additional offsets, transitions, joints, cut-ins, and replace portions of existing as required to facilitate connections of new.

END OF SECTION

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Buried Ductile Iron Pipe and Fittings
2. Buried PVC (Polyvinyl Chloride) Pipe and Fittings
3. Buried Stainless Steel Pipe
4. Joint Restraints
5. Aboveground Black Steel Pipe and Fittings
6. Wall and Floor Penetrations and Sleeves
7. Switches, Valve Supervisory
8. Switches, Water Detector
9. Hangers and Supports
10. Struts and Strut Clamps
11. Sway Braces and Restraints
12. Anchors and Attachments
13. Pipe Stands
14. Gauges
15. Bells
16. Fire Department Connection
17. Valves
18. Backflow Prevention Devices
19. Pipe, Valve, and Fire Protection Equipment Identification
20. Signs
21. Drains

1.2 RELATED SECTIONS

- A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Division 22, Plumbing
 - 2. Division 23, Heating, Ventilating and Air Conditioning
 - 3. Division 26, Electrical
 - 4. Division 28, Electronic Safety and Security
 - 5. Division 31, Earthwork
 - 6. Section 21 00 00, Fire Suppression Basic Requirements
 - 7. Section 21 13 00, Fire Suppression Sprinkler Systems
 - 8. Section 21 13 19, Fire Suppression Deluge Sprinkler Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of ASCE 7, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers, latest adopted edition.

1.4 SUBMITTALS

- A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Material and Equipment: Listed for its intended fire protection use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, International Code Council Evaluation Service Reports and FM Global Approval Guide. All material and equipment to be new and from a current manufacturer.
 - 2. Provide per Contracting Officer requirements.
 - 3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved

versions of these standards.

4. Fire Suppression Screw-Thread Connections: Comply with local fire department/fire marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire department connections.
5. Manufacturers: Unless an item is marked "No substitutions", submit substitution request for materials of other than named manufacturers.
6. Noise and Vibration:
 - a. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.
 - b. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Contracting Officer.
 - c. In acoustically sensitive areas, design system in a manner that minimizes the number of wall penetrations.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 FLOW TEST

- A. If flow test information provided below has been conducted less than 12 months prior to working plan submittal, utilize for design of NFPA 13 fire sprinkler and NFPA 14 standpipe systems.
- B. If flow test information provided below has been conducted greater than 12 months prior to working plan submittal, the information provided is advisory only and not to be used for design. Provide materials and labor for a new water supply test on the closest nearby fire hydrants per NFPA 13 and NFPA 291. Utilize new flow test results for design of NFPA 13 fire sprinkler and NFPA 14 standpipe systems.
- C. Contractor to include materials for Flow Test:
 1. Flow: 1666 GPM at a residual pressure of 20 PSI.
 2. Static Pressure: 199 PSI.
 3. Location: Mulholland and Cornell.
 4. Date: 10/18/21.
 5. Information Provided By: National Parks Service.

1.8 SYSTEM IMPAIRMENT

- A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Buried Ductile Iron Pipe and Fittings:
 - 1. American Cast Iron Pipe Co.
 - 2. Atlantic States Cast Iron Pipe Co.
 - 3. Clow Water Systems Co.
 - 4. EBAA Iron, Inc.
 - 5. Griffin Pipe Products Co.
 - 6. McWane Cast Iron Pipe Co.
 - 7. Pacific States Cast Iron Pipe Co.
 - 8. United States Pipe Foundry Co.
 - 9. Star Pipe Products
 - 10. Tyler Union
 - 11. Or approved equal.
- B. Buried PVC (Polyvinyl Chloride Pipe and Fittings):
 - 1. Certainteed Corp.
 - 2. JM Eagle
 - 3. National Pipe and Plastics Inc.
 - 4. Or approved equal.
- C. Buried Stainless Steel Pipe:
 - 1. In Building Riser:
 - a. Ames
 - b. Zurn Wilkins
 - c. Or approved equal.

D. Joint Restraints:

1. Star Pipe Products
2. Tyler Pipe Co.
3. EBAA Iron, Inc.
4. Uni-Flange Corp.
5. Union Foundry Co.
6. United States Pipe and Foundry Co.
7. Or approved equal.

E. Aboveground Black Steel Pipe and Fittings:

1. Pipe:
 - a. Bull Moose Tube
 - b. Wheatland Tube Co.
 - c. Youngstown Tube Co.
 - d. Tex-Tube Co.
 - e. State Pipe and Supply, Inc.
 - f. Or approved equal
2. Fittings, Mechanical and Grooved Couplings:
 - a. Victaulic
 - b. Gruvlok
 - c. Shurjoint Piping Products Inc.
 - d. Smith-Cooper International
 - e. Tyco Fire Building Products
 - f. Viking Corp.
 - g. Allied Rubber and Gasket Co. Inc., dba ARGCO
 - h. Anvil International
 - i. Dixon Valve Coupling
 - j. Or approved equal.

3. Fittings, Threaded:
 - a. Ward Mfg.
 - b. Anvil International
 - c. Smith-Cooper International
 - d. Aegis Technologies
 - e. Or approved equal.
4. Fittings, Rubber Gasketed:
 - a. Victaulic
 - b. Anvil International
 - c. AnvilStar
 - d. EBAA Iron, Inc.
 - e. Shurjoint Piping Products, Inc.
 - f. Smith-Cooper International
 - g. Tyco Fire Building Products
 - h. Viking Corp.
 - i. Ward Mfg.
 - j. Allied Rubber and Gasket Co. Inc., dba ARGCO
 - k. Dixon Valve Coupling
 - l. Or approved equal.
5. Fittings, Welded:
 - a. Anvil International
 - b. Shurjoint Piping Products Inc.
 - c. Smith-Cooper International
 - d. State Pipe Supply, Inc.
 - e. Or approved equal.
6. Fittings, Flanged:
 - a. Victaulic

- b. United Brand Fittings
- c. U.S. Pipe
- d. Anvil S.P.F.
- e. Iowa Fittings Co.
- f. Tyco Fire Products
- g. Or approved equal.

F. Wall and Floor Penetrations and Sleeves:

- 1. Allied Rubber and Gasket Co., Inc., dba ARGCO
- 2. Fire Protection Products Inc. (FPPI)
- 3. Or approved equal.

G. Switches, Valve Supervisory:

- 1. Potter Electric Signal Co.
- 2. System Sensor
- 3. Or approved equal.

H. Switches, Water Detector:

- 1. Water Flow Switches:
 - a. Wet Sprinkler Systems:
 - 1) Potter Electric Signal Co.
 - 2) System Sensor
 - 3) Or approved equal.
- 2. Pressure Operated Alarm Switches:
 - a. Dry Pipe Sprinkler Systems:
 - 1) Detection of Water Flow:
 - (a) Potter Electric Signal Co.
 - (b) System Sensor
 - (c) Or approved equal.
 - 2) Detection of Low Pressure:

- (a) Potter Electric Signal Co.
- (b) System Sensor
- (c) Or approved equal.

I. Hangers and Supports:

- 1. Cooper B-Line Tolco
- 2. Anvil International
- 3. ITW Buildex Sammys
- 4. Erico International
- 5. PHD Mfg. Inc.
- 6. Or approved equal.

J. Struts and Strut Clamps:

- 1. Cooper B-Line Tolco
- 2. Or approved equal.

K. Sway Braces and Restraints:

- 1. Cooper B-Line Tolco
- 2. Anvil International
- 3. Erico International
- 4. PHD Mfg. Inc.
- 5. Or approved equal.

L. Anchors and Attachments:

- 1. Concrete:
 - a. Cast-In Place Anchors for Hangers:
 - 1) Cooper B-Line Tolco
 - 2) Erico International
 - 3) Or approved equal.
 - b. Cast-In Place Anchors for Braces:
 - 1) Cooper B-Line Tolco

- 2) Anvil International
 - 3) Erico International
 - 4) Or approved equal.
 - c. Attachments as specified or described by structural. If not specified or described by structural, then as follows:
 - 1) Hilti
 - 2) Powers
 - 3) Simpson Strong-Tie
 - 4) DeWalt
 - 5) Or approved equal.
- 2. Wood:
 - a. Cooper B-Line Tolco
 - b. Anvil International
 - c. Elco Construction Products
 - d. Erico International
 - e. ITW Buildex Sammys
 - f. Or approved equal.
- 3. Steel:
 - a. Cooper B-Line Tolco
 - b. Anvil International
 - c. Elco Construction Products
 - d. Erico International
 - e. ITW Buildex Sammys
 - f. Or approved equal.
- M. Pipe Stands:
 - 1. Cooper B-Line Tolco
 - 2. Anvil International

3. Or approved equal.

N. Gauges:

1. Ashcroft
2. US Gauge
3. Brecco
4. Reliable Automatic Sprinkler Co.
5. Fire Protection Products, Inc. (FPPI)
6. Allied Rubber and Gasket Co. Inc., dba ARGCO
7. Wika Instrument Corp.
8. Or approved equal.

O. Bells:

1. Potter
2. System Sensor
3. Or approved equal.

P. Fire Department Connection:

1. Guardian Fire Equipment
2. Fire End Croker Corp.
3. Potter-Roemer
4. Elkhart Brass
5. Tyco Fire Building Products
6. Fire Protection Products, Inc. (FPPI)
7. Or approved equal.

Q. Valves:

1. OS Y Gate:
 - a. Victaulic
 - b. Nibco
 - c. Mueller

- d. Or approved equal.
- 2. NRS Gate:
 - a. Nibco
 - b. Mueller
 - c. Victaulic
 - d. Or approved equal.
- 3. Swing Check:
 - a. Victaulic
 - b. Nibco
 - c. Mueller
 - d. Viking
 - e. Tyco
 - f. AnvilStar
 - g. Reliable
 - h. Or approved equal.
- 4. Wafer Check:
 - a. Nibco
 - b. Mueller
 - c. Viking
 - d. Tyco
 - e. Or approved equal.
- 5. Butterfly Valves:
 - a. Victaulic
 - b. Nibco
 - c. Tyco
 - d. Use lug body next to pumps; Nibco.
 - e. Reliable

- f. Or approved equal.
- 6. Pressure Relief:
 - a. Watts
 - b. United Brass Works
 - c. AGF
 - d. Or approved equal.
- 7. Automatic Ball Drip Drain Valve:
 - a. Tyco
 - b. Reliable Automatic Sprinkler Co.
 - c. Or approved equal.
- 8. Three-Way Gauge Valve:
 - a. Fire Protection Products Inc. (FPPI)
 - b. AGF Mfg. Inc.
 - c. Nibco
 - d. Or approved equal.
- 9. Automatic Air Release Valve:
 - a. Potter Electric Signal Co.
 - b. Or approved equal.
- 10. Ball Valve:
 - a. Victaulic
 - b. Apollo Valves
 - c. Fire Protection Products Inc. (FPPI)
 - d. Nibco
 - e. Or approved equal.
- R. Backflow Prevention Devices:
 - 1. Double Check Valve Assembly:
 - a. Ames

- b. Febco
- c. Zurn Wilkins
- d. Apollo Valves
- e. Or approved equal.

S. Pipe, Valve, and Fire Protection Equipment Identification:

- 1. Fire Protection Products, Inc. (FPPI)
- 2. Allied Rubber and Gasket Co., Inc., dba ARGCO
- 3. Or approved equal.

T. Signs:

- 1. Tyco Fire Products
- 2. Reliable Automatic Sprinkler
- 3. Viking Corp.
- 4. Allied Rubber and Gasket Co., Inc., dba ARGCO
- 5. Or approved equal.

U. Drains:

- 1. Reference Aboveground Black Steel Pipe and Fittings.
- 2. AGF
- 3. Victaulic
- 4. Or approved equal.

2.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe:

- 1. Thickness: Class 52 ductile iron, AWWA C151.
- 2. Pressure: 300 psi, 10.34 bar.
- 3. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

- B. Fittings: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

- C. Fittings restrained with thrust blocks or restraining rods per NFPA 24.
- D. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.
- E. Flexible Underground Expansion Joints:
 - 1. AWWA C153, AWWA C116, AWWA C105.
 - 2. Expansion joint designed and cast as an integral part of a ball and socket type flexible joint.
 - 3. Internal and external epoxy lined.
 - 4. Sealing Gasket: EPDM.
 - 5. Polyethylene sleeve.

2.3 BURIED PVC (POLYVINYL CHLORIDE) PIPE AND FITTINGS

- A. Pipe: SDR-18, AWWA C900.
- B. Fittings:
 - 1. AWWA C907, CSA B137.2.
 - 2. PVC fittings restrained with thrust blocks per NFPA 24.
 - 3. Ductile Iron Fittings and Restraining Rods: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.
 - 4. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.
- C. Install tracer wire on all non-metallic underground water lines. Type R.H.W., 10 A.W.G. stranded.

2.4 BURIED STAINLESS STEEL PIPE

- A. Single extended 90 degree fitting of fabricated stainless steel tubing, maximum working pressure 200 PSI. Grooved-end connection on building outlet side and CISPI coupler on underground inlet side.

2.5 JOINT RESTRAINTS

- A. Mechanical joint wedge action for ductile iron pipe.

- B. Gland: Ductile Iron.
- C. Wedges: Ductile iron.
- D. Full restraint pressure rating of pipe with minimum safety factor of 2:1.

2.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Wet Pipe Systems:

- 1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 40.
- 2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.
- 3. Exposed pipe 8-feet or less above finished floor: A minimum of Schedule 40.

B. Dry Pipe Systems:

- 1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; Schedule 40 only, shop welded, or threaded or cut grooved.
- 2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.
- 3. Exposed pipe 8-feet or less above finished floor: Minimum of Schedule 40.

C. Joints:

- 1. Threaded, flanged or bevel welded.
- 2. Piping installed in plenums or shafts to have welded joints.

D. Fittings:

- 1. Threaded:
 - a. Malleable Iron: Class 150 and Class 300, ANSI B16.3.
 - b. Cast Iron: Class 125 and 250, ANSI B16.3.
- 2. Flanged:
 - a. Cast iron; Class 125 and 250, ASME B16.1.
 - b. Raised ground face, bolt holes spot faced.
- 3. Welded:
 - a. Carbon Steel: Long radius, standard weight or extra strong.
 - b. Factory Wrought Steel Buttweld Fittings: ASME B16.9.

- c. Buttwelding Ends for Pipe, Valves, Flanges and Fittings: ASME B16.25.
 - d. Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234.
 - e. Steel Pipe Flanges and Flanged Fittings: ASME B16.5.
 - f. Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.
 - 4. Mechanical Fittings and Grooved Couplings:
 - a. Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design and ASTM A183 carbon-steel bolts and nuts.
 - b. FM Global approved.
 - E. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.
- 2.7 WALL AND FLOOR PENETRATIONS AND SLEEVES
- A. Below Grade and High Water Table Areas: Waterproof elastomeric compound.
- 2.8 SWITCHES, VALVE SUPERVISORY
- A. Provide to mount on applicable, compatible valve (OS Y gate, or PIV), with SPDT switches to match requirements of fire alarm system. Provide with cover tamper switch where required by Contracting Officer.
- 2.9 SWITCHES, WATER DETECTOR
- A. Provide with cover tamper switch where required by Contracting Officer.
 - B. Water Flow Switches:
 - 1. Vane-type; SPDT switches; electronic retard, adjustable time delay (0 to 75 seconds).
 - 2. Wet Sprinkler Systems, NFPA 13: 450 PSI, 18-feet per second, 4-10 gpm.
 - C. Pressure Operated Alarm Switches: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds).
- 2.10 HANGERS AND SUPPORTS
- A. General: Select size of hangers and supports to exactly fit pipe size for bare piping.
 - B. Hangers: Ferrous.
 - C. Hanger Rods: Zinc electroplated carbon steel.

- D. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- E. Materials:
 - 1. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
 - 2. Use stainless steel hangers, rods and attachments for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.
- F. Anti-Scratch Padding: Use padded hangers for piping subject to scratching.

2.11 STRUTS AND STRUT CLAMPS

- A. Electro-galvanized steel.
- B. Designed for supporting pipe runs from strut supports.
- C. Strut clamps UL listed for fire protection.
- D. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

2.12 SWAY BRACES AND RESTRAINTS

- A. Sway Bracing: From a single manufacturer and compatible with sway brace calculation program.
- B. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

2.13 ANCHORS AND ATTACHMENTS

- A. General: Anchor supports to masonry, concrete and block walls per anchoring system manufacturer's recommendations, or as modified by
- B. Materials:
 - 1. Ferrous.
 - 2. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas,

marine and beach environments, commercial laundries, and the like.

C. Cast in Place Anchors for Hangers: Verify listing is for hangers, braces, or both.

D. Attachments in Concrete:

1. Suitable for hanging and bracing fire protection systems in concrete which is subject to cracking in a seismic event.
2. Seismic Design Areas C, D, E and F:
 - a. Compatible with International Code Council Evaluation Service Acceptance Criteria AC-193 and AC308 for expansion, screw and adhesive anchors. Meet requirements of ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.
 - b. All models of Hilti HDI and ITW Red Head Multi-Set II anchors are not approved for attaching fire protection systems in Seismic Design Areas C, D, E and F. No Exceptions.

E. ITW Buildex Sammys with FM Approval only are not allowed in certain seismic zones. Verify with FM that FM Approval is effective in project's seismic zone.

2.14 PIPE STANDS

A. Adjustable Pipe Saddle Support with Yoke:

1. Designed to support horizontal pipe from floor stanchion.
2. U-bolt and hex nuts to hold pipe securely to saddle or pipe clamp type.
3. ANSI/MSS SP-69; SP-58. Type 37.
4. Steel pipe with steel saddle.

B. Base Stand:

1. Steel pipe welded to steel base plate.
2. Meet requirements of 12X anchor diameter hole spacing for seismic applications.

2.15 GAUGES

A. Pressure Gauges: 3.5-inch, dial type, bronze bourdon tube or spring type, stainless steel case. 0 to 300 PSI.

2.16 BELLS

A. Exterior Alarm Bells: Minimum weatherproof backbox, typical 90 dBA at 10-feet.

B. Provide sign that reads, "When Bell Rings - Call 911".

2.17 FIRE DEPARTMENT CONNECTION

A. General:

1. Thread to match fire department hardware; automatic drip connected to drain; threaded dust cap and chain of same material and finish as body.
2. Provide with individual clappers.

B. Type: Free-Standing Type

C. Finish: Ductile Iron

D. Inlet Size: 2-1/2-inch.

E. Number of Inlets: Two.

F. Outlet Size: 4-inch.

G. Size of Pipe between Fire Department Connection and Sprinkler System: 4-inch.

H. Drain: 3/4-inch automatic ball drip, to outside.

I. Sign: Auto Sprinkler Fire Department Connection.

J. Locking Storz Inlet x Female NPT outlet, hard coated aluminum.

K. Straight adapter.

L. 30 degree angle pattern adapter.

M. Free-standing type.

N. Cap.

2.18 VALVES

A. OS Y Gate:

1. 2-1/2-inches and Larger: Iron body.
2. 2-inches and Smaller: Bronze body.

B. NRS Gate:

1. Iron body. Non-rising stem with indicator post.
2. Underground Butterfly Valves: Telescopic barrel type.

C. Swing Check: Iron body, rubber and bronze faced checks.

D. Wafer Check: Iron body, rubber seat, spring actuated.

- E. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.
- F. Pressure Relief: Bronze body, stainless steel spring.
- G. Automatic Ball Drip Drain Valve: Bronze, spring-type.
- H. Three-Way Gauge Valve: Brass; rated to 300 psi.
- I. Automatic Air-Release Valve for Wet Systems:
 - 1. Rated to 300 psi.
 - 2. Automatic float-type with shutoff mounted in a water retention pan.
 - 3. Single set 24VAC 2A for electronic supervision.
 - 4. Ball valve switch with cover tamper.
- J. Ball Valves: Brass body, brass stem; forged brass ball disc.

2.19 BACKFLOW PREVENTION DEVICES

- A. Double Check Valve Assembly:
 - 1. Two check valves in series with OS Y gate or butterfly valves at each end.
 - 2. Provide detector if required by local utility.
 - 3. UL listed or FM Global Approved for fire suppression service as an assembly.
 - 4. Approved by local and state authorities, including project's State Department of Health for the position in which it is installed.
- B. Provide Water Bureau approved Bypass-Meter and compatible Touch-Pad. Touch-Pad unit must be accessible from right-of-way.

2.20 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

- A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
- B. Corrosion-resistant chain or permanent adhesive.

2.21 SIGNS

- A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.
- B. Corrosion-resistant chain or permanent adhesive.

2.22 DRAINS

- A. Reference Aboveground Black Steel Pipe and Fittings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.

3.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe Sleeves:

1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking firestopping, smokestopping and water stopping grout or approved equal caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM approved fire-rated firestopping compound. Provide fire-rated assemblies per local Contracting Officer requirements.
4. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
2. Excavation and Backfill:
 - a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
 - b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Contracting Officer.
 - c. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of a testing laboratory.
 - d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation

material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Contracting Officer. Adequate width of trench for proper installation of piping or conduit.

e. Support Foundations:

- 1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Contracting Officer as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
- 2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Contracting Officer.
- 3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
- 4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:

- 1) Following installation and successful completion of required tests, backfill piping in lifts.
 - (a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
 - (b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
- 2) Backfill Material:
 - (a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

- (b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

- 1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - (a) Mechanical tamper,
 - (b) Vibratory compacter, or
 - (c) Other approved methods appropriate to conditions encountered.
- 2) Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

- C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.3 BURIED PVC (POLYVINYL CHLORIDE) PIPE AND FITTINGS

- A. Securely fasten tracer wire to top of water line and place along the outside of transition to ductile iron pipe with one foot of slack placed adjacent to ductile iron pipe.
- B. Buried Pipe:
 - 1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
 - 2. Excavation and Backfill:
 - a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
 - b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Contracting Officer.
 - c. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of a testing laboratory.

- d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Contracting Officer. Adequate width of trench for proper installation of piping or conduit.
- e. Support Foundations:
 - 1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Contracting Officer as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
 - 2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Contracting Officer.
 - 3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
 - 4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.
- f. Backfilling:
 - 1) Following installation and successful completion of required tests, backfill piping in lifts.
 - (a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
 - (b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
 - 2) Backfill Material:

- (a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
- (b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

- 1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - (a) Mechanical tamper,
 - (b) Vibratory compacter, or
 - (c) Other approved methods appropriate to conditions encountered.
- 2) Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

- C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.4 BURIED STAINLESS STEEL PIPE

- A. Underground Steel Piping Corrosion Protection: Factory wrap uninsulated underground stainless steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating, equivalent to "Republic X-Tru-Coat." Wrap joints spirally with a minimum overlap of 1/2 tape width. Extend wrap not less than 3-inches above grade. Provide cathodic protection to meet requirements of governing authorities and servicing utility.
- B. Buried Pipe:
 - 1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
 - 2. Excavation and Backfill:
 - a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.

- b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Contracting Officer.
- c. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of a testing laboratory.
- d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Contracting Officer. Adequate width of trench for proper installation of piping or conduit.
- e. Support Foundations:
 - 1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Contracting Officer as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
 - 2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Contracting Officer.
 - 3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
 - 4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.
- f. Backfilling:
 - 1) Following installation and successful completion of required tests, backfill piping in lifts.
 - (a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

- (b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
 - 2) Backfill Material:
 - (a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
 - (b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
- g. Compaction of Trench Backfill:
 - 1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - (a) Mechanical tamper,
 - (b) Vibratory compacter, or
 - (c) Other approved methods appropriate to conditions encountered.
 - 2) Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.
- C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.5 JOINT RESTRAINTS

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.

3.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

- A. Piping Routing:
 - 1. Route piping, except as otherwise indicated, vertically and horizontally (sloped to drain). Avoid diagonal runs wherever possible. Orient horizontal routes parallel with walls and beam lines.
 - 2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

3. Install piping in concealed spaces above finished ceilings. Prior to design and installation, obtain pre-approval by Contracting Officer for exposed piping.
4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Contracting Officer's and Contracting Officer's approval of exposed piping installation.
5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.
6. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.
8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Do not route piping above electric power or lighting panel, switchgear, low voltage panel, or similar electric device.
9. Rooms Protected by Alternative Systems: Route water filled and dry system piping around rooms protected by pre-action systems, clean agent systems, gaseous suppression systems and other alternative fire suppression systems.
10. Install pipe runs to minimize obstruction to other work.
11. Pitch all dry and pre-action system piping 1/4-inch per 10-feet for mains and 1/2-inch per 10-feet for branch lines, including pipe passing through both warm and cold areas.

B. Couplings:

1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:

1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical

restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.

2. Coordinate support of pipe 4-inches and larger with Contracting Officer.
3. Provide clearances around piping per NFPA 13.
4. Install dry and pre-action welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.7 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Escutcheons: Install on exposed pipes passing through walls or floors.

1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking fire and water resistant grout or approved equal caulking compound. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local Contracting Officer requirements.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM Approved fire-rated firestopping compound. Provide fire-rated assemblies per local Contracting Officer requirements.
4. Beam Sleeves:
 - a. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings.
 - b. Field cutting of beams not allowed without written approval of Contracting Officer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
5. Penetrations in Fire-Rated Wall/Floor Assemblies:
 - a. Reference Division 07, Thermal and Moisture Protection.
 - b. Coordinate with Drawings location of fire rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.

- c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.
- d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.8 SWITCHES, VALVE SUPERVISORY

- A. Coordinate with Division 28, Electronic Safety and Security.

3.9 SWITCHES, WATER DETECTOR

- A. Wire pipe cutout coupon at point of connection of switch to pipe.
- B. Flow switches: Connect to system side of valves and drain connections.
- C. Coordinate with Division 28, Electronic Safety and Security.

3.10 HANGERS AND SUPPORTS

- A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel and other accessory materials required for proper support of pipe lines and equipment. Provide supplementary materials for proper support and attachment of hangers.

3.11 STRUTS AND STRUT CLAMPS

- A. Install per manufacturer's listed orientation.

3.12 SWAY BRACES AND RESTRAINTS

- A. Locate per orientation and spacing as required by sway brace calculations.
- B. Attach sway bracing directly to pipe or equipment being braced.
- C. Do not attach sway bracing to bottom of truss members.

3.13 ANCHORS AND ATTACHMENTS

- A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.
- B. Do not use powder-driven attachments.
- C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- D. Hanger and Support Attachments:

1. Concrete:
 - a. Before Pouring: Prior to installation, coordinate locations of cast in place concrete inserts with other trades. Install in accordance with manufacturer's instructions.
 - b. After Pouring:
 - 1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.
 - 2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.
 - 3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.
2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.
3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.
4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.
5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural products according to the structural product manufacturer specifications.
- E. Make available to the Contracting Officer information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.14 PIPE STANDS

- A. Secure to floor.
- B. Install to maintain pipe level and plumb.
- C. Securely attach to supported pipe by u-bolt.

3.15 GAUGES

- A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal and service.
- B. Install with dial positioned for maximum visibility.

3.16 BELLS

- A. Locate exterior alarm bells at 8-feet above finished grade. Coordinate with Contracting Officer.

- B. Coordinate with Divisions 26, Electrical and Division 28, Electronic Safety and Security.

3.17 FIRE DEPARTMENT CONNECTION

- A. Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- B. Provide method of draining FDC piping. Drain to sanitary sewer by indirect connection, or to exterior where damage, including damage to landscaping and staining of concrete, will not occur.
- C. Locate away from building egress paths. Coordinate location with Fire Marshal.

3.18 VALVES

- A. General:
 - 1. Provide post indicator on buried control valves.
 - 2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
- B. Installation:
 - 1. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.
 - 2. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.
 - 3. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.
- C. Pressure Relief Valves: Provide piping to permanent drain.

3.19 BACKFLOW PREVENTION DEVICES

- A. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.
- B. Provide listed backflow assembly at sprinkler system water source connection. Coordinate with local utility; conform to their installation requirements.
- C. Provide method of forward flow testing at full system demand without dismantling any part of the system. Indicate location, method of testing and location of test drain discharge on submittal and As-Built Drawings. Provide signage as required by NFPA 13. Locate drainage for forward testing where damage will not occur, including damage to landscaping.
- D. Chain and padlock in "open" position. Provide two sets of keys.

- E. Provide control valve supervisory switches connected to the fire alarm system.
- F. Reduced Pressure Backflow Preventer:
 - 1. Locate within 5-feet of finished floor near drain shown on Plumbing Drawings or an existing drain of sufficient size which can accept full discharge of relief valve without doing damage or arrange and pay for installation of a suitable size drain.
 - 2. Provide drain piping to sanitary sewer. Coordinate with Division 22, Plumbing.

3.20 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

- A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each Item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each Item or device.
- B. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks and similar equipment.
- C. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes and characteristics.
- D. Piping to bear the manufacturer's name, schedule of thickness, size and ASTM identification number
- E. Provide valve tag on every valve, control device, main drain, auxiliary drain, and drum drip in each system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.
- F. List each tagged item and its location in valve schedule; identify on fire suppression drawings.
- G. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.
- H. Provide identification sign on ceiling tile below valve location.
- I. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.
- J. Adjusting: Relocate fire suppression identification device which has become visually blocked.
- K. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.21 SIGNS

- A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other

acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:

1. Name and Location of the Facility Protected
 2. Presence of High-Piled and/or Rack Storage
 3. Maximum Height of Storage Planned
 4. Flow Test Data
 5. Location of Auxiliary Drains and Low Point Drains
 6. Original Results of Main Drain Flow Test
 7. Name of Installing Contractor or Designer
 8. Indication of presence and location of other auxiliary systems.
- B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.22 DRAINS

- A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.
- B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.
- C. Coordinate location of auxiliary drains with Contracting Officer. Contracting Officer to approve location before drain is installed.
- D. Protect drains from tampering and accidental operation.
- E. Protect drain discharge at the exterior with a turned-down 45 degree elbow.

END OF SECTION 21 05 00

SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sprinklers
2. Flexible Sprinkler Hose Fitting Assembly - For fire sprinklers in suspended ceilings which are supplied by a wet pipe system.
3. Oversized Sprinkler Escutcheons - For dry sprinklers in suspended ceilings which are supplied by a wet pipe or dry pipe system.
4. Riser Manifold
5. Inspector's Test Connection
6. Wet System Air Vent
7. Spare Sprinkler Cabinet
8. Sprinkler Guards

B. This is a contractor designed system. Contact Contracting Officer prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by Contracting Officer.

C. Scope:

1. Wet-Pipe Sprinkler System.
2. Private fire service main running from 5-feet outside the building to the inlet connection inside the building. Provide required valves and appurtenances.

D. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.

E. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, air compressors, sump pumps, fire pumps, jockey pumps and pump controllers.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Section 21 00 00, Fire Suppression Basic Requirements
6. Section 21 05 00, Common Work Results for Fire Suppression
7. Section 21 13 19, Fire Suppression Deluge Sprinkler Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. Hydraulic calculations.
 2. Sway brace calculations.
 3. Details of sway bracing.
 4. Details of interval and end of branch line restraints.
 5. Details of flexible sprinkler hose fitting assembly, including number and radius of bends, corresponding to equivalent feet used in hydraulic calculations. Provide details of sign to be installed at each flexible sprinkler hose fitting assembly.
 6. Details of oversized ceiling penetrations and oversized sprinkler escutcheons.
 7. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.
 8. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Fire sprinkler systems to be designed by someone meeting one or more of the following requirements:
 - a. A fire protection engineer.
 - b. A NICET III technician for the type of system designed.
2. Fire sprinkler system to be installed by someone meeting one or more of the following requirements:
 - a. State of municipal certified/licensed sprinkler contractor.
 - b. NICET Level II.
 - c. As approved by the Contracting Officer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Provide coverage for entire building. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by Contracting Officer. Provide design and installation based on more stringent requirements if this specification and Contracting Officer requirements differ from Code.

B. Design Parameters:

1. Building Areas: Lobby, Corridors, Offices, Restrooms, Auditoriums, Porches.
 - a. Occupancy Classification: Light.
 - b. Outside Hose Allowance: 100 GPM.
2. Building Areas: Storage Rooms, Electrical Rooms, Mechanical Rooms, Supply and Janitor Closet.
 - a. Occupancy Classification: Ordinary Group 1.
 - b. Outside Hose Allowance: 250 GPM.
3. Building Areas: Platform (Auditorium), Exhibit Area.
 - a. Occupancy Classification: Ordinary Group 2.
 - b. Outside Hose Allowance: 250 GPM.

4. Design parameters above are NFPA 13 minimums. Provide increased design densities, design areas and hose allowances to meet requirements of Contracting Officer.
 - C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.
 - D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant or flow test or effective point of water supply where characteristics of water supply are known.
- 1.8 EXTRA STOCK
- A. Provide extra sprinklers per code.
 - B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.
- 1.9 CONTROL VALVES
- A. Sprinkler system control valves to be OS&Y or butterfly valves located inside building in a room with outside door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sprinklers:
 1. Finished Areas:
 - a. Victaulic
 - b. Viking
 - c. Tyco
 - d. Reliable
 - e. Globe
 - f. Senju
 - g. Or approved equal.
 2. Nonfinished Areas:
 - a. Victaulic
 - b. Viking
 - c. Tyco

- d. Reliable
 - e. Globe
 - f. Or approved equal.
- 3. Dry Sprinklers:
 - a. Victaulic
 - b. Viking
 - c. Tyco
 - d. Reliable
 - e. Or approved equal.
- B. Flexible Sprinkler Hose Fitting Assembly:
 - 1. Victaulic; VicFlex.
 - 2. Flexhead Industries
 - 3. SprinkFLEX
 - 4. Allied Rubber and Gasket Company, Incorporated, dba ARGCO
 - 5. Reliable Automatic Sprinkler Company
 - 6. Tyco Fire and Building Products
 - 7. Viking Corporation
 - 8. Or approved equal.
- C. Oversized Sprinkler Escutcheons:
 - 1. Victaulic; FireLock Expansion Plates.
 - 2. Viking Corporation; Expansion Plate.
 - 3. Tyco Fire Protection Products; Wide Adapter Plates.
 - 4. Reliable Automatic Sprinkler; Extender Rings.
 - 5. Globe Fire Sprinkler Corporation; Seismic Escutcheons.
 - 6. Or approved equal.
- D. Riser Manifold:

1. Viking EasyPac
 2. Reliable; Model CR.
 3. AGF; Model 8011.
 4. Tyco; Model RM-1
 5. Or approved equal.
- E. Inspector's Test Connection:
1. Combination Test and Drain:
 - a. Victaulic; Series 720 TestMaster II Alarm Test Module with pressure relief valve.
 - b. AGF; Model 1011, 2511, 3011, with pressure relief valve.
 - c. Or approved equal.
 2. Dry System Inspector's Test Connection:
 - a. AGF; Model 3011.
 - b. Or approved equal.
- F. Wet System Air Vent:
1. Potter Electric Signal Company; Model PAV
 2. Or approved equal.
- G. Spare Sprinkler Cabinet:
1. Victaulic
 2. Fire Protection Products, Inc. (FPPI).
 3. Tyco Fire & Building Products
 4. Allied Rubber and Gasket Co.
 5. Potter Roemer Fire Pro.
 6. Or approved equal.
- H. Sprinkler Guards:
1. Victaulic
 2. Viking

3. Tyco
4. Reliable
5. Globe
6. Senju
7. Or approved equal.

2.2 SPRINKLERS

A. Finished Areas:

1. Type: Glass-Bulb
2. Style:
 - a. Concealed
 - b. Recessed
3. Response: Quick-Response
4. Finish: Match ceiling finish
5. Escutcheon: Match ceiling finish
6. Coverplate for Concealed Sprinklers: Match ceiling finish

B. Nonfinished Areas:

1. Type: Glass-Bulb
2. Response: Quick-Response
3. Finish: Brass

C. Dry Sprinklers:

1. Type: Glass-Bulb
2. Style:
 - a. Concealed
 - b. Recessed
3. Response: Quick-Response
4. Finish:

- a. Chrome
 - b. White Polyester
- 5. Escutcheon:
 - a. Chrome
 - b. White Polyester
- 6. Coverplate for Concealed Sprinklers:
 - a. Flat Plate
 - b. Chrome
 - c. White
- 7. Dry Sprinkler Boot: Manufactured for use with the dry sprinkler it protects.
- D. Pendent sprinklers supplied by dry or preaction piping: Dry pendent type.

2.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

- A. Fully welded non-mechanical fittings, stainless steel, braided, leak-tested with minimum 1-inch true-bore internal corrugated hose diameter. 175 psi.
- B. Ceiling Bracket: Galvanized steel, direct attachment type, with integrated snap-on clip ends and removable flexible hose attachment with set screw. FM1637, UL 2443.
- C. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

2.4 OVERSIZED SPRINKLER ESCUTCHEONS

- A. Metal.
- B. Provide oversized ceiling penetrations and oversized sprinkler escutcheons for pendent sprinklers to comply with Building Code and ASCE-7 seismic requirements.
- C. Same manufacturer as sprinklers.

2.5 RISER MANIFOLD

- A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, pressure gauge with 3-way gauge control valve and drain valve, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed. Provide cover tamper switch when required by Contracting Officer.

2.6 INSPECTOR'S TEST CONNECTION

- A. Combination Test and Drain: Bronze body, brass stem, impregnated Teflon seat, chrome coated brass ball, steel handle with positive stops, tamper resistant test orifice, integral tamper resistant sight glasses, tapped and plugged port for system access, steel identification plate. Provide with pressure relief valve and drainage piping with bronze body and stainless steel spring.
- B. Dry System Inspector's Test Connection: Bronze, brass stem, steel handle, chrome-plated bronze ball, Teflon valve seat, tamper and corrosion resistant orifice equivalent to smallest sprinkler orifice, sight flow connection.

2.7 WET SYSTEM AIR VENT

- A. Brass, UL 2573 with ball valve supervisory switch.

2.8 SPARE SPRINKLER CABINET

- A. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.
- B. Welded steel with hinged steel cover.
- C. Red enamel or polyester coated finish inside and out.

2.9 SPRINKLER GUARDS

- A. Metal.
- B. Listed for use with sprinkler model to which it is attached.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's requirements and recommendations.

3.2 SPRINKLERS

- A. Center sprinklers in center or quarter points of suspended ceiling tile.
- B. Align sprinklers with architectural column lines, lighting, diffusers and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost to Contracting Officer.
- C. Install dry sprinklers in a manner which does not trap water.

3.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

- A. Install flexible sprinkler hose fitting assemblies where pendent sprinkler heads are located in acoustic ceiling tiles.
- B. Install with no more bends than are included in equivalent footage used in hydraulic calculations.
- C. Maintain manufacturer's recommended bending radius as included in equivalent footage used in hydraulic calculations.
- D. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

3.4 OVERSIZED SPRINKLER ESCUTCHEONS

- A. Coordinate oversized sprinkler escutcheons with ceiling construction and sprinkler style.
- B. Provide for dry sprinkler penetrations in suspended ceilings.

3.5 RISER MANIFOLD

- A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.
- B. Provide connection to drain.
- C. Pipe pressure relief valve to drain.
- D. Install with supervised control valve(s) and check valve.

3.6 INSPECTOR'S TEST CONNECTION

- A. Locate where full flow discharge or pressure relief valve discharge will not do damage, including damage to landscaping and will not cause dangerous conditions to walking surfaces or discoloration to building surfaces.
- B. Locate within 5-feet of finished floor.

3.7 WET SYSTEM AIR VENT

- A. Locate at a point in the system that will vent the most air.
- B. Connect at top of pipe.
- C. Locate so as not to interfere with sprinkler spray pattern.
- D. Locate where it can be easily accessed for inspection and cleaning.

- E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.8 SPARE SPRINKLER CABINET

- A. Attach to wall at the main sprinkler system riser.
- B. Locate so cover is easy to open and readily accessible.
- C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit.
- D. Locate sprinkler wrenches inside cabinet.
- E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

3.9 SPRINKLER GUARDS

- A. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 21 13 19 - FIRE SUPPRESSION DELUGE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Deluge Valves
2. Sprinklers
3. Releasing Control Panel
4. Manual Release Devices
5. Valve Tamper Switches and Supervisory Pressure Switches
6. Notification Appliances
7. Miscellaneous

B. The deluge suppression system is a contractor designed system. Contact Contracting Officer prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by the Contracting Officer.

C. Scope: Deluge suppression system for exposure protection

D. Coordinate location and type of tamper switches.

E. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, control equipment, and power supplies.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Section 21 00 00, Fire Suppression Basic Requirements
6. Section 21 05 00, Common Work Results for Fire Suppression
7. Section 21 13 00, Fire Suppression Sprinkler Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Hydraulic calculations.
 - 2. Sway brace calculations.
 - 3. Details of sway bracing.
 - 4. Details of interval and end of branch line restraints.
 - 5. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Provide a manually actuated deluge fire suppression system for exterior wall exposure protection for the barn, pavilion, restroom, and small events buildings.
- B. Field verify field conditions prior to submittal to bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by Contracting Officer. Provide design and installation based on more stringent requirements if this specification or Contracting Officer requirements differ from Code.
- C. In addition to Code requirements, provide manual release stations at exits from the protected space within 5-feet of the exit door operator.
- D. Design Parameters:
 - 1. Building Area: Provide wall exposure protection on the exterior of each building in accordance with NFPA 13 and manufacturer installation requirements

- E. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.
- F. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant or flow test or effective point of water supply where characteristics of water supply are known.

1.8 EXTRA STOCK

- A. Provide extra sprinklers per code.
- B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.
- C. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet an issue or revision date of the list.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Deluge Valves:
 - 1. Tyco Fire Products; Model DV-5 Deluge Valve.
 - 2. Viking Corporation; Model G-XXXX, Preaction Valve.
 - 3. Reliable Automatic Sprinkler; Model DDX, Deluge Valve.
 - 4. Or approved equal.
- B. Sprinklers:
 - 1. Building Exterior:
 - a. Viking Corporation Model C-1.
 - b. Or approved equal.
- C. Releasing Control Panel:
 - 1. Potter Electric Signal Company
 - 2. Viking Corporation
 - 3. Notifier
 - 4. Or approved equal.
- D. Manual Release Devices:

1. Same manufacturer as control equipment.
 2. Or approved equal.
- E. Valve Tamper Switches and Supervisory Pressure Switches:
1. Potter Electric Signal Company
 2. System Sensor
 3. Or approved equal.
- F. Notification Appliances: Notification appliances must be compatible with control equipment.
1. Same manufacturer as control equipment.
 2. Wheelock
 3. Gentex
 4. Federal Signal
 5. System Sensor
 6. Or approved equal.
- G. Miscellaneous:
1. Circuit Conductors:
 - a. Allied Wire and Cable
 - b. CCI
 - c. West Penn Wire
 - d. Or approved equal.
 - e. No substitutions permitted.
 2. Locks and Keys:
 - a. Same manufacturer as fire alarm control equipment.
 - b. Or approved equal.
 - c. No substitutions permitted.
 3. Instruction Charts:
 - a. Trade
 - b. Or approved equal.

- c. No substitutions permitted.
- 4. Caution and Advisory Signs and Placards:
 - a. Fire Protection Products, Incorporated
 - b. Allied Rubber and Gasket Company Incorporated, dba ARGCO
 - c. Or approved equal.
- 5. Document Storage Cabinet:
 - a. Same manufacturer as fire alarm control equipment.
 - b. Meir Products
 - c. Space Age
 - d. Or approved equal.
 - e. No substitutions permitted.

2.2 DELUGE VALVES

- A. Pilot operated
- B. External reset.
- C. Internal check diaphragm.

2.3 SPRINKLERS

- A. Building Exterior:
 - 1. Type: Open
 - 2. Style: Window/wall exposure protection.
 - 3. Finish: Corrosion-resistant brass.

2.4 RELEASING CONTROL PANEL

- A. Dedicated, microprocessor, zone-type or addressable control panel UL listed for releasing service.
- B. Contains logic, software and hardware to operate the system per the design sequence.
- C. Quantity of releasing circuits required for correct system operation.
- D. Control panel compatible with manual release devices, notification appliances and preaction actuation solenoid.

- E. Programmed control point activation includes control of power systems, HVAC systems and other require fire safety functions
- F. Power Supply: Provide power supply(s), adequate to serve control panel modules, initiating and control devices, notification appliances and other connected devices.
- G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under fire alarm, electrical and mechanical specifications.
- H. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.
- I. System Reset: Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.
- J. Lamp Test: Manual "lamp test" function causes the annunciation lamps to illuminate at control panel
- K. Power Requirements:
 - 1. Loss of normal and emergency power automatically causes system to transfer to battery power. Indicate battery power operation by yellow indicator and audible annunciation at control panel. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.
 - 2. Provide batteries in locking cabinet manufactured for purpose. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

2.5 MANUAL RELEASE DEVICES

- A. Manual Release Stations:
 - 1. Semi-flush Single or double action, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.
 - 2. Provide with "Fire Suppression Release" label or equivalent placard.
 - 3. Stations do not allow closure without keyed reset.

2.6 VALVE TAMPER SWITCHES AND SUPERVISORY PRESSURE SWITCHES

- A. Monitor each tamper switch or supervisory pressure switch with releasing control panel.

2.7 NOTIFICATION APPLIANCES

- A. Combination Horn/Strobe:
 - 1. Multi-candela, flush, wall mount, red finish, insect-proof.

2. Provide horn/strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971.

3. Candela rating as required by NFPA 72 for the space where used.

B. Strobe:

1. Multi-candela, flush, wall mount, red finish, insect-proof.
2. Provide strobes that meet latest requirements of NFPA 72, ANSI 117.1 and UL 1971.
3. Candela rating as required by NFPA 72 for the space where used.

C. Bell:

1. Vibrating type, 6-inch diameter, red finish.
2. Provide bell that meets the latest requirements of NFPA 72.

D. Horn:

1. Flush, wall mount, red finish. Insect-proof.
2. Provide horn that meets the latest requirements of NFPA 72.

- E. Surface Backboxes: Provide manufacturer surface backboxes where devices cannot be installed recessed.

2.8 MISCELLANEOUS

A. Circuit Conductors:

1. Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP as required by NEC. Provide conductors in compliance with the requirements of the manufacturer.
2. Minimum signaling line circuit and initiating device circuit wire size: AWG18. Minimum notification appliance circuit wire size: AWG14, or as approved by Contracting Officer.

B. Locks and Keys:

1. Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.
2. Provide a different standard lock and key for key operated disable switch; provide five keys of each type.

C. Instruction Charts:

1. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble). Charts to be easily readable from normal operator's station.

2. Frame: Constructed from stainless steel or aluminum with polycarbonate or glass cover. Provide one for each control unit where operations are to be performed.
- D. Caution and Advisory Signs and Placards:
1. Provide manual release station operation placards.
 2. Provide signs and placards compliant with NFPA 13 and manufacturer requirements.
- E. Document Storage Cabinet:
1. Suitable for as-built drawings, operation and maintenance manual, system data file disk, spare parts and tools.
 2. Constructed from steel with baked enamel finish, size adequate for full size drawings, operation and maintenance manual, spare parts and tools.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain approval of system design from Contracting Officer prior to installation. Do not begin installation without approval from Contracting Officer and submittal review comments from Contracting Officer.
- B. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.
- C. In accordance with manufacturer's instructions, provide nozzles, pipe, fittings, manual release stations, abort stations, notification appliances, shutdowns, auxiliary system interfaces, signs, wiring, conduit and outlet boxes, piping, bracing, hangers, etc., required for the erection of a complete system as described in these specifications, as shown on Drawings and as required by Contracting Officer.
- D. Provide wiring to meet the requirements of national, state and local electrical codes.
- E. Conceal wiring, conduit, boxes and supports where installed in finished areas.
- F. Provide complete conduit system for wiring.
- G. At junction boxes and termination points, provide identification tags on wires and cables.
- H. Route wiring and piping to avoid blocking access to equipment requiring service, access, or adjustment.
- I. Provide machine printed zone label on initiating devices visible from the floor without magnification.
- J. Obtain Contracting Officer's approval of locations of devices before installation.
- K. Install instruction placards in or adjacent to control panel.

- L. Install warning and advisory placards adjacent to manual release stations and notification appliances at the entrance to the protected space and in the protected space.
- M. Provide control panel and remote power supplies with 120VAC dedicated circuit per NFPA requirements.
- N. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.
- O. System Operation:
 - 1. Alarm Sequence of Operation:
 - a. Activation of one manual release station causes system to enter “alarm” mode including following operations:
 - 1) Provide local annunciation of alarm zone and condition and audible and visual alarm signal at control panel.
 - 2) Provide manual "acknowledge" function at control panel to silence audible alarm signal. Visual signal remains displayed until initiating alarm is cleared.
 - 3) Transmit “alarm” signal to building fire alarm control panel.
 - 4) Initiate the alarm bells located in the protected space.
 - 5) Open solenoid valve thereby operating sprinkler deluge valve and filling the sprinkler pipes with water in the protected space.
 - 6) Operate emergency power off for the equipment in the protected space.
 - 7) Operate HVAC fan shutdown and damper closure in the protected exterior area.
- P. Fire Safety Systems Interfaces and Functions:
 - 1. Provide power and control conduit, wiring, boxes and terminations to power devices and interface devices to preaction system.
 - 2. Provide alarm, supervisory and trouble relay output connections to the building fire alarm system.
 - 3. Emergency Power Shutdown: Provide control wiring from relay contacts to activate emergency power shutdown for the protected space.
 - 4. HVAC Control: Provide control wiring from relay contacts to activate fan shutdown and damper closure for the protected space.
- Q. Inspection and Testing for Completion:

1. System inspection, testing and commissioning to be performed by a certified manufacturer's representative.
2. Perform testing and inspection in accordance with NFPA 13. In addition, test the fire control and detection system in accordance with NFPA 72. Document each inspection and test.
3. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.
4. Provide tools, software and supplies required to accomplish inspection and testing.
5. Prepare for testing by ensuring work is complete and correct; perform preliminary tests as required to test system.
6. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.
7. Notify Contracting Officer seven days prior to beginning completion inspections and tests.
8. Notify Contracting Officer and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
9. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - a. Record system operations and malfunctions.
 - b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - c. Contracting Officer will provide attendant operator personnel during diagnostic period; schedule training to allow Contracting Officer's personnel to perform normal duties.
 - d. At end of successful diagnostic period, submit completed test documentation.

R. Contracting Officer's Personnel Instruction:

1. Comply with all requirements of Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements.
2. Provide the Following Instruction to Designated Contracting Officer Personnel:
 - a. Hands-On Instruction: On-site, using operational system.
 - b. Classroom Instruction: Contracting Officer furnished classroom, on-site or at other local facility.
 - c. Factory Instruction: At control unit manufacturer's training facility.

3. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff, combination of classroom and hands-on.
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.
4. Detailed Operation: Two-hour sessions for staff, combination of classroom and hands-on:
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.
5. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.
6. Provide means of evaluation of trainees suitable to type of training given; report results to Contracting Officer.

S. Closeout:

1. Comply with all requirements of Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements.
2. Closeout Demonstration: Demonstrate proper operation of functions to Contracting Officer.
 - a. Be prepared to conduct any of the required tests.
 - b. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.
 - c. Have authorized technical representative of control unit manufacturer present during demonstration.
 - d. Demonstration may be combined with inspection and testing required by Contracting Officer. Notify Contracting Officer in time to schedule demonstration.
 - e. Repeat demonstration until successful.
3. Substantial Completion of the project cannot be achieved until inspection and testing is successfully completed.
4. Diagnostic Period:
 - a. Specified diagnostic period without malfunction has been completed.
 - b. Approved operating and maintenance data has been delivered.
 - c. Aspects of operation have been demonstrated to Contracting Officer.

- d. Final acceptance of the fire alarm system has been given by Contracting Officer.
- e. Occupancy permit has been granted.
- f. Specified pre-closeout instruction is complete.
- g. Perform post-occupancy instruction within three months after date of occupancy.

T. Inspection, Testing and Maintenance, Post-Completion:

- 1. Reference Division 01, General Requirements and Section 21 00 00, Fire Suppression Basic Requirements, for additional requirements relating to maintenance service.
- 2. Provide to Contracting Officer, at no extra cost, a written maintenance contract for two years, to include the work described below.
- 3. Provide to Contracting Officer a proposal for later acceptance, for a maintenance contract for two years, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.
- 4. Perform routine inspection, testing and preventive maintenance required by NFPA 72 and NFPA 13, including:
 - a. Maintenance of fire safety interface connected to fire suppression system.
 - b. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
- 5. Record keeping required by NFPA 13, NFPA 72 and Contracting Officer.
- 6. Provide system test and inspection during the sixth, eleventh and twelfth month after substantial completion. Correct deficiencies and replace defective components at no cost to the Contracting Officer.
- 7. Provide trouble call-back service upon notification by Contracting Officer:
- 8. Provide on-site response within two hours of notification.
- 9. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed and parts replaced.
- 10. Submit duplicate of each log entry to Contracting Officer upon completion of site visit.
- 11. Comply with Contracting Officer's requirements for access to facility and security.

3.2 DELUGE VALVES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Install with sufficient access for ease of reset.

3.3 SPRINKLERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 RELEASING CONTROL PANEL

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B.
 - 2. Signaling Line Circuits (SLC): Class B.
 - 3. Notification Appliance Circuits (NAC): Class B.
- D. Power Sources:
 - 1. Primary: Dedicated branch circuits of facility power distribution system.
 - 2. Secondary: Storage batteries.
 - 3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.

3.5 MANUAL RELEASE DEVICES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Coordinate with Division 28, Electronic Safety and Security.

3.6 VALVE TAMPER SWITCHES AND SUPERVISORY PRESSURE SWITCHES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Coordinate with Division 28, Electronic Safety and Security.

3.7 NOTIFICATION APPLIANCES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Coordinate with Division 28, Electronic Safety and Security.

3.8 MISCELLANEOUS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Circuit Conductors: Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.
- D. Locks and Keys: Deliver keys to Contracting Officer.
- E. Instruction Charts:
 - 1. Locate charts as to be easily readable from operator's station.
 - 2. Obtain approval of Contracting Officer prior to mounting. Mount in location acceptable to Contracting Officer.
 - 3. Provide extra copy of Operation and Maintenance data submittal.
- F. Caution and Advisory Signs and Placards: Mount signs and placards at manual release stations and as required by NFPA 13, NFPA 72 and manufacturer's recommendations.
- G. Document Storage Cabinet: Obtain approval of Contracting Officer prior to mounting. Mount in location acceptable to Contracting Officer.

END OF SECTION 21 13 19

SECTION 22 00 00 - PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of plumbing systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 01, General Requirements, Drawings, Addenda, and Contracting Officer Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 22, Plumbing Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement
 - e. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. CA Title 24 Part 6 California Energy Code
 - 8. IFC - International Fire Code
 - 9. NFPA 101 Life Safety Code
 - 10. CA Title 24 Part 8 California State Historic Building
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 4. ANSI - American National Standards Institute
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 7. ASHRAE Guideline 0, the Commissioning Process
 - 8. ASME - American Society of Mechanical Engineers
 - 9. ASPE - American Society of Plumbing Engineers
 - 10. ASSE - American Society of Sanitary Engineering

11. ASTM - ASTM International
 12. AWWA - American Water Works Association
 13. CFR - Code of Federal Regulations
 14. CGA - Compressed Gas Association
 15. CISPI - Cast Iron Soil Pipe Institute
 16. ETL - Electrical Testing Laboratories
 17. EPA - Environmental Protection Agency
 18. FM - FM Global
 19. IAPMO - International Association of Plumbing and Mechanical Officials
 20. GAMA - Gas Appliance Manufacturers Association
 21. HI - Hydraulic Institute Standards
 22. ISO - International Organization for Standardization
 23. MSS - Manufacturers Standardization Society
 24. NEC - National Electric Code
 25. NEMA - National Electrical Manufacturers Association
 26. NFGC - National Fuel Gas Code
 27. NFPA - National Fire Protection Association
 28. NRCA - National Roofing Contractors Association
 29. NSF - National Sanitation Foundation
 30. OSHA - Occupational Safety and Health Administration
 31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 32. TEMA - Tubular Exchanger Manufacturers Association
 33. TIMA - Thermal Insulation Manufacturers Association
 34. UL - Underwriters Laboratories Inc.
- D. See Division 22, Plumbing individual Sections for additional references.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 - 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Contracting Officer. At Contractor's option, two separate submittals may be provided, consisting of underground work and building work. Deviations will be returned without review.
 - 3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
 - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.

- c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
 - e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
- 5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Contracting Officer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.
- 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
- 9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- 10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or

connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
 - a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Contracting Officer for approval prior to installation.
 - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - 1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
 - 2) When submitting drawings for Contracting Officers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Contracting Officer's Instructions:
 - a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed

equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.

- 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 4) Include copy of startup and test reports specific to each piece of equipment.
 - 5) Include copy of final water systems balancing log along with pump operating data.
 - 6) Include commissioning reports.
 - 7) Include copy of pressure, flow, leakage and purity test data and air and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
 - 8) Include copy of valve charts/schedules.
 - 9) Include Warranty per Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
 - 10) Include product certificates of warranties and guarantees.
 - 11) Contracting Officer will return incomplete documentation without review. Contracting Officer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Contracting Officer's hourly rates.
- b. Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".
- c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

- a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
- d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
- e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer, in writing, before starting work.

- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.
- G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.
- I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings) to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades onto master coordination documents.
- B. Prepare Drawings as follows:

1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
 3. Indicate plumbing system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
 4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
 5. Incorporate Addenda items and change orders.
 6. Distribute drawings to trades and provide additional coordination as requested by other trades.
- C. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
- D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.8 WORK INCLUDED

- A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.
- B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 - 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer and Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

- a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
- b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
- c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

- 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

- 1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Contracting Officer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
- 2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

- 1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Contracting Officer of discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 22 Plumbing Sections.
- B. Piping:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

C. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Contracting Officer at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1. Prior to requesting a final punch visit from the Contracting Officer, request from Contracting Officer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Contracting Officer. Request a final punch visit from the Contracting Officer, upon Contracting Officer's acceptance that the plumbing systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.

2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
3. Coordinate transfer time to new service with Contracting Officer. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Contracting Officer for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Contracting Officer.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 - 2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 - 3. Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - 1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
 - 2. Provide pump impellers to obtain Basis of Design design capacities.
- D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
 - 1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Contracting Officer.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Contracting Officer.
 - 6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document and Commissioning Reports
- B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Contracting Officer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's

recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION

SECTION 22 05 19 - PLUMBING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Dial Thermometers
 - 2. Water Hammer Arrestors (Shock Absorbers)
 - 3. Trap Primers

1.2 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Dial Thermometers:
 - 1. Ashcroft
 - 2. Trerice
 - 3. Weiss
 - 4. Marshalltown

5. Weksler
6. Or approved equivalent.

B. Water Hammer Arrestors (Shock Absorbers):

1. Piston Type:
 - a. PPP
 - b. Sioux Chief
 - c. Or approved equivalent.

C. Trap Primers:

1. MIFAB
2. Zurn
3. J.R. Smith
4. PPP
5. Or approved equivalent.

2.2 DIAL THERMOMETERS

A. Thermometers: ASTM E 1, cast aluminum case, vapor or liquid actuated with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens, adjustable 360 degrees in horizontal plane. 180 degrees in vertical plane.

1. Size: 4-1/2-inch diameter dial.
2. Lens: Clear glass.
3. Length of Capillary: Minimum 6-feet (for remote reading if required).
4. Accuracy: 2 percent.
5. Calibration: 2 Degrees F graduations.
6. Basis of Design: Trerice Model 80742.

2.3 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Bellows-type, stainless steel casing and bellows, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.
- B. Piston-type, copper, brass or stainless steel with O-ring piston, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

2.4 TRAP PRIMERS

- A. Trap automatic primer valve with integral anti siphon protection. Code approval required.
- B. Electronic trap seal automatic primer valve with integral anti siphon protection and timer. Coordinate quantity, locations and voltage characteristics for control points.
- C. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP CPO 500.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Contracting Officer for approval prior to purchase and installation of access panel. See Section 22 00 00, Plumbing Basic Requirements for additional requirements.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Install per manufacturer recommendations.

3.2 DIAL THERMOMETERS

- A. See "Thermometers" Article above.
- B. Install per manufacturer recommendations.

3.3 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Install in upright position, in locations and of sizes in accordance with PDI WH-201 or ASSE 1010, and elsewhere as indicated.
- B. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201 or ASSE 1010. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.
- C. Install per manufacturer recommendations.

3.4 TRAP PRIMERS

- A. Flush supply line prior to installation.
- B. Install valve plumb using caution to not over tighten. Tightening to more than 55 ft. lbs. can damage valve and void the warranty. Do not wrench on hex.
- C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).

D. Do not subject trap primer valve to pressure in excess of 125 PSI.

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Valves, General
2. Balancing Valves
3. Ball Valves
4. Swing Check Valves
5. Thermostatic Master Mixing Valves (ASSE 1017 Rated)
6. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated)

1.2 RELATED SECTIONS

- ##### A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. California Standard AB 1953 and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
2. ISO 9001 Certified.
3. IAPMO Certified for Low Lead.

- ##### C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

- D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.
- B. Valves, General:
 - 1. Apollo
 - 2. Armstrong
 - 3. ASCO
 - 4. Cla-Val
 - 5. Conbraco
 - 6. Crane
 - 7. Clow
 - 8. Griswold
 - 9. Hammond
 - 10. Josam
 - 11. Milwaukee
 - 12. Mueller
 - 13. Nibco
 - 14. Red-White Valve
 - 15. Wade
 - 16. Watts
 - 17. Wilkins
 - 18. Zurn

19. Or approved equivalent.
- C. Balancing Valves:
1. Caleffi
 2. Griswold
 3. Hays
 4. Armstrong CBV
 5. Tour Anderson
 6. Or approved equivalent.
- D. Ball Valves:
1. See Valves General above.
 2. NSF Valves:
 - a. Clow
 - b. Kennedy
 - c. Nibco
 - d. Or approved equivalent.
- E. Swing Check Valves:
1. See Valves General above.
- F. Thermostatic Master Mixing Valves (ASSE 1017 Rated):
1. Holby Tempering Valve
 2. Lawler Series 66
 3. Leonard Type TM
 4. Powers LFMM430 (Lead Free)
 5. Symmons Temp Control Series 5
 6. Or approved equivalent.
- G. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated):
1. Lawler

2. Leonard
3. Powers Hydroguard
4. Or approved equivalent.

2.2 VALVES - GENERAL

A. General:

1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

C. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:

1. Shutoff and Isolation Valves:
 - a. Pipe Sizes 3-inches and Smaller: Ball Valve.
2. Drain Service: Ball Valves.
3. Strainer Blow-Off: Ball Valve.
4. Check Valves: Swing.

2.3 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:

1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
 - a. Precise flow measurement.
 - b. Precision flow balancing.
 - c. Positive drip-tight shut-off.
2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves to be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.
3. 2-1/2-inch and Larger: Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
 - a. Precise flow measurement.
 - b. Precision flow balancing.
 - c. Positive drip-tight shut off. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators location on the valve handwheel. Valves to have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch - five turns, sizes 4-inch to 6-inch - 6 turns, sizes 8-inch to 10-inch - 12 turns and size 12-inch - 14 turns. Flange adapters to be provided to prevent rotation.

2.4 BALL VALVES

- A. All ball valves on brazed piping are to be three-piece.
- B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.
- C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.
- D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.5 SWING CHECK VALVES

- A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.

2.6 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

- A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1017.
- B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.
- C. Flow from the tempered water circulating pump to be split to mixing valve and building hot water heating system.

2.7 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

- A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1070.
- B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, grooves, and weld ends.
 3. Set ball valves open to minimize exposure of functional surfaces.
 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.
- D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.
- E. Purge and clean all piping to be connected to valve.
- F. Install per manufacturer's recommendations.
- G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.
- H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- I. Do not attempt to repair defective valves; replace with new valves.
- J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.
- L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

- M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.
- N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.
- O. Seats: Renewable seats, except where otherwise indicated.
- P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.
- Q. If valve applications are not indicated on Drawings, use the following:
 - 1. Shutoff Service: Ball valves.
- R. Valves, except wafer/butterfly types, with the following end connections:
 - 1. For Copper Tubing, 2-inches and Smaller. Threaded ends except where solder-joint valve-end.
 - 2. For Copper Tubing, 2-1/2-inches to NPS 4-inches. Flanged ends except where threaded valve-end.
- S. Valve Adjusting and Cleaning:
 - 1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
 - 2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 BALANCING VALVES

- A. See General Installation Requirements above.
- B. Install with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

3.3 BALL VALVES

- A. See General Installation Requirements above.

3.4 SWING CHECK VALVES

- A. See General Installation Requirements above.

- B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.
- C. Domestic Water and Circulation Pump Discharge Check Valves:
 - 1. 2-inches and Smaller: Bronze body, spring loaded, lead free, lift check.

3.5 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

- A. See General Installation Requirements above.
- B. Install mixing valve per manufacturer's instruction manual.

3.6 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

- A. See General Installation Requirements above.
- B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Pipe Hangers and Supports for Plumbing Piping and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

- ##### A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- ##### B. In addition, meet the following:
1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
 2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
 3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
 4. Install piping per SMACNA's requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. General - Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.
 - 2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 - 1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
- D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pipe Hangers and Supports for Plumbing Piping and Equipment:
 - 1. Pipe Hangers/Supports:
 - a. B-Line Systems, Inc.
 - b. Anvil International
 - c. HOLDRITE
 - d. Erico Co., Inc.
 - e. Snappitz Thermal Pipe Shield Manufacturing
 - f. Rilco Manufacturing Co. Inc.
 - g. Nelson-Olson Inc.

- h. Or approved equivalent.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Anvil International, Anvit-Strut
 - c. Erico Hanger Co., Inc.; O-Strut Div.
 - d. Unistrut Corp.
 - e. HOLDRITE EZ-Strut Systems
 - f. Or approved equivalent.
 - 3. Thermal-Hanger Shield Inserts:
 - a. Erico Hanger Co., Inc.
 - b. Pipe Shields, Inc.
 - c. Rilco Manufacturing Co., Inc.
 - d. HOLDRITE Insulation Couplings
 - e. Or approved equivalent.
- B. Wall and Floor Sleeves:
- 1. Below Grade and High Water Table Areas:
 - a. Modular Link Sealing System at Pipe Sleeves:
 - 1) Thunderline Corporation
 - 2) Or approved equivalent.
 - 2. Pre-Engineered Firestop Pipe Penetration Systems:
 - a. HOLDRITE HydroFlame
 - b. Proset
 - c. Or approved equivalent.
- C. Building Attachments:
- 1. Anchor-It
 - 2. Gunnebo Fastening Corp.

3. ITW Ramset/Red Head
4. Masterset Fastening Systems, Inc.
5. Or approved equivalent.

D. Flashing:

1. Fastenal
2. Or approved equivalent.

E. Miscellaneous Metal and Materials:

1. See Miscellaneous Metal and Materials article below.
2. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.
 - e. Or approved equivalent.

2.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:

1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
2. Use only one type by one manufacturer for each piping service.
3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
5. Provide padded pipe hangers, clamps and supports for thermoplastic piping system.
6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.

B. Pipe Hangers, Guides and Channel Systems:

1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resist corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
5. Pipe Guides:
 - a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

C. Pipe Saddles and Shields:

1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.

2. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate.
 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
 5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
 6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.
- E. Concrete Inserts:
1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
- F. Continuous Concrete Insert:
1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
- G. Below Ground:
1. Pipe Hangers: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 316. MSS Type 1. If PVC piping to be used, provide Type 1 hanger, coated for PVC piping.
 2. Rod: 5/8-inch stainless steel Type 316.
 3. Eyebolt: Stainless steel Type 316.
 4. Nuts and Washers: Stainless steel Type 316.
- H. Hangers for Pipe Size 2-inches and Smaller:
1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.
- I. Hangers for Pipe Size 2-1/2-inches and Larger:
1. Adjustable clevis type, UL listed, Type 1.
- J. Riser Clamps:
1. Steel, UL listed. MSS Type 8.
- K. Plumbers Tape:
1. Not permitted as pipe hangers or pipe straps.

2.3 WALL AND FLOOR SLEEVES

A. Below Grade and High Water Table Areas:

1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's Contracting Officer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.

D. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
 - a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
 - b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
 - c. Sleeve Sizes 7-inches and Larger: 14 gauge.
 - d. Fire-Rated Safing Material:
 - 1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
 - 2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

- A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Contracting Officer. Provide anchor bolts suitable for cracked concrete.
- B. Anchor Bolts:
 - 1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.
- C. Beam Clamps:
 - 1. MSS Type 19 and 23, wide throat, with retaining clip.
 - 2. Universal Side Beam Clamp: MSS Type 20.
- D. Powder-Actuated Drive Pin Fasteners:
 - 1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- F. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Non-staining, noncorrosive, and non-gaseous.
 - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.5 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.

- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.
- D. Provide hot dipped galvanized components for items exposed to weather.

2.6 MISCELLANEOUS METAL AND MATERIALS

- A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.
 - 1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.
- G. Provide hot dipped galvanized components for items exposed to weather.
- H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.
- I. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Non-staining, noncorrosive, and non-gaseous.
 - 3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examination:

1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Preparation:

1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project Contracting Officer proper placement of inserts, anchors and other building structural attachments.

3.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Hangers and Supports:

1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
2. Pipe Ring Diameters:
 - a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
 - b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
4. Pipe Support Brackets: Support pipe with pipe slides.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - a. Field assemble and install according to manufacturer's written instructions.

7. Pipe Guides:
 - a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
 - b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
10. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
11. Do not support piping from other piping.
12. Fire protection piping will be supported independently of other piping.
13. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
14. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
15. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
16. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
17. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
18. Insulated Piping: (comply with the following)

- a. Attach clamps and spacers to piping.
 - 1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - 2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 3) Do not exceed pipe stress limits according to ASME B31.9.
 - b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
 - 1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - d. Shield Dimensions for Pipe, not less than the following:
 - 1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
 - 2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
 - 3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
 - 4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
 - 5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
 - e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
 - f. Insert Material: Length at least as long as protective shield.
 - g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
19. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear

panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.

20. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.

B. Pipe Curb Assemblies:

1. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.
2. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.

C. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
3. Riser to be supported at each floor penetration.
4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

D. Adjusting and Painting:

1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.3 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
- B. Fabricated Pipe Sleeves:
 - 1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
 - 2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
 - 3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
 - 4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.4 BUILDING ATTACHMENTS

- A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.
- B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.
- C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
- E. Install powder-actuated drive pin fasteners 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. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- G. Anchor Bolts:

1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.
- H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
- I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.
- J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
1. Install fabricated pipe sleeve.
 2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
 3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
- K. Piping Penetrations Through Fire-rated (1 to 3 hour) Assemblies:
1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
 2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.
- L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- 3.5 FLASHING
- A. Flash and counter flash where piping passes through weather or waterproofed walls, floors and roofs.
- B. Flash vent soil pipes with flashings per Division 01, General Requirements.

- C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches x 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.
- D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

3.6 MISCELLANEOUS METAL AND MATERIALS

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
- C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
 - 1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- F. Fabrication:

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
 - 1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

G. Metal Fabrication:

1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

- b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
4. Provide hot dipped galvanized components for items exposed to weather.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Plastic Nameplates
2. Tags
3. Plastic Pipe Markers

1.2 RELATED SECTIONS

- ##### A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

- ##### B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:

1. Equipment Type:

a. Identification:

b. Background:

1) Size:

2) Color:

c. Lettering:

1) Size:

2) Color:

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 - 2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.
- B. Plastic Nameplates:
 - 1. Brady Corporation
 - 2. Or approved equivalent.
- C. Tags:
 - 1. Brady Corporation
 - 2. Brimer
 - 3. Champion America Inc.
 - 4. Craftmark
 - 5. Seton Identification Products
 - 6. Or approved equivalent.
- D. Plastic Pipe Markers:
 - 1. Brady Corporation
 - 2. Brimer

3. Champion America Inc.
4. Craftmark
5. Seton Identification Products
6. Or approved equivalent.

2.2 PLASTIC NAMEPLATES

- A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.
 1. Letter Color: White.
 2. Letter Height: 1/2 inch.
 3. Background Color: Black.
 4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
 5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.
 6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
 - a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
 - b. Letter Color: Red.
 - c. Letter Height: 1/2 inch.
 - d. Background Color: White.
 - e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.
- B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.
- C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

- D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
- E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.
- F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7-inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

2.4 PLASTIC PIPE MARKERS

- A. Color: Conform to ASME A13.1 and ANSI Z535.1.
- B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Lettering and Graphics:
 - 1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
 - 2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

- B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.
- C. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- D. Install valve schedule at each mechanical room.
- E. Access Doors: Provide markers on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

3.2 PLASTIC NAMEPLATES

- A. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners.

3.3 TAGS

- A. Small devices, such as in-line pumps, may be identified with tags. Use metal tags on piping 3/4-inch diameter and smaller.
- B. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
- C. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- D. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.
- E. Install tags with corrosion resistant chain.

3.4 PLASTIC PIPE MARKERS

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- C. For exterior underground piping installations, install underground plastic pipe markers with tracer wire 6 to 8-inches below finished grade directly above buried pipe.
- D. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms)

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. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

END OF SECTION 22 05 53

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Type 1, Glass Wool Pipe Insulation
2. Type 2, Flexible Elastomeric Insulation
3. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
4. Accessories
5. Pipe Fitting Insulation Covers

1.2 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Installer qualifications.
 2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
 3. Material Test Reports: From a qualified testing agency acceptable to Contracting Officer indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.
- B. In addition, meet the following:
 1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
 2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
 3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
 4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Type 1, Glass Wool Pipe Insulation:
 1. Owens-Corning
 2. Johns Manville
 3. Or approved equivalent.
- B. Type 2, Flexible Elastomeric Insulation:

1. Insulation:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
 2. Glue:
 - a. Armacell LLC Armaflex Low VOC Adhesive
 - b. K-Flex
 - c. Or approved equivalent.
 3. Paint:
 - a. Armacell LLC Armaflex
 - b. K-Flex
 - c. Or approved equivalent.
- C. Type 7, ADA Accessible Lavatory/Sink Insulation Kit:
1. IPS/Truebro
 2. McGuire/Pro-Wrap
 3. Plumberex/Pro-Extreme
 4. Brocar Trap Wrap
 5. Or approved equivalent.
- D. Accessories:
1. ITW Insulation Systems
 2. Or approved equivalent.
- E. Pipe Fitting Insulation Covers:
1. Zeston Johns Manville
 2. ITW Insulation Systems
 3. Or approved equivalent.

2.2 TYPE 1, GLASS WOOL PIPE INSULATION

- A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.
 - 1. Thermal Conductivity Value: 0.27 BTU*in/(hr*sf°F) at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
 - 3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

- A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.
 - 1. Thermal Conductivity Value: 0.25 BTU*in/(hr*sf°F) at 75 degrees F.
 - 2. Maximum Service Temperature of 220 degrees F.
 - 3. Maximum Flame Spread: 25.
 - 4. Maximum Smoke Developed: 50 (3/4-inch thick and below).
 - 5. Connection: Waterproof vapor retarder adhesive as needed.
 - 6. UV Protection: UV outdoor protective coating per manufacturer's requirements.
- B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.
- C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.4 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards meeting ASTM C1822. Molded closed cell insulation with vinyl cover and nylon fasteners, paintable. Provide accessories as required for complete installation covering all exposed waste piping, water piping, stops and supplies. Color white.

2.5 ACCESSORIES

- A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of

jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.6 PIPE FITTING INSULATION COVERS

- A. PVC Plastic Fitting Covers: Schuller Zeston 2000, Knauf Proto Fitting or approved equivalent. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION INFORMATION

- A. Verification of Conditions:
 - 1. Do not apply insulation until pressure testing and inspection of piping has been completed.
 - 2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
 - 1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
 - 2. Piping and Equipment:
 - a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
- D. Provide accessories as required. See Part 2 Article "Accessories" above.
- E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.
- G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe

directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).

H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Hot Water Piping Above Grade (105F to 140F)	1	<1-inch	1-inch
		=>1-inch	1-1/2-inch
Cold Water Piping Above Grade	1	=<1-1/2-inch	1/2-inch
		>1-1/2-inch	1-inch
ADA Accessible Lavatory/Sink	7	All	As Listed
Condensate Drain Piping	1, 2	All	1/2-inch

3.2 TYPE 1, GLASS WOOL PIPE INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.
- D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.
- E. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

3.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions for below grade installation.
- C. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.
- D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

- E. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

3.4 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Provide lavatory/sink insulation kit. Install on waste fittings, hot and cold water stops and supplies.

3.5 ACCESSORIES

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.
- C. Furnish and install accessories for all insulation types listed in this Section.

3.6 PIPE FITTING INSULATION COVERS

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
3. Water Piping, Buried Within 5-feet of Building
4. Hot and Cold Domestic Water Above Grade
5. Condensate Piping
6. Primer Piping
7. Cleanouts

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- ##### B.
- In addition, meet the following:
1. NSF 61, Annex G.
 2. California Standard AB 1953.
 3. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
 4. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
 5. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
 6. Manufacturer's Standards Society (MSS) for valving and support reference standard.
 7. American Water Works Association (AWWA) for Valving Assembly Standards.
 8. American Society of Sanitation Engineers (ASSE) for Valving Standards.
 9. American National Standards Institute (ANSI) for Piping Standards.

10. NFPA Standard 51B - "Fire Prevention in Use of Cutting and Welding Processes".
11. Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

1.4 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. See component manufacturers listed in individual articles below.
- B. American-USA
- C. Cerro
- D. Charlotte
- E. Clamp-All
- F. Conbraco/Apollo Press
- G. Elkhart
- H. Husky
- I. Ideal
- J. Mission
- K. Mueller
- L. Nibco
- M. Orion
- N. Sioux Chief
- O. Tyler

- P. Zurn
- Q. Or approved equivalent.
- R. Cleanouts:
 - 1. J.R. Smith
 - 2. Mifab
 - 3. Sioux Chief
 - 4. Wade
 - 5. Watts
 - 6. Zurn
 - 7. Or approved equivalent.
- S. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:
 - 1. Hilti
 - 2. Proset
 - 3. Or approved equivalent.

2.2 GENERAL

- A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
- B. Manufactured materials delivered, new to the project site and stored in their original containers.
- C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5- FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
 - 1. Fittings: Cast iron.
 - 2. Coupling Assembly:

- a. Heavy Duty: ASTM C1540, Clamp-All Hi-Torq 125, Husky SD 4000, Mission HeavyWeight couplings.
- b. Mechanical joint coupling for hubless pipe and fittings is to consist of an elastomeric sealing sleeve and a metallic shield that comply with CISPI 310, ASTM C or ASTM C 1540. The elastomeric sealing sleeve is to conform to ASTM C564 or CSA B602 and is to be provided with a center stop. Mechanical joint couplings are to be installed in accordance with the manufacturer's instructions.

2.4 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
 - 1. Fittings: Cast iron.
 - 2. Coupling Assembly:
 - a. Standard Duty: ASTM C1277 or CISPI 310.
- B. Copper Tube: ASTM B 306, DWV
 - 1. Fittings: ASME B16.29, wrought copper.
 - 2. Joints: ASTM B32, alloy Sn50 solder.

2.5 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Copper Pipe: ASTM B88, hard drawn, Type K (A).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: Brazed - BCuP2.

2.6 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type K (A), Drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Brazed BCuP2.
- B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.
 - 1. Fittings: ASME B16.18 copper.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.7 CONDENSATE PIPING

- A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A), L (B), or M (C).
 - 1. Fittings: ASME B16.29, wrought copper.

2. Joints: ASTM B32, alloy Sn50 solder.

B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.

C. CPVC (Chlorinated Polyvinyl Chloride) Pipe and Fittings - Except Exterior of the Building and in Plenums and Rated Assemblies:

1. Pipe and Fittings: Schedule 40, NSF-14, ASTM 439, IAPMO IS20-96, socket fittings, solvent weld.

2.8 PRIMER PIPING

A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.

B. Below Ground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.

2.9 CLEANOUTS

A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:

1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and standard screws.

2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.

3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.

4. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.

5. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Underground Piping Systems:

1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.

2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Contracting Officer.
3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Contracting Officer.
4. Tests: During progress of work for compacted fill, Contracting Officer reserves right to request compaction tests made under direction of testing laboratory.
5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
6. Support Foundations:
 - a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Contracting Officer as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.
 - b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Contracting Officer.
 - c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	C		C	
S				
O				

- d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.

7. Backfilling:

- a. Following installation and successful completion of required tests, backfill piping in lifts.
 - 1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
 - 2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
 - b. Backfill Material:
 - 1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
 - 2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
8. Compaction of Trench Backfill:
- a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
 - 1) Mechanical tamper,
 - 2) Vibratory compactor, or
 - 3) Other approved methods appropriate to conditions encountered.
 - b. Contracting Officer to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

B. General Installation:

- 1. Work performed by experienced journeyman plumbers. No exceptions.
- 2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
- 3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
- 4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
- 5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not

otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.

- a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
- b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
- c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.
- d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
- e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.
- f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.
- g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
- h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
- i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
- j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping.

Provide hose connections and caps on drain lines.

- k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

C. Testing:

1. General:

- a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
- b. Notify Contracting Officer and local Plumbing Inspector 2 days before tests.
- c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- e. Send test results to Contracting Officer for review and approval and include in Operation and Maintenance Manual.

2. Testing of Pressurized Systems:

- a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
- b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Corrosive Soil Conditions:

- 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's

recommendations.

2. Provide epoxy coated cast iron pipe and fittings for drainage systems.
3. Obtain and review project soils report for verification of requirements concerning corrosive soils.

E. Protection:

1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.

F. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

G. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.

H. Provide joints of type indicated in each piping system.

I. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

J. Sleeves:

1. Pipe Sleeves:

- a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
- b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local Contracting Officer requirements
- c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link

sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local Contracting Officer requirements.

- d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of Contracting Officer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
 - a. Install fabricated pipe sleeve.
 - b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
 - c. Seal each end airtight with a resilient nonhardening seal per code.
3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
 - a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
 - b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.2 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5- FEET OF BUILDING

- A. Excavation and Backfill:
 1. See 3.01 above.
- B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- C. Corrosive Soil Conditions:
 1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.

2. Provide epoxy coated cast iron pipe and fittings for drainage systems.
- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.
- E. Sanitary and Storm Drainage:
1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
 2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
 3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
 4. Drains:
 - a. Install drains to suit finished floor. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
 - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
 5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
 6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
 7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.
- F. Epoxy Coated Cast Iron Pipe and Fittings: Coat the piping terminus of any cut piping with an applied epoxy per manufacturer's instructions. Denso Protal 7200 fast-cure epoxy repair coating.
- 3.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE
- A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
- B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.
- E. Sanitary and Storm Drainage:
1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
 2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
 3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
 4. Drains:
 - a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
 - b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
 5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
 6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
 7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.
- 3.4 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING
- A. Excavation and Backfill:

1. See 3.01 above.
- B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- C. Domestic Water:
1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
 8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
 9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
 10. Make ferrous to non-ferrous connections with dielectric fittings.
 11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
 12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ends in wall at through-wall pipes.
 13. Provide drain valves at base of risers and at low points on the system.
 14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.
- D. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.
5. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

E. Buried Pre-Insulated Pipe Installation:

1. Installation and Testing: Install and test products in accordance with manufacturer's installation instructions.
2. Manufacturer's installation instructions are to describe the following:
 - a. Storage and handling of pipes.
 - b. Trench preparation.
 - c. Installing pipe.
 - d. Installing accessories.
 - e. Installing fittings.
 - f. Building penetrations.
 - g. Field insulation kits.
 - h. Testing.

3.5 HOT AND COLD DOMESTIC WATER ABOVE GRADE

- A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
- B. Testing of Pressurized Systems:
 1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.
- D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
- E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.
- F. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.
- G. Domestic Water:
1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
 2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
 3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
 4. Use unions for piping connections to equipment.
 5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
 6. Use reducers or increasers. Use no bushings.
 7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.

8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
10. Make ferrous to non-ferrous connections with dielectric fittings.
11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
13. Provide drain valves at base of risers and at low points on the system.
14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.

H. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.
5. Provide water line disinfections performed by a D1 Water Operator licensed in the State of California.

3.6 CONDENSATE PIPING

A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

3.7 PRIMER PIPING

A. Excavation and Backfill:

1. See 3.01 above.

B. Testing:

1. See 3.01 above.

3.8 CLEANOUTS

- A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Contracting Officer to coordinate locations and types of cleanouts with Contracting Officer prior to installation.

END OF SECTION 22 10 00

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Commercial Light Duty Electric Storage Type Water Heaters
2. Domestic Circulation Pumps - Close-Coupled, In-Line
3. Garbage Disposal

1.2 RELATED SECTIONS

- ##### A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Seismic anchor details and calculations signed and stamped by licensed California Contracting Officer with equipment data.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NSF 61, Annex G compliant.
2. ISO 9001 Certified.
3. IAPMO Low Lead Certification
4. California Standard AB 1953

- ##### C. Products approved for installation by state authorizing agency, no exceptions.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Commercial Light Duty Electric Storage Type Water Heaters:

1. A.O. Smith
2. Bradford White
3. Lochinvar
4. State
5. Rheem/Ruud
6. Or approved equivalent.

- B. Domestic Circulation Pumps - Close-Coupled, In-Line:

1. Bell and Gossett Series
2. Grundfos
3. Paco
4. Taco
5. Or approved equivalent.

- C. Garbage Disposal:

1. In-Sink-Erator
2. Hobart
3. Waste King
4. Or approved equivalent.

2.2 GENERAL

- A. Reference drawings for capacities and specific model numbers.

2.3 COMMERCIAL LIGHT DUTY ELECTRIC STORAGE TYPE WATER HEATERS

- A. System: Domestic Hot Water

- B. Entire unit is to be delivered complete with operating controls and require only plumbing and electrical service connections.
- C. Tank welded steel commercial construction designed for 150 PSI. Tank is to be lined with seamless Hydrastone cement to minimum thickness of 1/2-inch on 100 percent of interior tank surfaces, tank to be fabricated from solid copper-silicon and not require any type of anodic protection. Tank designed and fabricated with non-ferrous copper-silicon threaded tapings and non-ferrous inlet and outlet piping for maximum corrosion resistance. Steel tank tapings will not be acceptable. Entire tank is to be insulated with minimum of 2-inches thick polyurethane foam insulation and exceed latest ASHRAE standard for stand-by heat loss. Complete heater supplied with high impact colorized composite protective jacket which cannot rust or corrode and does not require painting.
- D. Cold water inlet 3/4-inch Female NPT (1-1/2-inch Male NPT) and include non-corrosive strata-flow diffuser which prevents incoming cold water from mixing too rapidly with hot water in tank. 3/4-inch hose connection drain is supplied. Hot water outlet 3/4-inch Male NPT (1-1/2-inch Male NPT) and includes factory installed built-in heat trap to prevent water from radiating through piping during stand-by periods. Separate 3/4-inch Female NPT tapping is to be provided for relief valve installation. An ASME rated automatic reseating combination temperature and pressure safety relief valve set at 150 PSI and 210 degrees F factory supplied.

2.4 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

- A. System: Domestic water
- B. Description: Factory-assembled and tested, single-stage, close-coupled, in-line, seal-less centrifugal pump.
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
 - 2. Casing: Bronze/stainless steel, with threaded companion-flange connections.
 - 3. Impeller: Corrosion-resistant material.
 - 4. Motor: Non-overloading at any point on pump curve, Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements."
- C. Capacities and Characteristics as per Drawings.
- D. See detail on Drawings for pump controls.

2.5 GARBAGE DISPOSAL

- A. Residential Duty:
 - 1. General: Complete food waste disposal to include a stainless steel sink flange adapter assembly to match fixture. Dishwasher connection. Stainless steel or galvanized grind

chamber, shredder ring, and two 360 degree swivel impellers/lugs. Continuous feed.

2. Single phase, permanently lubricated motor with manual reset, corrosion protection shield, and sound absorbing upper shell. UL listed.
3. Warranty: 2 year parts and in-home service.

B. Commercial Light Duty:

1. General: Complete food waste disposal to include a stainless steel sink flange adapter assembly to match fixture. Stainless steel grind chamber, shredder ring, and two 360° swivel impellers. Continuous feed, automatic
2. Stainless steel grind chamber, shredder ring, and two 360° swivel impellers. Continuous feed, automatic.
3. Reversing split-phase motor, corrosion protection shield, and sound absorbing upper shell. UL listed.
4. Warranty: Commercial 1 year parts and service.

PART 3 - EXECUTION

3.1 GENERAL

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orients so controls and devices needing service and maintenance have adequate access.
- D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- E. Connect water piping to units with shutoff valves and unions.
- F. Equipment Start-Up:
 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
 2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Contracting Officer for approval.
 3. Remove and replace filters when start-up testing is executed.
 4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.

5. Contracting Officer and Commissioning Agent will be notified 10 days prior to start-up and will be present at start-ups.
6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
8. Seismic Verification:
 - a. Contracting Officer will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
 - b. Contracting Officer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.2 COMMERCIAL LIGHT DUTY ELECTRIC STORAGE TYPE WATER HEATERS

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- C. Orients so controls and devices needing service and maintenance have adequate access.
- D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.
- E. Connect water piping to units with shutoff valves and unions.

3.3 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

- A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Orients so controls and devices needing service and maintenance have adequate access.
- C. Connect water piping to units with shutoff valves and unions.
- D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.
- E. Equipment Start-Up:
 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.

2. Contracting Officer and Commissioning Agent will be notified 10 days prior to start-up and will be present at start-ups.
3. Seismic Verification:
 - a. Contracting Officer will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
 - b. Contracting Officer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.4 GARBAGE DISPOSAL

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install complete food waste disposal system including water, waste connections, and electrical connection, including associated control devices. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. Set devices and adjust any support or mounting assemblies per manufacturer's recommendations.
- C. Water supplies, as applicable are to be provided with shut-off valves, solenoid valves, backflow preventers and water hammer arrestors.
- D. Coordinate power requirements and connection methods with Division 26.
- E. Equipment Start-Up:
 1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
 2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Contracting Officer for approval.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Plumbing Fixtures:
 - a. China Fixtures, White Only
 - b. Faucet Fittings
 - c. Fiberglass Fixtures, White Only
 - d. Molded Resin or Stone Fixtures
 - e. Stainless Steel Fixtures
 - f. Thermostatic Mixing Valves
2. Carriers
3. Drinking Fountains
4. Fixture Trim
5. Floor Drains
6. Floor Sinks
7. Flushometers - Water Closet/Urinal
8. Hose Bibbs
9. Water Closet Seats

1.2 RELATED SECTIONS

- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.
 - 2. NSF 61, Annex G, Drinking Water System Components, Compliant.
 - 3. ISO 9001, Quality Management Standard Certified.
 - 4. IAPMO Low Lead Certification.
 - 5. California Standard Assembly Bill AB 1953, No-Lead Law
 - 6. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
 - 7. Items approved for use by State of California.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. "Or approved equivalent" as defined in 22 00 00, Plumbing Basic Requirements. Substitution process requirements apply to approved equivalent products.
- B. General Plumbing Fixtures: See Schedule on Drawings for type.
 - 1. China Fixtures - White Only:
 - a. American Standard
 - b. Briggs
 - c. Crane
 - d. Eljer
 - e. Kohler
 - f. Universal-Rundle

- g. Or approved equivalent.
- 2. Faucet Fittings:
 - a. Public:
 - 1) American Standard
 - 2) Chicago
 - 3) Delta Commercial
 - 4) Moen Commercial
 - 5) Sloan
 - 6) Symmons
 - 7) T & S Brass
 - 8) Or approved equivalent.
- 3. Fiberglass Fixtures - White Only:
 - a. Aqua-Glass
 - b. Briggs
 - c. Crane
 - d. Comfort Designs
 - e. Florestone
 - f. Hytec
 - g. Mustee
 - h. Universal-Rundle
 - i. Or approved equivalent.
- 4. Molded Resin or Stone Fixtures:
 - a. Fiat
 - b. Mustee
 - c. Stern Williams
 - d. Or approved equivalent.

5. Stainless Steel Fixtures:
 - a. Elkay
 - b. Haws
 - c. Just
 - d. Or approved equivalent.
 6. Thermostatic Mixing Valves:
 - a. Bradley
 - b. Powers
 - c. Symmons
 - d. Holby
 - e. Or approved equivalent.
- C. Carriers:
1. JR Smith
 2. Zurn
 3. Or approved equivalent.
- D. Drinking Fountain:
1. Elkay
 2. Halsey-Taylor
 3. Haws
 4. Oasis
 5. Sunroc
 6. Or approved equivalent.
- E. Fixture Trim:
1. McGuire
 2. Dearborn Brass
 3. Oatey

4. Or approved equivalent.

F. Floor Drains:

1. Mifab
2. Sioux Chief
3. Smith
4. Wade
5. Watts
6. Zurn

G. Floor Sinks:

1. Commercial Enameling
2. Mifab
3. Sioux Chief
4. Smith
5. Wade
6. Watts
7. Zurn
8. Or approved equivalent.

H. Flushometers - Water Closet/Urinal:

1. Delaney
2. Sloan
3. Zurn
4. Or approved equivalent.

I. Hose Bibbs:

1. Chicago
2. JR Smith
3. Mifab

4. Wade
5. Woodford
6. Zurn
7. Or approved equivalent.

J. Water Closet Seats:

1. Bemis
2. Or approved equivalent.

2.2 GENERAL PLUMBING FIXTURES

- A. Review substitution request requirements in Division 01, General Requirements and 22 00 00, Plumbing General Requirements.
- B. Reference Architectural Details for mounting height and location of fixtures.
- C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.
- E. Plumbing Fixture Thermostatic Mixing Valves:
 1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
 2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
 3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
 4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.
 5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

2.3 CARRIERS

A. Wall Hung Water Closets:

1. Vertical: Zurn Z-1204-N4-X-50 or Z-1204-ND4-X-50 (JR Smith 230y-M54-M12 or 230DY-M54-M12). Adjustable vertical load siphon jet with 500 lb. capacity.
2. Horizontal: Zurn ZE-1203-N4-X-50 or ZE-1203-ND4-X-50 (JR Smith 220 R or L-Y-M54-M12 or 220DY-M54-M12). Adjustable horizontal siphon jet with 500 lb. load capacity.

B. Wall Hung Urinal: Zurn Z-1218-WS or Z-1222-WS. (JR Smith 637). Coupling type or plate type with bearing plate 200 lb. capacity.

C. Wall Hung Lavatory: Zurn Z-1231 (D). (JR Smith 700). Concealed arm or Plate type, 250 lb. capacity.

D. Wall Hung Drinking Fountain: Zurn Z-1225-BL (JR Smith 834-97-98). Plate type. 300 lb. capacity.

2.4 DRINKING FOUNTAINS

A. See Schedule on Drawings for type.

2.5 FIXTURE TRIM

A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.

1. Sink: McGuire 8912-C-DF.
2. Lavatory: McGuire 8902-C-DF.

B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems. Stops: T-handle or Loose Key type.

1. Lavatory: McGuire LFH 2165 CK
2. Sink: McGuire LFH 2167 LK
3. Water Closets: McGuire

C. Lavatory Grid Strainer: McGuire 155A.

D. Sink Grid Strainer: McGuire 152N.

E. Shower Grid Strainer: McGuire 1266.

F. Sink Basket Strainer: McGuire 151.

- G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or True-bro.
- H. Escutcheons: McGuire wrought brass deep bell.
- I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

2.6 FLOOR DRAINS

- A. See Schedule on Drawings for types.

2.7 FLOOR SINKS

- A. See Schedule on Drawings for types.
- B. Plastic components are not allowed.

2.8 FLUSHOMETERS - WATER CLOSET/URINAL

- A. See Schedule on Drawings for types.

2.9 HOSE BIBBS

- A. See Schedule on Drawings for types.

2.10 WATER CLOSET SEATS

- A. See Schedule on Drawings for type.

PART 3 - EXECUTION

3.1 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

- A. Verification of Conditions:
 - 1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
 - 2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.
 - 3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
 - 4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
 - 5. Install a stop valve in a readily accessible location in water connection to each fixture.

6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or approved equivalent. Match sealant color to fixture color.
8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
10. Replace washers or cartridges of leaking or dripping faucets and stops.
11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.
15. Do not use lead flashing.

B. Contracting Officer Furnished Equipment:

1. Rough-in and make final connections to Contracting Officer furnished equipment. Provide necessary items to complete installation.
2. Comply with requirements of this Section and Drawings for installation procedures.

C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.

D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Contracting Officer.

E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.

F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.

- G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 CARRIERS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.
- C. Coordinate wall thickness so carrier has adequate depth to be concealed.

3.3 DRINKING FOUNTAIN INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.4 FIXTURE TRIM INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.5 FLOOR DRAINS INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.6 FLOOR SINK INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.7 FLUSHOMETERS - WATER CLOSET/URINAL INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.8 HOSE BIBB INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

3.9 WATER CLOSET SEAT INSTALLATION

- A. Install components in accordance with manufacturer's instructions and approved product data submittals.
- B. Set plumb, level and rigid.

END OF SECTION

SECTION 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of heating, ventilating and air conditioning systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 01, General Requirements, Drawings, Addenda and Contracting Officer Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 23, HVAC Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement

- e. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. CA Title 24 Part 6 California Energy Code
 - 8. IFC - International Fire Code
 - 9. NFPA 101 Life Safety Code
 - 10. CA Title 24 Part 8 California State Historic Building
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ABMA - American Bearing Manufacturers Association
 - 3. ADA - Americans with Disabilities Act
 - 4. AHRI - Air-Conditioning Heating & Refrigeration Institute
 - 5. AMCA - Air Movement and Control Association
 - 6. ANSI - American National Standards Institute
 - 7. ASCE - American Society of Civil Engineers
 - 8. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
 - 9. ASHRAE Guideline 0, The Commissioning Process
 - 10. ASME - American Society of Mechanical Engineers

11. ASPE - American Society of Plumbing Engineers
12. ASSE - American Society of Sanitary Engineering
13. ASTM - ASTM International
14. AWWA - American Water Works Association
15. CFR - Code of Federal Regulations
16. CGA - Compressed Gas Association
17. CISPI - Cast Iron Soil Pipe Institute
18. EPA - Environmental Protection Agency
19. ETL - Electrical Testing Laboratories
20. FM - FM Global
21. GAMA - Gas Appliance Manufacturers Association
22. HI - Hydraulic Institute Standards
23. IAPMO - International Association of Plumbing & Mechanical Officials
24. IFGC - International Fuel Gas Code
25. ISO - International Organization for Standardization
26. MSS - Manufacturers Standardization Society
27. NEC - National Electric Code
28. NEMA - National Electrical Manufacturers Association
29. NFPA - National Fire Protection Association
30. NFGC - National Fuel Gas Code
31. NRCA - National Roofing Contractors Association
32. NSF - National Sanitation Foundation
33. OSHA - Occupational Safety and Health Administration
34. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
35. TEMA - Tubular Exchanger Manufacturers Association
36. TIMA - Thermal Insulation Manufacturers Association

37. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Contracting Officer. At Contractor's option, four separate submittals may be provided, consisting of long lead items, underground/site work, building work, and building automation system. Deviations will be returned without review.
3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.

- b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
 - c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
 - d. For vibration isolation of equipment, list make and model selected with operating load and deflection.
 - e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.
- 5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Contracting Officer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- 6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.
- 7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
- 8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
- 9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- 10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

- b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.
- 11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.
- 12. Samples: Provide samples when requested by individual Sections.
- 13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - 1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
 - 2) When submitting drawings for Contracting Officers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
- 14. Operation and Maintenance Manuals, Contracting Officer's Instructions:
 - a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

- 1) Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
 - 3) Include Warranty per Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include copy of startup and test reports specific to each piece of equipment.
 - 7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
 - 8) Include commissioning reports.
 - 9) Include copy of valve charts/schedules.
 - 10) Contracting Officer will return incomplete documentation without review. Contracting Officer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Contracting Officer's hourly rates.
- b. Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing

revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

- b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
- d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

- F. Provide products that are UL listed.
- G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
- H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
- I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades onto master coordination documents.
- B. Prepare Drawings as follows:
 - 1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.

3. Indicate hydronic and air distribution system piping including fittings, hangers, access panels, valves, and bottom of pipe and duct elevations above finished floor.
 4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
 5. Incorporate Addenda items and change orders.
 6. Distribute drawings to trades and provide additional coordination as requested by other trades.
- C. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
- D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL approved or have adequate approval or be acceptable by State, County, and City authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer and Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Contracting Officer. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

- a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Contracting Officer of any discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.
- B. Piping and Ductwork:
 1. Per CBC or OSHPD's OPM requirements.
- C. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 1. Underground system installation prior to backfilling.
 2. Prior to covering walls.
 3. Prior to ceiling cover/installation.
 4. After major equipment is installed.
 5. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.
- C. Final Punch:

1. Prior to requesting a final punch visit from the Contracting Officer, request from Contracting Officer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Contracting Officer. Request a final punch visit from the Contracting Officer, upon Contracting Officer's acceptance that the mechanical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
 3. Coordinate transfer time to new service with Contracting Officer. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
 - a. If overtime is necessary, there will be no allowance made by Contracting Officer for extra expense for such overtime or shift work.
 4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section

will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Contracting Officer.
- B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Contracting Officer.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
 2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 3. Protect bright finished shafts, bearing housings and similar items until in service.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - 1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.
- D. Provide miscellaneous supports/metals required for installation of equipment, piping and ductwork.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. After acceptance by Contracting Officer, In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Contracting Officer.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Contracting Officer.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing and Balancing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates
 - g. Start-up/Test Document
 - h. Commissioning Reports
- B. Reference State of California requirements for specific testing procedures and documentation requirements. Comply with State and local governmental standards and requirements for

testing, and completion and submittal of appropriate forms as required by Title 24 and local governmental agencies related to this work.

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
 - 2. During site evaluations by Contracting Officer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.15 ELECTRICAL INTERLOCKS

- A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.16 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

- A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Contracting Officer and how the units are sized. Submit this procedure to the Contracting Officer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Contracting Officer moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage,

miscellaneous steel and structural supports required to support the temporary system.
Installation of the system to comply with all applicable codes and be acceptable to Contracting Officer.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Starters
2. Shaft Grounding
3. Motors

1.2 RELATED SECTIONS

- ##### A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- ##### B. In addition, meet the following:
1. NEMA Premium Efficiency
 2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- ##### B. In addition, meet the following:
1. Field Installed Motors: Installed motors to be of single type, from one source and from a single manufacturer.
 2. Electrical components and materials to be UL and ETL listed/labeled as suitable for location and use.

1.6 WARRANTY

- ##### A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Starters:

1. Cerus
2. Eaton Electrical
3. General Electric
4. Siemens
5. Schneider Electric/Square D
6. Or approved equivalent.

B. Shaft Grounding:

1. Shaft Grounding Inc.
2. Aegis SGR Bearing Protection Ring
3. Or approved equivalent.

C. Motors:

1. Lincoln Motor
2. Century Electric Motors (formerly A.O. Smith Electrical Products)
3. Baldor Electric
4. General Electric
5. Toshiba
6. Exception: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.
7. Or approved equivalent.

2.2 STARTERS

A. Single Phase Motors:

1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.

2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be non operative if thermal unit is removed.
 3. Single-phase motors with automatic controls. Provide motor-rated relay with coils rated for control voltage.
- B. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.

2.3 SHAFT GROUNDING

- A. Variable Speed Motor Shaft Grounding: Shaft grounding ring; solid ring type.
- B. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motors life.
- C. Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety Health Administration (OSHA) regulations.
- D. Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.
- E. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.
- F. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.

2.4 MOTORS

- A. Construction:
1. Open drip-proof type except where specifically noted otherwise.
 2. Design for continuous operation in 40 degrees C environment.
 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
 5. Service Factor: 1.15 for poly-phase motors except 1.25 for motors associated with shaft pressurization system fans and 1.35 for single phase motors.
 6. Efficiency: Provide NEMA Premium Efficiency motors.

7. Motors used in conjunction with variable speed drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 Volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating
- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- C. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.
- D. Single Phase Power, Split Phase Motors:
1. Starting Torque: Less than 150 percent of full load torque.
 2. Starting Current: Up to seven times full load current.
 3. Breakdown Torque: Approximately 200 percent of full load torque.
 4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
 5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
- E. Single Phase Power, Permanent-Split Capacitor Motors:
1. Starting Torque: Exceeding one fourth of full load torque.
 2. Starting Current: Up to six times full load current.
 3. Multiple Speed: Through tapped windings.
 4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.
- F. Single Phase Power, Capacitor Start Motors:
1. Starting Torque: Three times full load torque.
 2. Starting Current: Less than five times full load current.
 3. Pull-up Torque: Up to 350 percent of full load torque.

4. Breakdown Torque: Approximately 250 percent of full load torque.
5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

G. Three Phase Power, Squirrel Cage Motors:

1. Starting Torque: Between 1 and 1-1/2 times full load torque.
2. Starting Current: Six times full load current.
3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
5. Insulation System: NEMA Class B or better. Use class F insulation when motors are controlled by a VFD.
6. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: To NEMA MG 1.
11. Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
12. Nominal Efficiency: Meet or exceed NEMA Premium Efficiency rating when tested in accordance with IEEE 112.

13. Nominal Power Factor: Minimum at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.
- B. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
- C. Unless otherwise indicated, motors 1-HP and larger to meet/exceed Title 24, NEMA Premium Efficiency, and latest EPACT.
- D. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.
- E. Exception: Motors less than 250 watts, for intermittent service, motors furnished with equipment manufacturer's standard package equipment need not conform to these specifications.
- F. Single phase motors for air compressors and pumps: Capacitor start type.
- G. Motors located in exterior locations or wet air streams are to be of totally enclosed type.
- H. Disconnects: Provided by Division 26, Electrical unless specified otherwise.
- I. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.2 STARTER INSTALLATION

- A. Install starters in accordance with manufacturer's instructions.
- B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.
- C. Provide NEMA housing appropriate to installation location.
- D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.
- E. Meet mounting height and accessible location requirements per local code.
- F. Provide fuses for fusible switches.
- G. Select and install overload heater elements in motor starters to match installed motor characteristics.

- H. Single Phase 120 Volt Starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring and devices necessary to match sequence of operation for equipment.

3.3 SHAFT GROUNDING INSTALLATION

- A. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.
- B. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.
- C. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds 3 volts.
- D. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- E. Check line voltage and phase and ensure agreement with nameplate.
- F. Verify motor rotation.

3.4 MOTOR INSTALLATION

- A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical.
- B. Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.
- C. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- D. Check line voltage and phase and ensure agreement with nameplate.
- E. Verify motor rotation.
- F. Field Quality Control:
 - 1. Prepare for acceptance tests as follows:
 - a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - b. Test interlocks and control features for proper operation.
 - c. Verify that current in each phase is within nameplate rating.
 - 2. Testing: Perform the following field quality-control testing:
 - a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.

- b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- 3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 - a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
 - b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - c. Verify bearing lubrication.
 - d. Verify proper motor rotation.
 - e. Test Reports: Prepare a written report to record the following test procedures used:
 - 1) Test results that comply with requirements.
 - 2) Test results that do not comply with requirements and corrective action taken to achieve compliance.
- G. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.
- H. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 23 05 13

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Hangers and Supports for HVAC Ductwork and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

- ##### A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- ##### B. In addition, meet the following:
1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
 2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
 3. Install ductwork and piping per SMACNA's requirements.
 4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- ##### B. In addition, meet the following:
1. Welding:

- a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
2. Welding for Hangers:
 - a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
3. Engineering Responsibility:
 - a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.
 - 1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
5. Support systems to be supplied by a single manufacturer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. Provide ductwork and equipment hangers and supports in accordance with the following:
 1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
 2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems:
 1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
 2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

- C. Provide seismic restraint hangers and supports for ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.
- D. Obtain approval from Contracting Officer for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hangers and Supports for HVAC Ductwork and Equipment:

1. Anvil International
2. B-Line Systems, Incorporated
3. Erico Company, Incorporated
4. Nelson-Olsen Incorporated
5. Rilco Manufacturing Company, Incorporated
6. Snappitz Thermal Pipe Shield Manufacturing
7. Unistrut Corporation

B. Wall and Floor Sleeves:

1. Thunderline Corporation "Link Seal".
2. Or approved equivalent.

C. Building Attachments:

1. Anchor-It
2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Incorporated

2.2 **N E S ND S O TS FO C D CT O ND E I ENT**

- A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

- B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
- C. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

2.3 WALL AND FLOOR SLEEVES

- A. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

2.4 BUILDING ATTACHMENTS

- A. Beam Clamps:
 - 1. MSS Type 19 and 23, wide throat, with retaining clip.
 - 2. Universal Side Beam Clamp: MSS Type 20.
- B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Anchor Bolts:
 - 1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Contracting Officer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
 - 2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
 - 4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.5 FLASHING

- A. Steel Flashing: 26 gauge galvanized steel.
- B. Safes: 8 mil thick neoprene.
- C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. General:

1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

D. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

E. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

F. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

G. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

H. Grout:

1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
3. Properties: Nonstaining, noncorrosive, and non gaseous.
4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
- B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
- C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.
- D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.2 **N E S ND S □ O TS FO □ C D □ CT □ O ND E □ I ENT**

- A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
- B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.
- C. Design hangers and supports to allow for expansion and contraction.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:
 - 1. Support horizontal duct runs at not more than 4 feet intervals.
 - 2. Support vertical risers at not more than 6 feet intervals.
 - 3. Limit sag between support hangers to 1/2-inch per foot of spacing support.
 - 4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.

5. Duct bends shall be not less than 1.5 duct diameter bend radius.
- F. Use double nuts and lock washers on threaded rod supports.
- G. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.
- H. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.
- I. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.
- J. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.
- K. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.
- L. 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.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
- O. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.
- P. Plumber's Tape not permitted as pipe hangers or pipe straps.
- Q. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
- R. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
- S. Fire protection piping will be supported independently of other piping.
- T. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
- U. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below

ceiling corridor walls, and through equipment room walls and floors.

3.3 WALL AND FLOOR SLEEVES

- A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

3.4 BUILDING ATTACHMENTS

- A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.
- B. Select size of building attachments to suit hanger rods.
- C. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- D. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.
- E. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
- G. Install powder-actuated drive-pin fasteners 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. Test powder-actuated insert attachments with a minimum load of 100 pounds.
- H. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.
- I. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
- J. Anchor Bolts:
 - 1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.
 - 2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.5 FLASHING

- A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.
- B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.6 MISCELLANEOUS METAL AND MATERIALS

- A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
- B. Finishes:
 - 1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - 2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - 3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.
- C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws

and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

- E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.
- F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
- I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
- M. Provide galvanized components for items exposed to weather.

3.7 FIRE RATED SUPPORTS

- A. Provide fire rated support as required by Codes.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Vibration Isolation
2. Seismic Restraint Devices
3. Factory Finishes
4. Seismic-Bracing/Restraint Devices/Systems for Equipment and Ductwork

B. General:

1. Vibration isolation for mechanical ductwork and equipment.
2. Seismic restraint for mechanical ductwork and equipment.
3. Seismic Certification for equipment, hangers and systems.
4. Special inspections for systems.

C. Scope of Work:

1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in architectural drawings.

1.2 RELATED SECTIONS

- ##### A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Vibration Isolation:

- a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
 - b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:
 - 1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
 - 2) Equipment mounting holes.
 - 3) Dimensions.
 - 4) Size and location of concrete and steel bases and curbs.
 - 5) Isolation selected for each support point.
 - 6) Details of mounting brackets for isolator.
 - 7) Weight distribution for each isolator.
 - 8) Details of seismic snubbers.
 - 9) Code number assigned to each isolator.
 - c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Seismic Restraint:
 - a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by Contracting Officer licensed in State of California.
 - b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by Contracting Officer licensed in State of California.
 3. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.
 4. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.

5. Welding certificates.
6. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Vibration Isolation:
 - a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.
 - b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.
 - c. Isolator Stability:
 - 1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
 - 2) Springs have minimum additional travel to solid equal to 50 percent of rated deflection.
 - 3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.
 - d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.
 2. Seismic Restraint:
 - a. Code and Standard Requirements:
 - 1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of IBC Chapter 16.
 - b. Confirm Seismic Control requirements in Division 01, General Requirements and Structural documents.
 - c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-16. Anchorage systems to bear anchorage

preapproval number from Contracting Officer, showing maximum seismic-restraint ratings. Ratings based on independent testing or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by Contracting Officer licensed in State of California. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.

- d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:
 - 1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
 - 2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
 - 3) In-line duct devices connected to ductwork weighing 75 pounds or greater.
 - 4) Housekeeping slabs: provide reinforcement and anchorage to building structure.
- e. Where required, seismic sway bracing of suspended duct and piping meet following:
 - 1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
 - 2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
 - 3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.
- f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:
 - 1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.
 - 2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.

- 3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.

C. Seismic restraints, including anchors to building structure, be designed by registered Contracting Officer licensed in State of California. Design includes:

1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.
3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered Contracting Officer who designed layout of braces.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Vibration Isolation:
 1. The VMC Group
 2. B-Line Systems, Inc.
 3. Kinetics Noise Control, Inc.
 4. Mason Industries, Inc.
 5. M.W. Saussé - Vibrex
 6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

B. Seismic Restraint Devices:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. California Dynamics Corporation
7. Cooper B-Line Tolco
8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
9. Hilti, Inc.

C. Factory Finishes:

1. Kynar 500 Fluoropolymer Coating
2. Or approved equivalent.

D. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:

1. The VMC Group
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Hilti, Inc.
5. Cooper B-Line, Inc.
6. California Dynamics Corporation
7. Unistrut
8. ISAT, Inc.
9. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

2.2 VIBRATION ISOLATION

- A. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 2. Minimum Additional Travel: 50 percent of required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside. Baseplates limit floor load to 100 PSIG (690 kPa).
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
 7. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 8. Mason Type: SLFH or SLF.
- B. Type 4a - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops (out of contact during normal operation) to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Restraining bolts have large rubber grommets to provide cushioning in vertical and horizontal directions. A minimum clearance of 3/8-inch maintained around restraining bolts so as not to interfere with spring action.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 3. Minimum Additional Travel: 50 percent of 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. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 7. Mason Type: SLR.
- C. Type 4b - Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint with neoprene acoustical cup, spring inspection ports and rebound adjustment ports.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
 4. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
 5. Mason Type: SSLFH.
- D. Type 5a - Restrained Elastomeric Hangers: Double-deflection type, with molded, oil-resistant natural rubber or bridge bearing neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range. Seismic rebound steel and bonded LDS rubber washer to limit upward seismic movement. Mason Type: RWHD.
- E. Type 5c - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Mason Type: RW30.
- F. Type FC-1, Flexible duct connectors. See Specification Section 23 33 00 Air Duct Accessories.
- G. Type FC-3, Flexible Compensator, Double Sphere:
1. Body: Molded twin spherical type. Neoprene with internal cord or wire.
 2. Minimum Pressure Rating, Sizes 2-inch to 12-inch: 225 PSI at 170 degrees F.

3. Minimum Pressure Rating, Sizes 14-inch to 20-inch: 125 PSI at 170 degrees F.
4. Minimum Allowable Compression: 1-1/2 inches.
5. Minimum Allowable Elongation: 1-1/8 inches.
6. Minimum Allowable Offset: 1-1/8 inches.
7. Minimum Allowable Angular Movement: 20 degrees.
8. Joint: Steel flanges.
9. Accessories: Galvanized aircraft-type cable or control rods to prevent over extension.
10. Basis of Design: Metraflex Doublesphere.

2.3 SEISMIC RESTRAINT DEVICES

- A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.
- B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.
 1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.
- C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.
- D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.4 FACTORY FINISHES

- A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:
 1. Conform to AAMA 605.2.
 2. Apply coating following cleaning and pretreatment.
 3. Cleaning: AA-C12C42R1X.

4. Dry system before final finish application.
5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.

B. Finish:

1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.
2. Powder coating on springs and housings.
3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.
4. Baked enamel for metal components on isolators for interior use.
5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

2.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

- A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to Contracting Officer.
- B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.
- C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.
- D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
- E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.
- B. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
- C. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.

- D. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.
- E. Provide roof curbs, equipment supports and roof penetrations. Work to maintain roof warranty. Coordinate location, size, structural connections/requirements and flashing prior to installation.
- F. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.
- G. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.
- H. Examination:
 - 1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.
 - 2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- I. Testing: Perform following field quality-control testing:
 - 1. Isolator seismic-restraint clearance.
 - 2. Isolator deflection.
 - 3. Snubber minimum clearances.
- J. Adjusting:
 - 1. Adjust snubbers according to manufacturer's written recommendations.
 - 2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.
- K. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

- L. Demonstration: Engage factory-authorized service representative to train Contracting Officer's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference Division 01, General Requirements.

3.2 VIBRATION ISOLATION

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.
- D. Install isolation as indicated on drawings by type and location and where indicated below.
- E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Utility Set Centrifugal Fans	All	4A	1.5
Axial, Cabinet, Centrifugal Inline Fans	0 to 23.5-inch diameter	Type 3, 4A, 4B, 5C, FC-1	0.75

- F. Isolation Mounts:
1. Install minimum of four seismic snubbers on isolated equipment. 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.
 3. Provide flexible piping connection and flexible ductwork connection to equipment with isolation mounts or bases.

- G. Isolating Hangers:
1. Support piping and ductwork connected to isolated equipment within equipment rooms on isolating hangers as scheduled on drawings. Unless otherwise noted, first three hangers from isolated equipment to have a minimum of 1/2 static deflection of equipment isolators. Other isolating hangers to have a minimum of 1/4 static deflection of equipment isolators.
 2. Position isolating hanger elements as high as possible in hanger rod assembly, but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.

3. Unless otherwise noted, air supply units with internally isolated fans do not require isolating hangers for connecting pipes and ductwork.
4. Where parallel running pipes are hung together on an isolated trapeze, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in same trapeze.
5. Install limit stops so they are out of contact during normal operation.

H. Adjusting:

1. Adjust isolators after piping systems have been filled and equipment is at operating weight.
2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

3.3 SEISMIC RESTRAINT DEVICES

- A. Reference 3.01, General Installation Requirements.
- B. Install in strict accordance with manufacturer's written instructions and certified submittal data.
- C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.
- D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 Degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.4 FACTORY FINISHES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

C. Finishes to be factory-applied. No field patching or holidays allowed.

3.5 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Plastic Nameplates
2. Tags
3. Ceiling Tags

1.2 RELATED SECTIONS

- ##### A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

- ##### A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01 General Requirements.

B. In addition, provide:

1. Submit schedule of identification type, including material, for each class of tagged item.
2. Submit locations at which Valve Schedules will be installed.

PART 2 - PRODUCTS

2.1 PLASTIC NAMEPLATES

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.

1. Letter Color: White.
2. Letter Height: 1/2-inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.2 TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark

5. Seton

- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.
- C. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.
- D. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7-inches.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

2.3 CEILING TAGS

- A. Manufacturers:
 - 1. Brady Corporation
 - 2. Brimar
 - 3. Champion America
 - 4. Craftmark
 - 5. Seton
- B. Description: Steel with 3/4-inch diameter color coded head.
- C. Color code as follows:
 - 1. Yellow - HVAC equipment.
 - 2. Red - Fire dampers/smoke dampers.
 - 3. Blue - Heating/cooling valves.
 - 4. Ceiling tile labels, machine generated, adhesive backed tape labels with black letters, clear tape.

PART 3 - EXECUTION

3.1 GENERAL - INSTALLATION

- A. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
- B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).
- C. Degrease and clean surfaces to receive adhesive for identification materials.
- D. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- E. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.
- F. Install all products in accordance with manufacturer's instructions.
- G. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.2 PLASTIC NAMEPLATES

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners.
- B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.
- C. Identify thermostats with nameplates.

3.3 TAGS

- A. Use metal tags on piping 3/4-inch diameter and smaller.
- B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.
- C. Install tags with corrosion resistant chain.
- D. Small devices, such as in-line pumps, may be identified with tags.

- E. Identify valves with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.
- F. Identify air terminal units and radiator valves with numbered plastic tags.
- G. Tag automatic controls, instruments, and relays. Key to control schematic.
- H. Install valve schedule at each mechanical room.

3.4 CEILING TAGS

- A. Provide ceiling tags to locate valves, dampers, and equipment above accessible ceilings. Locate in corner of ceiling tee grid closest to equipment.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Requirements and Procedures
2. Ductwork Pressure Testing
3. Fundamental Air Systems Balancing Procedures
4. Temperature Control Verification
5. Constant Volume Air Systems Balancing Procedures
6. Final Reports:
 - a. Report Requirements
 - b. General Report Data
 - c. System Diagrams
 - d. Fans
 - e. Duct Traverses
 - f. Diffusers/Registers/Grilles
 - g. Instrument Calibration
7. Additional Tests

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:

1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and this Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
2. Pre-Construction Phase Report:
 - a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
 - 1) A complete set of report forms intended for use on the project, with data filled in except for the field readings. Forms to be Project-specific.
 - 2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
 - 3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
 - 4) A narrative of any project specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.
3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.
4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 below. Include a complete set of report forms intended for use on this Project.
5. Specify reports required because of editing procedures in Part 3 of this Section.
6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.
7. Sample Report Forms: Submit two sets of sample TAB report forms.
8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.
9. Final Report.
10. Provide additional submittals to commissioning authority as dictated in commissioning specifications.

1.5 QUALITY ASSURANCE

- A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Acceptable TAB Agencies:

a. Northern California:

- 1) RSAnalysis, Inc.
- 2) National Air Balance Company (NABCO)
- 3) Mesa 3

2. Balance Firm Qualifications:

a. General:

- 1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
- 2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.

b. Testing and Balancing firm is certified by AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.

c. Industry Standards: Testing and Balancing will conform to AABC, and American National Standards Institute (ANSI) as follows:

- 1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- 2) AABC: Comply with National Standards for Total System Balance.
- 3) ANSI:
 - (a) S1.4 Specifications for sound level meters.
 - (b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
 - (c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

d. Test Observation: If requested, conduct tests in the presence of the Commissioning Authority and Contracting Officer.

3. Code Compliance: Perform tests in the presence of the Contracting Officer where required by the Contracting Officer.

4. Contracting Officer Witness: Perform tests in the presence of the Commissioning Authority and Contracting Officer.
5. Contracting Officer Witness: The Contracting Officer reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by Contracting Officer.
7. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.
8. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.
9. TAB Conference: Meet with the Commissioning Authority and Contracting Officer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
 - a. Agenda Items: Include at least the following:
 - 1) Submittal distribution requirements.
 - 2) Contract Documents examination report.
 - 3) TAB plan.
 - 4) Work schedule and Project site access requirements.
 - 5) Coordination and cooperation of trades and subcontractors.
 - 6) Coordination of documentation and communication flow.
10. Certification of TAB Reports: This certification includes the following:
 - a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
11. TAB Reports: Use standard forms from AABC.
12. Instrumentation Type, Quantity, and Accuracy: As described in AABC.
13. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Contracting Officer may request a recheck of up to 10 percent of total number of terminals, or resetting of any outlet, coil, or device listed in the final TAB report.
 - 2. Guarantee: Meet the requirements of the following programs:
 - a. Provide a guarantee on AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.
 - 2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.7 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a persons skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. TAB: Testing, Adjusting, and Balancing.
- K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- L. Test: A procedure to determine quantitative performance of a system or equipment.
- M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- N. AABC: Associated Air Balance Council.
- O. AMCA: Air Movement and Control Association.
- P. CTI: Cooling Tower Institute.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Witness leakage and pressure tests carried out by Section 233100.
- D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS AND PROCEDURES

- A. Project Conditions:
 - 1. Full Contracting Officer Occupancy: The Contracting Officer will occupy the site and existing building during the entire TAB period. Cooperate with the Contracting Officer during TAB operations to minimize conflicts with the Contracting Officer's operations.
- B. General Requirements:

1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with Contracting Officer.
2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
3. Where Contracting Officer occupies building during the testing period, cooperate with Contracting Officer to minimize conflicts with Contracting Officer's operations.

C. Examination:

1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
2. Examine approved submittal data of HVAC systems and equipment.
3. Examine project record documents described in Division 01, General Requirements.
4. Examine Contracting Officer's design data, including Basis of Design, 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.
5. Examine equipment performance data, including fan and pump curves. 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. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
6. Coordinate requirements in system and equipment with this Section.

7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
8. Examine system and equipment test reports.
9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
11. Report deficiencies discovered before and during performance of TAB procedures.

D. Preparation:

1. Prepare a TAB plan that includes strategies and step-by-step procedures.
2. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - a. Permanent electrical power wiring is complete.
 - b. Hydronic systems are filled, clean, and free of air.
 - c. Automatic temperature-control systems are operational.
 - d. Equipment and duct access doors are securely closed.
 - e. Balance, smoke, and fire dampers are open.
 - f. Isolating and balancing valves are open and control valves are operational.
 - g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.
3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 - a. Attendance is required by installers whose work will be tested, adjusted, or balanced.
4. Provide instruments required for TAB operations. Make instruments available to Contracting Officer to facilitate spot checks during testing.

E. General TAB Procedures:

1. Perform TAB procedures on each system according to the procedures contained in AABC and this Section.
2. Coordinate location of test probes prior to start of TAB procedures and make test probes available for Contracting Officer's tests after start of occupancy. Where required, cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
2. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.
3. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:

1. Field Logs: Maintain written logs including:
 - a. Running log of events and issues.
 - b. Discrepancies, deficient or uncompleted work by others.
 - c. Contract interpretation requests.
 - d. Lists of completed tests.
2. Ensure recorded data represents actual measured or observed conditions.
3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.

5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Contracting Officer or Commissioning Agent.

3.2 DUCTWORK PRESSURE TESTING

- A. Test ductwork prior to connection to fan equipment. Repair leaks and retest until stipulated results are achieved.
- B. Provide air pressure testing of ductwork as noted below for various project types and systems:
 1. Supply and return ductwork located inside shafts and outside building envelope.
 2. Exhaust ductwork located inside shafts.
 3. Exhaust ductwork located outside building envelope, when used in a heat recovery system.
 4. For low-rise and high-rise multi-family, and single-residence Dwelling Units: not required.
 5. Exhaust systems serving compounding pharmacies, laboratories, laboratory support spaces, fume hoods, bio-safety cabinets, or hazardous exhausts: pressure test all ductwork.
 6. For other project types or systems: pressure test ductwork in accordance with SMACNA HVAC Air Duct Leakage Test Manual, of representative sections of installed ductwork totaling not less than the total installed duct areas noted below:
 - a. For variable air volume supply, return, or exhaust air systems' ductwork of higher than 2-inches pressure class: pressure test 40 percent of the total installed duct area.
 - b. For variable air volume supply, return, or exhaust air systems' ductwork of 2-inches or less pressure class: pressure test ductwork connected to 10-percent of the total installed duct area of such ductwork, but not less than ductwork connected to two terminal units. Where the tested 10-percent fails to comply, then pressure test 40-percent of the total installed duct area.
 - c. For constant air volume supply, return, or exhaust systems: pressure test 40-percent of the total installed duct area.
 7. Where tests are required, provide separate tests for each of supply, return and exhaust air systems.

8. Where the tested 40-percent fails to comply with the requirements of this section, then pressure test 100-percent of the total installed duct area. Sections shall be selected by the building Contracting Officer or the Contracting Officer and shall include sections of ductwork upstream and downstream of terminal units. Positive pressure leakage testing may be utilized for negative pressure ductwork.
 9. Area requirement of 40-percent of the total installed duct area is inclusive of ductwork located in shafts or outside building envelope.
- C. Test ductwork prior to connection to fan equipment. Repair leaks and retest until stipulated results are achieved. Pressure testing to meet the following leakage classifications below as a minimum (2012 SMACNA HVAC Air Duct Leakage Manual, Table 4-1):
1. Leakage class to be as defined below as a minimum.

a. Minimum Duct Leakage Classification

Duct Type	Leakage Class
Metal (Flexible excluded)	
Round and flat oval	3
Rectangular	6

2. Testing machine: Meet requirements of SMACNA standards. Pacific Air Products "Port-O-Lab", Rolok, or United Sheet Metal
3. Test supply systems prior to connecting terminal units.
4. Perform tests in presence of Contracting Officer. Give 48 hours advance notice before commencement of each test.
5. Test ductwork systems in sections as large as possible and record test results accordingly.
6. Leak test grease exhaust ductwork per requirements of latest edition of NFPA-96 and local Mechanical Code.
7. Coordinate testing with ceiling installation.
 - a. Provide sheet-metal plates and install between each duct test section (applies to main-to-main fittings, branch-to-branch fittings and main-to-branch fittings). At each plate location, fabricate joint with Ductmate. Insert 14 gauge sheet metal between Ductmate using a neoprene gasket on both sides of metal plate.
 - b. Leave plates in place until isolated section has been tested and approved by Contracting Officer.
 - c. Once sections have passed test, remove plates and reattach Ductmate joints. After fan unit is running, test joint for leakage by using a mixture of soap and water. If any noise or bubbling occurs, reseal joint. Contracting Officer to witness this procedure.

8. Test duct at 1.5 times the design air pressure, up to pressure class of the duct. Seal any audible leaks.

3.3 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

- A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- B. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- C. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- D. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.
- E. Prepare schematic diagrams of systems' "as-built" duct layouts.
- F. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- G. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- I. Verify that motor starters are equipped with thermal protection, sized for the connected load.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.
- L. Check that condensate drains are installed, trapped and primed and routed to drain.
- M. Check for readily observable leaks in air-handling unit components and ductwork.
- N. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.

3.4 TEMPERATURE CONTROL VERIFICATION

- A. Examine automatic temperature system components to verify the following:
 1. Dampers, valves, and other controlled devices operate by the intended controller.
 2. Dampers and valves are in the position indicated by the controller.

3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, equipment, drafts, and cold walls.
 6. Sensors are located to sense only the intended conditions.
 7. Sequence of operation for control modes is according to the Contract Documents.
 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to design values.
- B. Verify that controllers are calibrated and commissioned.
 - C. Check transmitter and controller locations and note conditions that would adversely affect control functions.
 - D. Record controller settings and note variances between set points and actual measurements.
 - E. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
 - F. Verify free travel and proper operation of control devices such as damper and valve operators.
 - G. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
 - H. Confirm interaction of electrically operated switch transducers.
 - I. Confirm interaction of interlock and lockout systems.
 - J. Verify main control supply-air pressure and observe compressor and dryer operations.
 - K. Note operation of electric actuators using spring return for proper fail-safe operations.
- 3.5 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES
- A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.
 1. Measure fan static pressures to determine actual static pressure as follows:

- a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Measure static pressure across each air-handling unit component under final balanced condition.
 3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
 4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
 6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
 7. Calibrate airflow measuring stations.

3.6 FINAL REPORTS

A. Report Requirements:

1. General:
 - a. Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.
 - b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
 - 1) Include a list of the instruments used for procedures, along with proof of calibration.

- c. Final Report Contents: In addition to the certified field report data, include the following:
 - 1) Pump curves.
 - 2) Fan Curves
 - 3) Manufacturers Test Data
 - 4) Field test reports prepared by system and equipment installers.
 - 5) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

B. General Report Data:

- 1. In addition to the form titles and entries, include the following data in the final report, as applicable:
 - a. Title Page
 - b. Name and Address of TAB Agent
 - c. Project Name
 - d. Project Location
 - e. Contracting Officer's Name and Address
 - f. Contractor's Name and Address
 - g. Report Date
 - h. Signature of TAB Agent who Certifies the Report
 - i. Summary of Contents, Including the Following:
 - 1) Design versus Final Performance
 - 2) Notable Characteristics of Systems
 - 3) Description of System Operation Sequence if it varies from the Contract Documents
 - j. Nomenclature Sheets for Each Item of Equipment
 - k. Data for Terminal Units, including Manufacturer, Type Size, and Fittings
 - l. Notes to explain why certain final data in the body of reports vary from design values.

m. Test Conditions for Fans and Pump Performance Forms, Including the Following:

- 1) Settings for Outside-, Return-, and Exhaust-air Dampers
- 2) Conditions of Filters
- 3) Cooling Coil, Wet- and Dry-bulb Conditions
- 4) Face and Bypass Damper Settings at Coils
- 5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
- 6) Inlet Vane Settings for Variable-Air-Volume Systems
- 7) Settings for Supply-air, Static-pressure Controller
- 8) Other System Operating Conditions that affect Performance

C. System Diagrams:

1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
 - a. Quantities of Outside, Supply, Return, and Exhaust Airflows
 - b. Water and Steam Flow Rates
 - c. Duct, Outlet, and Inlet Sizes
 - d. Pipe and Valve Sizes and Locations
 - e. Terminal Units
 - f. Balancing Stations

D. Fans:

1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - a. Fan Data: Include the following:
 - 1) System Identification
 - 2) Location
 - 3) Make and Type
 - 4) Model Number and Size
 - 5) Manufacturer's Serial Number

- 6) Arrangement and Class
 - 7) Sheave Make, Size in Inches, and Bore
 - 8) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches.
- b. Motor Data: Include the following:
- 1) Make and Frame Type and Size
 - 2) Horsepower and rpm
 - 3) Volts, Phase, and Hertz
 - 4) Full-load Amperage and Service Factor
 - 5) Sheave Make, Size in Inches, and Bore
 - 6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
 - 7) Number of Belts, Make, and Size
- c. Test Data: Include design and actual values for the following:
- 1) Total Airflow Rate in cfm
 - 2) Total System Static Pressure in Inches wg
 - 3) Fan rpm
 - 4) Discharge Static Pressure in Inches wg
 - 5) Suction Static Pressure in Inches wg

E. Duct Traverses:

1. Include a diagram with a grid representing the duct cross-section and record the following:
 - a. Report Data: Include the following:
 - 1) System and Air-handling Unit Number
 - 2) Location and Zone
 - 3) Duct Static Pressure in Inches wg
 - 4) Duct Size in Inches
 - 5) Duct Area in SF
 - 6) Design Airflow Rate in cfm

- 7) Design Velocity in fpm
- 8) Actual Airflow Rate in cfm
- 9) Actual Average Velocity in fpm

F. Diffusers/Registers/Grilles:

1. For diffusers, registers and grilles, include the following:
 - a. Unit Data: Include the following:
 - 1) System and Air-handling Unit Identification
 - 2) Location and Zone
 - 3) Test Apparatus Used
 - 4) Area Served
 - 5) Air-terminal-device Make
 - 6) Air-terminal-device Number from System Diagram
 - 7) Air-terminal-device Type and Model Number
 - 8) Air-terminal-device Size
 - 9) Air-terminal-device Effective Area in SF
 - b. Test Data: Include design and actual values for the following:
 - 1) Airflow Rate in cfm
 - 2) Air Velocity in fpm
 - 3) Final Airflow Rate in cfm
 - 4) Final Velocity in fpm
 - 5) Space Temperature in Degrees F

G. Instrument Calibration:

1. For instrument calibration, include the following:
 - a. Report Data: Include the following:
 - 1) Instrument Type and Make
 - 2) Serial Number

3) Application.

4) Dates of Use

b. Dates of Calibration.

3.7 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing 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 inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Type A, Flexible Glass Wool Blanket
 - 2. Type B, Duct Liner
 - 3. Jacketing
 - 4. Accessories
 - 5. Duct Insulation Accessories
 - 6. Duct Insulation Compounds

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Installer qualifications.
 - 2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
 - 3. Material Test Reports: From a qualified testing agency acceptable to Contracting Officer indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
 2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
 3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
 4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 FIRE HAZARD CLASSIFICATION

- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.
- B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15".
- C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Acceptable Manufacturers:
 1. Certainteed
 2. Johns Manville
 3. Knauf

4. Owens-Corning

- B. ASTM C553, Type 1, Class B-2; flexible blanket.
- C. 'K' Value: 0.27 BTU in/(hr sf F) at 75 degrees F installed, maximum service temperature: 250 degrees F.
- D. Density: 0.75 pounds per cubic foot.
- E. DBDE-free. UL/E validated to be formaldehyde-free.
- F. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

2.2 TYPE B, DUCT LINER

A. Acceptable Manufacturers:

- 1. Certainteed
- 2. Johns Manville
- 3. Knauf
- 4. Owens-Corning

- B. ASTM C1071; flexible blanket.
- C. 'K' Value: ASTM C518, 0.25 BTU in/(hr sf F) at 75 degrees F, maximum service temperature: 250 degrees F.
- D. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."
- E. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.
- F. Adhesive: UL listed waterproof type.
- G. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
- H. Erosion-Resistant Surfaces: UL 181.
- I. ASTM G21 and ASTM G22 Microbial Growth Resistance.
- J. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per UL 2824-"GREENGUARD Certification Program Method for Measuring Microbial Resistance". DBDE-free. UL/E validated to be formaldehyde-free.

2.3 JACKETING

A. Acceptable Manufacturers:

1. ITW Insulation Systems
 2. General Insulation Company
 3. 3M
 4. Or approved equivalent.
- B. Insulation Jacketing and Insulation Jacketing Tape for Ductwork and Piping: 0.024-inch thick multi-layered laminate with tensile strength of 187 lb/inch, puncture resistance of 68 pounds per ASTM D1000, emittance of 0.03 per ASTM C1371, WVTR of 0.00 perm per ASTM E96, and service temperature of -94 degrees F to 248 degrees F, as manufactured by 3M, VentureClad1579GCW-E, or approved equivalent.
- C. PVC preformed molded insulation covers, for piping. Zeston or approved equivalent.
- D. Stainless Steel Jacket: Type 304 stainless steel, 0.010-inch, smooth finish.

2.4 ACCESSORIES

- A. Acceptable Manufacturers:
1. ITW Insulation Systems
 2. Or approved equivalent.
- B. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.
- C. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- D. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water-soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.5 DUCT INSULATION ACCESSORIES

- A. Acceptable Manufacturers:
1. Certainteed
 2. Johns Manville
 3. Owens-Corning

- B. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

2.6 DUCT INSULATION COMPOUNDS

- A. Acceptable Manufacturers:
 - 1. Certainteed
 - 2. Johns Manville
 - 3. Owens-Corning
- B. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated. Comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 in accordance with LLE EQ 4.1.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verification of Conditions:
 - 1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.
 - 2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Preparation: Clean and dry surfaces to be insulated.
- C. Installation:
 - 1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
 - 2. Piping and Equipment:
 - a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
 - b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position seam on bottom of pipe.
- D. Cover insulation on exposed refrigerant piping above ground, outside of building with heavy duty multi-layered laminated jacketing tape. Position seams on bottom of pipe. Use Venture Tape VentureClad Plus 1579GCW-E or approved equal.

- E. Provide accessories as required. See Part 2 Article "Accessories" above.
- F. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- G. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.
- H. Ductwork:
1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
 2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
 3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
 4. Coat staples and seals with vapor barrier coating.
 5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 3-inches beyond break or penetration on all directions and secure with adhesive and staples. Seal staples and joints with vapor barrier coating.
 6. Fill jacket penetrations. i.e., hangers, thermometers and damper operating rods, and other voids in insulation with vapor barrier coating. Seal penetration with vapor barrier coating. Insulate hangers and supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.
 7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
 8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.
 9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.
- I. Ductwork Surfaces to be Insulated: California

I □ □ □ □ □ □ □ I □ □ □ □ □ □ □	S □ □ □ □ I □ □ □ □ □ □ □ T □ □ □	D □ □ S □ □	I □ □ □ □ □ □ □ T □ □ □ □ □ □ □
Supply ductwork where duct is not specified to be lined.	A	All	1.5-inch

Outside Air Ducts	A	All	3-inch
HVAC plenums and unit housings not preinsulated	B	All	1.5-inch
Exhaust ducts within 10-feet of exterior	A	All	3-inch

1. Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

3.2 TYPE A, FLEXIBLE GLASS WOOL BLANKET

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code.) Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

3.3 TYPE B, DUCT LINER

- A. Install insulation in conformance with manufacturer's recommendations and requirements.
- B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners 15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of Project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

3.4 JACKETING

- A. See General Installation Requirements above.
- B. Install in accordance with manufacturer's instructions.

3.5 ACCESSORIES

- A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.

- B. See General Installation Requirements above.
- C. Furnish and install accessories for all insulation types listed in this Section.

3.6 DUCT INSULATION ACCESSORIES

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.7 DUCT INSULATION COMPOUNDS

- A. Install insulation in conformance with manufacturer's recommendations and requirements.

END OF SECTION 23 07 00

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Definitions, warranties, test equipment requirements, and mechanical commissioning requirements.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 01 91 13, General Commissioning Requirements.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Current edition of ASHRAE Guideline 0, The Commissioning Process.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Certificates of readiness.
2. Certificates of completion of installation, prestart, and startup activities.
3. Operation and Maintenance Manuals.
4. Test reports.
5. Control Drawings Submittal
 - a. Provide a key to abbreviations.
 - b. Provide graphic schematic depictions of the systems and each component.

- c. Include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
- d. Provide a full points list with at least the following included for each point:
 - 1) Controlled system
 - 2) Point abbreviation
 - 3) Point description
 - 4) Display unit
 - 5) Control point or set point (Yes / No)
 - 6) Monitoring point (Yes / No)
 - 7) Intermediate point (Yes / No)
 - 8) Calculated point (Yes / No)
- 6. Contracting Officer forwards one set of submittals for systems to be commissioned to Commissioning Agent at same time as design team.
- 7. Commissioning Agent forwards comments to design team for consideration in their submittal response.
- 8. Design team sends consolidated response to submittals and copies to Commissioning Agent.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to Commissioning Authority upon request.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:

1. Commissioning, inspecting, and testing will not modify terms or time periods of mechanical equipment, systems, and controls warranties including related equipment and systems, and adjacent work.
2. Control system warranty period starts from date of Commissioning Agent acceptance.

1.7 COORDINATION

- A. Reference Section 01 91 13, General Commissioning Requirements, for requirements pertaining to coordination during the commissioning process.

1.8 PURPOSE

- A. Purpose of commissioning process is to provide Contracting Officer assurance that systems have been installed in prescribed manner and will operate within performance guidelines. Commissioning is intended to enhance quality of system startup and aid in orderly transfer of systems to beneficial use by Contracting Officer.
- B. Commissioning procedures and results will be observed by Commissioning Authority or Contracting Officer's staff. Contractor is expected to verify functional readiness of systems to be tested prior to performing the tests in presence of Contracting Officer's witness. A high rate of test failure will indicate that Contractor has not adequately verified readiness of systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the mechanical contractor of Division 23, HVAC will ultimately be responsible for standard testing equipment for the HVAC&R system and controls system in Division 23, HVAC, except for the equipment specific to and used by TAB in their commissioning responsibilities. Provide a sufficient quantity of two-way radios by each subcontractor.
- B. Include special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing in the base bid price to the Contracting Officer and leave on site, except for stand-alone data logging equipment that may be used by the Commissioning Authority.
- C. Manufacturer of equipment to provide proprietary test equipment and software required for programming and/or start-up, whether specified or not. Manufacturer provides the test equipment, demonstrates its use, and assists in the commissioning process as needed. Proprietary test equipment (and software) become the property of the Contracting Officer upon completion of the commissioning process.
- D. Data logging equipment and software required to test equipment will be provided by the Commissioning Authority, and will not become the property of the Contracting Officer.

- E. Use only testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution of plus or minus 0.1 degree F. Pressure sensors have an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractors, the Commissioning Authority will prepare prefunctional checklists for commissioned components, equipment, and systems
- B. Red-Lined Drawings:
 - 1. Verify equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
 - 2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
 - 3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
 - 4. The contracted party, as defined in the Contract Documents will create the as-built drawings.
- C. Operation and Maintenance (O&M) Data:
 - 1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.
 - 2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.
 - 3. The Commissioning Authority will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.
- D. Demonstration and Training:
 - 1. Contractor will provide demonstration and training as required by the specifications.
 - 2. A complete training plan and schedule must be submitted by the contractor to the Commissioning Authority four weeks prior to any training.

3. A training agenda for each training session must be submitted to the Commissioning Authority one week prior the training session.
4. Notify the Commissioning Authority at least 72 hours in advance of scheduled tests so that testing may be observed by the Commissioning Authority and Contracting Officer. Provide a copy of the test record to the Commissioning Authority and Contracting Officer.
5. Engage a factory-authorized service representative to train Contracting Officer's maintenance personnel to adjust, operate, and maintain specific equipment.
6. Train Contracting Officer's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23, HVAC are as follows (references apply to commissioned equipment only):
 1. Perform commissioning tests at the direction of the Commissioning Authority.
 2. Attend construction phase controls coordination meetings.
 3. Attend testing, adjusting, and balancing review and coordination meetings.
 4. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.
 5. Provide information requested by the Commissioning Authority for final commissioning documentation.
 6. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or subcontract written.
 7. Prepare preliminary schedule for mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for Contracting Officer. Distribute preliminary schedule to commissioning team members.
 8. Update schedule as required throughout the construction period.
 9. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.

10. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.
 11. Assist the Commissioning Authority in verification and functional performance tests.
 12. Gather operation and maintenance literature on equipment, and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.
- B. Coordinate with the Commissioning Authority to provide 48 hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
- C. Notify the Commissioning Authority a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.
- D. Participate in, and schedule vendors and contractors to participate in the training sessions.
- E. Provide written notification to the Construction Manager/General Contractor (CM/GC) and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.
1. HVAC&R equipment including fans, air handling units, ductwork, dampers, terminals, and other equipment furnished under this Division.
 2. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
 3. Fire detection and smoke detection devices furnished under other divisions of the specification.
- F. Equipment supplier to document the performance of his equipment.
- G. Test, Adjust and Balance Contractor:
1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
 2. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.
- H. Provide training of the Contracting Officer's operating staff using expert qualified personnel, as specified.
- I. Equipment Suppliers:

1. Provide requested submittal data, including detailed start-up procedures and specific responsibilities of the Contracting Officer, to keep warranties in force.
 2. Assist in equipment testing per agreements with contractors.
 3. Provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.
- J. Reference Section 01 91 13, General Commissioning Requirements for additional contractor responsibilities.

3.3 CONTRACTING OFFICER'S RESPONSIBILITIES

- A. Reference Section 01 91 13, General Commissioning Requirements for Contracting Officer's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

- A. Reference Section 01 91 13, General Commissioning Requirements for Design Professional's Responsibilities.

3.5 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

- A. Reference Section 01 91 13, General Commissioning Requirements for Commissioning Authority's Responsibilities.

3.6 TESTING PREPARATION

- A. Certify in writing to the Commissioning Authority that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the Commissioning Authority that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the Commissioning Authority.

3.7 TESTING, ADJUSTING AND BALANCING VERIFICATION

- A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the Commissioning Authority.
- B. Notify the Commissioning Authority at least 10 days in advance of testing and balancing Work, and provide access for the Commissioning Authority to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the Commissioning Authority.
 - 1. The Commissioning Authority will notify testing and balancing subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. Testing and balancing subcontractor to use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items to result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB to result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the Commissioning Authority so verification of failed portions can be performed.

3.8 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.
- B. Scope of HVAC&R testing to include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing to include measuring capacities and effectiveness of operational and control functions.
- C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The Commissioning Authority along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor to prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the

Commissioning Authority and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

- G. The Commissioning Authority may direct that set points be altered when simulating conditions is not practical.
- H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Contracting Officer. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.9 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23, HVAC Sections. Provide submittals, test data, inspector record, and certifications to the Commissioning Authority.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23, HVAC Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the Commissioning Authority with preparation of testing plans.
- C. Pipe System Cleaning, Flushing, Hydrostatic Tests, and Chemical Treatment: Test requirements are specified in Division 23, HVAC Piping Sections. HVAC&R Contractor to prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the Commissioning Authority. Plan to include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Provide drawings keyed to pipe zones or sectors formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

- D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of components, systems and sub-systems. Evaluate the following equipment and systems:
 - 1. HVAC Equipment and Systems (all)
 - 2. Boiler
 - 3. Building Automation System
 - 4. Chilled Water System
 - 5. Computer Room AC
 - 6. Domestic Hot Water Systems
 - 7. Renewable Energy Systems
 - 8. Pumps
 - 9. VFDs
- 3.10 DEFICIENCIES/NONCONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT
 - A. Reference Division 01, General Requirements for requirements pertaining to deficiencies/nonconformance, cost of retesting, or failure due to manufacturer defect.
- 3.11 OPERATION AND MAINTENANCE MANUALS
 - A. The Operation and Maintenance Manuals to conform to Contract Documents requirements as stated in Division 23, HVAC.
 - B. Provide an updated as-built version of the control drawings and sequences of operation in the final controls O&M manual submittal.
- 3.12 TRAINING OF CONTRACTING OFFICER PERSONNEL
 - A. Mechanical Contractor's Training Responsibilities:
 - 1. Provide the Commissioning Authority with a training plan two weeks before the planned training.
 - 2. Provide designated Contracting Officer personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, HVAC equipment (i.e., pumps, heat exchangers, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.).

3. Training starts with classroom sessions followed by hands-on training on each piece of equipment to illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. Controls contractor to attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training Includes:
 - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. Training to include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
 - c. Discussion of relevant health and safety issues and concerns.
 - d. Discussion of warranties and guarantees.
 - e. Common troubleshooting problems and solutions.
 - f. Explanatory information included in the O&M manuals and the location of plans and manuals in the facility.
 - g. Discussion of any peculiarities of equipment installation or operation.
9. Schedule training after functional testing is complete, unless approved otherwise by the Contracting Officer.

B. Controls Contractor's Training Responsibilities:

1. Provide the Commissioning Authority and A/E with a training plan four weeks before the planned training.
2. Provide designated Contracting Officer personnel training on the control system in this facility. The intent is to clearly and completely instruct the Contracting Officer on the capabilities of the control system.
3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals include detailed description of the subject matter for each session. Manuals to cover control sequences and have a definitions section that fully describes relevant words used in the manuals and in software displays. Manuals will be approved by the Commissioning Authority and A/E. Deliver copies of audiovisuals to the Contracting Officer.
4. The trainings will be tailored to the needs and skill-level of the trainees.
5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. Contracting Officer to approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
7. Attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
8. Three Training Sessions, as Follows:
 - a. Training I - Control System. The first training consists of eight hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
 - b. Training II - Building Systems. The second session held on-site for a period of eight hours of actual hands-on training after the completion of system commissioning. The session includes instruction on:
 - 1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.

- 2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
 - 3) Trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
 - 4) Completely discuss every screen, allowing time for questions.
 - 5) Use of keypad or plug-in laptop computer at the zone level.
 - 6) Use of remote access to the system via phone lines or networks.
 - 7) Setting up and changing an air terminal unit controller.
 - 8) Graphics generation.
 - 9) Point database entry and modifications.
 - 10) Understanding DDC field panel operating programming (when applicable).
- c. Training III - The third training will be conducted on-site six months after occupancy and consist of eight hours of training. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

END OF SECTION

SECTION 23 09 33 - ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Room Thermostats
2. Smoke Detection for Projects with a Building Fire Alarm System
3. Relays and Contactors
4. Transformers
5. Wiring
6. Damper Operators

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Power wiring per Division 26, Electrical.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Drawings: complete control diagram, including written description of control sequences.
2. Operation and Maintenance Manual: Include record wiring drawings showing installed condition and operating changes made during start-up.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Within 30 days prior to warranty expiration date, control supplier to visit job site and check calibration, operation, and adjustment of temperature, pressure and humidity sensors, valves, dampers, thermostats and other devices installed by control supplier. Make repair or replacement of defective control equipment as required at no charge to Contracting Officer.
 - 2. Submit letter to Contracting Officer certifying that this work has been completed.
 - 3. Attach copy of service report signed by Contracting Officer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Room Thermostats:
 - 1. Honeywell
 - 2. Siemens
 - 3. Johnson Controls
 - 4. Reliable Controls
 - 5. Alerton
 - 6. Or approved equivalent.
- B. Duct/Spot-Type Smoke Detectors (Project with Fire Alarm System):
 - 1. See Division 28 for Products.
- C. Damper Operators:
 - 1. Belimo
 - 2. Honeywell
 - 3. Siemens
 - 4. Or approved equivalent.

2.2 ROOM THERMOSTATS

- A. Electric Thermostat: Wall mounted thermostat with heat anticipation, automatic changeover and standard Fahrenheit slide switch with thermometer 1 stage heat, 2 stage cooling. Heat/auto/cool and continuous fan switch. Basis of Design: Honeywell Econostat.
- B. Line Voltage, Cooling Thermostat: Wall mounted thermostat, non-programmable, dial adjustment between 44 degrees F and 86 degrees F, gold color. Basis of Design: Honeywell T65.
- C. Provide opaque locking guards on new thermostats. Provide matching key for covers.

2.3 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

- A. See Division 28 for Products.

2.4 RELAYS AND CONTACTORS

- A. Provide relays and contactors where required or as shown on Drawing to meet operating sequence where not internal to manufacturer's equipment.
- B. Furnish relays or contactors with required coil voltage and contact amperage rating for use specified on Drawing and in manufacturer's equipment.
- C. Mount relays in single control cabinet with hinge door and latch.
- D. Control cabinet contains relays and numbered terminal strips for connection of relays and field wiring. Mount cabinet on painted plywood panel securely attached to wall framing. Mount time clock, transformer and motor contactors (if required) on plywood adjacent to control panel.

2.5 TRANSFORMERS

- A. Transformers selected and sized for appropriate VAC capacity and installed and fused according to applicable codes. Provide wiring to nearest suitable power source as required.

2.6 WIRING

- A. In accordance with Division 26, Electrical and applicable codes.
- B. Provide line and low voltage wiring relating to control system. Includes wiring of contactors, relays, circuits, and incidental power wiring: operation power for time clock, power when run through stat/timeclock/relay, transformers.

2.7 DAMPER OPERATORS

- A. Size operators to operate dampers properly against system pressures, pressure differentials and velocities. Damper operators sized for 150 percent of damper forces normally encountered. Spring return closed for outside air applications.

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

- A. AC Units: Room thermostats to modulate economizer cycle, cooling and heating in sequence to maintain setpoint. Provide motorized low leakage outside air dampers. Dampers to be closed on fan shutdown and during NLL operation. Program thermostats to time schedule coordinated with Contracting Officer. See below for fire shut-down.
- B. Night Low Limit: Provide night low limit thermostat to bypass system clock to maintain night setting of 60 degrees F.
- C. Exhaust Fans:
 - 1. EF-1, EF-2 and EF-3: Controlled from wall switch. Provide delay-off relay and set to turn fan off 5-minutes after switch is turned off.
 - 2. EF-4
 - a. Line voltage room thermostat runs fan when space temperature exceeds 80 F (adj) and stops fan when space temperature falls to 2 degrees F or more, below setpoint.
 - b. Monitor room temperature and generate an alarm at high room temperature.
 - 3. Supply Fan (SF-1 through SF-8)
 - a. Determine minimum fan speed in cooperation with the Test and Balance Agent, with an initial speed of 20 percent of fan peak design speed. Limit fan speed change to 33 percent per minute during startup only and to 10 percent at other times.
 - b. Control fan speed to maintain duct static pressure setpoint at remote duct static pressure sensor located downstream of supply fan at approximately 2/3 length of ductwork, with minimum speed as determined above.
 - c.

3.2 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

- A. Smoke detector furnished and powered/wired under Division 28, Electronic Safety and Security. Coordinate with fire alarm equipment supplier. Installation of duct smoke detector housing and sampling tube under Division 23, HVAC.
- B. Install smoke detectors in return air systems greater than 2000 CFM.
- C. Install smoke detectors at each story prior to connection to return air riser in systems greater than 15,000 CFM and serving more than one story.

3.3 INSTALLATION OF AUXILIARY CONTROL DEVICES

A. General:

1. Install sensors and thermostats in accordance with manufacturer's recommendations.
2. Room sensors and thermostats installed at 48-inches AFF to midline of sensor on concealed junction boxes properly supported by wall framing at the locations shown on the Drawings.

B. Actuators:

1. General:
 - a. Mount and link control damper actuators according to manufacturer's instructions.
 - b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
2. Actuator Mounting for Damper and Valve arrangements to comply to the following:
 - a. Damper Actuators: Do not install in the air stream.
 - b. Use a weather proof enclosure (clear and see through) if actuators are located outside.
 - c. Damper or valve actuator ambient temperature not-to-exceed 122 degrees F through any combination of medium temperature or surrounding air. Provide appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation as necessary. Mount per manufacturer's recommendations.
 - d. Actuator cords or conduit to incorporate a drip leg if condensation is possible. Do not allow water to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point to be avoided to prevent water from condensing in conduit and running into actuator.

END OF SECTION

SECTION 23 21 13 - HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Refrigerant Piping

1.2 RELATED SECTIONS

- ##### A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Failed test results and corrective action taken to achieve requirements.
3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.
4. Grooved couplings, fittings, valves, and specialties: Show grooved joint couplings and fittings on Shop Drawings and product submittals, and specifically identify with the applicable coupling style number.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.
2. Welder Qualifications: Certify in accordance with ASME (BPV IX).
3. ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.
4. Grooved couplings, fittings, valves, and specialties: Provide all grooved couplings, fittings, valves, and specialty products from a single manufacturer. Utilize only grooving tools from the same manufacturer as the grooved components. Date-stamp all castings used for couplings housings, fittings, or valve and specialty bodies for quality assurance and traceability.
5. Refrigerant Piping:
 - a. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX "Welding and Brazing Qualifications."
 - b. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
 - c. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
 - d. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical" or UL 429 "Electrically Operated Valves."

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Piping:
 1. Copper Tube: ASTM B 280, Type ACR, annealed-temper tube, clean, dry and capped.
 - a. Fittings: ASME B16.22 wrought copper.
 - b. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy (15 percent Silver).
- B. Valves:
 1. Manufacturers:

- a. Hansen Technologies Corporation
 - b. Henry Technologies
 - c. Danfoss Flomatic
 - d. Substitutions: See Section 23 00 00, HVAC Basic Requirements, Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
2. Packaged Ball Valves:
- a. Two piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of and maximum temperature of 300 degrees F.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written instructions and requirements.
- B. Install hydronic piping in accordance with the following:

	Above Grade			Below Grade Preinsulated Pipe					Below Grade Uninsulated Piping			
Service	W/S	GC	Cu	Stl	Cu	PEX	PVC	HDPE	Stl	Cu	PVC	HDPE
Chilled Water	X	X	X	X					N/A	N/A	N/A	N/A
Heating Hot Water	X		X	X			N/A		N/A	N/A	N/A	N/A
Condenser Water	X	X	X						X	X		

- 1. Key:
 - a. W/S Welded/Screwed Steel
 - b. GC Grooved Coupling Steel
 - c. Cu Copper
 - d. Stl Steel
- C. Preparation:
 - 1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
 - 2. Remove scale and dirt on inside and outside before assembly.
 - 3. Prepare piping connections to equipment with flanges or unions.

4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

D. Above Grade Piping Installation:

1. Install per manufacturer's written instructions and requirements.
2. Install heating water, glycol, condenser water, piping to ASME B31.9 requirements.
3. Route piping in orderly manner, parallel to building structure, and maintain gradient.
4. Install piping to conserve building space and to avoid interference with use of space.
5. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
6. Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.
7. Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.
8. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
9. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
10. Drawings are diagrammatic and do not necessarily show top connections in all cases. Install branch connections to mains using tee fittings in main, with takeoff coming out of the top unless trade coordination conditions preclude it.
11. Anchor piping for proper direction of expansion and contraction.
12. Inserts:
 - a. Provide inserts for placement in concrete formwork.
 - b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
 - d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
13. Pipe Hangers and Supports:

- a. Install in accordance with Division 23, HVAC, Hangers and Supports.
 - b. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - c. Place hangers within 12-inches of each horizontal elbow.
 - d. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - e. Support vertical piping at top, bottom, and not less than every other floor. Support riser piping independently of connected horizontal piping.
 - f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - g. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
 - h. Provide copper plated hangers and supports for copper piping.
 - i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- 14. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 15. Provide access where valves and fittings are not exposed.
 - 16. Use eccentric reducers to maintain top of pipe level.
 - 17. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
 - 18. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- E. Field Quality Control:
- 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush system with clean water. Clean strainers.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.

5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
6. Perform the following tests on hydronic piping:
 - a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - b. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
 - c. Check expansion tanks to determine that they are not air bound and that system is full of water.
 - d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
 - e. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 - f. Prepare written report of testing.

F. Flushing and Cleaning of Piping Systems:

1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.
2. Use temporary strainers and temporary pumps that can create fluid velocities up to 10 feet per second to flush and clean the piping systems. Do not use Contracting Officer's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.
3. When constructing minor piping modifications or additions, verify with Contracting Officer if the Contracting Officer's pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, ensure the strainer baskets and screens installed in the piping systems permanent strainers are replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Contracting Officer. Fit the Contracting Officer's strainers with a line size blowoff valve.

4. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.
5. Circulate a chemical cleaner in chilled and heating water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The chilled and heating water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Contracting Officer so that the reinstallation of clean strainer screens may be witnessed.

G. Pipe Painting Requirements:

1. Paint all ferrous metal pipe including flanges. Do not paint flange bolts, washers and nuts. At flexible coupling the only the flanges are to be painted. All rubber portions are to remain unpainted.
2. Paint exterior uninsulated steel piping with exterior latex, semi-gloss (AE), Master Painters Institute MPI 11, suitable for metallic surfaces B, Haze Gray color.
3. Use ready-mixed (including colors) paint. Prime paint with pigment and vehicle, compatible with substrate and finish coats specified. Volatile Organic Compounds (VOC) content of paint materials shall not exceed 50g/l for exterior latex paints and primers. Lead-based paint is not permitted.
4. Do not apply coating when air or substrate conditions are:
 - a. Less than 5 degrees F above dew point.
 - b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the product manufacturer.
5. Do no exterior painting when it is windy and dusty. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
6. Apply only on clean, dry and frost-free surface. Remove all materials the will affect the ability of the paint to adhere to the pipe including painted pipe identification labels.
7. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. All surfaces are to be dry at the time paint is applied.
8. Apply paint in two coats; prime, and finish. Apply each coat evenly and cover substrate completely. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions.

9. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects. Apply by brush, roller or spray.

3.2 REFRIGERANT PIPING INSTALLATION

- A. Install systems in accordance with ASHRAE Standard 15.
- B. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- C. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- D. Flood piping system with nitrogen when brazing.
- E. Follow ASHRAE Standard 15 procedures for charging and purging of systems and for disposal of refrigerant.
- F. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- G. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- H. Fully charge completed system with refrigerant after testing.
- I. Field Quality Control:
 1. Test refrigeration system in accordance with ASME B31.5.
 2. Pressure test system with dry nitrogen to 200 PSI. Perform final tests at 27-inches vacuum and 200 PSI using electronic leak detector. Test to no leakage.

END OF SECTION 23 21 13

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Ductwork, Joints and Fittings
2. Insulated Flexible Duct
3. Ductwork Joint Sealers and Sealants

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates
2. Field Quality Control Reports

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NFPA Compliance:
 - a. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
 - b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.

2. Comply with NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, Ch. 3, Duct System for range hood ducts, unless otherwise indicated.
3. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
4. Provide ductwork pressure testing and leakage testing per Section 23 05 93, Testing, Adjusting and Balancing for HVAC.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Contracting Officer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.1 DUCTWORK, JOINTS AND FITTINGS

A. Manufacturers:

1. Ductmate
2. Lindab Inc.
3. Nexus Inc.
4. SEMCO
5. United McGill Corporation
6. Ward Industries

B. Materials:

1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating. Ducts to have mill phosphatized finish for surfaces exposed to view.

2. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts with liquid-tight joints when containing condensate vapor or liquids in suspension.
 3. Stainless Steel: Fabricated in accordance with ASTM A167 and A480 with liquid-tight joints when containing condensate vapor or liquids in suspension.
- C. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
 3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- D. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
 2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
 3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.
- E. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
 4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

- F. 90-Degree Tees and laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.
- G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
 - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
 - a. Ducts 3- to 36-inches in Diameter: 0.034-inch .
 - b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
 - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
 - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
 - 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
 - a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
 - b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
 - c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
 - d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
 - 4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 - 5. Round Elbows:
 - a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.

- b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 - c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
- 6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
- 7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- 8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
- 9. Not acceptable:
 - a. Corrugated or flexible metal duct.
 - b. Adjustable elbows.

2.2 INSULATED FLEXIBLE DUCT

- A. Manufacturers:
 - 1. ATCO
 - 2. Flexmaster
 - 3. J.P. Lamborn Co.
 - 4. Hart and Cooley
- B. Construction: Standard factory fabricated product. Inner wall: Impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix.
- C. Insulation: Fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier.
- D. Listing: UL 181 listed Class 1 flexible air duct material. Overall thermal transmission: No more than 0.25 BTU/in or hr/sq. degrees F at 75 degrees F differential, per ASTM C335.
- E. Vapor transmission value no more than 0.10 perm, per ASTM E96.
- F. Pressure Rating: 4-inch wg positive pressure and 1-inch wg negative pressure.
- G. Performance Air Friction Correction Factor: 1.3 maximum at 95 percent extension. Working air velocity: Minimum 2000 FPM.

- H. Flame Spread Rating: No more than 25.
- I. Smoke Development Rating: No more than 50 as tested per ASTM E84.
- J. Insertion Loss: Minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter at 500 Hz.

2.3 DUCTWORK JOINT SEALERS AND SEALANTS

- A. Manufacturers:
 - 1. Ductmate
 - 2. Duro Dyne
 - 3. Hardcast
 - 4. United McGill Corporation
 - 5. Vulkem
 - 6. Foster
 - 7. Childer
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
- C. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
- D. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.
- E. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
- F. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.
- G. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
- H. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- I. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Medium pressure supply (fan to terminal unit)	0.5-inch higher than air handlers discharge pressure (min 4-inch pressure class).	A	3	6
Low pressure (downstream of terminal unit)	+ 1-inch	A	3	6
Return and exhaust	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	3	6

- B. Ductwork Installation:

- General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
- The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Contracting Officer determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Contracting Officer.
- Install ducts with fewest possible joints.

4. Install fabricated fittings for changes in directions, size, shape, and for connections.
5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.
9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
11. Electrical and IT Equipment Spaces: route ducts to avoid passing through transformer vaults, electrical equipment spaces, IDF/MPOE rooms, and enclosures.
12. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.
13. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and Contracting Officer, including sleeves, and firestopping sealant.
14. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Reference Mason Seismic Restraint and Support Systems.
15. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
16. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
17. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Contracting Officer prior to any fabrication. Provide fittings for construction per SMACNA.

18. Install flexible ductwork to limit sag between support hangers to 1/2-inch per foot of spacing support.

C. Flanged Take-Offs:

1. Install at branch takeoffs to outlets using round or flex duct.
2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:

1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
2. Grille and Exposed Duct Cleaning:
 - a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.
 - b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.
 - c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

3.2 DUCTWORK, JOINTS AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:

1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Supply, Return, Transfer, and Exhaust - Low Pressure (downstream of terminal units)	Single Wall, Galvanized Steel
Supply, Return, and Exhaust - Medium Pressure (upstream of terminal units)	Single Wall, Galvanized Steel
General Exhaust Branch Serving Air Inlet in Shower Room or Toilet Room with Shower	Single Wall, Aluminum or Type 304 Stainless Steel

B. Ductwork Installation:

1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.3 INSULATED FLEXIBLE DUCT INSTALLATION

- A. Provide sheet metal plenum or rigid elbow and connect to diffusers and grilles with ductwork connections. Refer to Drawings for more information. Provide straight section of flexible duct with minimum length of 2-feet and maximum length of 5-feet and connect to sheet metal plenums and rigid elbows connected to diffusers and grilles, unless noted otherwise.
 1. Provide round neck grilles/diffusers or square-to-round transitions. Flexible duct connections directly to diffuser and grilles is not allowed.
 2. Flexible duct allowed in concealed spaces above lay-in ceilings only.

3.4 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

- A. Joints and Seam Joint Sealing:
 1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
 2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
 3. Seal ducts before external insulation is applied.
 4. Tape joints of PVC coated metal ductwork with PVC tape.
 5. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
 6. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
 7. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.

8. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
9. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
10. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
11. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
12. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sheet Metal Materials
2. Backdraft Dampers
3. Dampers
4. Concealed Damper Hardware
5. Access Doors
6. Duct Test Holes
7. Turning Vanes
8. Flexible Connectors

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory. Include leakage, pressure drop and maximum back pressure data.
2. Shop Drawings: Indicate air duct accessories.
3. Manufacturer's installation instructions: Provide instructions for each factory fabricated duct accessory.
4. Maintenance Materials: Furnish the following for Contracting Officer's use in maintenance of project.

- a. See Division 01, General Requirements, Product Requirements for additional provisions.
- b. Extra Fusible Links: One of each type and size.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum five years of documented experience.
 - 2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
 - 3. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
 - 4. AMCA 511 - Certified Ratings Program for Air Control Devices.
 - 5. AMCA 611, latest edition - Certified Ratings Program - Product Rating Manual for Airflow Measurement Stations.
 - 6. AMCA 610, latest edition - Laboratory Methods of Testing Airflow Measurement Stations for Performance Rating.
 - 7. CSFM - California State Fire Marshal Listing for Fire Damper and Smoke Damper.
 - 8. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
 - 9. NFPA 92A - Smoke-Control Systems.
 - 10. NFPA 92B - Smoke Control Systems in Atria, Covered Malls and Large Areas.
 - 11. NFPA 101 - Life Safety Code.
 - 12. UL 555 - Standard for Safety; Fire Dampers.
 - 13. UL 555S - Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M. Galvanizing: 1-1/4 ounces per square foot total both sides; ducts to have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

2.2 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Air Balance
 - 2. Cesco
 - 3. Greenheck
 - 4. Nailor
 - 5. Ruskin
- B. Basis-of-Design: Ruskin CB D6.
- C. Description: Multiple-blade gravity balanced with center pivoted blades with sealed edges, assembled in rattle free manner with 90-degree stop, adjustment device to permit setting for varying differential static pressure.
- D. Frame: 0.125-inch thick 6063-T5 extruded aluminum channel with galvanized steel braces at mitered corners. Provide mounting flange.
- E. Blades: Single piece, overlap frame, parallel action, horizontal orientation, minimum 0.07-inch 6063-T5 extruded aluminum material, maximum 6-inch width.
- F. Bearings: Corrosion-resistant synthetic, formed as single piece with axles.
- G. Blade Seals: Extruded vinyl, mechanically attached to blade edge.

- H. Blade Axles: Corrosion-resistant, synthetic formed as single piece with bearings, locked to blade.
 - I. Tie Bars and Brackets: Galvanized steel.
 - J. Return Spring: Adjustable tension.
 - K. Damper Capacity:
 - 1. Closed Position: Maximum back pressure of 16-inches water gauge.
 - 2. Open Position: Maximum air velocity of 2,500-feet per minute.
 - L. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade. Must be capable of operating over wide range of pressures.
 - M. Finish: Mill aluminum.
 - N. Temperature Rating: -40 degrees F to 200 degrees F.
 - O. Operation of Blade:
 - 1. Start to Open: 0.01-inch wg
 - 2. Fully Open: 0.05-inch.
 - P. Pressure Drop: Maximum 0.15-inch wg at 1,500-feet per minute through 24-inch by 24-inch damper.
 - Q. Factory Sleeve: Minimum 20 gauge thickness, 12-inches in length.
 - R. Screen: At outdoor intake or discharge. 1/4-inch aluminum.
- 2.3 DAMPERS
- A. Manufacturers:
 - 1. Air Balance
 - 2. Cesco
 - 3. Greenheck
 - 4. Nailor
 - 5. Ruskin
 - B. Basis-of-Design:
 - 1. Rectangular ductwork for velocities and pressures up to 1,500 fpm and 2.5-inch wg, respectively: Ruskin MD-35.

2. Rectangular ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CD-60.
 3. Round ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CDSR-15.
- C. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- D. Rectangular Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design with linkage concealed in frame and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 - a. Roll-Formed Steel Blades: Galvanized sheet steel, 16 gauge thick for velocities up to 1,500 fpm, and 14 gauge thick for velocities up to 3,000 fpm.
 - b. Blade Axles: Minimum 1/2-inch diameter, plated steel, hex shaped, mechanically attached to blade.
 - c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
 - d. Tie Bars and Brackets: Galvanized steel.
 - e. Mill galvanized.
- E. Round Volume Dampers: Single-blade suitable for horizontal or vertical applications.
1. Steel Frames: Galvanized, roll formed, minimum of 20 gauge thick with beads at each end.
 2. Blades: Minimum 14 gauge thick, galvanized sheet steel, round, single-piece.
 3. Blade Axles: Minimum 1/2-inch square, plated steel, mechanically attached to blade.
 4. Bearings: Molded synthetic sleeve, turning in hole in frame.
 5. Finish: Mill galvanized.
 6. Capacity:
 - a. Closed Position: Maximum pressure of 4-inches wg.

- b. Open Position: Maximum air velocity of 3,000-feet per minute.
- 7. Leakage: Maximum 20 cfm at 4-inches wg.
- 8. Pressure Drop: Maximum 0.02-inch wg at 1,500-feet per minute through 20-inch diameter dampers.
- F. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
 - 2. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include 2-inch elevated platform for insulated duct mounting.

2.4 CONCEALED DAMPER HARDWARE

- A. Manufacturers:
 - 1. Young Regulator Company
- B. Concealed Damper Hardware: For dampers above non-removable ceilings (gyp, plaster, decorative, etc.) where access panels have not been shown on Architectural drawings or in locations where dampers are more than 2-feet above the ceiling, provide:
 - 1. Concealed Damper Regulator: Young Regulator Company Model 315 or approved equivalent.
 - 2. Cable System: Young Regulator Company or approved equivalent.
 - 3. Controller: Young Regulator Company 270-275 or approved equivalent.
 - 4. Control wrenches, wire stops, casing nuts, and stainless steel wire.
 - 5. Paint cover plate to match ceiling color or as directed by Contracting Officer.

2.5 ACCESS DOORS

- A. Manufacturers:
 - 1. Ductmate
 - 2. Cesco
 - 3. Ruskin
 - 4. Nailor

- B. Duct Pressure Class 2-inch WC and Greater: Sandwich-type design with threaded locking bolt assembly. Closed cell neoprene gasket permanently bonded to inside panel. Zinc-coated steel wing nuts or polypropylene molded knobs with threaded metal inserts - zinc coated bolts sealed to inner panel.
- C. Duct Pressure Class 1-1/2-inch WC and Less: Galvanized steel assembly incorporating frame, door, hinges, and latch(es). Frame tabbed for attachment to duct panel. Double wall door panel with 1-inch insulation. Open cell neoprene gasket attached to frame. Cam latches for tight closure.
- D. Plenum Doors: Extruded aluminum frames with extruded santoprene seals. Double-wall 20 gauge galvanized steel door panel with fiberglass insulation.
- E. Size: Maximum size available to fit rectangular duct panel dimension or round duct diameter. Plenum doors minimum 2-feet wide by 4-feet high.
- F. For outdoor installation, only provide waterproof access doors installed vertically.

2.6 DUCT TEST HOLES

- A. Manufacturers:
 - 1. Ventlok
- B. Temporary 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.
- C. Permanent Test Holes (where shown on Drawings): Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 TURNING VANES

- A. Manufacturers:
 - 1. Aerodyne
 - 2. Ductmate Industries
 - 3. Duro Dyno Corp.
 - 4. Metalaire Inc.
- B. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners to automatically align vanes.
- C. Manufactured Turning Vanes: For medium pressure ductwork, ductwork upstream of terminal units, and in ductwork with equal inlet width and height dimensions and outlet width and height dimension, provide double thickness airfoil turning vanes. Low pressure ductwork and

ductwork downstream of terminal units use either single thickness or double thickness turning vanes. For mitered rectangular elbows with changes in size from inlet to outlet, only use single thickness turning vanes. Use 2-inch radius vanes spaced on centers of 1.5-inches for single thickness. Use 2-inch radius vanes spaced on centers of 2.125-inches for double thickness.

- D. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics Inc.
3. Ductmate Industries
4. Hardcast

- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 4-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. Select metal compatible with ducts.

- D. Provide a spring and bracket assembly to reinforce the fabric with sufficient tension to prevent connector collapse under negative or positive pressure. Number and positioning of spring-link fixture to be determined by the manufacturer to maintain straight axis and without kinks between two sections of duct, or between duct and the moving element. Hardcast Spring-Link SL-200, or equal.

- E. Indoor System, Flexible Connector Fabric (FC-I): Glass fabric double coated with neoprene.

1. Minimum Weight: 30 ounces per square yard.
2. Tensile Strength: 395 pounds of force per inch in the warp and 255 pounds of force per inch in the filling.
3. Service Temperature: -40 degrees F to 200 degrees F.

PART 3 - EXECUTION

3.1 DUCT ACCESSORIES GENERAL INSTALLATION

- A. Inspect areas to receive air duct accessories. Notify Contracting Officer of conditions that would adversely affect the installation of the dampers. Do not proceed until conditions are corrected.

- B. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- D. Do not compress or stretch damper frames into duct or opening.
- E. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators, or jack shafts.
- F. Adjust duct accessories for proper settings.

3.2 SHEET METAL MATERIALS INSTALLATION

- A. Install bracing for multiple sections to support assembly weights and hold against system pressure. Install bracing as needed.

3.3 BACKDRAFT DAMPERS INSTALLATION

- A. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Provide at outside air intakes where motorized dampers are not shown on drawings.

3.4 DAMPERS INSTALLATION

- A. Where installing volume dampers in ducts with liner, avoid damage to and erosion of duct liner.
- B. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts for air balancing. Install at a minimum of two duct widths from each branch takeoff. Provide balancing dampers for all air inlets and outlets.
- C. Install dampers square and free from racking with blade running horizontally.

3.5 CONCEALED DAMPER HARDWARE INSTALLATION

- A. Coordinate location in Reflected Ceiling Plan and color of concealed damper hardware with Contracting Officer prior to installation.

3.6 ACCESS DOORS INSTALLATION

- A. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
 - 1. On both sides of duct coils.
 - 2. Downstream from volume dampers, turning vanes and equipment.
 - 3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.

4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. Install the following sizes for duct-mounting, rectangular access doors:
 - a. One-Hand or Inspection Access: 8-inches by 5-inches.
 - b. Two-Hand Access: 12-inches by 6-inches.
 - c. Head and Hand Access: 18-inches by 10-inches.
 - d. Head and Shoulders Access: 21-inches by 14-inches.
 - e. Body Access: 25-inches by 14-inches.
 - f. Body Plus Ladder Access: 25-inches by 17-inches.
6. Install the following sizes for duct-mounting, round access doors:
 - a. One-Hand or Inspection Access: 8-inches in diameter.
 - b. Two-Hand Access: 10-inches in diameter.
 - c. Head and Hand Access: 12-inches in diameter.
 - d. Head and Shoulders Access: 18-inches in diameter.
 - e. Body Access: 24-inches in diameter.
7. Label access doors.

3.7 DUCT TEST HOLES INSTALLATION

- A. Provide test holes at fan inlets and outlets where indicated and where required for air testing and balancing.

3.8 TURNING VANES INSTALLATION

- A. Vanes must be installed, eliminating every other vane is not allowed.
- B. Single thickness vanes cannot be over 36-inches long without intermediate vane runner.
- C. Install per SMACNA and fasten/support to prevent vibration, noise, and to maintain proper alignment at design velocity.

3.9 FLEXIBLE CONNECTORS INSTALLATION

- A. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Provide sheet metal weather cover over flexible connections located outdoors. Attach sheet metal to either equipment side or ductwork side, but not both.

- B. Per NFPA, do not use flexible connectors on grease exhaust fans.
- C. Securely attach spring-lock brackets to the metal strips of the connector collar using No. 8 sheet metal screws.
- D. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- E. Adjust the following types in the following locations:
 - 1. FC-I: Indoors.

END OF SECTION

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Centrifugal Fans
2. In-Line Centrifugal Fans
3. High Volume Low Speed Fans

1.2 RELATED SECTIONS

- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gauges and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Motors: Premium efficiency per Section 23 05 13, Common Motor Requirements for HVAC Equipment. Electrically Commutated Motors (ECM) where scheduled on Drawings.

2. Sound power levels as scheduled on Drawings. If not scheduled, within 5 percent of Basis of Design at design flow.
3. Project Altitude: Base air ratings on sea-level conditions for project sites below 2,000 feet in elevation. Base air ratings on actual site elevations for project sites above 2,000 feet in elevation.
4. Operating Limits: Classify according to AMCA 99.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Contracting Officer, and marked for intended use.
6. AMCA Compliance: Products are to comply with performance requirements and are to be licensed to use the AMCA-Certified Ratings Seal.
7. NEMA Compliance: Motors and electrical accessories are to comply with NEMA standards.
8. UL Standard: HVAC Fans are to comply with UL 705. Fans used in grease exhaust applications are to be UL 762 listed for grease exhaust.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Centrifugal Fans:

1. Greenheck
2. Cook
3. Twin City

B. In-Line Centrifugal Fans:

1. Greenheck
2. Cook
3. Twin City

C. High Volume Low Speed Fans:

1. Big Ass Fans
2. Kelley
3. MacroAir

2.2 CENTRIFUGAL FANS

A. Description: Centrifugal or utility type centrifugal fans, as indicated, standard factory finish, AMCA rated, single width, single inlet, double width, double inlet, forward curved, backward inclined, or airfoil blades as scheduled.

B. Wheel and Inlet:

1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
2. Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
3. Statically and dynamically balance wheel within its own bearings with maximum balance quality grade at bearings of G16 (0.20 in/sec peak velocity, filter-in as measured at fan RPM) for 5 hp and below and G6.3 (0.15 in/sec peak velocity, filter-in as measured at fan RPM) for 7.5 hp and above per ANSI S2.19. AMCA 210 rated.

C. Housing:

1. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.
2. Finish: Factory finish to manufacturer's standard (Permatector) or Factory finish to manufacturer's standard with Hi-Pro polyester finish exceeding 1,000 hours of salt spray under ASTM B117 test method. For fans handling air downstream of humidifiers, provide two additional coats of paint or fabricate of galvanized steel. Prime coating of aluminum parts is not allowed.
3. Removable angles and bolts for attaching flexible connections and discharge dampers on fan outlet.
4. Housing Discharge Arrangement: Adjustable to eight standard positions.

D. Bearings and Drives:

1. Bearings: Heavy duty pillow block type, self-greasing ball bearings, with ABMA 9 L-10 life at 100,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard. Provide anti-corrosive coating.
3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.
4. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
5. Belt Guard: Fabricate to SMACNA Duct Construction Standards - Metal and Flexible; 0.106-inch thick, 3/4-inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

E. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.

F. Accessories:

1. Inlet/Outlet Screens: Galvanized steel welded grid, removable, at unit outlet for outdoor installation, and unit inlet for unducted conditions.
2. Access Doors: Shaped to conform to scroll, with quick opening latch type handles and gaskets.
3. Scroll Drain: 1/2-inch steel pipe coupling welded to low point of fan scroll for outdoor installation.

4. AMCA 99 Type B spark proof construction where scheduled.
5. Protective coating on fan wheel and interior of fan housing where scheduled. Apply coating before balancing fans and repair any breaks in coating which occur during balancing. One 6-mil coat of white plastic #7122 and one 6-mil coat of black plastic #7122.
6. Vibration isolation as scheduled and specified. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

2.3 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, belt-driven, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- B. Wheel: Cast aluminum backward inclined with inlet cone statically and dynamically balanced within its own bearings.
- C. Housing:
 1. Heavy gauge steel or aluminum housing, suitable for Fan Class, factory standard finish.
 2. Removable panels for access to all interior components.
 3. Horizontal or vertical configuration, as indicated.
 4. Inlet and discharge duct collars.
 5. 1-inch thick, 1.5 pounds per cubic foot density fiberglass liner.
 6. Aluminum straightening vanes.
 7. Support bracket adaptable to floor, sidewall, or ceiling mounting.
- D. Bearings and Drives:
 1. Bearings: Heavy duty pillow block type, self greasing ball bearings with ABMA 9 life at 50,000 hours.
 2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
 3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor. Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts

within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

- a. Inverter duty motor for use with variable frequency drive where indicated on Fan Schedule on Drawings.
- 4. Drive: Direct drive matched to fan loads with speed controller. Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
 - a. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.

E. Accessories:

- 1. Belt guard.
- 2. AMCA 99 Type B spark proof construction where scheduled.
- 3. Variable-Speed Controller: Provide solid-state control to reduce speed from 100 percent to less than 50 percent for motors 1/2 HP or smaller.
- 4. Discharge Dampers: Parallel blade for mixing or open/close applications and opposed blade for modulating . Heavy duty steel or aluminum, where scheduled. Damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
- 5. Flat roof cap.
- 6. Hooded wall cap.
- 7. Pitched roof cap.
- 8. Elbow discharge with grille.
- 9. Louvered wall discharge with bird screen.

F. Inlet/Outlet Screens: Galvanized steel welded grid, removable.

G. Vibration Isolation: Wheel and motor mounted on integral double deflection neoprene isolators.

H. Vibration isolation as scheduled and specified. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

- 1. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.

2.4 HIGH VOLUME LOW SPEED FANS

- A. General: Fan designed to move air for cooling, air movement, and destratification in large spaces. The fan and components designed specifically for high volume and low speed.
- B. Comply with ANSI/AMCA 230-07.
- C. Sound levels from the fan operating at maximum speed not to exceed 40dBA in accordance with ANSI/AMCA 230-07.
- D. Fan blades: extruded aluminum, airfoil shape optimized for high airflow movement, winglets designed to direct outward airflow downward.
- E. Motor: Constructed with permanent magnet brushless motor rated for continuous operation at maximum speed with capability of modulating the fan speed from 0 - 100 percent in 0 degrees F to 122 degrees F ambient conditions.
- F. Mounting System: Designed for quick and secure installation from a structural support beam. All components in the mounting system welded construction using powder coated steel.
- G. Provide safety cables for additional means of securing the fan assembly to the building structure conditions.
- H. Controller: Integral Variable Frequency Drive (VFD) pre-wired to the motor. The controller prewired to the motor.
- I. Wall Control: Digital keypad device equipped with touchpad controls and an LCD for controlling the fan's spin direction, operation, and speed. Communication between the fan drive and controller by standard CAT5 or higher Ethernet cable.
- J. BAS/DDC Interface: Controller includes capability of monitoring and control by the BAS/DDC system, including control of fan on/off operation, speed, spin direction, status feedback, error reporting, and keypad lockout.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's instructions.
- B. Install power ventilators level and plumb.
- C. Fans used for exhaust of kitchen grease hoods are to be UL 762 listed for grease exhaust. Provide fans with grease terminator. Pipe from grease terminator to Code approved location.
- D. Fans used for exhaust of moist air are to be constructed of aluminum construction and be warranted for their application in moist conditions.

- E. Fans used in welding, chemical, and/or fume exhaust applications are to be of spark-proof construction and are to be protected with coatings as required to protect parts in the air stream from the chemicals and materials the fan will be exposed to.
- F. Install floor-mounting units on concrete bases.
- G. Units using vibration isolation devices are scheduled on Drawings.
- H. Support suspended units from structure threaded steel rods and vibration isolation device scheduled on Drawings.
- I. In seismic zones, restrain support units.
- J. Install units with clearances for service and maintenance.
- K. Provide fixed sheaves required for final air balance.
- L. Provide safety screen where inlet or outlet is exposed.
- M. Pipe scroll drains to nearest floor drain.
- N. Provide backdraft dampers on discharge of exhaust fans and as indicated on Drawings.
- O. Duct installation and connection requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors per Section 23 33 00, Air Duct Accessories.
- P. Install ducts adjacent to power ventilators to allow service and maintenance.
- Q. Ground equipment.
- R. 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.
- S. Equipment Startup Checks:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Verify lubrication from bearings and other moving parts.

6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

7. Disable automatic temperature-control operators.

T. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.

2. Measure and record voltage and amperage.

U. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

V. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

W. Shut unit down and reconnect automatic temperature-control operators.

X. Replace fan and motor pulleys as required to achieve design airflow.

Y. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

Z. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

AA. Adjust damper linkages for proper damper operation.

BB. Adjust belt tension.

CC. Lubricate bearings.

DD. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

EE. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

FF. Engage a factory-authorized service representative to train Contracting Officer's maintenance personnel to adjust, operate, and maintain HVAC fans. Train Contracting Officer's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.2 HIGH VOLUME LOW SPEED FANS

A. Minimum distance above floor is 10 feet in accordance with OSHA guidelines.

- B. Minimum distance between fan and any obstructions such as lights, cables, conduit, piping and building structure is 2 feet.
- C. Minimum distance between fan and sprinkler deflectors is 3 feet.
- D. All fans shall be interlocked to shut down immediately upon receiving a water flow signal from the alarm system in accordance with the requirements of NFPA 72.

END OF SECTION

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Grilles, Registers, Diffusers

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A.
- Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size and accessories furnished.

1.5 QUALITY ASSURANCE

- ##### A.
- Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Air Distribution Diffuser, Register, and Grille Schedule lists Basis of Design, with any specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design:
 - a. Construction materials and appearance.
 - b. Frame/installation method.
 - c. Isothermal throw plus or minus 5 percent at design flows shown on drawings.

- d. Noise Criteria: NC value plus or minus 1 at design flows shown on drawings.
- e. Accessories: Equal to Basis of Design.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC sections, where more than a single type is specified for the application, provide single selection for each product category.
- B. Grilles, Registers, Diffusers:
 - 1. Anemostat
 - 2. Carnes
 - 3. Environmental Air Products
 - 4. Krueger
 - 5. Metalaire
 - 6. Nailor
 - 7. Price Co.
 - 8. Shoemaker
 - 9. Titus
 - 10. Tuttle Bailey
 - 11. Seiho
 - 12. Or approved equivalent.

2.2 GRILLES, REGISTERS, DIFFUSERS

- A. Diffuser, Register and Grille Schedule lists Basis of Design, with specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design, including accessories and finish:
 - 1. Matching construction materials and appearance. Equal installation method/frame.
 - 2. Pressure drop equal to or less than Basis of Design at CFM on Drawings.

3. Throw: Isothermal jet throw plus or minus 5 percent of Basis of Design at CFM listed on Drawings.
 4. Noise Criteria: Plus or minus 1 NC of Basis of Design at CFM listed on Drawings. If Basis of Design NC is below registered level, submitted must match. NC rating with 10 dB room factor or less.
- B. Provide 1-, 2-, 3-, or 4-way deflection as indicated on Drawings.
 - C. Provide pattern controllers for linear supply air diffusers.
 - D. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturer same as grilles/diffuser.
 - E. Coordinate mounting frames with ceiling construction type. Verify per reflected ceiling plans.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install in accordance with manufacturer's instructions. Provide seismic supports, clips, and bracing per local code. Coordinate installation of framing. Provide complete coverage of rough openings by integral device flanges or auxiliary frames. Where above ceiling location is unconditioned space, caulk rough openings; repair and re-paint locations where dust entrainment streaks develop due to unsealed openings.
- B. Damp locations, such as lockers, restrooms, showers, natatoriums, whirlpool/spas, to have aluminum construction even if scheduled otherwise; mounting hardware to be stainless steel.
- C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- D. Unless otherwise shown on drawings, for ceiling mounted air outlets with adjustable airflow pattern controllers mounted at a height of 12 feet or less, adjust the air outlets for horizontal air distribution, and adjust to vertical air distribution for ceiling height above 12 feet.
- E. Exterior color of grilles per Contracting Officer. White finish if not otherwise scheduled or noted by Contracting Officer. Paint ductwork visible behind air outlets and inlets matte black.
- F. Ceiling Membrane: Protect ceiling membrane per code. Fire caulk around openings. Provide listed radiation damper in rated roof/ceiling or floor/ceiling assemblies as required per code.
- G. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.2 GRILLES, REGISTERS AND DIFFUSERS INSTALLATION

- A. Coordinate with Architectural Reflected Ceiling Plan(s). Reflected ceiling plans determine final locations.
- B. Install diffusers to ductwork with air tight connection. 18-inch straight duct section or acoustic plenum at connection. Provide square to round adapters where required for connection to round ducts.
- C. Provide integral balancing dampers for diffusers, and grilles and registers where duct manual balancing dampers are not shown or specified.
- D. Linear Slot Diffusers:
 - 1. Coordinate connection plenum dimensions with linear slot final dimensions to conform with manufacturer's recommendations, or as indicated. Total and active lengths as noted on drawings. Blank off unused sections. Coordinate frame type with Contracting Officer.
 - 2. Paint surfaces visible behind air outlets and inlets, including blank-off sections, matte black unless otherwise called for on drawings.

END OF SECTION 23 37 00

SECTION 23 40 00 - HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Disposable Panel Filters

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 01, General Requirements, Temporary Facilities and Controls: Filters for temporary heating and ventilating.
2. Division 26, Electrical, Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ANSI/AHRI 850 I-P - Performance Rating of Commercial and Industrial Air Filter Equipment.
2. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
3. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
4. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods; Military Specifications and Standards.
5. UL 586 - High Efficiency, Particulate, Air Filter Units; Underwriters Laboratories Inc.
6. UL 867 - Electrostatic Air Cleaners; Underwriters Laboratories Inc.
7. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.

1.4 SUBMITTALS

- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
 - 2. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
 - 3. Samples: Submit two samples of replacement filter media of each type and each filter frame.
 - 4. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.
 - 5. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.
 - 6. Maintenance Materials: Furnish the following for Contracting Officer's use in maintenance of project.
 - a. See Division 01, General Requirements for additional provisions.
 - b. Extra Filters: One set of each type and size.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. Conform to ANSI/AHRI 850 I-P - Performance Rating of Commercial and Industrial Air Filter Equipment, Section 7.4.
 - 1. Dust Spot Efficiency: Plus or minus 5 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Filters:

1. American Filtration Inc.
2. AAF International/American Air Filter
3. Camfil Farr Company
4. Eco-Air Products
5. Filtration Group
6. Flanders Corporation
7. Or approved equivalent.

2.2 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.

1. Nominal Size: 12 x 24-inches.
2. Thickness: 2-inch.

B. Performance Rating:

1. Face Velocity: 500 FPM.
2. Face Velocity: 350 FPM (2.54 m/sec).
3. Initial Resistance: 0.15-inch WG.
4. Initial Resistance: 0.23-inch WG (37 Pa).
5. Recommended Final Resistance: 0.50-inches WG.
6. MERV Rating: 13.

C. Casing: Cardboard frame.

D. Holding Frames: 20 gauge minimum galvanized steel frame with expanded metal grid on outlet side and steel rod grid on inlet side, hinged with pull and retaining handles.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install air cleaning devices in accordance with manufacturer's instructions.

- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Furnish and install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position/location. Adjust and level.
- D. Operation During Construction: If air handlers are operated during construction, provide treated 2-inch media construction filter in front of prefilters and replace periodically to prevent dirt carryover. Install clean prefilters prior to air balancing.
- E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- F. Provide filter gauges on filter banks, installed with separate static pressure tips upstream and downstream of filters.

3.2 SCHEDULES

- A. Air Filter Schedule
- B. Drawing Code
- C. Location
- D. Type
- E. Number
- F. Size
- G. Air Flow
- H. Face Velocity
- I. Overall Height
- J. Overall Width
- K. Initial Resistance
- L. Final Resistance

END OF SECTION 23 40 00

SECTION 26 00 00 - ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 01, General Requirements, Drawings, Addenda and Contracting Officer Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement
 - e. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. IFC - International Fire Code
 - 8. NFPA 101 Life Safety Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process
 - 7. ASTM - ASTM International
 - 8. CFR - Code of Federal Regulations
 - 9. EPA - Environmental Protection Agency
 - 10. ETL - Electrical Testing Laboratories
 - 11. FCC - Federal Communications Commission
 - 12. FM - FM Global

13. IBC - International Building Code
14. IEC - International Electrotechnical Commission
15. IEEE - Institute of Electrical and Electronics Engineers
16. IES - Illuminating Engineering Society
17. ISO - International Organization for Standardization
18. MSS - Manufacturers Standardization Society
19. NEC - National Electric Code
20. NECA - National Electrical Contractors Association
21. NEMA - National Electrical Manufacturers Association
22. NETA - National Electrical Testing Association
23. NFPA - National Fire Protection Association
24. OSHA - Occupational Safety and Health Administration
25. UL - Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification

Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Contracting Officer. Deviations will be returned without review.

- a. Provide separate submittals for power system study (per Specification Section 26 05 73) and electrical equipment (for example, switchboards and panelboards).
 - b. Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
 - c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Contracting Officer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural

components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:

- a. Make any corrections or change in submittals when required. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
- b. Resubmit for review until review indicates no exception taken or "make corrections as noted".

14. Operation and Maintenance Manuals, Contracting Officer's Instructions:

- a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - 1) Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
 - 3) Include Warranty per Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - 6) Include commissioning reports.
 - 7) Include copy of startup and test reports specific to each piece of equipment.
 - 8) Contracting Officer will return incomplete documentation without review. Contracting Officer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Contracting Officer's hourly rates.

- b. Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
- c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:

- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, show changes and deviations from the Drawings in red on one set of black-line drawings. Include written Addendums, RFIs, and change order items. Make changes to Drawings in a neat, clean, and legible manner.
- d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- F. Provide products that are UL listed.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prepare and submit coordinated layout drawings (composite drawings), prior to construction, to coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including plumbing, fire protection, electrical, ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements or Division 01, General Requirements, Division 23, HVAC to combine information furnished by other trades into master coordination documents.
- B. Prepare Drawings as follows:
 - 1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 - 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
 - 3. Incorporate Addenda items and change orders.
 - 4. Provide additional coordination as requested by other trades.

- C. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
- D. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 - 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer and Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 - 1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- F. Plenums:
 - 1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Contracting Officer of discrepancy.

- G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.
- B. General:
 - 1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of Contracting Officer.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by Contracting Officer.
 - 3. Provide stamped shop drawings from licensed Contracting Officer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
 - 4. Provide stamped shop drawings from licensed Contracting Officer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
 - 5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.

4. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.

C. Final Punch:

1. Prior to requesting a final punch visit from the Contracting Officer, request from Contracting Officer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Contracting Officer. Request a final punch visit from the Contracting Officer, upon Contracting Officer's acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm requirements in Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Contracting Officer.

3.6 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
 - 2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 - 3. Protect bus duct and similar items until in service.

3.7 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.8 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.9 INSTALLATION

- A. Confirm Installation requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.10 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Contracting Officer.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Contracting Officer.
 - 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

- A. Confirm requirements in Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

- a. Cleaning
- b. Operation and Maintenance Manuals
- c. Training of Operating Personnel
- d. Record Drawings
- e. Warranty and Guaranty Certificates
- f. Start-up/Test Document and Commissioning Reports

3.12 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Contracting Officer provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.13 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 26 00 05 - ELECTRICAL PRE-CLOSEOUT CHECKLIST

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grounding and Bonding
- B. Lighting
- C. Mechanical/Plumbing Equipment Installation
- D. Panelboards
- E. Raceways
- F. Static UPS
- G. Surge Protective Devices
- H. Switchboards

1.2 PRE-CLOSEOUT CHECKLIST SUBMITTAL

- A. Two weeks prior to the Contracting Officer's Punch-Walk request, complete and submit Pre-closeout Checklist to document compliance with the Contract Documents and that systems are functionally operational and ready for Closeout Inspection.
- B. A Closeout/Punch-Walk inspection will only be scheduled after completion of Pre-closeout Checklist and Contracting Officer's acceptance of its completeness.
- C. The Pre-closeout Checklist is a general guide to document compliance with the Contract Documents and is not an all-inclusive list of Contract requirements, and it is the responsibility of the Contractor to ensure the installation is complete and in full conformance with the Contract Documents.
- D. Complete and submit Pre-closeout Checklist, as indicated in Part 3.
- E. Unless all similar equipment have exactly the same level of completeness, reproduce the Checklist as needed and submit one checklist for each piece of equipment.

PART 2 - EQUIPMENT - NOT USED

PART 3 - INSTALLATION

3.1 PRE-CLOSEOUT CHECKLIST

- A. Grounding and Bonding
 - 1. Installation:

Yes	No	Task	Comment
		Concrete encased electrode (UFER) installed and connected.	
		Ground rods driven so that a minimum of 8 feet is in contact with soil. Any portion of ground rod remaining above ground, and connections to ground rod are protected from physical damage.	
		Test wells provided at ground rods where indicated in contract documents.	
		Water service and other metal piping bonded to grounding system.	
		Metal raceway systems bonded.	
		Equipment grounding conductors installed.	
		Receptacles tested for proper grounding and polarity.	
		Bonding and grounding properly torqued at all connection and termination points.	

2. Testing:

Yes	No	Task	Comment
		Grounding continuity tested and results submitted for each receptacle in patient care areas per NFPA 99.	
		Grounding system resistance to ground tested. Results not to exceed limits stated in specifications. Test results submitted.	
		Tests listed in NETA Standard AB and done in accordance with NETA standard ATS.	

B. Lighting

1. Installation:

Yes	No	Task	Comment
		Installed per manufacturer's instructions.	
		Luminaires uniformly aligned and level.	
		No interference with required clearances for other equipment.	

Yes	No	Task	Comment
		Emergency power provided to emergency egress luminaires.	
		UL 924 relays provided as required for intended luminaire control.	
		Unswitched hots provided to all night lights and exit signs.	
		Unswitched hots provided for battery charging.	
		Exit sign directional arrows in place.	
		All luminaires cleaned inside and out, and relamped per specifications.	
		Mounting support provided per IBC.	
		Concrete bases provided for pole mounted exterior luminaires.	
		All lamps are operational.	
		All ballasts within Contracting Officer acceptable noise level.	
		LED drivers access provided per manufacturer instructions. Provide close coordinations for areas with very high ceilings.	
		Surface mounted luminaires and exit signs properly secured to prevent movement.	
		Fire rating accessories and firestopping provided for recessed luminaires where required.	
		All specified luminaire accessories installed.	
		Grounding and bonding complete.	
		Adequate accessibility provided at remote ballasts and drivers. Conductors to remote ballasts and drivers are upsized as required for voltage drop.	
		Adjustable luminaires are adjusted and aimed as indicated in contract documents.	
		Any damage to luminaires has been repaired or luminaires replaced.	

2. Testing:

Yes	No	Task	Comment
		All luminaries are operational and properly connected. Demonstrate luminaires operation for minimum of 2	

		hours.	
--	--	--------	--

C. Mechanical/Plumbing Equipment Installation

1. Installation:

Yes	No	Task	Comment
		Power provided to equipment disconnects.	
		Power provided to equipment control panels.	
		Correct voltage provided to equipment.	
		Correct motor rotation verified.	
		Equipment disconnects and starters located within sight of equipment served.	
		Code clearance provided in and around disconnect switches and starters.	
		Lockable VFD installed. If not lockable then lockable disconnect installed ahead of VFD.	
		Terminations properly torqued.	
		Proper size fuses installed in disconnect switches.	
		Exterior disconnect switches and starters are type NEMA 3R or 4X.	
		Weatherproof maintenance receptacle provided within 25 feet of equipment.	
		If VFDs installed outdoors provide VFD's enclosures with strip heaters to prevent condensation.	

2. Controls:

Yes	No	Task	Comment
		Required controls installed.	

D. Panelboards

1. Installation:

Yes	No	Task	Comment
		Securely mounted and seismically braced as required.	
		Permanent ID label installed.	
		Arc-flash labels installed.	
		Electronic breakers settings set as per the Electrical Distribution Studies.	

Yes	No	Task	Comment
		Nameplates installed.	
		Grounding and bonding complete.	
		Interior and exterior clean of construction dust and debris.	
		Any damage to enclosure has been repaired or replaced.	
		Door(s) work and close properly.	
		Key works and door(s) lock properly.	
		Filler plates installed in all unused spaces.	
		Spare conduit provided out of recessed panels.	
		Typed panel directories are up to date and complete.	
		Permanent identification numbers installed at each pole position.	
		Handle guards provided where indicated on plans and as required by code.	
		Tie handles installed for multi-wire branch circuits (unless separate neutrals provided for each circuit).	
		AIC rating exceeds AFC noted on plans.	
		Panel wiring diagram, UL label, and short circuit rating provided on interior of panel.	
		Phase loads checked and balanced.	
		Breaker terminations are tight.	
		Feeder lugs torqued per manufacturer's instructions.	

2. Testing:

Yes	No	Task	Comment
		Shunt trip circuit breakers tested.	
		GFCI breakers tested.	
		Grounding and bonding tested.	

E. Raceways

1. Installation:

Yes	No	Task	Comment
		Installed per NECA 101.	
		Appropriate type used in exposed locations.	
		Hazardous locations installed per NEC	

Yes	No	Task	Comment
		501.	
		Pull stings installed in all empty conduit and secured at each end.	
		Caps provided at ends of empty conduit.	
		Labels provided at both ends of empty conduit with location of opposite end.	
		Flexible metal conduit used at motor and equipment connections subject to movement and/or vibration.	
		Metal conduit not in contact with HVAC ductwork, piping, or other objects or equipment.	
		Conduit minimum 12 inches away from steam and hot water radiant heating lines and 3 inches away from waste and water lines.	
		Supports provided per code.	
		No unrelated conduit in elevator equipment rooms.	
		No conduit runs between floors in stairwells.	
		Conduit fitting types per specifications.	
		Conduit fittings properly tightened and providing an effective ground path.	
		Appropriate fittings or assembly installed at expansion and seismic joints.	

F. Static UPS

1. Installation:

Yes	No	Task	Comment
		Concrete pad installed.	
		Nameplates installed.	
		Seismically braced.	
		Arc-flash labels installed.	
		Grounding and bonding complete.	
		Accessories installed and power provided.	
		Adequate lighting in room with emergency battery back-up.	
		Sequence of operation in compliance with specifications.	
		Interior and exterior clean of construction dust and debris.	

Yes	No	Task	Comment
		Any damage to enclosure has been repaired or replaced.	
		Feeder lugs torqued per manufacturer's instructions.	
		Adjustments and final connections supervised by manufacturer's field technician.	
		Control wire terminations and plugs checked for tightness and proper seating.	
		All alarms in "go" condition.	
		Service maintenance contract offered to Contracting Officer.	
		Spare parts provided.	

2. Controls:

Yes	No	Task	Comment
		Remote controls and monitoring in place and operational.	

3. Testing:

Yes	No	Task	Comment
		System testing supervised by manufacturer's field technician.	
		Battery discharge and recharge time measured and results submitted.	
		Utility power loss simulated.	
		Unit operated at 77 degrees F for eight hours.	
		DC bus tested for short circuit.	
		DC link holding voltage tested.	
		AC output voltage and wave forms checked.	
		Proper DC, walkup and AC phases checked.	
		DC link voltage and inverter ac output checked.	
		Voltage and phase rotation checked for input and bypass power.	
		Lamps checked and operating.	
		Synchronization tested.	
		Voltage difference between inverter input and bypass source checked.	

G. Surge Protective Devices

1. Installation:

Yes	No	Task	Comment
		Installed per manufacturer's instructions.	
		Securely mounted and seismically braced as required.	
		Permanent id label installed.	
		Grounding and bonding complete.	
		Interior and exterior clean of construction dust and debris.	
		Any damage to enclosure has been repaired or replaced.	
		Door(s) work and close properly.	
		Key works and door(s) lock properly.	
		Terminations torqued per manufacturer's recommendations.	

2. Controls:

Yes	No	Task	Comment
		Remote status monitoring installed and operational.	

3. Testing:

Yes	No	Task	Comment
		Tolerance limit tested.	

H. Switchboards

1. Installation:

Yes	No	Task	Comment
		Seismically braced.	
		Switches/breakers have permanent labels.	
		Arc-flash labels installed.	
		Nameplates installed.	
		Grounding and bonding complete.	
		Interior and exterior clean of construction dust and debris.	
		Housekeeping pad installed.	
		Any damage to enclosure has been repaired or replaced.	
		Electronic breakers settings set as per the Electrical Distribution Studies.	

Yes	No	Task	Comment
		AIC rating exceeds AFC noted on plans.	
		Busbars and feeder lugs torqued per manufacturer instructions.	
		Adjustable breaker trip and time delay settings set per fault current, coordination, and arc-flash studies.	
		Adequate ventilation in room.	

2. Testing:

Yes	No	Task	Comment
		Tested per NETA STD ATS, Section 7.1.	
		Insulation resistance tested with Megger and results submitted.	
		Key interlock systems checked, tested, and properly functioning.	
		Shunt trip circuit breakers tested.	
		Grounding and bonding tested.	
		Circuit breakers ground fault protection tested.	
		Control wiring tested.	

END OF SECTION

SECTION 26 05 09 - EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment connections, whether furnished by Contracting Officer or other Divisions of the Contract.

1.2 RELATED SECTIONS

- ##### A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition:

1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- ##### A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- ##### A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.2 GENERAL

- ##### A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:

1. 3/4 HP and Under: 120 volt, 1 phase.
 2. 1 HP and Over: 208 volt, 3 phase.
- B. Safety Switches: Provide as required by NEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Contracting Officer and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Contracting Officer and equipment furnished under the following divisions of work under this contract:
1. Division 8, Openings
 2. Division 11, Equipment
 3. Division 21, Fire Suppression
 4. Division 22, Plumbing
 5. Division 23, HVAC, Heating, Ventilating and Air Conditioning
 6. Division 27, Communications
 7. Division 28, Electronic Safety and Security

3.2 INSTALLATION

- A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Contracting Officer .
- B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
- C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
- D. Install motor starters and controllers for equipment furnished by others.
- E. Appliance/Utilization Equipment:
1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.

2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 01, General Requirements.

3.4 SYSTEMS STARTUP

- A. Provide field representative to prepare and start equipment.
 1. Test and correct for proper rotation of polyphase motors.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Contracting Officer.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Lugs and Pads
2. Wires and Cables
3. Connectors

1.2 RELATED SECTIONS

- ##### A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

- ##### A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- ##### A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lugs and Pads:

1. Anderson

2. IlSCO
3. Panduit
4. Thomas & Betts
5. 3M
6. Or approved equivalent.

B. Wires and Cables:

1. General:
 - a. General Cable
 - b. Okonite
 - c. Southwire
 - d. Encore Wire
 - e. Or approved equivalent.

C. Connectors:

1. Anderson Power Products
2. Burndy
3. IlSCO
4. 3M
5. Thomas & Betts
6. Or approved equivalent.

2.2 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.
- B. Copper Pads: Drilled and tapped for multiple conductor terminals.
- C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

- A. Building Wires:

1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2 above grade and XHHW-2 below grade.
- B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.
- C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

- D. MC Cable: Not allowed.
 - E. AC Cable (Armored Cable): Not allowed.
 - F. NMB Cable: Not allowed.
 - G. Service Entrance Cables: Shall be provided by Southern California Edison (SCE) Utility Company
- 2.4 CONNECTORS
- A. Split bolt connectors not allowed.
 - B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer instructions and NEC.
- B. Field Quality Control:
 1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Contracting Officer if insulation resistance is less than 1 megohm.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

- A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.
- B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

- A. General:
 1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F). All wire and cable must be acclimated to temperatures above freezing for no less than 24 hours prior to installation.
 2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 3. Install conductors with care to avoid damage to insulation.
 4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
 6. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12 AWG unless otherwise shown.
 - b. Provide required conductors for a fully operable system.
 - c. Power Circuits: No. 12 AWG minimum, except as follows:
 - 1) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
 - 2) No. 8 AWG for 20A, 120V circuits longer than 100 ft.
 - d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80

percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.

7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.

B. Conductors in Cabinets:

1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
2. Tie and bundle feeder conductors in wireways of panelboards.
3. Hold conductors away from sharp metal edges.

C. Homeruns:

1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
2. MC cable homeruns are not allowed unless indicated on drawings.

- D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

- E. Exposed cable is not allowed.

- F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

- G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

3.4 CONNECTORS

- A. Install to assure a solid and safe connection.
- B. Select hand twist connectors for wire size and install tightly on conductors.
- C. Install compression connectors using methods and tools recommended by the manufacturer.
- D. Do not install stranded conductors under screw terminals unless compression lugs are installed.
- E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Grounding Electrodes
2. Connectors and Accessories
3. Grounding Busbar
4. Grounding Conductor
5. Grounding Test Well

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A.
- Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- ##### B.
- In addition, provide:
1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

- ##### A.
- Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- ##### B.
- In addition, meet the following:
1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

- ##### A.
- Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grounding Electrodes:

1. Erico
2. Thomas Betts
3. Talley
4. Or approved equivalent.

B. Connectors and Accessories:

1. Burndy Hyground Compression System
2. Erico/Cadweld
3. Amp Ampact Grounding System
4. Pipe Grounding Clamp:
 - a. Burndy GAR Series
 - b. O Z Gedney
 - c. Thomas Betts
 - d. Or approved equivalent.

C. Grounding Busbar:

1. Chatsworth
2. Erico
3. Schneider Electric/Square D
4. Panduit
5. Or approved equivalent.

D. Grounding Conductor

1. General Cable
2. Okonite
3. Southwire
4. Or approved equivalent

E. Grounding Test Well

1. Erico
2. Harger
3. Thompson
4. Or approved equivalent

2.2 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.3 CONNECTORS AND ACCESSORIES

- A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.
- B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.4 GROUNDING BUSBAR

- A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.5 GROUNDING CONDUCTOR

- A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than 10 AWG Bare. Solid copper for wire sizes 10 AWG and smaller.
- B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

2.6 GROUNDING TEST WELL

- A. Grounding Well:
1. Well Pipe: 8-inch diameter by 12-inch long concrete pipe with belled end.
 2. Well Cover: Cast iron with legend "GROUND" embossed on cover. Provide lip on bottom of cover, sized to match interior pipe diameter to hold cover in place.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify site conditions prior to beginning work.

- B. Bond Sections of service equipment enclosure to service ground bus.
- C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.
- D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- E. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.
- F. Resistance of grounding electrode system: measure using a four-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.
- G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.
- H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 GROUNDING ELECTRODES INSTALLATION

- A. Concrete-Encased Electrode (“Ufer Ground”):
 1. From service equipment ground bus provide grounding electrode conductor to footing/foundation rebar.
 2. Bond 4 grounding electrode conductor to one minimum 20-foot long, 3/4-inch diameter independent steel rebar(s).
 3. Protect grounding electrode conductor from footing/foundation to service equipment grounding bus with rigid PVC conduit where grounding electrode conductor passes through concrete floor or other concrete structure. Do not use rigid metal conduit for grounding electrode conductor protection.
 4. Coordinate bonding of rebar in base of building concrete footing with installer prior to placement of concrete.
- B. Ground Rod Electrode:
 1. Verify that final backfill and compaction have been completed before driving rod electrodes.
 2. Bond 6 grounding electrode conductor to driven ground rods as indicated on Drawings.
 3. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit

for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.

- C. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.
- D. Other Metal Piping Systems: Bond gas piping system, fire sprinkler piping system and other metal piping systems to service equipment ground bus or to the grounding electrode system.
- E. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.

3.3 CONNECTORS AND ACCESSORIES INSTALLATION

- A. Install per manufacturer's instructions.

3.4 GROUNDING BUSBAR INSTALLATION

- A. Install per manufacturer's instructions.

3.5 GROUNDING CONDUCTOR INSTALLATION

- A. Raceways:
 - 1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.
 - 2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.
 - 3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
 - 4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.
- B. Feeders and Branch Circuits:
 - 1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
 - 2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.
- C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

- D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.
- E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

3.6 GROUNDING TEST WELL INSTALLATION

- A. Provide grounding test well with cover at each rod location. Install test well pipe top flush with finished grade.
- B. Install per manufacturer's instructions

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Anchors, Threaded Rod and Fasteners
2. Support Channel, Hangers and Supports
3. Rooftop Conduit Supports

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A.
- Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- ##### A.
- Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B.

In addition, meet the following:

1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
2. Support systems to be supplied by a single manufacturer.
3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Contracting Officer.
 - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
 - 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a Contracting Officer registered in the State of California.
 - 1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
- D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
- E. Provide seismic restraint hangers and supports for conduit and equipment.
- F. Obtain approval from Contracting Officer for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Anchors, Threaded Rod and Fasteners:
 - 1. Anchor It
 - 2. Epcon System
 - 3. Hilti-Hit System
 - 4. Power Fast System
 - 5. Or approved equivalent.
- B. Support Channel, Hangers and Supports:

1. B-Line
2. Kindorf
3. Superstrut
4. Unistrut
5. Or approved equivalent.

C. Rooftop Conduit Supports:

1. Cooper B-Line Dura-Block Rooftop Support Base
2. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchors and Fasteners:
 1. Do not use powder-actuated anchors.
 2. Concrete Structural Elements: Use precast inserts.
 3. Steel Structural Elements: Use beam clamps.
 4. Concrete Surfaces: Use self-drilling anchors.
 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 6. Solid Masonry Walls: Use expansion anchors.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood Elements: Use wood screws.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

- A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 - 1. Channel Material: Carbon steel.
 - 2. Coating: Hot dip galvanized.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: 90 lb. test with steel hooks.
- D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.
 - 1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.4 ROOFTOP CONDUIT SUPPORTS

- A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load
- B. Capacity of 500 pounds per linear foot of support.
- C. UV resistant.
- D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gauge strut galvanized per ASTM A653 for bridge series.
- E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduit supports.
- F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

- G. Provide load distribution plates when required for heavy loads.
- H. Finish: Black with safety yellow striping.
- I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
 - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
 - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
 - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

- A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.

- B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.
- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per IBC requirements.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Use spring lock washers under fastener nuts for strut.
- I. Cutting and Drilling
 - 1. Do not drill or cut structural members without prior permission from Contracting Officer.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- C. Verify mounting height of luminaires prior to installation when heights are not detailed.
- D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
- F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
- G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- I. Do not use supports or fastening devices to support other than one particular item.
- J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by NEC.
- K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by NEC.

- L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by NEC.
- M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by NEC.
- N. Maximum distance between supports for rigid PVC conduits unless otherwise required by NEC is as follows:
 - 1. 3/4-inch and 1-inch conduit, 3-feet apart.
 - 2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
 - 3. 2-1/2-inch and 3-inch conduit, 5-feet apart.
 - 4. 4-inch and 5-inch conduit, 6-feet apart.
- O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by NEC is as follows:
 - 1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.
 - 2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.
- P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by NEC.
- Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Contracting Officer for optimal appearance.
- R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- S. Provide seismic bracing per IBC requirements.
- T. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- U. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- V. Wet and Damp Locations:
 - 1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

3.4 ROOFTOP CONDUIT SUPPORTS INSTALLATION

- A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection.
- B. Do not use supports that will void roof warranty.
- C. Install supports per manufacturer's instructions and recommendations.
- D. Use properly sized clamps to suit conduit sizes.
- E. Install supports for rooftop raceways to raise raceways a minimum of 7/8-inches above the roof structure unless otherwise noted.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Rigid Metal Conduit (RMC)
 2. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Metal Conduit
 3. Electrical Metallic Tubing (EMT)
 4. Flexible Metal Conduit (FMC)
 5. Liquidtight Flexible Metal Conduit (LFMC)
 6. Electrical Polyvinyl Chloride (PVC) Conduit, Schedule 80
 7. Conduit Fittings
- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
 2. Section 26 05 34, Boxes
 3. Section 26 05 43, Electrical Vaults and Underground Raceways

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Rigid Metal Conduit (RMC):
 - 1. Allied Tube Conduit
 - 2. Beck Manufacturing Inc.
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- B. Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit:
 - 1. Allied Tube Conduit
 - 2. Thomas Betts Corporation
 - 3. Robroy Industries
 - 4. O'kote Inc.
 - 5. Or approved equivalent.
- C. Electrical Metallic Tubing (EMT):
 - 1. Allied Tube Conduit
 - 2. Beck Manufacturing WL
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- D. Flexible Metal Conduit (FMC):

1. AFC Cable Systems Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Or approved equivalent.
- E. Liquidtight Flexible Metal Conduit (LFMC):
1. AFC Cable Systems Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Or approved equivalent.
- F. Electrical Polyvinyl Chloride (PVC) Conduit, Schedule 80:
1. AFC Cable Systems Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. JM Eagle
 5. Or approved equivalent.
- G. Conduit Fittings:
1. Bushings:
 - a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
 - 1) Thomas Betts 1222 Series
 - 2) O-Z Gedney B Series
 - 3) Or approved Equivalent.
 2. Raceway Connectors and Couplings:
 - a. Thomas Betts Series
 - b. O-Z Gedney Series
 - c. Or approved Equivalent.
 3. Expansion/Deflection Fittings:

- a. EMT: O-Z Gedney Type TX
 - b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse Hinds XD
 - c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
 - d. Or approved equivalent.
- 2.2 RIGID METAL CONDUIT (RMC)
 - A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
 - 1. Fittings: NEMA FB2.10.
- 2.3 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID METAL CONDUIT
 - A. Description: UL 6, ANSI C80.1, and NEMA RN 1; rigid steel conduit with external PVC coating.
 - 1. PVC Coating: Minimum 40 mils in thickness.
 - B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.
- 2.4 ELECTRICAL METALLIC TUBING (EMT)
 - A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
 - B. Fittings: NEMA FB 1; steel, compression type.
- 2.5 FLEXIBLE METAL CONDUIT (FMC)
 - A. Description: UL 1, Interlocked steel construction.
 - B. Fittings: NEMA FB 2.20.
- 2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
 - A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.
 - B. Fittings: NEMA FB 2.20.
- 2.7 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT, SCHEDULE 80
 - A. Description: UL 651, NEMA TC 2; Schedule 40 PVC or Schedule 80 as required by installation.

- B. Fittings: NEMA TC 3.

2.8 CONDUIT FITTINGS

- A. Bushings:

1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.
2. Insulated grounding type for threaded raceway connectors.

- B. Raceway Connectors and Couplings:

1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

- C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Contracting Officer.

- B. Conduit Size:

1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

- C. Underground Installations:

1. More than 5-feet from Foundation Wall: Use PVC.
2. Within 5-feet from Foundation Wall: Use PVC coated RMC.

3. In or Under Slab on Grade: Use PVC.
 4. Minimum Size: 1-inch.
- D. In Slab Above Grade:
1. Use PVC.
 2. Maximum Size Conduit in Slab: Contact Contracting Officer for maximum outside diameter of conduit.
- E. Provide two pull strings/tapes in empty conduits. Types:
1. Utility Company Conduit: Polyester measure/pulling tape, Greenlee 4436 or approved equivalent. Coordinate exact requirements with utility company.
 2. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
 3. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
 4. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
 5. Secure pull string/tape at each end.
 6. Provide caps on ends of empty conduit to be used in future.
 7. Label both ends of empty conduits with location of opposite end.
- F. Elbows: Use fiberglass or PVC coated RMC for underground installations.
- G. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.
- H. Verify that field measurements are as shown on drawings.
- I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.
- J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
1. Where shown on the structural drawings.
 2. As approved by the Contracting Officer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- K. Verify routing and termination locations of conduit prior to rough-in.
- L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

- M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.
- O. Install nonmetallic conduit in accordance with manufacturer's instructions.
- P. Inserts, anchors and sleeves.
 - 1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
 - 2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.
- Q. Conduit Supports:
 - 1. Arrange supports to prevent misalignment during wiring installation.
 - 2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 - 3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
 - 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 5. Do not attach conduit to ceiling support wires.
- R. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
- S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
- T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.
- U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
- V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.
- W. Arrange conduit to maintain headroom and present neat appearance.
- X. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

- Y. Exposed conduits are permitted only in following areas:
1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
 2. Existing walls that are concrete or block construction.
 3. Where specifically noted on Drawings.
 4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
- Z. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
- AA. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
- BB. Below Grade Conduit:
1. See Section 26 05 43, Electrical Vaults and Underground Raceways.
 2. Use PVC, PVC coated RMC, or fiberglass conduit.
 3. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.
- CC. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- DD. Maintain adequate clearance between conduit and piping.
- EE. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.
- FF. Cut conduit square using saw or pipecutter; deburr cut ends.
- GG. Bring conduit to shoulder of fittings; fasten securely.
- HH. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.
- II. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
- JJ. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.
- KK. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- LL. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- MM. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

- NN. Feeders: Do not combine or change feeder runs.
- OO. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- PP. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

- A. Outdoor Locations Above Grade: RMC.
- B. Damp Locations: RMC.
- C. In areas exposed to mechanical damage: RMC.
- D. For security conduits installed exposed and subject to tampering: RMC.

3.3 POLYVINYL CHLORIDE (PVC) EXTERNALLY COATED GALVANIZED RIGID METAL CONDUIT INSTALLATION

- A. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.

3.4 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

- A. Dry Locations (Where Not Subject to Physical Damage):
 - 1. Concealed: EMT.
 - 2. Exposed: EMT.
- B. Dry, Protected (Where Not Subject to Physical Damage): EMT.

3.5 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

- A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
- B. Install 12-inch minimum slack loop on flexible metallic conduit.
- C. FMC shall not exceed 6-feet in length.

3.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

- A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.
- B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

- C. LFMC shall not exceed 6-feet in length.

3.7 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION, SCHEDULE 80

- A. Install in accordance with manufacturer's instructions.
- B. Provide equipment grounding conductor in PVC conduit runs containing power conductors.
- C. Underground Installation:
 - 1. Areas subject to vehicular traffic: Schedule 80 PVC.
 - 2. Utility primary and secondary conduit: Schedule 80 PVC.
 - 3. Other underground applications: Schedule 40 PVC, except where prohibited by the NEC or local codes.
- D. Convert PVC conduit to Rigid Metal Conduit (RMC) prior to emerging from underground, concrete encasement, or concrete slab.
- E. Provide expansion fittings to compensate for expansion and contraction per NEC 352.44.
- F. PVC elbows are not acceptable. Use fiberglass or PVC coated RMC.
- G. Trim cut ends inside and outside to remove rough edges.
- H. Provide bushings when entering a box, fitting or other enclosure.

3.8 CONDUIT FITTINGS INSTALLATION

- A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.
- B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.
- D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.
- E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

- F. Use PVC coated, threaded type fittings in corrosive environments.
- G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.
- H. Condulets and Conduit Bodies:
 - 1. Do not use condulets and conduit bodies.
- I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
- J. Expansion Joints:
 - 1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.
 - 2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
 - 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
 - 4. Verify expansion/deflection requirements with Contracting Officer prior to installation.
- K. Seismic Joints:
 - 1. No conduits cast in concrete allowed to cross seismic joint.
 - 2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Contracting Officer that 15-inches is adequate for designed movement, and if not, increase this length as required.
 - 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
- L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION 26 05 33

SECTION 26 05 34 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Outlet Boxes
2. Pull and Junction Boxes
3. Box Extension Adapter
4. Weatherproof Outlet Boxes

- B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 33, Raceways
2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:

1. Hubbell
2. Thomas Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

B. Pull and Junction Boxes:

1. Eaton/Crouse-Hinds
2. Hoffman
3. Or approved equivalent.

C. Box Extension Adapter:

1. Hubbell
2. Thomas Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

D. Weatherproof Outlet Boxes:

1. Legrand (Pass Seymour)
2. Hubbell
3. Thomas Betts
4. Eaton/Crouse-Hinds
5. Intermatic
6. Or approved equivalent.

2.2 OUTLET BOXES

- A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.
- B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Single- or two-gang flush

device raised covers.

- C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring. Provide under provisions of Division 27, Communications.
- D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.
- E. Masonry Boxes: Outlets in concrete.
- F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.
- G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 PULL AND JUNCTION BOXES

- A. Construction: Provide ANSI 61 gray polyester powder painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.
- C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 - 1. Construction: Galvanized cast iron.
 - 2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: ELECTRIC.

2.4 BOX EXTENSION ADAPTER

- A. Construction: Diecast aluminum.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.5 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.
- B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.
- C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.
- F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10-feet if required to accommodate intended purpose.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

- K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.
- L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.
- M. Install knockout closures in unused box openings.
- N. Clean interior of boxes to remove dust, debris, and other material.
- O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

- A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
 - 1. Control Switches:
 - a. 48-inches to the top of outlet box.
 - b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
 - 2. Receptacles: 15-inches to the bottom of outlet box.
 - 3. Telecom Outlets: 15-inches to the bottom of outlet box. Coordinate with Division 27, Communications.
 - 4. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.
- D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.
- E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Contracting Officer.
- G. Use flush mounting outlet box in finished areas.
- H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.

- I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Use adjustable steel channel fasteners for hung ceiling outlet box.
- M. Use gang box where more than one device is mounted together. Do not use sectional box.
- N. Use gang box with plaster ring for single device outlets.
- O. Adjust flush-mounting outlets to make front flush with finished wall material.

3.3 PULL AND JUNCTION BOXES INSTALLATION

- A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Do not fasten boxes to ceiling support wires.
- D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.4 BOX EXTENSION ADAPTER INSTALLATION

- A. Match material to box.
- B. Install gaskets at exterior and wet locations.

3.5 WEATHERPROOF OUTLET BOXES INSTALLATION

- A. Use cast outlet box in exterior locations exposed to weather and wet locations.
- B. Install gaskets.

END OF SECTION 26 05 34

SECTION 26 05 43 - ELECTRICAL VAULTS AND UNDERGROUND RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Handholes
2. Raceways

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. Section 26 05 33, Raceways

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit (EPC-40 and EPC-80).
 2. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 3. NEMA TC 6/8 - Extra-Strength PVC Plastic Utilities Duct for Underground Installation.
 4. NEMA TC 9 - Fittings for Extra-Strength Plastic Utilities Duct for Underground Installation.
 5. NEMA TC 14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 6. UL 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Shop drawings detailing items provided under this Section:
 - a. Duct entry schedule.

- b. Pulling iron working load.
- c. ASTM load designation and percentage increase in live load for impact.
- d. Rebar and piling support details.
- e. Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes and handholes.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.
 - 2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Handholes:
 - 1. Oldcastle Precast
 - 2. Jensen Precast
 - 3. Hubbell/Quazite
 - 4. Or approved equivalent.
- B. Raceways:
 - 1. See Section 26 05 33, Raceways.
 - 2. Fiberglass (RTRC):
 - a. FRE Composites Corp.
 - b. Champion Fiberglass

c. United Fiberglass of America

2.2 HANDHOLES

- A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors. All in ground boxes must have an ANSI-77 tier 22 rating for traffic application.
- B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during construction.
- C. Lid: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors, with nonskid finish, neoprene gaskets and stainless steel screws. Same size as opening of housing for as much hand space as possible for wire access. All in ground boxes must have an ANSI-77 tier 22 rating for traffic application.
- D. Lid Legend: ELECTRICAL.
- E. Cable Entrance: Pre-cut 6 x 6-inch cable entrance at center bottom of each side.

2.3 RACEWAYS

- A. See Section 26 05 33, Raceways.
- B. PVC Conduit: NEMA TC 2; Schedule 40. Fittings and Conduit Bodies: NEMA TC 3.
- C. Plastic Utilities Duct: NEMA TC 6/8; PVC Type DB.
- D. Plastic Utility Duct Fittings: NEMA TC 9.
- E. Fiberglass Conduit (RTRC), Elbows and Fittings: NEMA TC 14 and UL 1684.
 - 1. Conduit and Fittings: 0.095 inches wall thickness.
 - 2. Large Sweep Elbows: 1.110 inches wall thickness.
 - 3. Joining Method: Supply each length of conduit with a tapered spigot and an integral bell with an integral urethane Tri-Seal gasket held in place with a retaining ring. Minimum 400 pound for the Tri-Seal joint.
 - 4. Adapters: Provide appropriate UL Listed adapters for transitions to and from PVC and steel conduit.
 - 5. Provide conduit in 20 foot lengths, free of burrs and ridges.
 - 6. Fabricate sweeps in one piece, without couplings, joints or tangent lengths, other than at ends.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's instructions and recommendations.
- B. Plan locations of duct runs in advance of the installation. Coordinate with site utility systems and building foundation depths.
- C. Duct bank routing is shown on drawings in approximate locations unless dimensions are indicated. Verify routing and termination locations of duct bank prior to excavation for rough-in. Route as required to complete duct system.

3.2 HANDHOLES

- A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported.
- B. Set base plumb and level. Set handhole such that cover surface matches finished grade.
- C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.
- D. Turn conduits up into handhold with required bend radius per guidance in 26 05 33, Raceways.
- E. Engrave cover of handhole to identify its purpose (examples: "Power," "Emergency Power," "Signal," "Fire Alarm").

3.3 RACEWAYS

- A. Power and System Duct Bank Raceways: PVC, Fiberglass (RTRC) or PVC coated Rigid Metal Conduit.
- B. Elbows for Power and System Raceways: Fiberglass (RTRC) elbows or PVC coated Rigid Metal Conduit elbows.
- C. Provide all excavation and backfill required to support Division 01 and this Division of work. Coordinate trench specs for concrete, soil or sand backfill.
- D. Excavate trenches six inches deeper and wider than ductbank burial and cross-sectional requirements. Remove from the site all excavated materials not suitable or specified for backfill.
- E. Backfill trenches with sand, tamped firm and even to trench depth level.
- F. Backfill with non-expansive soil with limited porosity. Deposit all backfill soil in 6-inch layers. Thoroughly and carefully tamp all backfill soils to 90-95 percent compaction until the ductbank is covered by no less than 12 inches of material. Backfill and tamp the remainder of the excavation at 12-inch intervals. Uniformly grade the finished surface.

- G. Provide sheeting, shoring, dewatering and cleaning required to keep the trenches and their grades in proper condition for the work to be carried on.
- H. Restore all landscape and paving to like new to match existing.
- I. Slope raceways away from buildings and drain towards manholes or vaults with a minimum slope of 3 percent. Drain raceways into manholes or vaults, not into building structures or panels. Where sloping cannot be fully provided and there is a section of raceway where water would flow to a panel, switchboard, transformer, or building, provide a means to discharge the excess water from the raceway, or raceway system, consisting of a box or fitting at a low point prior to equipment entry, or at building entry, with a fitting or plug that can be removed to allow drainage.
- J. Cut raceway square using saw or pipe cutter; de-burr cut ends.
- K. Insert raceway to shoulder of fittings; fasten securely.
- L. Join PVC raceway using adhesive as recommended by manufacturer.
- M. Wipe PVC raceway dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- N. Number of equivalent 90-degree bends permitted between pull points: Maximum of three bends for power system conduit banks.
- O. Provide suitable fittings to accommodate expansion and deflection where required.
- P. Terminate raceway at manhole entries using end bells.
- Q. Use suitable separators and chairs installed not greater than 5 feet on centers.
- R. Provide 1/4-inch polypropylene pull rope in each empty raceway except sleeves and nipples.
- S. Swab raceway. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- T. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.
- U. Minimum conduit size acceptable is 3/4-inch.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Equipment Nameplates
 - 2. Device Labels
 - 3. Wire Markers
 - 4. Underground Warning Tape

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 - 2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
 - 3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment Nameplates:

1. B & I Nameplates
2. Intellicum
3. JBR Associates
4. Or approved equivalent.

B. Device Labels:

1. Kroy
2. Brady
3. Or approved equivalent.

C. Wire Markers:

1. Brady
2. Panduit
3. Sumitomo
4. Or approved equivalent.

D. Underground Warning Tape:

1. Allen Systems
2. Brady
3. Or approved equivalent.

2.2 EQUIPMENT NAMEPLATES

A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.

B. Color:

1. Normal (Utility): White letters on black background.

C. Letter Size:

1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.
2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.
3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Contracting Officer, Commissioning Agent and Contracting Officer reserve the right to make modifications to the nameplates as necessary.

F. Locations:

1. Switchboards, distribution panels, and branch panels.
2. Main breakers and distribution breakers in switchboards, and distribution panels.
3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels.
5. Distribution transformers.

2.3 DEVICE LABELS

- A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.
- B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

- A. Description: Vinyl-cloth self-adhesive type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.
- C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.

- D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.5 UNDERGROUND WARNING TAPE

- A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate designations used on Drawings with equipment nameplates and device labels.
- B. Install nameplates and labels parallel to equipment lines.
- C. Identify empty conduit and boxes with intended use.
- D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.
- E. Provide color coded boxes as follows:
 - 1. Fire Alarm: Red.

3.2 EQUIPMENT NAMEPLATES

- A. Degrease and clean surfaces to receive nameplates.
- B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.
- C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Verify emergency system distribution equipment nameplate colors with Contracting Officer.
- E. Provide master nameplate at each incoming utility service to identify the following (each on a separate line):
 - 1. Serving Utility Transformer (ex. Utility Service #1).
 - 2. Project.
 - 3. Serving Utility Company.
 - 4. Consulting Engineering Firm of Record.
 - 5. Month and Year of Completion.

6. Voltage, Phase, and Wire Configuration.

- F. Switchboards, and panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.
- G. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Contracting Officer if nameplate on outside of door is required.
- H. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V). Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.
 - 1. See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project.

3.3 DEVICE LABELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Degrease and clean surfaces to receive labels.

3.4 WIRE MARKERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide wire markers on each conductor for power, control, signalling and communications circuits.
- D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

3.5 UNDERGROUND WARNING TAPE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

- C. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finish grade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

END OF SECTION

SECTION 26 05 73 - ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Protective Devices
2. Short Circuit Study
3. Selective Coordination Study
4. Arc Flash Labels
5. Arc Flash Risk Assessment
6. Load-Flow and Voltage Drop Study

B. Scope of Work: Provide short circuit analysis, selective coordination study, and load flow / voltage-drop analysis to provide the following:

1. Settings for adjustable trip breakers;
2. Arc flash labeling on panelboards and switchboards per NFPA 70E;
3. Demonstrate with choice of overcurrent protection and trip settings that code-required selective coordination is provided for the emergency power branch and elevators.
4. Transformer tap settings and feeder sizes for less than 2-percent voltage drop.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition provide:
 - 1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.
 - 2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Contracting Officer where not in compliance with Code and Contract Documents for selective coordination.
 - a. Provide written verification with Stamp or Seal and signature of preparing Contracting Officer.
 - 3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Study Preparer Qualifications: Qualified Contracting Officer of switchgear manufacturer.
 - a. Experienced in preparation of studies of similar type and magnitude.
 - b. Familiar with software analysis products specified.
 - 2. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.
 - a. Acceptable Software Products:
 - 1) EasyPower
 - 2) Operation Technology, Inc; ETAP.
 - 3) SKM Systems Analysis, Inc; Power Tools for Windows.
 - 3. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
 - 1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
 - 2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 - 3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
 - 4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.
- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
 - 1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.
 - 2. Breaker and fuse ratings.
 - 3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - 4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - 5. Identification of each bus, with voltage.
 - 6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

2.2 PROTECTIVE DEVICES

- A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.
- B. Replace existing protective devices to achieve specified performance.

- C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 2. Identify any equipment that is underrated as specified.
 3. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Contracting Officer and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
 4. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
 5. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Contracting Officer, provide a discussion of alternatives and logical compromises for best achievable coordination.
 6. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Contracting Officer.
- D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
1. Device identification.
 2. Relay CT ratios, tap, time dial, and instantaneous pickup.
 3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
 4. Fuse rating and type.
 5. Ground fault pickup and time delay.
 6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
 7. Highlight devices that as furnished by Contractor will not achieve required protection.
- E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.

- F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.

2.3 SHORT CIRCUIT STUDY

- A. Calculate fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
 - 1. Show fault currents available at key points in system down to fault current of 1,000 A at 208 V.
 - 2. Include motor contributions in determining momentary and interrupting ratings of protective devices.
 - 3. Primary Fault Level Assumptions: Obtain data from utility company.

2.4 SELECTIVE COORDINATION STUDY

- A. For all emergency, legally required standby and critical operations systems over current devices, perform an organized time-current analysis of each protective device in series from individual device back to source, under normal power conditions.
 - 1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
 - 2. Plot specific time-current characteristics of each protective device on log-log paper.
 - 3. Organize plots so that upstream devices are clearly depicted on one sheet.
 - 4. Also show following on curve plot sheets:
 - a. Device identification.
 - b. Voltage and current transformer ratios for curves.
 - c. 3-phase and 1-phase ANSI damage curves for each transformer.
 - d. No-damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum short circuit cutoff point.
 - h. Simple one-line diagram for portion of system that each curve plot illustrates.
 - i. Software report for each curve plot, labeled for identification.
- B. Devices to coordinate down to 0.01 seconds. Coordination required for emergency systems.

2.5 ARC FLASH LABELS

- A. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

2.6 ARC FLASH RISK ASSESSMENT

- A. Calculate arc flash incident energy (AFIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at each bus and piece of equipment during normal conditions, emergency power conditions, and other operations that could result in maximum arc flash incident energy levels.
 - 1. Show flash protection boundary distance.
 - 2. Include incident energy levels.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Provide services of Contracting Officer and necessary tools and equipment to test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.
- B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.
- C. Submit report showing final adjusted settings of protective devices.

3.2 ELECTRICAL POWER SYSTEM STUDIES

- A. Short Circuit Analysis Study:
 - 1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including contributions from normal source of power without alternative sources of power. Include complete low voltage distribution systems as specified in this Section.
 - 2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.
 - 3. Perform study in accordance with applicable ANSI/IEEE Standards.
 - 4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generator contributions; applicable circuit parameters and contribute to short circuit duty.

5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).
6. Perform equipment evaluation study to determine adequacy of overcurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Contracting Officer in writing where problem areas or inadequacies appear in electrical equipment.
7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utility and generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Selective Coordination Study:

1. Perform time-current coordination analysis with aid of computer software intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.
2. Where necessary, make an appropriate compromise between system protection and service continuity with service continuity considered more important than system protection.
3. Provide sufficient number of computer generated log-log plots to indicate degree of system protection and coordination by displaying time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
 - b. Terminate device characteristic curves at a point reflecting maximum symmetrical fault current to which the device is exposed.
 - c. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 - d. No more than 3 devices per TCC.

- e. Plot the following listed characteristic curves, as applicable:
 - 1) Power utility's overcurrent protective device.
 - 2) Medium-voltage equipment overcurrent relays.
 - 3) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - 4) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - 5) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - 6) Cables and conductors damage curves.
 - 7) Ground-fault protective devices.
 - 8) Generator short-circuit decrement curve and generator damage point.
 - 9) The largest feeder circuit breaker in each motor-control center and panelboard.
 - 5. Study includes separate, tabular computer printout containing suggested device settings of adjustable overcurrent protective devices, equipment where device is located, and device number corresponding to device on system one-line diagram.
 - 6. Provide computer generated system one-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and maximum available short-circuit current at each bus when known.
 - 7. Discussion Section which evaluates degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
 - 8. Call significant deficiencies in protection and/or coordination to attention of Contracting Officer and recommendations made for improvements as soon as they are identified.
 - 9. Contractor responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in timely manner to allow time-current analysis to be completed prior to final installation.
- C. Arc Flash Risk Assessment:
- 1. Perform arc flash risk assessment with aid of computer software intended for this purpose.

2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.
3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.
6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.
7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
8. Proposed vendor demonstrates experience in providing equipment labels in compliance with NEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

D. Load-Flow And Voltage Drop Study:

1. Perform a load-flow and voltage drop study to determine the steady state loading profile of the system. Determine load-flow and voltage drop based of full load current shown in the design. The model should include all loads indicated in the panel schedules, one-line diagram, and equipment connection schedules, as applicable.
2. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded; indicate voltage drop for all buses in the system.
3. Provide recommendations for areas that have voltage drop values higher than 2-percent for feeders.
4. Indicate the recommended fixed transformer taps that might be used to solve the voltage drop issues.

END OF SECTION

SECTION 26 08 05 - ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included: Testing, evaluation, and calibration of:
 - 1. Power Distribution Equipment
- B. Test procedures specified in this Section are in addition to those specified in other Sections of Division 26, Electrical.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by NETA.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Test Reports:
 - a. Maintain written record of tests.
 - b. At completion of project, assemble and certify a final test report. Document testing and performance compliance with NETA recommended forms, parameters, and level of detail. Submit report to Contracting Officer prior to final acceptance to include:
 - 1) Summary of Project
 - 2) Description of Equipment Tested
 - 3) Visual Inspection Report
 - 4) Description of Tests

- 5) Test Results
- 6) Conclusions and Recommendations

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Qualifications of Testing Firm:
 - a. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
 - b. Independent organization as defined by a NETA Level II ETT certified testing agency in compliance with NETA Level II ETT certified testing requirements and practices.
 - c. Regularly engaged in testing of electrical materials, devices, appliances, electrical installations and systems for purpose of preventing injury to persons or damage to property and other equipment.
 - d. Engaged in testing practices for minimum of five years.
 - e. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
 - f. Submit proof of above qualifications with Bid Documents.
 - 2. Certifications:
 - a. Comply with NETA Level II ETT certified testing agency criteria for accreditation of testing laboratories. Full membership in NETA constitutes proof of such criteria.
 - b. Lead, on site, technical person currently certified by NETA in Electrical Power Distribution System Testing.
 - c. Instruments used by testing firm to evaluate electrical performance meet NETA Specifications for Test Instruments.

1.6 PERFORMANCE REQUIREMENTS

- A. Retain services of recognized independent testing firm for purpose of performing inspections and tests as specified.

- B. Independent test firm providing report direct to Contracting Officer.
- C. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.
- D. Intent of these tests to assure that electrical equipment, Contractor or Contracting Officer supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
- E. Tests and inspections determine suitability for energization.
- F. Supply to independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction), setting of adjustable devices and other information requested by testing agency.

1.7 SCOPE OF WORK

- A. Provide testing, evaluation, and calibration of the following:
 - 1. Dry Type Transformers
 - 2. Low Voltage Circuit Breakers (greater than 100 amp)
 - 3. Switchboards
 - 4. Panelboards
 - 5. Grounding Systems
- B. Test cable, equipment and systems listed above to assure proper installation, setting, connections, and functioning in accordance with the Drawings, Specifications, and the manufacturer's recommendations. It is the intent that field testing be extensive, and complete as specified, to provide positive assurance of totally correct installation and operation of equipment.
- C. Furnish necessary test equipment to satisfactorily perform tests specified.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION EQUIPMENT

- A. The testing agency provides test equipment.
- B. Care and Precautions:
 - 1. Contractor responsible for any damage to equipment or material due to improper test procedures or test apparatus handling. Replace or restore to original condition any damaged equipment or material.
 - 2. Provide and use safety devices such as rubber gloves and blankets, protective screen, barriers and danger signs to adequately protect and warn personnel in the vicinity of the

tests.

3. Use test equipment that is calibrated and certified traceable to the National Bureau of Standards. Certification Date: No later than 6 months.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:

1. Contractor's Responsibilities:

- a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.
- b. Notify testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.

2. Testing Firm's Responsibilities:

- a. Notify Contracting Officer prior to commencement of any testing.
- b. Report directly to Contracting Officer any systems, material or installation found defective on basis of acceptance tests.
- c. Provide auxiliary portable power supply necessary for conducting tests.

3.2 REPLACEMENT OF DEFECTIVE MATERIAL OR EQUIPMENT

- A. Repair or replace any material or equipment found defective or cannot pass the tests specified in this Section at no additional cost to the Contracting Officer.
- B. Complete correction of defective material or equipment and retesting within the Contract period.
- C. If the equipment or material cannot pass the second test, remove the defective equipment and replace it with equivalent equipment that meets the requirements of the Specifications. Such replacement at no additional cost to the Contracting Officer.

3.3 ADJUSTING

- A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Contracting Officer's specified values.

END OF SECTION 26 08 05

SECTION 26 08 10 - BUILDING LIGHTING ACCEPTANCE TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Duties of the Team
2. Time Schedule
3. Acceptance Testing - Phase I - Documentation
4. Acceptance Testing - Phase II - Inspection and Testing
5. Acceptance Testing - Phase III - Certification

- B. This Section describes the acceptance testing and documentation of the lighting system(s) and outlines the duties and responsibilities of the contracting team for acceptance testing.
- C. Supply the acceptance requirements to products, equipment and systems provided under this Division, where indicated on Drawings by ASHRAE Standard 90.1 requirements.
- D. Engage the services of a firm specializing in commissioning of lighting systems or submit contractor qualifications for review by Contracting Officer where testing and documentation is to be performed by contractor.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 COMMISSIONING TEAM

- A. Form the Commissioning Team of:

1. Electrical Contractor's Representative
2. Lighting Controls Manufacturer's Representative
3. Inspector of Record
4. Contracting Officer's Staff Representative

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 DUTIES OF THE TEAM

- A. The duties of the Team are as outlined in the ASHRAE Standard 90.1 requirements and summarized below:
 1. Plan, organize and implement the acceptance testing process and within 1 month of the award of the contract, submit the names and addresses of the Testing team member(s).
 2. The acceptance testing team to submit a complete description of the testing procedures and systems to be tested to the Contracting Officer for review.
 3. The acceptance testing team to coordinate tests of systems and equipment and assemble documentation related to tests. Submit documentation relative to tests and proposed procedures to design Contracting Officer for review prior to submitting documentation to Contracting Officer. Team responsible for performing data analysis, calculation of performance indices and cross-checking of results with the requirements of ASHRAE Standard 90.1 and the Contract documents. The installing contractor or agent responsible for testing and documentation to record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.
 4. Responsible for submitting Certificate of Acceptance including paper and electronic copies of measurements and monitoring results and supporting documentation to the . Where questions results or requires additional testing, complete additional testing and provide required documentation at no additional cost to the Contracting Officer.

3.2 TIME SCHEDULE

- A. Determine the time period of the commissioning of the systems by the general contractor and acceptance testing team. It is important to note that will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the ASHRAE Standard 90.1 standards.

3.3 ACCEPTANCE TESTING - PHASE I - DOCUMENTATION

- A. Team to assemble documentation showing lighting fixture locations, lighting control device locations, control sequences and notes.
- B. Per ASHRAE Standard 90.1 requirements, team to provide record drawings to building Contracting Officer within 90 days of receiving a final occupancy permit (reference other specification Sections for requirements on record drawings.)
- C. Per ASHRAE Standard 90.1 requirements, team to provide operating and maintenance manuals to the building Contracting Officer (reference other specification Sections for requirements on operation and maintenance manuals.)

3.4 ACCEPTANCE TESTING - PHASE II - INSPECTION AND TESTING

- A. Team to review the installation, perform acceptance testing and document results for the following systems:
 - 1. Occupancy Sensors
 - 2. Automatic Time Switch Controls
- B. Review of installation to confirm lighting fixtures and lighting controls are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

3.5 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

- A. Team to document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the prior to receiving final occupancy permit.

3.6 ACCEPTANCE TESTS AND DOCUMENTATION

- A. Reference State of California requirements for specific testing procedures and documentation requirements. Contractor is responsible for reviewing and complying with standards as required by Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements as well as State and governmental standards related to this work.

END OF SECTION

SECTION 26 09 25 - DIGITAL LIGHTING CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Standalone lighting control systems and associated components:

1. LED drivers.
2. Power interfaces.
3. Main units (Lutron Grafik Eye QS).
4. Timeclock.
5. Lighting control modules (Lutron Energi Savr Node).
6. Control stations.
7. Low-voltage control interfaces.
8. Wired sensors.
9. Wireless sensors.
10. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 27 26 - Wiring Devices:
1. Finish requirements for wall controls specified in this section.
 2. Accessory receptacles and wallplates, to match lighting controls specified in this section.
- C. Section 26 51 00 - Lighting

1.3 REFERENCE STANDARDS

- A. References and Standards per Division 01, General Requirements and Section 26 00 00, Electrical Basic Requirements.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate the placement of wall controls with actual installed door swings.
 3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 4. Where motorized window treatments are to be controlled by the lighting control system provided under this section, coordinate the work with other trades to provide compatible products.
 5. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
 6. Notify Contracting Officer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Preinstallation Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
1. Low voltage wiring requirements.
 2. Separation of power and low voltage/data wiring.
 3. Wire labeling.
 4. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 5. Control locations.
 6. Load circuit wiring.
 7. Connections to other equipment.
 8. Installer responsibilities.
- C. Sequencing:
1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Layout of sensors indicating their sensing distribution on reproducible Architectural Floor Plans.
 - 2. Shop Drawings: Provide wiring diagrams indicating low voltage and line voltage wiring requirements for occupancy sensors, and each digital lighting control system shown on the electrical drawings.
 - 3. Closeout Submittals:
 - a. Sustainable Design Closeout Documentation: Lighting Control System.
 - b. Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results
- C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- F. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Contracting Officer's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications:

1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

D. Maintenance Contractor Qualifications: Manufacturer's authorized service representative.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1. System Requirements - Lutron, Unless Otherwise Indicated:

- a. Ambient Temperature:

- 1) Lighting Control System Components, Except Those Listed Below:
Between 32 and 104 degrees F (0 and 40 degrees C).
- 2) Fluorescent Electronic Dimming Ballasts: Between 50 and 140 degrees F
(10 and 60 degrees C).

- b. Relative Humidity: Less than 90 percent, non-condensing.

1.9 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

- B. Manufacturer's Standard Warranty, With Manufacturer Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:

1. Manufacturer Lighting Control System Components, Except Ballasts/Drivers and Ballast Modules:

- a. First Two Years:

- 1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
- 2) First-available on-site or remote response time.

- 3) Remote diagnostics for applicable systems.
 - b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
2. Ballasts/Drivers and Ballast Modules: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Lutron Electronics Company, Inc; www.lutron.com.
- B. Other Acceptable Manufacturers:
 1. Or approved equivalent.
 2. Products by listed manufacturers are subject to compliance with specified requirements and prior approval of Contracting Officer.
- C. Substitutions: Permitted
 1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Contracting Officer a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
- D. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

- A. Sensor Layout and Tuning: Include as part of the base bid additional costs for Lighting Control Manufacturer's Sensor Layout and Tuning service; Lutron LSC-SENS-LT:
 1. Lighting Control Manufacturer to take full responsibility for wired or wireless sensor layout and performance for sensors provided by Lighting Control Manufacturer.
 2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.
 3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.

4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.
- C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.
- E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
- F. Dimming and Switching (Relay) Equipment:
 1. Designed so that electrolytic capacitors operate at least 36 degrees F (2 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.
 2. Inrush Tolerance:
 - a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.
 - b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.
 3. Surge Tolerance:
 - a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.
 - b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
 4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
 5. Dimming Requirements:
 - a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus

2 percent change in RMS voltage per cycle), frequency shifts (plus or minus 2 Hz change in frequency per second), dynamic harmonics, and line noise.

- 1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
- b. Incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
- c. Utilize air gap off to disconnect the load from line supply.
- d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
- e. Load Types:
 - 1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
 - 2) Provide capability of being field-configured to have load types assigned per circuit.
- f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.
- g. Line Voltage Dimmers:
 - 1) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
- h. Low Voltage Dimming Modules:
 - 1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.
 - 2) Single low voltage dimming module; capable of controlling the following light sources:
 - (a) 0-10V analog voltage signal.
 - (1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
 - (2) Sink current according to IEC 60929.
 - (3) Source current.
 - (b) 10-0 V reverse analog voltage signal.

- (c) DSI digital communication.
- (d) DALI broadcast communication per IEC 60929:
 - (1) Logarithmic intensity values complying with IEC 60929.
 - (2) Linear intensity values for use with LED color intensity control.
- (e) PWM per IEC 60929.

6. Switching Requirements:

- a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
- b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
- c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

G. Device Finishes:

- 1. Wall Controls: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated
- 2. Standard Colors: Comply with NEMA WD1 where applicable.
- 3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
- 4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.3 LED DRIVERS

A. General Requirements:

- 1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
- 2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.
- 3. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.

4. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
5. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
6. UL 8750 recognized or listed as applicable.
7. UL Type TL rated or UL Class P listed where possible to allow for easier fixture evaluation and listing of different driver series.
8. Suitable for field replacement as applicable; listed in accordance with UL 1598C or UL 8750, Class P as indicated.
9. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
10. Class A sound rating; Inaudible in a 27 dBA ambient.
11. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.
12. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
13. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 0.1 percent, 100 to 1 percent or 100 to 5 percent as applicable.
14. Meet NEMA 410 inrush requirements for mitigating inrush currents with solid state lighting sources.
15. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
16. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

B. 3-Wire Control:

1. Provide integral fault protection to prevent driver failure in the event of a mis-wire.
2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.

C. Digital Control (when used with compatible Lutron lighting control systems):

1. Employ power failure memory; LED driver to automatically return to the previous state/light level upon restoration of utility power.

2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.
3. Automatically go to 100 percent light output upon loss of control link voltage and lock out system commands until digital control link voltage is restored. Manufacturer to offer UL 924 compliance achievable through use of external Lutron Model LUT-ELI-3PSH interface upon request.
4. Each driver responds independently per system maximum:
 - a. Up to 32 occupant sensors.
 - b. Up to 16 daylight sensors.
5. Responds to digital load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by three percent to 27 percent).
6. Digital low-voltage control wiring capable of being wired as either Class 1 or Class 2.

D. Product(s):

1. Digital Control, 0.1 Percent Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume Premier 0.1 percent Constant Voltage (L3D0-Series):
 - a. Dimming Range: 100 to 0.1 percent measured output current.
 - b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black™) low end dimming performance for an incandescent-like dimming experience.
 - c. Typically dissipates 0.25 W standby power at 120 V and 0.40 W standby power at 277 V.
 - d. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V and residential applications at 120 V.
 - e. Total Harmonic Distortion (THD): Less than 20 percent at maximum power; complies with ANSI C82.11.
 - f. Class 2 output designed to withstand hot swap of LED loads; meets UL 1310 and CSA C22.2 No. 223.
 - g. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
 - h. Constant Voltage Drivers:
 - 1) Support for cove and under-cabinet fixtures at 24 V.
 - (a) Support LED arrays from 2 W to 96 W.

- (b) Pulse Width Modulation (PWM) dimming frequency meets IEEE 1789.
 - (c) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - (d) UL listed.
- 2. 3-Wire Control, 0.1 Percent Dimming; Lutron Hi-lume Premier 0.1 percent Constant Voltage (L3D0-Series):
 - a. Dimming Range: 100 to 0.1 percent measured output current.
 - b. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V and residential applications at 120 V.
 - c. Total Harmonic Distortion (THD): Less than 20 percent at maximum power; complies with ANSI C82.11.
 - d. UL Class 2 output designed to withstand hot swap of LED loads.
 - e. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
 - f. Constant Voltage Drivers:
 - 1) Support for cove and under-cabinet fixtures at 24 V.
 - (a) Support LED arrays from 2 W to 96 W.
 - (b) Pulse Width Modulation (PWM) dimming frequency meets IEEE 1789.
 - (c) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - (d) UL listed.
- 3. Digital Control, 0.1 Percent Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume Premier 0.1 percent Constant Current (PEQ0-Series):
 - a. Dimming Range: 100 to 0.1 percent measured output current.
 - b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black™) low end dimming performance for an incandescent-like dimming experience.
 - c. Typically dissipates less than 0.5 W standby power at 120/277 V.

- d. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120/277 V.
 - e. Class 2 output designed to withstand hot swap of LED loads; meets UL 1310 and CSA C22.2 No. 223.
 - f. Driver outputs to be short circuit protected and open circuit protected.
 - g. Constant Current Drivers:
 - 1) Support for downlights and pendant fixtures from 150 mA to 1.05 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 20 W.
 - (b) Constant Current Reduction (CCR) dimming method.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - 2) Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 1.05 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 20 W.
 - (b) Constant Current Reduction (CCR) dimming method.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
4. Digital Control, 1 Percent Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume Premier 1 percent Constant Current (PEQ1-Series):
- a. Dimming Range: 100 to 1 percent measured output current.
 - b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black™) low end dimming performance for an incandescent-like dimming experience.
 - c. Typically dissipates less than 0.5 W standby power at 120/277 V.
 - d. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120/277 V.

- e. Class 2 output designed to withstand hot swap of LED loads; meets UL 1310 and CSA C22.2 No. 223.
 - f. Driver outputs to be short circuit protected and open circuit protected.
 - g. Constant Current Drivers:
 - 1) Support for downlights and pendant fixtures from 150 mA to 1.05 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 20 W.
 - (b) Constant Current Reduction (CCR) dimming method.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - 2) Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 1.05 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 20 W.
 - (b) Constant Current Reduction (CCR) dimming method.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
5. Forward Phase (Neutral Wire Required), One Percent Dimming; Lutron Hi-lume 1 percent (LTE-Series):
- a. Dimming Range: 100 to one percent relative light output.
 - b. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial and residential applications at 120 V.
 - c. Total Harmonic Distortion (THD): Less than 20 percent at full output for 40 W loads; complies with ANSI C82.11.
 - d. Constant Current Drivers:
 - 1) Support for downlights and pendant fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 53 W.

- (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
- 2) Support for troffers, linear pendants, and linear recessed fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
- 3) Support for cove and under-cabinet fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
 - (c) UL listed.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
- e. Constant Voltage Drivers:
 - 1) Support for downlights and pendant fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - (c) UL listed Class P.

- (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - 2) Support for troffers, linear pendants, and linear recessed fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - (c) UL listed Class P.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
 - 3) Support for cove and under-cabinet fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - (c) UL listed.
 - (d) Meets solid state requirements for power factor, transient protection, start time, and operating frequency in Energy Star for Luminaires Version 2.0.
- 6. 3-Wire and Digital Control, One Percent Dimming; Lutron Hi-lume 1 percent (L3D-Series):
 - a. Dimming Range: 100 to one percent relative light output.
 - b. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120 V or 277 V.
 - c. Total Harmonic Distortion (THD): Less than 20 percent at full output for loads greater than 25 W typical (higher for select models); complies with ANSI C82.11.
 - d. Constant Current Drivers:
 - 1) Support for downlights and pendant fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 53 W.
 - (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.

- 2) Support for troffers, linear pendants, and linear recessed fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
- 3) Support for cove and under-cabinet fixtures from 200 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) or Constant Current Reduction (CCR) dimming methods available.
 - (c) UL listed.
- e. Constant Voltage Drivers:
 - 1) Support for downlights and pendant fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - 2) Support for troffers, linear pendants, and linear recessed fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - 3) Support for cove and under-cabinet fixtures from 10 V to 60 V (in 0.5 V steps) to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) Pulse Width Modulation (PWM) dimming method.
 - (c) UL listed.
- 7. Digital Control, Five Percent Dimming; Lutron 5-Series (LDE5-Series):
 - a. Dimming Range: 100 to five percent measured output current.
 - b. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.

- c. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
 - d. Constant Current Reduction (CCR) dimming method.
 - e. Total Harmonic Distortion (THD): Less than 21 percent at full load; complies with ANSI C82.11.
 - f. Constant Current Drivers:
 - 1) Lutron K-Case Form Factor: Support for downlights and pendant fixtures in currents from 220 mA to 1.4 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 40 W.
 - (b) UL listed Class P.
 - 2) Lutron M-Case Form Factor: Support for troffers, linear pendants, and linear recessed fixtures from 150 mA to 2.1 A to ensure a compatible driver exists.
 - (a) Support LED arrays up to 75 W.
 - (b) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in ENERGY STAR for Luminaires Version 2.0.
 - (c) Models available to meet the DesignLights Consortium (DLC) power line quality requirements.
 - (d) UL listed Class P.
8. Digital Control, One Percent Dimming with Soft-On and Fade-to-Black Low End Performance; Lutron Hi-lume 1 percent Soft-on Fade-to-Black (LDE1-Series):
- a. Dimming Range: 100 to one percent measured output current.
 - b. Features smooth fade-to-on and fade-to-black (Lutron Soft-On, Fade-to-Black™) low end dimming performance for an incandescent-like dimming experience.
 - c. Typically dissipates 0.2 W standby power at 120 V and 0.3 W standby power at 277 V.
 - d. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277 V.
 - e. Employs true Constant Current Reduction (CCR) dimming method from 100 to five percent light level and Pulse Width Modulation (PWM) dimming method from five percent to off.
 - f. Pulse Width Modulation (PWM) frequency of 240 Hz.

- g. Total Harmonic Distortion (THD): Less than 20 percent at full output for drivers greater than 25 W; complies with ANSI C82.11.
- h. UL Class 2 output.
- i. Driver outputs to be short circuit protected, open circuit protected, and overload protected.
- j. Constant Current Drivers:
 - 1) Lutron K-Case Form Factor: Support for fixtures from 220 mA to 1.4 A over multiple operating ranges.
 - (a) Support LED arrays up to 40 W.
 - (b) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in ENERGY STAR for Luminaires Version 2.0.
 - (c) UL listed Class P.
 - 2) Lutron M-Case Form Factor: Support for fixtures from 150 mA to 2.1 A over multiple operating ranges.
 - (a) Support LED arrays up to 75 W.
 - (b) Meets solid state requirements for power factor, transient protection, standby power consumption, start time, and operating frequency in ENERGY STAR for Luminaires Version 2.0.
 - (c) Models available to meet the DesignLights Consortium (DLC) power line quality requirements.
 - (d) UL listed Class P.

2.4 POWER INTERFACES

- A. Provide power interfaces as indicated or as required to control the loads as indicated.
- B. General Requirements:
 - 1. Phase independent of control input.
 - 2. Rated for use in air-handling spaces as defined in UL 2043.
 - 3. Utilize air gap off to disconnect the load from line supply.
 - 4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

C. Product(s):

1. Phase-Adaptive Power Module; Lutron PHPM-PA: Provides interface for phase control input to provide full 16 A circuit output of forward/reverse phase control for compatible loads.
2. Switching Power Module; Lutron PHPM-SW: Provides interface for phase control or switched input to provide full 16 A circuit output of switching for compatible non-dim loads.
3. Ten Volt Interface; Lutron GRX-TVI: Provides interface for phase control input to provide full 16 A circuit output of switching and 0-10 V low voltage control for compatible fluorescent electronic dimming ballasts or LED drivers.

2.5 TIMECLOCK

A. Product: Lutron Model QSGR-TC-3S-WH.

B. Allows set up of shade presets using buttons on control unit.

C. Built-in Astronomical Timeclock:

1. 7 day schedules available.
2. One available holiday schedule is programmable by date up to one year in advance.
3. 25 events per day maximum.
4. Astronomic times are programmable by integral city database or entering latitude and longitude. Time automatically adjusts throughout the year based on location.
5. Automatically adjusts for Daylight Savings Time (DST), adjusted for the new dates; DST is programmable.
6. Afterhours Mode:
 - a. When an area is triggered to enter afterhours mode, flash lights to give warning to occupants of impending lighting shutoff.
 - b. Turn lights off after a specified time delay if there is no occupant manual override.
 - c. Allow occupant to temporarily override lighting shutoff for a specified time period by pressing button on any control assigned to the area. After specified time period has expired, enter afterhours mode again and initiate warning as described above.
7. Security lockout via password for timeclock settings.

D. Contact Closure Input (CCI):

1. Capable of operating in the following modes:

- a. Afterhours: Allows the CCI to start and end the afterhours mode.
- b. Timeclock: Allows the CCI to enable and disable the timeclock.
- c. Disable CCI: CCI will have no effect on the system and will not appear on the list of available sensors.

2.6 LIGHTING CONTROL MODULES (LUTRON ENERGI SAVR NODE)

A. Provide lighting control modules as indicated or as required to control the loads as indicated.

B. General Requirements:

1. Listed to UL 508 as industrial control equipment.
2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
 - a. Occupancy sensors.
 - b. Daylight sensors.
 - c. IR receivers for personal control.
6. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
7. Contact Closure Input:
 - a. Directly accept contact closure input from a dry contact closure or sold-state output without interface to:
 - 1) Activate scenes.
 - (a) Scene activation from momentary or maintained closure.
 - 2) Enable or disable after hours.
 - (a) Automatic sweep to user-specified level after user-specified time has elapsed.
 - (b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
 - (c) Occupant can reset timeout by interacting with the lighting system.

3) Activate or deactivate demand response (load shed).

(a) Load shed event will reduce lighting load by user-specified amount.

8. Emergency Contact Closure Input:

- a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
- b. Allow configurable zone response during emergency state.
- c. Disable control operation until emergency signal is cleared.

9. Supplies power for control link for keypads and control interfaces.

10. Distributes sensor data among multiple lighting control modules.

11. Capable of being controlled via wireless sensors and controls.

C. Switching Lighting Control Modules:

1. Product(s):

- a. Lutron SoftSwitch Energi Savr Node; Model QSN-4S16-S: 16 A continuous-use per channel.
- b. Lutron SoftSwitch Energi Savr Node; Model QSN-4S20-S: 20 A (16 A ballast) continuous-use per channel.

2. Switching:

- a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
- b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
- c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
- d. Module to integrate up to four individually controlled zones.
- e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. Phase Adaptive Lighting Control Modules:

1. Product(s):

- a. Lutron PRO LED+ Phase Adaptive Energi Savr Node; Model QSN-4A5-S; 4-zone.

- 1) Zone 1: Rated for incandescent/halogen (800 W, 120/277 V), electronic low voltage (800 W, 120/277 V), magnetic low voltage (800 VA/525 W, 120/277 V), or neon/cold cathode (800 VA/525 W, 120/277 V), Lutron Hi-lume 1 percent 2-wire LED Driver (120 V, maximum of 20 drivers), NEMA SSL 7A forward phase LED (400 W, 120 V), reverse phase LED (6.6 A at 120 V and 2.9 A at 277 V).
 - 2) Zones 2 through 4: Each zone rated for incandescent/halogen (500 W, 120/277 V), electronic low voltage (500 W, 120/277 V), magnetic low voltage (500 VA/375 W, 120/277 V), or neon/cold cathode (500 VA/375 W, 120/277 V), Lutron Hi-lume 1 percent 2-wire LED Driver (120 V, maximum of 13 drivers), NEMA SSL 7A forward phase LED (200 W, 120 V), reverse phase LED (4.2 A at 120 V and 1.8 A at 277 V).
2. Provides leading-edge or trailing-edge dimming; automatic or manual configuration.
 3. Output Zones: One load type per zone.
 4. Manual Mode Operation: Provide buttons to turn loads on/off or dim loads up/down for each zone.
 5. Manual Override Contact Closure Input: Provides activation of manual override mode; turns all loads on and disables control from other devices.
 6. Provide cycle-by-cycle compensation for incoming line voltage variations, including changes in voltage, frequency shifts, harmonics, and line noise; accommodate up to plus/minus two percent change in frequency per second.
 7. Comply with NEMA SSL 7A.
 8. Capable of withstanding high-inrush LEDs, bulb blowouts, and direct shorts utilizing RTISS-ICM technology.
- E. 0-10V Lighting Control Modules:
1. Product(s):
 - a. Lutron 0-10 V Energi Savr Node; Model QSN-4T16-S: 16 A continuous-use per channel.
 - b. Lutron 0-10 V Energi Savr Node; Model QSN-4T20-S: 20 A (16 A ballast) continuous-use per channel.
 2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
 3. Single low voltage dimming module; capable of controlling following light sources:
 - a. 0-10 V analog voltage signal.

- 1) Provide Class 2 isolated 0-10 V output signal conforming to IEC 60929.
- 2) Sink current per IEC 60929.
- b. 10-0 V analog voltage signal.
 - 1) Provide Class 2 isolated 0-10 V output signal conforming to IEC 60929.
 - 2) Sink current per IEC 60929.
4. Switching:
 - a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
 - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
 - d. Module to integrate up to four individually controlled zones.
 - e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

F. Digital Fixture Lighting Control Modules:

1. Product(s):
 - a. Lutron EcoSystem Energi Savr Node; Model QSN-1ECO-S: One EcoSystem Digital Link.
 - b. Lutron EcoSystem Energi Savr Node; Model QSN-2ECO-S: Two EcoSystem Digital Links.
2. Provides two-way feedback with digital fixtures for energy monitoring, light level status, lamp failure reporting, and ballast/driver failure reporting.
3. Provide testing capability using manual override buttons.
4. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

2.7 DIGITAL DIMMING BALLAST AND SWITCHING MODULES (LUTRON ECOSYSTEM)

- A. Provide digital dimming ballast and switching modules as indicated or as required to control the loads as indicated.
- B. General Requirements:

1. Provide continuous 3-wire signal dimming to compatible 3-wire electronic dimming ballasts.
2. Utilize air gap off to disconnect the load from line supply.
3. Connect without interface to:
 - a. Occupancy sensor.
 - b. Daylight sensor.
 - c. Personal control input (wall station or infrared receiver).
4. Generate digital communication commands to distribute ballast and sensor data on the digital bus.
5. If power is interrupted and subsequently restored, lights automatically return to the setting prior to power interruption.
6. Each ballast module responds independently to:
 - a. Up to 32 occupancy sensors.
 - b. Up to 64 personal control inputs.
 - c. Two daylight sensors.
7. Unique internal reference number visible displayed on module cover.
8. Averages two independent daylight harvesting inputs internally.
9. Responds to digital load shed command.
 - a. Sets high end trim.
 - b. Automatically scales light output proportional to load shed command. (Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast to automatically set the maximum light output at 90 percent and lower current light output by 3 percent to 27 percent).
10. Provide integral fault protection to prevent ballast module failure in the event of a miswire.

C. Product(s):

1. 3-Wire Ballast Module, 2 Amp; Lutron EcoSystem Model C5-BMF-2A:
 - a. Integrates up to 2 amps of 3-wire electronic dimming ballasts into EcoSystem digital control system as a single zone.
2. 3-Wire Ballast Module, 16 Amp; Lutron EcoSystem Model C5-BMJ-16A:

- a. Integrates up to 16 amps of 3-wire electronic dimming ballasts into EcoSystem digital control system as a single zone.
 - b. Integrates up to 16 amps of switched high intensity discharge (HID) lighting load into EcoSystem digital control system as a single zone.
- 3. Switching Power Module, 16 Amp; Lutron EcoSystem Model C5-XPJ-16A:
 - a. Integrates up to 16 amps of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, HID, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads) into EcoSystem digital control system as a single zone.

2.8 CONTROL STATIONS

- A. Provide control stations with configuration as indicated or as required to control the loads as indicated.
- B. Wired Control Stations:
 - 1. General Requirements:
 - a. Power: Class 2 (low voltage).
 - b. UL listed.
 - c. Provide faceplates with concealed mounting hardware.
 - d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
 - e. Finish: White, unless otherwise indicated
 - 2. Multi-Scene Wired Control:
 - a. General Requirements:
 - 1) Allows control of any devices part of the lighting control system.
 - 2) Allows for easy reprogramming without replacing unit.
 - 3) Replacement of units does not require reprogramming.
 - 4) Communications: Utilize RS485 wiring for low-voltage communication.
 - 5) Engrave keypads with button, zone, and scene descriptions to be selected by Contracting Officer.
 - 6) Software Configuration:

- (a) Customizable control station device button functionality:
 - (1) Buttons can be programmed to perform single defined action.
 - (2) Buttons can be programmed to perform defined action on press and defined action on release.
 - (3) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
 - (4) Buttons can be programmed to perform automatic sequence of defined actions.
 - (5) Capable of deactivating select keypads to prevent accidental changes to light levels.
 - (6) Buttons can be programmed for raise/lower of defined loads.
 - (7) Buttons can be programmed to toggle defined set of loads on/off.
- 7) Status LEDs:
 - (a) Upon button press, LEDs to immediately illuminate.
 - (b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
 - (c) Support logic that defines when LED is illuminated:
 - (1) Scene logic (logic is true when all zones are at defined levels).
 - (2) Room logic (logic is true when at least one zone is on).
 - (3) Pathway logic (logic is true when at least one zone is on).
 - (4) Last scene (logic is true when spaces are in defined scenes).
- b. Wired Keypads; Lutron seeTouch QS Keypads:
 - 1) Style: Architectural Non-Insert Style
 - 2) Communications: Utilize RS485 wiring for low-voltage communications link.
 - 3) Mounting: Wallbox or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
 - 4) Button/Engraving Backlighting:

- (a) Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
 - (b) Backlight intensity adjustable via programming software.
 - 5) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
 - 6) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.
 - 7) Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.
3. Single-Scene or Zoned Wired Control:
- a. Product: Lutron Pico Wired Control.
 - b. Turn an individual fixture or group of fixtures on and off.
 - c. Raise and lower light levels.
 - d. Recall favorite light levels.
4. Four-Button Preset Wallstation:
- a. Product: Lutron EcoSystem CC-4BRL Four-Button Control.
 - b. Recall four scenes plus all on or all off for one group of fixtures.
 - c. Master raise/lower control for entire group of fixtures.
 - d. Integral IR receiver for personal control.
 - e. Immediate local LED response upon button activation to indicate that a system command has been requested.

C. Wireless (Radio Frequency) Controls:

- 1. Product(s):
 - a. 2-Button Control; Lutron Pico Wireless Control Module UPJ2-2B (BAA-Buy American Act Compliant).
 - 1) Button Marking: Light (icons)
 - b. 2-Button with Raise/Lower Control; Lutron Pico Wireless Control Module UPJ2-2BRL (BAA-Buy American Act Compliant).
 - 1) Button Marking: Light (icons)

2. Quantity: As indicated on the drawings
3. Communicates via radio frequency to compatible dimmers, switches, and plug-in modules.
4. Does not require external power packs, power or communication wiring.
5. Allows for easy reprogramming without replacing unit.
6. Button Programming:
 - a. Single action.
 - b. Toggle action.
 - c. Defined action on press and defined action on release.
7. Includes LED to indicate button press or programming mode status.
8. Mounting:
 - a. Capable of being mounted with a table stand or directly to a wall under a faceplate.
 - b. Faceplates: Provide concealed mounting hardware.
9. Power: Battery-operated with minimum ten-year battery life.
10. Finish:; White

2.9 LOW-VOLTAGE CONTROL INTERFACES

- A. Provide low-voltage control interfaces as indicated or as required to control the loads as indicated.
- B. UL listed.
- C. Contact Closure Interface:
 1. Product: Lutron Model QSE-IO.
 2. The contact closure input device to accept both momentary and maintained contact closures.
 3. The contact closure output device can be configured for maintained or pulsed outputs.
 4. Contact closure can be programmed using conditional logic off of a state variable such as time of day or partition status.
- D. Wallbox Input Closure Interface:
 1. Product: Lutron Model QSE-CI-WCI.

2. Mounts in wallbox behind contact closure keypad to provide interface for up to eight contact closure inputs.
3. The contact closure input device to accept both momentary and maintained contact closures.

E. RS232 and Ethernet Interface:

1. Product: Lutron Model QSE-CI-NWK-E.
2. Provide ability to communicate via Ethernet or RS232 to audiovisual equipment, touchscreens, etc.
3. Provide control of:
 - a. Light scene selections.
 - b. Fine-tuning of light scene levels with raise/lower.
 - c. Shade group presets.
 - d. Fine-tuning of shade preset levels with raise/lower.
 - e. Simulate system wall station button presses and releases.
4. Provide status monitoring of:
 - a. Light scene status.
 - b. Shade group status.
 - c. Wall station button presses and releases.
 - d. Wall station LEDs.
5. Provide ability to send custom output strings.

F. Sensor Modules:

1. Products:
 - a. Sensor module with both wired and wireless inputs; Lutron Model QSM2-4W-C.
 - b. Sensor module with wired inputs only; Lutron Model QSMX-4W-C.
 - c. Sensor module with wireless inputs only; Lutron Model QSM2-XW-C.
2. Wired Modules:
 - a. Provide wired inputs for:
 - 1) Occupancy sensors.

- 2) Daylight sensors.
 - 3) IR receivers for personal control.
 - 4) Digital ballast wall stations.
3. Wireless Modules:
- a. Provide wireless communication inputs for:
 - 1) Occupancy sensors.
 - 2) Daylight sensors.
 - 3) Wireless controller.
 - b. RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.
 - c. RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
4. Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.10 WIRED SENSORS

A. Wired Occupancy Sensors:

- 1. General Requirements:
 - a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.
 - b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
 - c. Accommodates all conditions of space utilization and all irregular work hours and habits.
 - d. Comply with UL 94.
 - e. Self-Adaptive Sensors: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space; furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
 - f. Provide capability to:
 - 1) Add additional timeout system-wide without need to make local adjustment on sensor.
 - 2) Group multiple sensors.

- g. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
 - h. Furnished with all necessary mounting hardware and instructions.
 - i. Class 2 devices.
 - j. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
 - k. Wall-Mounted Sensors: Provide swivel-mount base.
 - l. Color: White.
2. Wired Passive Infrared Sensors:
- a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - b. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
 - c. Product(s):
 - 1) Ceiling-Mounted Passive Infrared Sensor, 450 square feet (42 sq m); Lutron Model ULOS-CIR-450-WH (BAA-Buy American Act Compliant): Coverage of 450 square feet (42 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view; self-adaptive.
 - 2) Ceiling-Mounted Passive Infrared Sensor, 1500 square feet (140 sq m); Lutron Model ULOS-CIR-1500-WH (BAA-Buy American Act Compliant): Coverage of 1500 square feet (140 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view; self-adaptive.
 - 3) Wall-Mounted Passive Infrared Sensor; Lutron Model ULOS-WIR-WH (BAA-Buy American Act Compliant): Coverage of 1600 square feet (149 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 110 degree field of view; self-adaptive.
3. Wired Ultrasonic Sensors:
- a. Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.
 - b. Product(s):
 - 1) Ceiling-Mounted Ultrasonic Sensor, 500 square feet (46 sq m); Lutron Model ULOS-CUS-500-WH (BAA-Buy American Act Compliant):

Coverage of 500 square feet (46 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 180 degree field of view; self-adaptive.

B. Sensor Power Packs:

1. Product(s):
 - a. 347 VAC power input/24 VDC, 100 mA power output; 15 A ballast (347 V) relay contact rating; Lutron Model UPP-347H Power Pack (BAA-Buy American Act Compliant).
 - b. 120-277 VAC power input/24 VDC, 150 mA power output; 16 A lighting (120-177 V), 1 HP motor (120-277 V) relay contact rating; Lutron Model UPP-DV Power Pack (BAA-Buy American Act Compliant).
 - c. 120-277 VAC power input (manual)/24 VDC, 150 mA power output; 16 A lighting (120-177 V), 1 HP motor (120-277 V) relay contact rating Lutron Model UPP-DV-M Power Pack (BAA-Buy American Act Compliant).
 - d. Control relay only (no power input/output); requires another power pack for power and counts as one of three sensors connected to a power pack; 16 A lighting (120-277 V), 1 HP motor (120-277 V), 15 A ballast (347 V) relay contact rating; Lutron Model UPP-SH Power Pack (BAA-Buy American Act Compliant).
2. Provide sensor power packs where required for power connection to sensors.
3. For ease of mounting, installation and future service, power pack(s) to be able to mount through a 1/2 inch knockout in a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer to provide power to a minimum of three sensors.
4. Plenum-rated.
5. Control Wiring Between Sensors and Control Units: Class 2, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

C. Infrared Receivers:

1. Product: Lutron Model EC-IR-WH.
2. Use Class 2 wiring for low voltage communication.
3. Can be replaced without reprogramming.
4. 360 degree reception of wireless infrared remote controls.
5. Immediate local LED response upon reception of handheld transmitter communication.

6. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
7. Constructed via sonic welding.
8. Color: White.

D. Wired Daylight Sensors:

1. Digital Interior Daylight Sensor:
 - a. Product: Lutron Model EC-DIR-WH.
 - b. Use Class 2 wiring for low voltage communication.
 - c. Can be replaced without reprogramming.
 - d. Open-loop basis for daylight sensor control scheme.
 - e. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
 - f. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
 - g. Provide linear response from 0 to 500 footcandles.
 - h. Integral IR receiver for personal control.
 - i. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
 - j. Constructed via sonic welding.
 - k. Color: White.

2.11 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.
5. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).

6. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

B. Wireless Occupancy/Vacancy Sensors:

1. General Requirements:

- a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
- b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
- c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
- d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
- e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
- f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
- g. Color: White.
- h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
- i. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
- j. Sensor lens to illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
- k. Ceiling-Mounted Sensors:
 - 1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
 - 2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.

- 3) Provide customizable mask to block off unwanted viewing areas.
1. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.
2. Wireless Combination Occupancy/Vacancy Sensors:
 - a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
 - b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
 - c. Product(s):
 - 1) Ceiling-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model ULFR2-OCR2B-P-WH (BAA-Buy American Act Compliant: Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
 - 2) Wall-Mounted Occupancy/Vacancy Sensor; Lutron Radio Powr Savr Series, Model ULFR2-OWLB-P-WH (BAA-Buy American Act Compliant: Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 180 degree field of view.
- C. Wireless Daylight Sensors:
 1. Product: Lutron Model LFR2-DCRB.
 2. Open-loop basis for daylight sensor control scheme.
 3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
 4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
 5. Provide linear response from 0 to 10,000 footcandles.
 6. Color: White.
 7. Mounting:

- a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
 - b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
8. Meets CAL TITLE 24 P6 requirements.

2.12 ACCESSORIES

A. Emergency Lighting Interface:

- 1. Product: Lutron Model LUT-ELI.
- 2. Provides total system listing to UL 924 when used with lighting control system.
- 3. Senses all three phases of building power.
- 4. Provides an output to power panels or digital ballast interfaces if power on any phase fails and sends all lights controlled by these devices to 100 percent intensity. Lights to return to their previous intensities when normal power is restored.
- 5. Accepts a contact closure input from a fire alarm control panel.

B. Provide power supplies as indicated or as required to power system devices and accessories.

- 1. Product(s):
 - a. Junction box-mounted power supply for, keypads, and accessories, and for providing additional low voltage power to communication link; Lutron Model QSPS-J-1-35V; with miswire and thermal protection.
 - b. Plug-in power supply for keypads, and accessories, and for providing additional low voltage power to communication link; Lutron Model QSPS-P1-1-35V; with miswire protection; powered from standard receptacle using cord 6 feet (1.8 m) in length; complies with DOE Level VI regulation.
 - c. Ten output power supply panel for keypads and accessories, and for providing additional low voltage power to communication link; Lutron Model QSPS-10PNL; no replaceable fuses required for overload/miswire protection; contains DOE Level VI Compliant power supplies.
 - d. Power supply for keypads and accessories (not for shades/window treatments), and for providing additional low voltage power to communication link; Lutron Model QSPS-DH-1-75.

- e. Power supply for keypads and accessories (not for shades/window treatments), and for providing additional low voltage power to communication link; Lutron Model WQSPS-DH-1-75; TAA – Trade Agreement Act compliant.
- 2. Reversible to allow lock to be located on either side of control.
- 3. Compatible with IR controls.
- 4. Does not reduce specified IR range by more than 50 percent of its original specification.
- 5. Product(s):
 - a. 1-gang device for compatible Lutron QS keypads; Lutron Model GRX-1GLC.
 - b. 4-gang device for Lutron Grafik Eye QS main units; Lutron Model QSG-4GLC.

2.13 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory Testing; Lutron Standard Factory Testing:
 - 1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
 - 2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.
 - 3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for two hours.
 - 4. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130
- B. Install products in accordance with manufacturer's instructions.

- C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.
- D. Sensor Locations:
 - 1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.
 - 2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
- E. Mount exterior daylight sensors to point due north with constant view of daylight.
- F. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
- G. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- H. Lamp Lead Lengths: Do not exceed 3 feet (0.9 m) for T4 4-pin compact and T5 BIAX lamps and 7 feet (2.1 m) for T5, T5-HO, T8 U-bend, and T8 linear fluorescent lamps.
- I. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).
- J. Identify system components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Manufacturer's Startup Services; Lutron Standard Startup Services:
 - 1. Manufacturer's authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.
 - 2. Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".
 - 3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:
 - a. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM – GENERAL

REQUIREMENTS”, authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.

- b. Verify connection of power wiring and load circuits.
 - c. Verify connection and location of controls.
 - d. Address devices.
 - e. Verify system operation control by control.
 - f. Verify proper operation of manufacturer's interfacing equipment.
 - g. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
 - h. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
 - i. Train Contracting Officer on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
 - j. Obtain sign-off on system functions.
- C. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

- A. Training Visit: Lighting Control System Manufacturer to provide one day additional on-site system training to site personnel no less than two months after Substantial Completion, separate from start-up and programming visit.
- B. On-Site Walk Through: Lighting Control System Manufacturer to provide a factory certified Contracting Officer to demonstrate system functionality to the Commissioning Agent.
- C. Test lighting controls to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with Drawings and Specifications. Provide functional testing of sequences of operation to ensure operation in accordance with Drawings

and Specifications. Provide complete report of test procedures and results to Contracting Officer and insert approved copy into project closeout documents.

D. Testing Includes:

1. Occupant sensing automatic controls.
2. Automatic time controls for exterior lighting.

3.6 PROTECTION

- A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Switchboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 28 00, Overcurrent Protective Devices.
3. Section 26 43 00, Surge Protective Devices

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 891, Standards for Switchboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Operation and Maintenance Manuals:
 - a. After completion of work and start-up of the equipment at the project site, deliver to the Contracting Officer operation instructions, maintenance manuals and drawings presenting full details for care and maintenance of each time of equipment provided under this Contract. Number of copies in accordance with Division 01.
 - b. Each copy to contain the operating and maintenance information and parts lists for equipment provided under this Contract. When necessary, provide supplemental drawings to show system operation and servicing maintenance points. For

electrical components, provide wiring and connection diagrams. Include instructions required to accomplish specified operation and functions. Data to be neat, clean and legible.

- c. Switchboard drawings and wiring diagrams to be included and up to date at the completion of start-up and system acceptance by the Contracting Officer. Drawings and wiring diagrams to include any field modifications or changes to reflect actual as-installed conditions.
- d. In general, the manual to include, but not necessarily be limited to, the following:
 - 1) Switchboard Elevation and One Line.
 - 2) AC and DC Schematic and Physical Component Layout Drawings.
 - 3) Remote Interface Drawing.
 - 4) Bill of Material.
 - 5) Description of Operation.
- e. Provide manuals in accordance with Division 01 adequately labeled with the project name and location and the contents indexed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Switchboards
 - 1. Eaton
 - 2. GE Industries
 - 3. Siemens
 - 4. Basis of Design: Schneider Electric/Square D
 - 5. Or approved equivalent.

- B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances and selective coordination per Section 26 05 73, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Contracting Officer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Contracting Officer, that does not meet these conditions.

2.2 SWITCHBOARDS

- A. Description: NEMA PB 2 freestanding switchboard with electrical ratings and configurations as indicated and specified.
- B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electrical utility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.
- C. Enclosure to be suitable for having 100 percent rated circuit breakers installed and applied at 100 percent. Enclosure to meet minimum size and ventilation requirements set forth on the 100 percent circuit breaker or must be UL tested for 100 percent rating of the circuit breaker.
- D. Bus Material: Copper, standard size.
- E. Ground Bus: Extend length of switchboard, 50 percent of phase bus capacity.
- F. Neutral Bus: 100 percent rated, full length of switchboard.
- G. Lugs: Mechanical type for copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating. All device terminals/lugs must be UL listed to match their conductor ampacity rating.
- H. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
 - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 2. Include shunt trip where indicated.
- I. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.
- J. Utility Pull Section:
 - 1. Width as shown on Drawings. Depth and height to match switchboard.
 - 2. Arrange as shown on Drawings.

- K. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- L. Enclosure: NEMA Type 1 - Indoor.
 - 1. Align sections as shown on Drawings.
 - 2. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
 - 3. Removable front covers: Screw attached.
 - 4. Provide removable hinge pins on hinged doors.
 - 5. Provide full height barriers between sections.
- M. Surge Protective Device: Provide for emergency distribution systems equipment as required per NEC Article 700.8.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Provide concrete housekeeping pad. Extend 6-inches beyond switchboard width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
- B. Verify that field measurements are as indicated on Shop Drawings.
- C. Install in a neat and workmanlike manner and in location shown on Drawings, according to NEMA PB 2.1.
- D. Adjust all operating mechanisms for free mechanical movement.
- E. Tighten bolted bus connections in accordance with manufacturer's instructions.
- F. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

3.2 SWITCHBOARDS INSTALLATION

- A. Shop inspect and test switchboard according to NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Contracting Officer at least 7 days before inspection is allowed.
- C. Install switchboard in accordance with manufacturer's installation instructions.
- D. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

- F. Provide engraved nameplates per Section 26 05 53, Identification of Electrical Systems.
- G. Perform field inspection and testing.
- H. Perform inspections and tests listed in NETA STD ATS, Section 7.1.
- I. Measure, using a Megger, insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 Vdc; minimum acceptable value for insulation resistance is 1 megohm.
- J. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.
- K. Clean exterior and interior of switchboard in accordance with manufacturers installation instructions.
- L. Vacuum construction dust, dirt, and debris out of switchboard interior.
- M. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Power Distribution Panelboards
2. Panelboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 24 13, Switchboards.
3. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Distribution Panelboards:

1. Eaton
2. Basis of Design: ABB/General Electric
3. Siemens
4. Basis of Design: Schneider Electric/Square D
5. Or approved equivalent.

B. Panelboards:

1. Eaton
2. ABB/General Electric
3. Basis of Design: Siemens
4. Basis of Design: Schneider Electric/Square D
5. Or approved equivalent.

- C. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 05 73, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Contracting Officer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Contracting Officer, that does not meet these conditions.

2.2 POWER DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1 Type 1 or as indicated on drawings, circuit breaker type.
- B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault currents.
- C. Panelboard Bus: Non-reduced copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.
- D. Lugs: Mechanical type for copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating. All device terminals/lugs must be UL listed to match their conductor ampacity rating.

- E. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- F. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.
- G. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- H. Circuit Breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per NEC Article 240.87(B).
- I. Fully equip unused spaces for future devices, including manufacturer required connections and mounting hardware.
- J. Cabinet Front: Surface type door-in-door construction, metal directory frame, finished in manufacturer's standard gray enamel.

2.3 PANELBOARDS

- A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 or as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5-3/4-inches for flush mounted.
- B. Maximum Width: 20-inches.
- C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current.
- D. Panelboard Bus Non-Reduced: Copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.
- E. Lugs: Mechanical type for copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating. All mechanical terminals/lugs must be ul listed to match their conductor ampacity rating.
- F. Provide double lugs and/or feed-through lugs for feed through feeders. All mechanical terminals/lugs must be ul listed to match their conductor ampacity rating.
- G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.

4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
 5. Do not use tandem circuit breakers.
- H. Accessories: Provide where indicated: shunt trip and Class A ground fault circuit interrupter (GFCI).
- I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover door-in-door construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.
- J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.
- K. Furnish surface mounted cabinet boxes without knockouts.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.
- B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Contracting Officer designated room names and numbers, and not designations shown on drawings.
- F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.
- G. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- H. Provide concrete housekeeping pad for floor-mounted distribution panelboards. Extend 6-inches beyond distribution panel width and depth dimensions. Minimum 3-inches above finished floor. Install plumb and level.
- I. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
- J. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit

breaker pole position.

- K. Ground and bond panelboard enclosure per NEC.
- L. Paint:
 - 1. Standard factory finish unless noted otherwise.
 - 2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Contracting Officer. Covers to be painted off wall, then installed over dried, painted wall surface.
- M. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.
- N. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.
- O. Verify available recessing depth and coordinate wall framing with other divisions.
- P. Maintain fire rating of wall where panels are installed flush in fire rated walls.
- Q. Perform inspections and tests in accordance with manufacturer's requirements.
- R. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.
- S. Vacuum construction dust, dirt, and debris out of each panelboard.
- T. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.
- U. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

3.2 POWER DISTRIBUTION PANELBOARDS INSTALLATION

- A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.
- B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire

branch circuits.

3.3 PANELBOARDS INSTALLATION

- A. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- B. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- C. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 27 13 - ELECTRICAL METERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Utility Metering Equipment
 - 2. Energy Metering
 - 3. Power Quality Metering

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 23 09 00, Instrumentation and Control Performance Specifications
 - 2. Section 26 24 13, Switchboards

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product Data: List of components for power monitoring, including dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. Attach copies of Submittals for effected products (such as switchboards and switchgear) that describe power monitoring features to coordinate Product Data related to power monitoring.
 - 2. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - a. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - b. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components.

Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

- c. Wiring Diagrams: Detail specific wiring to suit Project. Coordinate nomenclature and presentation with a block diagram, and differentiate between manufacturer-installed and field-installed wiring.
- 3. Closeout Documentation: Documentation that details the start-up procedure being performed including a process to follow, details on tests performed, and an area that documents any test results.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Energy metering to be of a single-source manufacturer of the major components within the assembly. Manufacturer will have documented experience in the manufacture of energy metering for a minimum of three years.
 - 2. Installer will have documented experience in the installation of energy metering for a minimum of three years.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements Division 01, General Requirements.

1.7 COORDINATION

- A. Coordinate features of distribution equipment and power monitoring components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of specified functions.
 - 2. Coordinate Work of this Section with BAS to indicate and record designated alarms registered in power monitoring displays.
 - a. Coordinate power monitoring components so metered electrical load and demand values and associated summary and trend reports specified in this Section are made accessible to the BAS system.
 - b. Log and store data from power monitoring system to facilitate production of monthly reports associated with the facility.
 - c. Provide capacity to maintain logged data for a minimum of ten years. Provide auto archive capability and locally accessible storage.

- B. Coordinate Work of this Section with that in Sections specifying distribution components that are monitored by power monitoring equipment.
- C. Coordinate a communication link with BAS to meet input requirements of BAS integrator and gateway equipment provided as part of BAS installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Utility Metering Equipment

a. Meter Base:

- 1) Circle AW.
- 2) Or approved equivalent.

b. Metering Equipment Enclosure:

- 1) ABB/General Electric
- 2) Schneider Electric/Square D
- 3) Eaton Electrical
- 4) Siemens
- 5) Or approved equivalent.

2. Energy Metering

- a. E-Mon D-Mon Class 2000D or 3000 with ModBus Communications Series.
- b. Or approved equivalent.

3. Power Quality Metering

- a. Schneider Electric/Square D Powerlogic Series
- b. Or approved equivalent.

2.2 UTILITY METERING EQUIPMENT

- A. Meter Base: Surface or Flush mounted meter socket enclosure. Provide meter base(s) for energy/demand and reactive energy/demand bases as required by serving electric utility.
- B. Terminal Cabinet: Provide terminal cabinet that meets serving utility company's requirements. Construct as an integral part of main distribution switchboard.
- C. Provide fault withstand rating greater than utility determined available fault current.

- D. C.T. Enclosure: Provide enclosure that meets serving utility company's requirements. Construct as an integral part of main distribution switchboard.

2.3 ENERGY METERING

- A. Provide fully electronic meter with cycling 8-digit LCD display for energy consumption (kWh), current and peak load (kW). Meter includes rate of consumption indication and segment test button to ensure integrity of display.
- B. Energy Consumption: Meter to indicate real time power consumption levels for field-testing and certification. Manually reset to zero.
- C. Enclosure: Heavy duty JIC steel enclosure suitable for indoor installation, lockable for preventing unauthorized access.
- D. Operating Parameters:
 - 1. Voltage: Up to 600 volts rms AC available.
 - 2. Current: Up to 3200 amps rms AC available.
 - 3. Power Factor: 0.5 lagging to 0.5 leading.
 - 4. Frequency: 50 to 60 Hz.
 - 5. Voltage Operating Range: Plus or minus 25 percent of rated voltage.
 - 6. Temperature Range: Minus 20C to plus 50C.
 - 7. Humidity: 0 to 95 percent non-condensing.
 - 8. Voltage Overload: Plus 25 percent continuous, plus 100 percent for 20 cycles.
 - 9. Current Overload: Plus 100 percent without damaging meter.
- E. Current and Peak Load: Supply meter with demand (Kw) reading. Demand reading to show highest peak demand and date and time peak occurred.
- F. Sampling: 15 or 30 minute demand interval (factory default: 15 minutes).
- G. Integral self-contained back-up system to maintain memory and display during power failures.
- H. 0-2V voltage output current sensors to allow paralleling and/or mounting up to 2000-feet from meter. Split core type sensor configuration to allow installation without powering down.
- I. Standards: UL listed; compliant with ANSI C12.1 and C12.16 specifications with split-core current sensors.
- J. Provide meter with following auxiliary device for interfacing to energy management system: digital to analog converter: 0 to 10Vdc or 4 to 20mA, pulser module: 4.5 to 28Vdc, or ModBus communications.

- K. Include a submeter with voltage, current and wire-configuration (2-, 3- or 4-wire, single or three-phase, grounded and undergrounded) as required on drawings.
- L. Conductors from current sensors and conductors for monitoring line voltage can be run in same conduit.

2.4 POWER QUALITY METERING

A. Power Meters:

1. Current/Voltage Inputs:

- a. Energy Monitoring System (EMS) power meter with no less than 4 voltage inputs and 5 current inputs
- b. EMS power meter in its standard configuration capable of accepting 600VAC LL / 347VAC LN without using potential transformers.
- c. EMS power meter is capable of withstanding 1500 VAC RMS continuously without damaging device.
- d. EMS power meter is capable of nominal current ratings of 1A, 2A, 5A, 10A, and/or 20A and an overcurrent rating of 500A for 1s (5A nominal model) or 200A for 1s (1A nominal model).

2. Measured Values:

- a. Minimum Voltage Values:
 - 1) Voltage L-L Per-Phase.
 - 2) Voltage L-L 3-Phase Avg.
 - 3) Voltage L-N Per-Phase.
 - 4) Voltage 3-Phase Avg.
 - 5) Voltage percent unbalanced.
- b. Minimum Current Values:
 - 1) Current Per-Phase.
 - 2) Current, Neutral (measured).
 - 3) Current 3-Phase Avg.
 - 4) Current percent Unbalanced.
- c. Minimum Power Values:
 - 1) Real Power (Per-Phase, 3-Phase Total).

- 2) Reactive Power (Per-Phase, 3-Phase Total).
- 3) Apparent Power (Per-Phase, 3-Phase Total).
- 4) Power Factor - True (Per-Phase, 3-Phase Total).
- 5) Power Factor - Displacement (Per-Phase, 3-Phase Total).
- d. Minimum Energy Values:
 - 1) Accumulated Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute).
 - 2) Incremental Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute).
 - 3) Conditional Energy (Real kWh, Reactive kVARh, Apparent kVAh) (Signed/Absolute).
 - 4) Reactive Energy by Quadrant.
- e. Minimum/maximum value for any measured parameter.
- f. Capable of deriving values for any combination of measured or calculated parameter, using following arithmetic, trigonometric, and logic functions (or equivalent PLC capabilities):
 - 1) Arithmetic functions: division, multiplication, addition, subtraction, power, absolute value, square root, average, max, min, RMS, sum, sum-of-squares, unary minus, integer ceiling, integer floor, modulus, exponent, PI.
 - 2) Trigonometric functions: COS, SIN, TAN, ARCCOS, ARCSIN, ARCTAN, LN, LOG10.
 - 3) Logic functions: , , , , , AND, OR, NOT, IF.
 - 4) Thermocouple linearization functions: Type J, Type K, Type R, Type RTD, Type T.
 - 5) Temperature conversion functions: C to F, F to C.
3. Demand:
 - a. Minimum/maximum demand, present demand interval, running average demand, and predicted demand on multiple demand channels.
 - b. Perform multiple accepted demand calculation methods including block, rolling block, and thermal demand with user-programmable demand period lengths.
4. Accuracy:

- a. Meeting ANSI C12.20 accuracy class 0.2.
 - b. Meeting IEC62053-22: Electricity metering equipment (AC) -particular requirements -part 22: Static meters for active energy, accuracy class 0.2S.
 - c. Meeting IEC62053-23: Electricity metering equipment (AC) - particular requirements -part 23: Static meters for reactive energy, accuracy class 1.
 - d. 4-quadrant metering.
5. Sampling:
- a. Sample at 256 samples/cycle.
 - b. Perform high speed sag/swell detection of voltage disturbances on a cycle-by-cycle basis, providing duration of disturbance, minimum, maximum, and average value of voltage for each phase during disturbance. Disturbances less than one cycle in duration can be detected.
6. Logging:
- a. Minimum 5MB of user programmable onboard data logging.
 - b. EMS store all critical internal and revenue data upon sudden power loss.
 - c. Non-volatile memory.
 - d. Time-stamped event log with following features:
 - 1) Supports at least 500 events.
 - 2) Number of records in log is programmable.
 - 3) Each event is recorded with date and time of event, cause and effect of event, and priority of event.
 - 4) Events relating to setpoint activity, relay operation and self-diagnostics is recorded in event log.
 - 5) Time stamps have a resolution of 1 millisecond.
 - 6) Time stamps can be synchronized to within 100 ms between devices on same serial communications medium.
 - 7) Minimum event recording response time is 1/2 cycle (8.3ms 60Hz, 10ms 50Hz) for high speed events and 1 second for other events.
 - 8) Priority of setpoint events is programmable.
 - e. Log any parameter in meter including min/max and waveforms.
7. Alarming:

- a. Setpoint driven alarming capability.
 - b. Generates an email on an alarm condition.
 - c. Millisecond timestamp resolution on alarm entries.
 - d. Capable readjusting alarm setpoints based on alarm quantity (Alarm Setpoint Learning).
 - e. Support consecutive high-speed alarm conditions which trigger on a cycle-by-cycle basis with no “dead” time between events (i.e., no need for a rearming delay time between events).
 - f. Capable of operating relays on alarm conditions.
 - g. Capable of initiating datalog captures on alarm conditions.
 - h. Capable of controlling digital output relays in an AND or an OR configuration, using pulse mode or latch mode operation, for control and alarm purposes.
 - i. Capable of combining any logical combination of any number of available setpoint conditions to control any internal or external function or event.
8. Communications:
- a. Capable of communications methods simultaneously and independently: Ethernet over Fiber or copper media.
 - b. Can support any one of following communications protocols on any one port at any one time:
 - 1) ION
 - 2) Ethergate
 - 3) Modemgate
 - 4) DNP 3.0
 - 5) SMTP
 - 6) SNTP
 - 7) MV-90 compatibility
 - 8) XML compatibility
 - 9) SNMP
 - 10) HTTP (web pages)
 - c. Can support GPS time synchronization.

- d. Equipped with an Ethernet port are internet enabled and supports following functions:
 - 1) Automatically e-mail alarm notifications or scheduled system status updates. E-mail messages sent by EMS power meters can be received like any ordinary e-mail message. Data logs can also be sent on an event-driven or scheduled basis.
 - 2) Built in web pages in EMS power meters enables access to real-time values and basic power quality information using a standard web browser. Basic configuration of EMS power meters can also be performed through browser.
 - 3) Integration with custom reporting, spreadsheet, database and other applications with XML compatible data.
9. I/O Options:
- a. Capable of having 16 digital inputs capable of 1/2 cycle timing resolution.
 - b. Digital outputs that support pulse output relay operation for kWh total, kWh imported, kWh exported, kVARh total, kVARh imported, kVARh exported, and kVAh values.
 - c. 3 Form C relays which are isolated for up to 5000 VAC for 1 minute and 10A continuous for 30VDC and up to 240VAC.
 - d. 4 Form A analog inputs which are optically isolated.
 - e. 4 analog outputs with a 0-20mA range.
10. Display:
- a. 320 x 240 pixel LCD display.
 - b. Capable of supporting direct display of all parameters on front panel.
 - c. Capable of adding trend display of any parameter internally recorded at regular intervals.
 - d. User programmable custom display that is capable of displaying up to 20 quantities on single screen.
 - e. Capable of displaying advanced graphical representations of metering information including at minimum spectral components, phasor diagrams, and trending charts.
 - f. Capable of displaying measurements in either IEC or IEEE formats.
 - g. Capable of displaying following front panel screens:
 - 1) Numeric: Display 2, 3, 3 with timestamp, 4, 8, 10, or 20 parameters at a time.

- 2) Event Log: Display recent events written to EMS power meter's event log, including diagnostic events.
- 3) Nameplate: Display information in tabular format (default nameplates show Contracting Officer, meter and power system details).
- 4) Trend Bar: Display up to 4 real time numeric parameters along with their upper and lower extremes.
- 5) Histogram: Display harmonics content in histogram format, including 2nd to 63rd harmonic, THD (total, even, odd); current harmonics histogram screens display K Factor and Crest Factor.
- 6) Phasor: Display phase information in phasor diagram format, including phase, voltage and current magnitudes; phasors that are too small in magnitude are shown as table entries only.

11. Field Programmability:

a. Capable of being field programmable as follows:

- 1) Basic parameters: Voltage input scale, voltage mode (Wye, Delta, single phase), current input scale, auxiliary input and output scales, and communications setup parameters are programmable from front panel.
- 2) Basic parameters described above, plus additional setpoint/relay and data log setup parameters may be programmed via communications port using portable or remotely located computer terminal.
- 3) Custom configuration of operating parameters is possible through graphical, flexible programming language.
- 4) Configuration of device using programmable modules. Modules can be linked together in an arbitrary manner to create arbitrary functionality. Some example module types include min, max, setpoint, digital input, and digital output.
- 5) Programming through computer secured by user ID and password.
- 6) Programming through front panel is secured by password.
- 7) Programmability sectioned such that when meter is sealed, meter can still be configurable to an extent that does not affect accumulation of revenue metering related data.

12. Advanced Features:

a. Field upgradeable.

- b. Onboard meter clock can be paced by a choice of sources including GPS, power line, or internal clock.
- c. Multi-level security which supports customized access for up to 16 users.
- d. Revenue security capabilities including but not limited to following:
 - 1) Password protected, no hardware lock, or
 - 2) Password protected and hardware locked, or
 - 3) Following data is protected from alteration when locked:
 - (a) kWh and kVARh (import, export, net and total)
 - (b) kVAh (total)
 - (c) kW, kVAR, kVA demand (thermal and sliding window)
 - (d) kWh, kVARh, kVAh pulse outputs
- e. Provisions for conformal coating of its internal circuitry for installations exposed to high degrees of humidity. (Tropicalization treatment).
- f. Provisions for creating periodic or non-periodic schedules for up to two (2) years. These schedules may be used to perform following functions:
 - 1) Time of Use (TOU)
 - 2) Demand Control
 - 3) Load Scheduling
 - 4) Logging
 - 5) Periodic Resetting
 - 6) Alarm Gating
- g. Multiple tariffs and Time-of-Use (TOU) functionality to store and monitor up to 20 years of seasonal rate schedules. TOU feature allows four seasons, four day types (each one capable of at least eight switch times, with resolution of one minute). TOU feature supports four rate tariffs, and at least twelve holidays per year, and allows periodic self-read capability.
- h. Capable of determining (with a level of confidence) whether a disturbance event occurred upstream or downstream of meter. (Disturbance Direction Detection).
- i. Supporting two languages without having to upgrade its firmware.
- j. Supporting trending and forecasting of logged data values feature both on meter display and via webpages.

B. Factory-Assembled Meter Enclosures:

1. UL listed pad-lockable NEMA 12 enclosure.
2. Engraved nameplates: White lettering on black phenol background. Example: "Meter M7."
3. Dimensions: 20-inches high by 16-inches wide by 12-inches deep. Exception: provide larger enclosure as required to integrate main meter and sub-meters where more than one meter is used in an area to monitor total power consumption for one building.
4. Three-pole fusible disconnect for protection of meters in enclosure.
5. Control power for meter derived directly from meter voltage inputs.
6. CT shorting block: Six pole CT shorting block to accommodate 3 CTs per meter.
7. Digital and Analog I/O wiring: 8 DIs, 4 DOs and 3 relay outputs wired to terminal blocks.
8. Communication wiring: one 100BaseT Ethernet and one 100BaseFL equipped meter. COM1 and COM2 wired to 6 terminal blocks (3-IN, 3-OUT each COM port) for 12TBs total.

C. Split-Core CTs:

1. Construction: Directional silicon steel used for flexible core. Open split-core with manual twisting motion. Secondary windings: Copper. Unit enclosed in silicone rubber. Remains flexible from minus 45C to 200C.
2. Output at rated current: 5 amps AC.
3. Insulation level: 600VAC, BIL 10kV full wave.
4. Frequency: 50 to 60Hz.
5. Temperature range: minus 15C to 60C.
6. Humidity range: 0 to 95 percent non-condensing
7. Leads: UL 1015, 105C, 18-AWG, 24-inches long.
8. Thermal factor: 1.00 at 30C.
9. Accuracy: 1 percent for 200:5 to 1600:5 ratio.
10. Burden capacity: 2.5VA at 200:5 ratio; 22.5VA at 1600:5 ratio.
11. Basis of Design: Veris H6810 series.

D. Software:

1. Data base software with graphic user interface (GUI) to allow Contracting Officer to query for electrical power and energy consumption information, and steam consumption on mass flow rate, on building-by-building basis for requested time periods. Program software to allow Contracting Officer to direct compare buildings on tabular and graphical basis. Hyperlinks within software to allow Contracting Officer to then see meter-by-meter contribution to total building energy consumption.
2. Data queries that require Contracting Officer to determine total building energy consumption by reading separate meters and summing their results by hand or in Excel is not acceptable.
3. Example of required data queries:
 - a. Query for March 2008 to April 2009:
 - 1) Peak power demand (kW) for Gentle, Barnam and Landers Halls.
 - 2) Total energy consumption (kW-hr) for Gentle, Barnam and Landers Halls.
 - 3) Total steam consumption (lbs) for Gentle, Barnam and Landers Halls.
 - 4) Temperature (F) for return steam condensate for Gentle, Barnam and Landers Halls.
 - 5) Tabular and bar/line graph representation of peak power demand on day-by-day basis for each of these buildings. Provide overlay of three halls.
 - 6) Tabular and bar/line graph representation of total energy consumption on day-by-day basis for each of these buildings. Provide overlay of three halls.
 - 7) Tabular and bar/line graph representation of steam condensate flow rates on day-by-day basis for each of these buildings. Provide overlay of three halls.
 - 8) Tabular and bar/line graph representation of steam condensate temperature on day-by-day basis for each of these buildings. Provide overlay of three halls.
 - 9) Point-and-click to see hourly or 15-minute window power demand, energy consumption, steam consumption, condensate return temperature information for same three halls.
 - 10) Building sites can be selected for cross-comparison using a selection menu. Contracting Officer should not have to type building names by hand with exact spelling.
 - b. Query for 30 March 2009:
 - 1) Tabular and bar/line graph representation of total, real and reactive power, current and voltage for meter at Barnam Hall on 15-minute window basis over 24-hour period. Be capable of switching between different electrical

parameters using hyperlinks or pull down menus.

- 2) Switch to viewing another date by entering value at hyperlink or pull down menu.
- 3) Change to another date range (weekly, monthly, annual or specified range) by using hyperlink or pull down menu.
- c. Reports: Provide report results output to HTML, Excel, and PDF formats for queries for Contracting Officer use.
- d. Interaction screen for a given building, when doing single building queries, will also show:
 - 1) Partial building floor plan indicating meter location(s).
 - 2) Partial building one-line diagram indicating meter location(s) in power distribution system.
4. Software Licenses: Provide following:
 - a. ION Enterprise base, device and client licenses.
 - b. Integrated SQL server 2005 option: processor license for one CPU.
5. Software Development: Provide 3-4 weeks factory programming for following tasks:
 - a. Screen development for main menu.
 - b. Screen development for site plan.
 - c. Screen development for one-lines.
 - d. Steam meter integration.

PART 3 - EXECUTION

3.1 UTILITY METERING INSTALLATION

- A. Meter Bases: Locate to provide acceptable access for meter reading and maintenance. Locate to minimize risk of physical damage.
- B. Metering Equipment: Install current transformers supplied by serving electric utility.
- C. Verify utility requirements prior to bidding and provide associated work required by local utility including but not limited to:
 1. Service underground primary including conduit, pull cord, excavation and backfill.
 2. Underground pull vaults.
 3. Pole risers.

4. Transformer pads, and vaults.
5. Secondary service lateral raceways.
6. Grounding of transformers.
7. Service metering equipment.

3.2 ENERGY METERING INSTALLATION

A. Submetering Equipment:

1. Cabling between current and voltage sensors and meter display enclosure.
2. One-hour video recorded training period for Contracting Officer in use of meter.
3. Blank engraved phenol label with white lettering for each meter, listing load monitored (e.g., "Panel A," "Chiller 3," etc.). Use red label with white lettering where load is on generator backup.
4. Commons multiple meter unit cabinet with blank spaces where multiple meters are mounted as shown on one-line diagram and/or floor plans (e.g., 8 meter cabinet with 3 blank spaces where 5 meters are shown in common location).
5. Cabling between meter display enclosure and auxiliary device for communication to energy management system.
6. ModBus cabling between meters, and from meter to energy management system.

3.3 POWER QUALITY METERING INSTALLATION

- A. Install PTs and CTs in accordance with manufacturer instructions. Separate NEMA 1 enclosure for CTs and splicing and extension of existing feeder cables where existing power distribution equipment has insufficient space for installation of split-core CTs.
- B. Use irreversible compression long-barrel butt splices for splicing of feeder cables where needed; tape splices in minimum of three layers of electrical tape with 1000VAC insulation rating.
- C. Field Quality Control:
 1. Provide on-site testing and startup of metering led by factory technician. Field testing by electrician is not acceptable and will be repeated by factory technician at no cost to Contracting Officer.
 2. Provide Contracting Officer with copy of factory test report.
 3. Factory-approved testing of metering equipment is required prior to start of software commissioning phase. Commissioning work performed prior to completed testing and troubleshooting of power meters will be repeated at no cost to Contracting Officer.

- D. Software Configuration and Commissioning: Minimum of 40-hours of on-site software configuration and commissioning with direct Contracting Officer involvement. Use time to configure presentation of data in response to queries to satisfaction of Contracting Officer.
- E. System Training:
 - 1. Onsite customer system training for minimum 8-hour duration. Provide Contracting Officer with minimum 30-days notice prior to scheduled training so Contracting Officer has time to notify staff of training date, and provide videotaped coverage of training. Training must be by factory technician; training by installing electrician is not acceptable.
 - 2. Schedule this training for no less than 30 days after date of Contracting Officer signed acceptance of installation, including software.
 - 3. Provide Contracting Officer with minimum 30-days notice prior to scheduled training so Contracting Officer has time to notify staff of training date, and provide videotaped coverage of training.
 - 4. Provide video transcript of factory training for Contracting Officer's staff.

END OF SECTION 26 27 13

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provision of materials, installation and testing of:
 - 1. Wall Switches
 - 2. Receptacles
 - 3. Finish Plates
 - 4. Wall Dimmers
 - 5. Surface Covers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. UL 498, Attachment Plugs and Receptacles.
 - 2. UL 943, Ground Fault Circuit Interrupters (Class A GFCI).
 - 3. UL 1472, Standard for Solid State Dimming Controls.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Wall switches
 - 2. Receptacles
 - 3. Wall Plates
 - 4. Dimmers
 - 5. In-Use Cover

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1. Decorative AC Rocker Switch Characteristics:

- a. Cooper
- b. Hubbell
- c. Leviton
- d. Legrand P&S
- e. Or approved equivalent.

B. Receptacles:

1. Commercial Grade:

- a. 20 Amp:
 - 1) Cooper 5362
 - 2) Hubbell 5362
 - 3) Bryant CBR520
 - 4) Leviton 5362S
 - 5) Legrand P&S 5362
 - 6) Or approved equivalent.

2. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:

- a. Cooper WRSGF20W
- b. Hubbell GFR5362SGW

- c. Legrand P&S 2097TRWR
 - d. Or approved equivalent.
- 3. Federal Specification Grade Plug Load Control Duplex Receptacle:
 - a. Half Controlled, 20 amp:
 - 1) Legrand P&S 26352CH
 - 2) Leviton 163521P
 - 3) Hubbell DR20C1
 - 4) Legrand P&S PLT26351
 - 5) Or approved equivalent.
 - b. Dual Controlled, 20 amp:
 - 1) Legrand P&S 26352CD
 - 2) Leviton 163522P
 - 3) Hubbell DR20C2
 - 4) Or approved equivalent.
- C. Finish Plates:
 - 1. Bryant
 - 2. Cooper
 - 3. Hubbell
 - 4. Leviton
 - 5. Legrand P&S
 - 6. Or approved equivalent.
- D. Wall Dimmers:
 - 1. Lutron Maestro Series
 - 2. Or approved equivalent.
- E. Surface Covers:
 - 1. Aluminum with Gasket, Blanks, Single Gang:

- a. Bell 240-ALF
 - b. Carlon
 - c. Or approved equivalent.
- 2. 2-Gang:
 - a. Bell 236-ALF
 - b. Carlon
 - c. Or approved equivalent.
- 3. While-in-Use Weatherproof Cover:
 - a. Die Cast Cover:
 - 1) Intermatic
 - 2) Hubbell
 - 3) Cooper
 - 4) Or approved equivalent.

F. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

- A. Characteristics: Decorative AC Rocker Switch Characteristics: Quiet acting, 20 amp, 120 volt, UL Listed for motor loads up to 80 percent of rated amperage.
- B. Finish: White.
- C. Plug-Tails: Switches that use a plug-tail or snap-on connector are allowed; switches installed that do not meet these specifications (example: switch with plug-tails installed that is not fully rated for 20 amps load) are subject to removal and replacement at no cost to the Contracting Officer.

2.3 RECEPTACLES

- A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.
 - 1. Commercial Grade: Riveted. Back and side wired. Brass ground contact on steel strap. Nylon face and nylon base. 20 amp.
- B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.

- C. Specification Grade Plug Load Duplex Receptacle: 20A, 125V, Decora style duplex receptacle, straight blade, hot terminal split with 1 plug controlled, self grounding. Back and side wired.
- D. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.
- E. Finish:
 - 1. Same exposed finish as switches.
 - 2. All automatically controlled, nonlocking type, 125 volt, 15 amp and 20 amp rated receptacles to be permanently marked by the manufacturer with the "universal power" symbol and the word "controlled."
- F. Plug-Tails: Receptacles that use a plug-tail or snap-on connector are allowed; receptacles installed that do not meet these specifications (example: GFCI outlet with plug-tails installed that does not have UL self-test ability or is not weather or tamper resistant) are subject to removal and replacement at no cost to the Contracting Officer.

2.4 FINISH PLATES

- A. Finish Plates: Match building standard.
- B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 WALL DIMMERS

- A. Provide wall dimmers compatible with type of load controlled (i.e. line voltage, low voltage, 2-wire, 3-wire, 0-10v). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi gang coverplate.
- B. LED indicator dots show by what percentage controlled lighting is dimmed. Programmable settings for maximum and minimum trim settings, and rate of change in lighting levels.

2.6 SURFACE COVERS

- A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.
- B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.
- C. While-in-Use Weatherproof Cover: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
 - 1. Die cast cover with closed cell neoprene foam gasket: Capable of being locked closed to prevent tampering or unauthorized use.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Contracting Officer immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.
- B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Contracting Officer.
- C. Orientation:
 - 1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
 - 2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Contracting Officer.
 - 3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Contracting Officer.
- D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.
- E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

- A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

- A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
- B. In the following outlet locations, regardless of whether shown as GFCI on Drawings, either provide a GFCI duplex receptacle, or use a GFCI breaker where code would require a GFCI outlet to have a remote test switch:
 - 1. Bathrooms.
 - 2. Where receptacles are installed within 6-feet, 0-inches from edge of sinks.

3. Kitchens above counters.
 4. On rooftops.
 5. Outdoors.
 6. Where serving vending machines.
 7. Where serving electric drinking fountains.
- C. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.
- D. Provide a split wired receptacle or one controlled receptacle within 6 feet of each uncontrolled receptacle for the following areas: Offices, reception lobbies, conference rooms, kitchens, copy rooms.
- 3.4 FINISH PLATES INSTALLATION
- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.
- 3.5 WALL DIMMERS INSTALLATION
- A. Install per manufacturer's recommendations and wiring diagrams.
- 3.6 SURFACE COVERS INSTALLATION
- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION

SECTION 26 28 00 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fuses
2. Molded Case Circuit Breakers

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A.
- Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

- ##### A.
- Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- ##### A.
- Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:

1. Bussmann

2. Ferraz-Shawmut
3. Littelfuse
4. McGraw-Edison
5. Or approved equivalent.

B. Molded Case Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

2.2 FUSES

A. Characteristics:

1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
2. Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40 degrees C ambient temperature.
- D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
- F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:

1. Obtain and review the submitted product data for equipment furnished by the Contracting Officer, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.

B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES

A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:

1. 0 to 24: Provide 6 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS

- A. Provide testing of ground fault interrupting breakers.
- B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
- C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
- D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.
- E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Toggle Type Disconnect Switches
2. Manual Motor Starters
3. Safety Switches
4. Enclosed Circuit Breakers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 24 13, Switchboards.
3. Section 26 24 16, Panelboards.
4. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:

1. Cooper
2. Hubbell
3. Leviton
4. Legrand (Pass & Seymour)
5. Slater
6. Or approved equivalent.

B. Manual Motor Starters:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

C. Safety Switches:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

D. Enclosed Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D

5. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

- A. Rating: 120 volt, 1 pole, 20 amp, 1 hp maximum.
- B. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.

C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

- A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.
- B. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.

2.4 SAFETY SWITCHES

- A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.
- B. Clearly marked for maximum voltage, current, and horsepower.
- C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.
- D. Switches rated for maximum available fault current.
- E. Handle lockable in 'off' position.
- F. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.
- G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

- H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

2.5 ENCLOSED CIRCUIT BREAKERS

A. Molded case circuit breakers:

1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC as indicated on drawings.
2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
3. Calibrate for operation in 40C ambient temperature.
4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.
7. Provide handle mechanisms that are lockable in the open (off) position.
8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain and review the submitted product data for equipment furnished by the Contracting Officer, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
- B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating
- C. Install in accordance with manufacturer's instructions.

- D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

- A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.
- B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

- A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.
- B. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

- A. Install products, systems and equipment in accordance with manufacturer's written instructions and requirements.
- B. See General Installation Requirements above.

END OF SECTION

SECTION 26 33 23 - CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Components
2. Accessories

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Include battery product data.
 2. Shop drawings to include battery interconnection schematic diagrams, block diagrams of interconnection of internal elements, input terminals and output circuit breakers.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Manufacturer qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience with service facilities within 100 miles of project.

1.6 WARRANTY

- A. Warranty of materials and workmanship as outlined in Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Modular battery source inverter system complete with charger, transfer mechanism, integral maintenance bypass and output circuit breakers for purpose as emergency egress lighting backup power sources.
- B. IGBT-based, PWM inverter, 16 kHz switch speed. Suitable for HID, fluorescent and incandescent loads. Recombinant VRLA batteries.
- C. Provide two classes of output, one continuously energized, one energized only upon failure of input source.
- D. Meets UL 924, NFPA 101 and NFPA 111. Materials and installation compliant with state and local adopted Fire Code.

1.8 PERFORMANCE

- A. Environmental Conditions Required: 68 to 85 degrees F for batteries.
- B. Minimum throughput efficiency: 86 percent.
- C. Maximum Audible Noise: 52dBA.
- D. Maximum THD: less than 10 percent at full resistive load.
- E. Unit Power Capacity: 2.2 KW.
- F. Unit Input Voltage: 120 volts, single-phase, 2-wire.
- G. Inverter output frequency: 60 Hz plus 1 percent.
- H. Unit Output Voltage: 120 volts, single-phase, 2-wire.
- I. Maximum recharge time: 12 hours following 1.5 hour discharge.
- J. Physical Size: Maximum 36-inches wide by 72-inches high by 24-inches deep per cabinet. Two cabinets for unit power capacity cited above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Myers Power Products
- B. Chloride - Synthesis Series
- C. Lightguard Centarus IV Series
- D. Dual-Lite Spectron LSN Series
- E. On-Line Power Powerware Series

- F. Cooper Lighting
- G. Sure-Lites
- H. Controlled Power Company (CPC)
- I. Or approved equivalent.
- J. Basis of Design: Battery source inverter system on drawings is designed based on Myers Power Products product line. Approved manufacturers are allowed on condition of meeting specified conditions including available space for equipment (including Code required working clearances) Remove and replace electrical equipment installed not meeting these conditions at no cost to Contracting Officer.

2.2 COMPONENTS

A. Cabinet:

1. Welded steel, 12 gauge, constructed to NEMA-1 Specifications. Front and back accessibility. Convection cooling vents in enclosure.
2. Corrosion resistant paint finish.
3. Hinged, lockable doors.

B. Inverter:

1. Pulse-width modulated power supply based on IGBT transistors. Dual-conversion with no interruption to load.
2. Internal maintenance bypass switch, make-before-break.
3. Overload protection by static bypass switch; system rated to 42,000A symmetric short circuit.
4. Visual indicator (LED) to indicate inverter operation.
5. Each module protected against reverse battery polarity.
6. Each module includes an encapsulated ferroresonant transformer, UL Class H insulation.

C. Charger:

1. Dual rate design. Constant current voltage limited high rate charge followed by precision float voltage charge for maximum battery capability and life. Charger is temperature compensating to prevent thermal runaway condition with batteries.
2. Capable of fully recharging batteries within 12 hours following any rated discharge.
3. Reverse polarity protected.
4. Provide fuse protection for system DC input and charger AC input and DC output.

D. Monitor:

1. Monitor AC input for brownout or failure condition. Transfer to battery source when AC input voltage drops below 80 percent of nominal voltage.
2. Transfer time 30 to 80 milliseconds.
3. Low battery voltage shutdown set at 87.5 percent of nominal voltage.

E. Return to Normal Source: Two-minute time delay return to normal source once normal source has been reestablished.

F. Recombinant VRLA Batteries: Sufficient capacity to output voltage of the inverter for a period of at least 90 minutes at a rated load, without dropping below 87.5 percent nominal battery voltage. 10-year, sealed, lead-calcium. Requires no addition of water over life of battery. Construct case and cover of polypropylene, contain low-pressure safety release vents, and be non-gassing in normal use. 10-year design life expectancy at 77 degrees F. VRLA batteries to include self-resealing flame-arresting caps.

G. Output Regulation:

1. 60 Hz plus or minus 1 Hz.
2. Voltage regulation, plus or minus 6 percent or less from 0 percent to 100 percent of rated load.

2.3 ACCESSORIES

A. Status and Alarm Condition Monitor:

1. LCD Display to Include:
 - a. AC input voltage.
 - b. DC charger current.
 - c. Output power VA.
 - d. AC output amps.
 - e. DC battery voltage.
 - f. System temperature.
 - g. Output frequency.
2. Test switch to allow manual test of system without interrupting power to load.
3. Audible alarm and silence switch to monitor charger and inverter malfunctions and battery electrolyte level.
4. Remote annunciator as indicated on drawings

- B. Output circuit breakers, including normally on circuit breakers, as indicated on drawings.
- C. Self-Diagnostics:
 - 1. System to test for 5 minutes every 30 days and for 30 minutes every 6 months. An audible and visible alarm to activate upon:
 - a. Utility failure.
 - b. High temperature.
 - c. Inverter failure.
 - d. Charger failure.
 - e. System overload.
 - f. Output trip alarm.
 - 2. Output to e-mail for notices to Contracting Officer during alarm and trouble conditions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with manufacturer's instructions.
- B. Provide a level dry protected area with stable temperature conditions. Install units plumb and level.
- C. Batteries: Install batteries with acid neutralization pillow installed under each battery housing (comply with IFC 608.5.2 or local adopted Fire Code, whichever is more stringent). Enviroguard VRLA Pads or approved equal.
- D. Room installation: Provide room containing central battery system with signage, automatic smoke detection tied to central system (see Division 28) as required by IFC Section 608 or local adopted Fire Code, whichever is more stringent.
- E. Schedules:
 - 1. Provide output circuit schedule indicating loads connected to each output circuit breaker.
- F. Training:
 - 1. Provide Contracting Officer with minimum 4-hour training session, presented by factory technician, on use and maintenance of battery power system. Videotape training session for future use by Contracting Officer.
 - 2. Verify operation of each unit by simulating outage.
- G. Verify operation of each unit by simulating outage.

3.2 COMPONENTS

- A. Install per manufacturers written instructions and requirements.
- B. See General Installation Requirements above.
- C. Provide interconnection between cabinets. Secure cabinets with seismic restraint in accordance with IBC seismic zone classification of area. Confirm requirements with Contracting Officer.
- D. Comply with manufacturer's recommendations prior to start-up to prevent physical and electrical damage to components.

3.3 ACCESSORIES

- A. Install per manufacturers written instructions and requirements.
- B. See General Installation Requirements above.
- C. Connect pager, cell phone, fax to dial phone number as directed by Contracting Officer, printing out status report during alarm or trouble condition.
 - 1. Utility power is lost.
 - 2. Fire alarm system goes into alarm.
 - 3. Security system goes into alarm

END OF SECTION 26 33 23

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. SPD for Service Entrance - Modular Type
 - 2. SPD for Distribution Panels - Nonmodular Type
- B. Supply and install the Surge Protective Devices (SPD) having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Listed per UL 1449, third edition, and complimentary listed per UL 1283 as FRI/EMI filter.
 - 2. Comply with ANSI/IEEE C62.45 test procedures for Category-C3 established in C62.41.2 and CSA certified (C22.2).

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Related SPD Specifications, Drawings, maintenance manuals, installation instructions, and UL 1449, third edition, listed surge suppression ratings of specified protection modes.
 - 2. Project Record Documents: Record actual locations of SPDs.
 - 3. Maintenance Data:
 - a. Include module replacement instructions.
 - b. Include maintenance and troubleshooting instructions for electronic components.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: ISO 9001 certification SPD manufacturers complete quality control and documentation procedures of firms regularly engaged in manufacture of SPD product for Category-C3 (ANSI/IEEE C62.41.2) and whose product has been of satisfactory service for not less than 5 years.
 - a. Provide local support for SPD.
 - b. Provide both service entrance and distribution panel SPD of same manufacturer.
 - 2. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Advanced Protection Technologies, Inc. (APT)
- B. Current Technology
- C. Eaton Electrical
- D. Lea International
- E. Liebert
- F. Schneider Electric/Square D
- G. Surge Suppression Inc. (SSI)
- H. Siemens
- I. Or approved equivalent.

2.2 SPD FOR SERVICE ENTRANCE - MODULAR TYPE

- A. List SPD in accordance with UL 1449 (third edition), Standard for Safety, Surge Protective Devices, and UL 1283, Electromagnetic Interference Filters.

- B. Independently test SPD with Category-C3 high exposure waveform (20KV - 1.2/50 μ s, 10 kA - 8/20 μ s) per ANSI/IEEE C62.41.2.
- C. Provide SPD with copper bus bars for surge current path. Small gauge round wiring, plug-in type connections, or printed circuit boards not to be used in path for surge current diversion. Equally distribute surge current to individually fused MOV components to ensure equal stressing and maximum performance. Surge suppression platform must provide equal impedance paths to each matched (plus or minus one volt) MOV.
- D. Construct SPD using field replaceable surge current diversion modules (MOV based). Each module fused with user replaceable 200,000 AIC rated fuses. Monitor status of each module and MOV and indicate on front of SPD's enclosure as well as on each module.
- E. Encapsulated SPD, whether modular or chase nipple units, utilizes an encapsulant that is UL listed and holds 94-V2 fire retardant rating. Allow no encapsulant compounds that incorporate epoxy.
- F. Equip SPD with an audible alarm that activates when one of surge current modules have failed. Provide an alarm on/off switch to silence the alarm. Provide an alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of SPD's enclosure. Equip unit with an Event Counter that will indicate how many surges, sags, swells and outages have occurred at the location.
- G. Meet or exceed the following criteria:
- Maximum Single Impulse Current Rating: No less than 160, 200, or 300 kA per phase. Manufacturers must provide documented proof of independent third party verification of single impulse current withstand capabilities.
 - Pulse Life Test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41.2 Category-C3 transients without failure or degradation of UL 1449, third edition, clamp voltage by more than 10 percent.
 - UL 1449, third edition, clamping voltage not-to-exceed exceed the following:
- | Line Voltage | 1000V | 1500V | 2000V |
|--------------|-------|-------|-------|
| 208Y/120V | 800V | 800V | 800V |
- ANSI/IEEE C62.41.2 (2002) Category-C3 clamping voltage not to exceed the following:
- | Line Voltage | 1000V | 1500V | 2000V |
|--------------|-------|-------|-------|
| 208Y/120V | 470V | 470V | 470V |
- H. Provide response time that is no greater than five nanoseconds for any of individual protection modes.
- I. Provide SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.

1. Provide visible indication of proper SPD connection and operation. Indicator lights indicates which phase as well as which module is fully operable.
2. Equip SPD with the following items:
 - a. Provide connector along with dry contacts (normally open or normally closed) to allow connection to remote monitoring system.
 - b. Output of dry contacts indicates failure of phase or entire unit.
3. Provide terminals for necessary power and ground connections.
4. Provide SPD with minimum EFI/RFI filtering of 30dB at 100KHZ with an insertion loss ratio of 316:1 using Military Standard 220A methodology.
5. Provide SPD with 10 year warranty, incorporating unlimited replacement parts if they are destroyed by transients during warranty period.

2.3 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE

- A. List SPD in accordance with UL 1449 (third edition), Standard for Safety, Surge Protective Devices, and UL 1283, Electromagnetic Interference Filters.
- B. Independently test SPD with Category-C3 high exposure waveform (20KV - 1.2/50 μ s, 10 kA - 8/20 μ s) per ANSI/IEEE C62.41.2 (2002)
- C. Provide SPD with copper bus bars for surge current path. Small gauge round wiring, plug-in type connections, or printed circuit boards not be used in path for surge current diversion. Equally distribute surge current to MOV components to ensure equal stressing and maximum performance. Surge suppression platform must provide equal impedance paths to each matched MOV.
- D. Use no plug in component modules or printed circuit boards as surge current conductors. Hardwire internal components with connections utilizing low impedance conductors and compression fittings.
- E. In order to isolate SPD under any fault condition, manufacturer to provide:
 1. Individually fuse the MOV via copper fuse. Copper fuse provides protection during high (ka) surge events.
 2. Equip MOVs with thermal fuse which allows disconnection of suppression component at overheating stage common during TOV.
 3. Test overcurrent protection components in compliance with UL 1449 (3rd Edition) Limited Current Test and AIC rating test.
- F. Equip SPD with an audible alarm that activates when one of surge current modules have failed. Provide an alarm on/off switch to silence alarm. Provide an alarm push-to-test switch to test the alarm. Locate switches and alarm on the front cover of the SPD's enclosure.

G. Provide SPD that Meet or Exceed the Following Criteria:

1. Provide maximum single impulse current rating at no less than 100 kA per phase. Manufacturers must provide documented proof of independent third party verification of single impulse current withstand capabilities.
2. Pulse Life Test: Capable of protecting against and surviving 2000 ANSI/IEEE C62.41.2 Category-C3 transients without failure or degradation of UL 1449 (third edition) clamp voltage by more than 10 percent.
3. UL 1449 (third edition) clamping voltage not to exceed the following:

<input type="checkbox"/> O T E		N	N
208Y/120V	800V	800V	800V

4. Nominal discharge current of 20KA I (n).

H. Make SPD of solid-state components which operate bidirectionally.

I. Provide SPD with response time no greater than five nanoseconds for individual protection modes.

1. SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
2. Provide visible indication of proper SPD connection and operation. Provide 10 year warranty, incorporating unlimited replacements of SPD if they are destroyed by transients within warranty period.

J. Provide SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.

1. Provide terminals for necessary power and ground connections.
2. Provide SPD with minimum EFI/RFI filtering of 30dB at 100KHZ with an insertion loss ratio of 316:1 using Military Standard 220A methodology.
3. Provide SPD with 10 year warranty, incorporating unlimited replacement parts if they are destroyed by transients during warranty period.

PART 3 - EXECUTION

3.1 SPD FOR SERVICE ENTRANCE - MODULAR TYPE INSTALLATION

- A. Install SPD on load side of service entrance as directed by manufacturer's installation instructions. Provide 3 pole breaker for disconnect in service entrance equipment, size breaker to manufacturers installation instructions.
- B. Install one primary SPD at each utility service entrance to facility, according to manufacturer's recommendations.

- C. Integrate SPD unit into switch gear to maximize performance and reliability.
- D. Bond SPD's ground to service entrance ground.
- E. Maintenance Materials

- 1. Furnish the following for Contracting Officer's use in maintenance of project:
 - a. Replacement modules: One of each type and size.

3.2 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE INSTALLATION

- A. Install one secondary SPD at each distribution panel location as indicated on Drawings. SPD unit to be integral to panelboard.

END OF SECTION 26 43 00

SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Luminaires
 - 2. LED Drivers
 - 3. Lamps
 - 4. Emergency LED Luminaire Power Supply
 - 5. Lighting Poles
- B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NECA 500 - Commercial Lighting.
 - 2. UL 8750 – Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Submit product data for:
 - a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.
 - b. LED Drivers

- c. Lamps
 - d. Emergency LED Luminaire Power Supply
 - e. Lighting Poles
2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.
 3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.
 4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:
 - a. Luminaires
 - b. LED Drivers
 - c. Lamps
 - d. Emergency LED Luminaire Power Supply
 - e. Lighting Poles

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Provide luminaires acceptable to code authority for application and location installed.
 2. Comply with applicable ANSI standards.
 3. Comply with applicable NEMA standards.
 4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the Contracting Officer (e.g., UL, ETL, and the like).
 5. Comply with NEC as applicable to installation and construction of luminaires.
 6. Comply with fallout and retention requirements of IBC for diffusers, baffles, and louvers.

7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

- A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Luminaires:
 1. Reference description and manufacturers in Luminaire Schedule on Drawings.
 2. Or approved equivalent.
- B. LED Drivers:
 1. Indoor Drivers:
 - a. eldoLED Series
 - b. Advance/Philips
 - c. Osram Sylvania
 - d. Or approved equivalent.
 2. Outdoor Drivers:
 - a. Advance/Philips
 - b. Osram Sylvania
 - c. LG
 - d. Or approved equivalent.
- C. Lamps:

1. LED (Light Emitting Diode) Lamps:
 - a. Nichia
 - b. Cree
 - c. Osram Sylvania
 - d. GE Lumination
 - e. Or approved equivalent.
2. Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.
3. Special types as indicated in Luminaire Schedule.
4. Or approved equivalent.

D. Emergency LED Luminaire Power Supply:

1. Bodine
2. Hatch
3. Fulham
4. Or approved equivalent.

E. Lighting Poles:

1. Reference description and manufacturers in Luminaire Schedule on Drawings.
2. Or approved equivalent.

2.2 LUMINAIRES

- A. Luminaires: Reference description and manufacturers in Luminaire Schedule on drawings.
- B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.
- D. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.
- E. Finishes:

1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.
2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.
3. Exterior Finishes: As detailed in Luminaire Schedule or on drawings. Refer cases of uncertain applicability to Contracting Officer for resolution prior to release for fabrication.

F. Light Transmitting Components:

1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.

G. LED Luminaires:

1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.
2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.
3. Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.
4. LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.
5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.
6. Provide luminaires with integral LED thermal management system (heat sinking).
7. Luminaires to be equipped with an LED driver that accepts 120V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.
8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.3 LED DRIVERS

A. General:

1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.
4. Limit inrush current to minimize breaker tripping.
 - a. Base specification: NEMA 410 standard for inrush current for electronic drivers.
 - b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 120V for 100 watts of load.
5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
7. Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.
8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - a. Adjustment of forward LED voltage, supporting 3V through 55V.
 - b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.
 - c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
9. Operate for a (+/- 10 percent) supply voltage of 120V at 60Hz.

10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.
 - a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.
4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:
 - a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.
 - b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
 - c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.

C. Control Input:

1. Provide control protocol to match lighting control system specified for use with luminaire.
2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
 - a. Meet IEC 60929 Annex E for General White Lighting LED drivers.

- b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
- c. Meet ESTA E1.3 for RGBW LED drivers.

2.4 LAMPS

- A. Provide lamps for luminaires.
- B. Provide lamp catalogued for specified luminaire type.
- C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.
- D. LED (Light Emitting Diode):
 - 1. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.
 - a. Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.
 - b. Luminaire testing per IESNA LM-79 and LM-80 procedures.
 - c. Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.
 - d. Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.
 - e. LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.
 - f. Dimming: LED system capable of full and continuous dimming.
 - g. Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.
 - 1) Nominal CCT:
 - (a) 2700 K (2725 ± 145)
 - (b) 3000 K (3045 ± 175)
 - (c) 3500 K (3465 ± 245)
 - (d) 4000 K (3985 ± 275)

- h. Color Rendering Index (CRI) to be greater than or equal to 80.
 - 2. Special types as indicated in Luminaire Schedule.
- 2.5 EMERGENCY LED LUMINAIRE POWER SUPPLY
- A. Internal Type: Self-contained, modular, battery unit, factory mounted within luminaire body and compatible with driver. Comply with UL 924.
 - 1. Emergency Connection: Operate one LED module continuously at a minimum output of 1400 lumens each. Connect unswitched circuit to battery unit and switched circuit to luminaire driver.
 - 2. Test Push Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 3. Battery: Sealed, maintenance-free, nickel-cadmium type. Sized for a minimum output of 90 minutes.
 - 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - B. External Type: Self-contained, modular, battery unit, suitable for powering one or more LED modules, remote mounted from luminaire. Comply with UL 924.
 - 1. Emergency Connection: Operate one LED module continuously. Connect unswitched circuit to battery unit and switched circuit to luminaire driver.
 - 2. Charger: Fully automatic, solid-state, constant-current type.
 - 3. Housing: NEMA 250, Type 1 enclosure.
 - 4. Test Push Button: Visible and accessible without entering ceiling space.
 - a. Push-to-test type, in remote unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - c. Faceplate Finish: Verify finish with Contracting Officer for each room prior to ordering materials.

5. Battery: Sealed, maintenance-free, nickel-cadmium type. Sized for a minimum output of 90 minutes.

2.6 LIGHTING POLES

- A. Provide exterior light poles, with concrete bases or direct buried, which are structurally supportive of pole under design loading.
- B. Provide exterior poles clean and scratch free with base bolt covers to match pole and luminaire finish.
- C. Provide poles and pole bases rated for a minimum of 100 MPH, unless otherwise noted. Wind EPA loading for quantity and type of luminaire it supports with a 1.3 gust factor.
- D. Description:
 1. Material: Treated wood.
 2. Shape: Square.
 3. Finish: Primed for field painting.
 4. Base: Embedded.
 5. Accessories: Mast Arms.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written installation instructions and requirements.
- B. Install luminaires securely, in neat and workmanlike manner.
- C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.
- D. Wiring:
 1. Recessed luminaires to be installed using flexible metallic conduit or MC Cable as allowed by Section 26 05 19 with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.
 2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
 3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.

4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.
- E. Relamp luminaires which have failed lamps at substantial completion.
- F. Replace LED drivers deemed as excessively noisy by Contracting Officer.
- G. Install suspended exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.
- I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.
- J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- K. Install recessed luminaires to permit removal from below.
- L. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- M. Install clips to secure recessed grid-supported luminaires in place.
- N. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.
- O. Install accessories furnished with each luminaire.
- P. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- Q. Bond products and metal accessories to branch circuit equipment grounding conductor.
- R. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- S. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.
- T. Coordination:
 1. Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Contracting Officer for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Contracting Officer.

2. Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.
3. Provide lighting indicated on drawings with luminaire of the type designated and appropriate for location.
4. Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.
5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.

U. Field Quality Control:

1. Perform field inspection in accordance with Division 01, General Requirements.
2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

V. Cleaning:

1. Clean electrical parts to remove conductive and deleterious materials.
2. Remove dirt and debris from enclosures.
3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.
4. Clean photometric control surfaces as recommended by manufacturer.
5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.

W. Demonstrate luminaire operation for minimum of two hours.

3.2 LUMINAIRES

- A. Install per manufacturer's written installation instructions and requirements.
- B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.
- C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Contracting Officer.
- D. Emergency Egress Luminaires: Provide unswitched circuit for battery charging and autotransfer circuiting for exit signs and luminaires with integral batteries. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.
- E. Interior Luminaire Supports:

1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
2. Maintain luminaire positions after cleaning and relamping.
3. Support luminaires without causing ceiling or partition to deflect.
4. Provide mounting supports for recessed and pendant mounted luminaires as required by IBC.

F. Adjusting:

1. Aim and adjust luminaires as indicated.
2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Contracting Officer, at such time of day or night as required.
3. Align luminaires that are not straight and parallel/perpendicular to structure.
4. Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

- A. Install lamps per manufacturer's installation instructions and requirements.
- B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.
- C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

3.4 LIGHTING POLES

- A. Install lighting poles per manufacturer's installation instructions and requirements.
- B. Exterior Luminaire Supports:
 1. Provide concrete bases for pole-mounted lighting units and bollard lights at locations shown on site plan drawing(s). Provide concrete bases as shown on drawings or as recommended by manufacturer if not shown on drawings. Minimum base height above grade in automobile areas is 30-inches. Install luminaire poles plumb.
 2. Install pole concrete bases in undisturbed or compacted soil. Where soil is disturbed provide backfill and compaction per Division 31, Earthwork requirements.

END OF SECTION

SECTION 27 00 00 - COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 27 00 00, Communications Basic Requirements applies to Division 27, Communications work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of communications systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, and Contracting Officer(s) Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.
 - 5. Entrance Facility (EF): Area or location that contains entrance point (demarcation) cable and associated equipment for telecommunication services entering the building.
 - 6. Equipment Room (ER): Area or location that contains backbone cabling associated with interbuilding cable or cable that connects buildings together in a campus environment. ERs may contain Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms.
 - 7. Main Cross-Connect (MC): Area or location that contains telecommunications equipment for connecting backbone cable to/from Intermediate Cross-Connects and Horizontal Cross-Connects. Active telecommunications equipment will often be contained in this area to serve as the telecommunications hub or headend. Backbone cable from Local Exchange Carrier's point of demarcation will connect to building backbone cable or active telecommunications equipment at this location.

8. Main Point of Entry (MPOE): Area or location where service providers terminate and handoff to customer owned premise cabling system.
9. Main Telecommunications Room (MTR): Location that services as the main distribution point for client/Contracting Officer telecommunications system. The MTR connects to each TR and the MPOE. MTR should not be accessible by the service providers. In most cases the MTR is a private space.
10. Intermediate Cross-Connect (IC): Area or location that contains telecommunications equipment for connecting backbone cable from the MC to backbone cable distributing to one or many Horizontal Cross-Connects. This location may contain active telecommunications equipment.
11. Horizontal Cross-Connect (HC): Area or location that contains telecommunications equipment, cable terminations and cross-connect wiring. HC is the recognized connection point between backbone and horizontal pathway facilities.
12. Telecommunications Room (TR): Area or location containing telecommunications equipment, cable terminations and cross-connect wiring. Three applications serviced by TRs are horizontal cable connections, backbone system interconnection and entrance facilities. The TR provides facilities (space, power, grounding, etc.) for housing telecommunications equipment. TR may contain a MC, IC or HC and a demarcation point or an interbuilding entrance facility.
13. Interbuilding Cable: Backbone cable associated with connecting buildings together in a multibuilding or campus environment.
14. Intrabuilding Cable: Backbone cable associated with connecting Entrance Facility, Equipment Rooms, Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms together on single floor or multifloor building.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 27, Communications Contract Documents.
- B. Related Work:
 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement

- e. Codes, Standards, Public Ordinances and Permits
- C. Related Products/Systems within Division 28, Electronic Safety and Security:
 - 1. Section 28 10 00, Access Control and Intrusion Detection
 - 2. Section 28 23 00, Video Surveillance

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 27, Communications Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. CA Title 24 Part 6 California Energy Code
 - 8. IFC - International Fire Code
 - 9. NFPA 101 Life Safety Code
 - 10. CA Title 24 Part 8 California State Historic Building
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - a. ANSI/TIA-526-7-A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - b. ANSI/TIA-526-14-C Optical Power Loss of Installed Multimode Fiber Cable Plant

- c. ANSI/TIA-568.0-E - Generic Telecommunications Cabling for Customer Premises
 - d. ANSI/TIA-568.1-E - Commercial Building Telecommunications Infrastructure Standard
 - e. ANSI/TIA-568.2-D Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - f. ANSI/TIA-568.2-D-2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard Addendum 2
 - g. ANSI/TIA-568.3-D - Optical Fiber Cabling Components Standard. Commercial Building Telecommunicating Cabling Standard
 - h. ANSI/TIA-568.3-D-1- Optical Fiber Cabling Components Standard.
 - i. ANSI/TIA-568.4-D Broadband Coaxial Cabling and Components
 - j. ANSI/TIA-569-E - Commercial Building Standard for Telecommunications Pathways and Spaces
 - k. ANSI/TIA-570-D - Residential Telecommunications Infrastructure Standard
 - l. ANSI/IA-598-D Optical Fiber Cable Color Coding
 - m. ANSI/TIA-598-D-1 Optical Fiber Color Coding in Cable Addendum 1, additional Colors for Elements 3-16
 - n. ANSI/TIA-598-D-2 Optical Fiber Cable Color Coding Addendum 2, Jacket Color for OM5 Indoor Fiber Cables
 - o. ANSI/TIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure
 - p. ANSI/TIA-J-STD-607-D - Generic Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - q. ANSI/TIA-942 - Telecommunications Infrastructure Standard for Data Centers
- 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process
 - 7. ASIS INTL - American Society for Industrial Security International
 - 8. ASTM - ASTM International

9. AVIXA - Producer of InfoComm and international trade organization representing the audiovisual industry
10. BICSI - Building Industry Consulting Service International
 - a. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition
 - b. BICSI ESSDRM - Electronic Safety & Security Design Reference Manual
 - c. BICSI OSPDRM - Outside Plant Design Reference Manual, 6th Edition
11. CFR - Code of Federal Regulations
12. EPA - Environmental Protection Agency
13. ETL - Electrical Testing Laboratories
14. FCC - Federal Communications Division
15. IBC - International Building Code
16. IEC - International Electrotechnical Commission
17. IEEE - Institute of Electrical and Electronics Engineers
18. ISO - International Organization for Standardization
19. NEC - National Electric Code
20. NEMA - National Electrical Manufacturers Association
21. OSHA - Occupational Safety and Health Administration
22. TIA - Telecommunications Industry Association
23. UL - Underwriters Laboratories Inc.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
 1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction,

coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Contracting Officer on all transmissions/submissions.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 27, Communications Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades. Provide a red rectangle around part number and description with corresponding red arrow pointing to the item/material being submitted.
 - b. Include technical data, installation instructions, and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 27, Communications specification Sections for specific items required in product data submittal outside of these requirements.
 - c. See Division 27, Communications individual Sections for additional submittal requirements outside of these requirements.
5. Review with NPS Project Manager and Prime Consultant and NPS Contracting Officer and revise as directed.
6. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
7. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 27,

Communications Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.

8. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
9. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.
10. Shop Drawings:
 - a. Provide coordinated Shop Drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 27, Communications specification Sections for additional requirements for Shop Drawings outside of these requirements.
 - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
11. Samples: Provide samples when requested by individual Sections.
12. Resubmission Requirements:
 - a. Review with NPS Project Manager and Prime Consultant and NPS Contracting Officer and revise as directed.
13. Operation and Maintenance Manuals, Contracting Officer's Instructions:
 - a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring

servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.

- 1) Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: batteries, lamp lenses, speakers and filters.
 - 3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Sections.
 - 4) Include product certificates of warranties and guarantees.
 - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and subassemblies.
 - 6) Include copy of burn-in and test reports specific to each piece of equipment.
 - 7) Include copy of software/appliance programming.
 - 8) Include commissioning reports.
 - 9) Contracting Officer will return incomplete documentation without review. Contracting Officer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Contracting Officer's hourly rates.
- b. Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Submit copy of material used for Contracting Officer instruction. Field instruction per Section 27 00 00, Communications Basic Requirements Article titled "Demonstration."
- c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

14. Record Drawings:

- a. Maintain at site at least one set of drawings for recording “as-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed communication items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line Drawings created from CAD Files in version/release equal to Contract Drawings. Submit CAD disk and Drawings upon substantial completion.
- d. Invert elevations and dimensioned locations for incoming utilities and site raceways below grade extending to 5-feet outside building line.
- e. See Division 27, Communications individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- B. Whenever this Specification calls for material, workmanship, arrangement, or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., conduit) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer, in writing, before starting work.
- E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Contractor Qualifications:

1. Minimum of five years' experience in the design, installation, testing and maintenance of communications systems.
2. Must employ at least one full time BICSI certified Registered Communications Distribution Designer (RCDD) who is involved in reviewing work performed by contractor on this project.
3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
4. Be able to provide project references for three projects, including scope of Work, project type, Contracting Officer/user contact name and telephone number.
5. The contractor selected for this project must be certified by the manufacturer of the approved products and utilize these components for completion of work.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, prepare and submit coordinated layout Drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 27, Communications to combine information furnished by other trades onto master coordination documents.
- B. Prepare Drawings as follows:

1. Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
 3. Incorporate addenda items and change orders.
 4. Provide additional coordination as requested by other trades.
- C. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
- D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to jacks, patch panels, equipment connection cords and wall plates.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities. Equipment/fixture supplier is responsible for obtaining state, county, and city acceptance on equipment/fixture not UL approved or not listed for installation.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.

3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment requiring access (i.e., amplifiers, taps, zone controllers, volume controls, and storage devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
 1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

- a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Contracting Officer of discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 27 Communications Sections.
- B. General:
 - 1. Earthquake resistant designs for Communications (Division 27) equipment and distribution, i.e. cabinets and racks, ceiling assemblies, raceways, ladder racking, etc. to conform to regulations of Contracting Officer.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by Contracting Officer.
 - 3. Provide stamped Shop Drawings from licensed Contracting Officer of seismic bracing and seismic movement assemblies for cabinets, racks, major equipment and overhead raceways. Contracting Officer to design and provide stamped Shop Drawings cabinets, racks, major equipment and overhead raceway. Submit Shop Drawings along with equipment submittals.
 - 4. Provide stamped Shop Drawings from licensed Contracting Officer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.
 - 5. Provide means to prohibit excessive motion of communications equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.

- B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to ceiling cover/installation.
 - 3. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - 1. During remodeling or addition to existing structures, or addition of a structure to existing structure, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring to point of connection.
 - 3. Coordinate transfer time to new service with Contracting Officer. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum. If overtime is necessary, there will be no allowance made by Contracting Officer for extra expense for such overtime or shift work.
 - 4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - 1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 - 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section

will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.

3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Contracting Officer.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 2. Protect all equipment and conduit to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Maintenance Staff as specified in Division 01, General Requirements, Section 27 00

00, Communications Basic Requirements and individual Division 27, Communications Sections.

- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Contracting Officer, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment and devices in accordance with manufacturer's installation instructions, plumb and level and firmly secured to mounting surfaces. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test operation and demonstrate compliance with requirements. Replace damaged or malfunctioning equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - 1. Ferrous Metal: After completion of communications work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in telecommunications rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In a telecommunications room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as

selected by Contracting Officer. Fire rated plywood backboards to receive two coats of fire retardant paint on all six sides; color to be white.

3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Contracting Officer.
6. Covers: Covers such as handholes, maintenance holes, vaults, pullboxes and the like will be furnished with finishes which resist corrosion and rust. Covers shall be identified with 'Communications'. It is the contractor's responsibility to proactively seek and obtain approval with Contracting Officer prior to purchasing and prior to installation for terms of satisfaction.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing Reports, as outlined in their respective Division sections
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings, including cabling identifications, symbols, and locations
 - f. Warranty and Guaranty Certificates, including extended manufacturer's warranties
 - g. Start-up/test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals. All cabling test results shall be included.
2. During site evaluations by Contracting Officer provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Communications items were installed in accordance with manufacturer's recommendations, and UL listings and approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 27 05 28.28 - FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Firestop Sealants
 - 2. Fire Rated Cable Pathways

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Division 07, Thermal and Moisture Protection.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
 - 2. Schedule of UL System Drawings: Submit schedule of expected opening locations and sizes, penetrating items and required listed design numbers to seal openings to maintain fire resistance ratings. If engineering recommendations are necessary, list these in the schedule too.
 - 3. UL System Drawings: Furnish copies of UL Systems identified in schedule above. Include any engineering recommendations.
 - 4. Certificates: Product Certificate of Compliance from the firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.
 - 5. Installation Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Products/Systems: Provide firestopping systems that comply with the following requirements:
 - a. Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to Contracting Officer.
 - b. Firestopping products bear the classification marking of qualified testing and inspection agency.
 - 2. Installer Qualifications: Experience in performing work of this Section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.
 - 3. General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. Fire rated cable pathway devices to be used for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the Drawings. Such devices will:
 - 1. Meet the hourly fire rating of fire rated wall and or floor penetrated.
 - 2. Be tested for the surrounding construction and cable types involved.
 - 3. Have UL Systems permitting cable loads from “Zero to 100 percent Visual Fill.” This requirement eliminates need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 - 4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging alien cross-talk interference.

5. Be “Zero-Maintenance” defined as: No action required by cabling technician to open and/or close pathway for cable moves, adds, or changes, such as:
- a. Opening or closing of doors.
 - b. Spinning rings to open or close fabric liner.
 - c. Removal and/or replacement of any material such as firestop caulk, putty, pillows, bag foam muffins, foam blocks, or foam closures of any sort.
 - d. Furnish letter from manufacturer certifying compliance with this definition of Zero-Maintenance.
 - 1) Pathways will be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 2) Pathways will be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and resplicing them.
 - 3) Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, Contracting Officer and others the manufacturer of the device and the corresponding UL System number installed.
 - e. Where nonmechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, 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 characteristic during or after construction. Provide letter from manufacturer certifying compliance with this Section.
 - f. Cable pathway to replace conduit sleeves in walls and floors and;
 - 1) When installed individually in floors, devices to pass through core-drilled opening utilizing tested floor plates.
 - 2) When multiple units are ganged in floors, devices to be anchored by means of a tested grid.
 - 3) When installed individually in walls, devices to pass through core-drilled opening utilizing tested wall plates.
 - 4) When multiple units are ganged in walls, devices to be anchored by means of a tested grid.
 - g. Cable tray will terminate at each fire barrier and resume on the other side such that cables pass independently through devices. Cable tray will be properly supported on each side of fire barrier.

1.8 PROJECT CONDITIONS

- A. Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- B. Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
- C. Maintain minimum temperature before, during and for a minimum 3 days after installation of materials.
- D. Do not use materials that contain flammable solvents.
- E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- F. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- G. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Firestop Sealants:
 - 1. Basis of Design: Specified Technologies Inc. (STI).
 - 2. Or approved equivalent.
- B. Fire Rated Cable Pathways:
 - 1. Basis of Design: Specified Technologies Inc. (STI).
 - 2. Or approved equivalent.

2.2 FIRESTOP SEALANTS

- A. STI SpecSeal[®] Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal[®] Series SSS Sealant.
 - 2. Specified Technologies Inc. (STI) SpecSeal[®] Series LCI Sealant.
- B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- C. Basis of Design: Firestop components shown on Drawings and listed in this specification Section are designed based on Specified Technologies, Inc. product line. Manufacturer listed is

allowed on condition of meeting the specified conditions including the available space for the equipment (including code-required working clearances). Remove and replace components installed not meeting these conditions at no cost to Contracting Officer.

2.3 FIRE RATED CABLE PATHWAYS

- A. STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.
- B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.
- C. Basis of Design: Firestop components shown on Drawings and listed in this specification Section are designed based on Specified Technologies, Inc. product line. Manufacturer listed is allowed on condition of meeting the specified conditions including the available space for the equipment (including code-required working clearances). Remove and replace components installed not meeting these conditions at no cost to Contracting Officer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS





- A. Examination:
 - 1. Before beginning installation, verify that substrate conditions previously installed under other Sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
 - 2. Surfaces will be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants and any other substances that may inhibit optimum adhesion.
 - 3. Provide masking and temporary covering to protect adjacent surfaces.
 - 4. Do not proceed until unsatisfactory conditions have been corrected.
- B. Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- C. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.
- D. Field Quality Control:
 - 1. Inspections: Contracting Officer will engage qualified independent inspection agency to inspect through-penetration firestop systems.
 - 2. Keep areas of work accessible until inspection by Contracting Officer.

3. Where deficiencies are found, repair firestopping products so they comply with requirements.

E. Adjusting and Cleaning:

1. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
2. Clean surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

F. Schedules:

			
Blank Opening	C-AJ-0100, C-AJ-0101	C-AJ-0100, C-AJ-0101	
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits/Raceways	C-AJ-2140, C-AJ-2292	W-J-2018, W-J-2076	W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099	W-L-3218, W-L-3219
Cable Trays	C-AJ-4029	W-J-4021, W-J-4022, W-J-4033	W-L-4008, W-L-4029, W-L-4043

G. Documentation:

1. Place system stickers on each side of wall penetrations.
2. Place a reproduction (photocopy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the Section of the system description that list the allowed cable types.

3.2 FIRESTOP SEALANTS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 FIRE RATED CABLE PATHWAYS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION 27 05 28.28

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Electrical Metallic Tubing and Fittings
2. Conduit Accessories
3. Penetration Sealing Systems
4. Telecommunications Outlet Boxes
5. Pull Boxes

B. This Section specifies the requirements to provide communications conduit raceways, boxes and fittings.

C. All network cabling to be run in metal conduit for its entire pathway.

1.2 RELATED SECTIONS

A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. Provide plan drawings showing completions and as-built corrections which indicate type, size, placement, routing and/or length for raceway and cable tray components; e.g., manholes, handholes, conduit, boxes, enclosures, etc.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Cabinet: A freestanding floor-mounted modular enclosure designed to house and protect rack-mounted electronic equipment.
- B. Conduit: Round raceway.
- C. Conduit Body: Separate portion of a conduit or tubing system that provides access through removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.
- D. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.
- E. Raceway: Enclosed channel designed expressly for holding wires or cables. Metal or insulating material and the term includes conduit, tubing, wireways, underfloor raceways and surface raceways; does not include cable tray.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Electrical Metallic Tubing and Fittings:
 - 1. Allied Tube and Conduit
 - 2. Wheatland Tube
 - 3. Appleton
 - 4. Or approved equivalent.
- B. Conduit Accessories:
 - 1. Duct Spacers:
 - a. Carlon
 - b. Allied Tube and Conduit
 - c. Or approved equivalent.
 - 2. Expansion/Deflection Fittings:
 - a. Appleton
 - b. Emerson
 - c. Or approved equivalent.
 - 3. Pulltape:

- a. George-Ingraham
 - b. Greenlee
 - c. Or approved equivalent.
- 4. Duct Plugs:
 - a. Carlon
 - b. Vikimatic
 - c. Or approved equivalent.
- C. Penetration Sealing Systems:
 - 1. SEMCO
 - 2. Or approved equivalent.
- D. Telecommunications Outlet Boxes:
 - 1. Raco
 - 2. Or approved equivalent.
- E. Pull Boxes:
 - 1. Hoffman
 - 2. Oldcastle (concrete)
 - 3. Or approved equivalent.
- 2.2 ELECTRICAL METALLIC TUBING AND FITTINGS
 - A. Type EMT: Electrogalvanized steel tubing.
 - B. Fittings and Conduit Bodies:
 - 1. In-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. Lbs.
 - 2. Wet Areas: Steel compression-type couplings and nipples.
 - 3. Dry Areas: Set screw-type couplings and nipples.
 - 4. Bonding Locknuts:
 - a. Malleable iron with set screws and lug screws.
 - b. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.

- c. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug screws.

2.3 CONDUIT ACCESSORIES

A. Duct Spacers:

1. Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch diameter conduit with 1-1/2-inch separation.
2. Base Spacer: S288NHN.
3. Intermediate Spacer: S289NHN.

B. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.

C. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch tape 9216-JK.

D. Duct Plugs:

1. Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch PVC plugs with pull tab, P258NT.
2. Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g. Vikimatic 4-inch, Part Number 40D402U. Use appropriate part number according to duct size.

2.4 PENETRATION SEALING SYSTEMS

A. Firestopping: Provide fire barrier penetration sealing materials as specified in Division 07, Firestopping Section.

B. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

2.5 TELECOMMUNICATIONS OUTLET BOXES

A. Sheet Metal Outlet Boxes: Minimum 4-inch square by 2-1/8-inch deep, galvanized steel for use with single- or double-gang plaster rings.

B. Five Square Outlet Boxes: Minimum 5-inch square by 2-7/8-inch deep with built-in cable management for use with single- or double-gang plaster rings. Randl P/N T-55017 approved.

2.6 PULL BOXES

A. Construction: NEMA Standard No. 250. Type 1 galvanized steel enclosures designed for use as junction boxes and pull boxes with flat screw-applied covers, with or without knockouts and

gray enamel finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Workmanship:

1. All cabling to be run in metal conduit, minimum 3/4-inch for its entire pathway.
2. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.
3. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
4. Place support for raceways, cable trays, backboards, equipment racks and cabinets.

B. Protection During Construction: Protect products from the effects of moisture, corrosion and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing and wireway capped with manufactured seals during construction.

C. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:

1. Provide a watertight seal.
2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.

D. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.

E. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).

F. Grounding: Provide ground connections and bonding continuity between raceway and wire basket runway sections, boxes, enclosures, cabinets and fittings as required per code and industry standard.

3.2 ELECTRICAL METALLIC TUBING AND FITTINGS

A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's written instructions and recommendations.
- C. Minimum Conduit Size: Size recessed conduits to surface raceway serving multiple data outlets as follows. Sizing is based on TIA/EIA 569-B for 28 percent conduit fill, assuming Category 6A cables (nominal outer diameter 0.24-inch) to each data outlet. Provide recessed backbox between surface raceway and recessed conduit sized for conduit.

1 to 6 cables	1-inch conduit
7 to 10 cables	1-1/4-inch conduit
11 to 15 cables	1-1/2-inch conduit
16 to 20 cables	2-inch conduit
Above 20 cables	Use multiple runs of conduit from surface raceway based on above table

- D. Minimum Backbone Conduit Requirements: Install three 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.
- E. Conduit Type:
1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
 - a. Interior Dry Locations, Exposed: EMT with set screw fittings.
 - b. Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
 - c. Interior Wet Locations: EMT with compression fittings.
- F. Conduit Bends and Sweeps:
1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
 2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
 3. Field-Made Bends and Sweeps:
 - a. Use an acceptable hickey or conduit-bending machine.
 - b. Do not heat metal raceways to facilitate bending.
 - c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.
 4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.

5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:
 - a. One-inch conduit, 11-inches
 - b. Two-inch conduit, 21-inches
 - c. Three-inch conduit, 36-inches
 - d. Four-inch conduit, 48-inches
 - e. Other sizes, 10 times the inside diameter of the conduit.
6. Do not install boxes, bends, elbows, tees, conduit bodies and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
 - a. Conduit Bodies: In-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2-inches ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.
 - b. Refer design or installation conflicts with these requirements to the Contracting Officer.

3.3 CONDUIT ACCESSORIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Duct Spacers: Install per manufacturer's recommendation.
- D. Expansion/Deflection Fittings: Install per manufacturer's recommendation.
- E. Pulltape: Install per manufacturer's recommendation.
- F. Duct Plugs: Install per manufacturer's recommendation.

3.4 PENETRATION SEALING SYSTEMS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
 1. Empty Conduits: Removable screwtight duct plugs.
 2. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.

3.5 TELECOMMUNICATIONS OUTLET BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Provide 4-inch by 4-inch by 2-1/8-inch deep outlet boxes for mounting telecommunications outlets with single-gang or double-gang plaster rings as required, or as indicated on the Drawings.
- D. Do not install outlet boxes back to back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
- E. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.
- F. Provide knockout closures for unused openings.
- G. Support telecommunications outlet boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.
- I. Install outlet boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches and backsplashes.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlet boxes in hollow stud wall.
- L. Provide cast outlet boxes in exterior and wet locations.

3.6 PULL BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. In-Ground: Size and install per manufacturer's recommendations.
- D. Aboveground: Size and install per manufacturer's recommendations.

END OF SECTION 27 05 28

SECTION 27 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Vaults
2. Vault Covers
3. Precast Vault Concrete Materials
4. Vault Components
5. Handholes

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
1. Section 27 05 28, Pathways for Communications Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Shop drawings detailing items provided under this Section:
 - a. Vault cover assigned designators
 - b. Duct entry schedule
 - c. Pulling iron working load
 - d. ASTM load designation and percentage increase in live load for impact
 - e. Vault Section weights.

- f. Rebar and piling support details.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Installer will have documented experience in the placement of vaults for a minimum of 3 years.
 - 2. Manufacturer will have documented experience in the manufacturer of vaults for minimum of three years.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Vaults:
 - 1. Oldcastle Precast
 - 2. Or approved equivalent.
- B. Vault Covers:
 - 1. Oldcastle Precast
 - 2. Neenah Foundry
 - 3. Or approved equivalent.
- C. Precast Vault Concrete Materials:
 - 1. Oldcastle Precast
 - 2. Or approved equivalent.
- D. Vault Components:
 - 1. Pull-In Irons:
 - a. McGraw-Edison
 - b. Joslyn

- c. Oliver
 - d. Or approved equivalent.
- 2. Vault Cable Rack Hardware:
 - a. Chance
 - b. Or approved equivalent.
- 3. Grade Rings:
 - a. Neenah Foundry
 - b. Or approved equivalent.

E. Handholes:

- 1. Oldcastle Precast
- 2. Chapman Electric Supply, Inc.
- 3. Jensen Precast
- 4. Or approved equivalent.

2.2 VAULTS

- A. Vaults will be precast, reinforced concrete Sections (top, base and where required, extension Sections) with knockouts or duct terminators PVC end bells or Carlon (utility vault Term-A-Duct) for main conduit entrances with recessed keyways and subsidiary duct entrances.
- B. Concrete inserts will be set in interior surfaces of walls of each Section to provide for cable rack mounting. Base Section will be equipped with pulling-in irons located opposite each main cable entrance.

2.3 VAULT COVERS

- A. Manufactured from metal casting, conforming to ASTM A48-83.
- B. Class 35B gray cast iron, with machine finished flat bearing surface.
- C. Vault covers shall be a minimum Light Vehicular traffic 100,000 pound wheel load.

2.4 PRECAST VAULT CONCRETE MATERIALS

- A. Concrete:
 - 1. Conforms to ASTM C478.
 - 2. Compressive Strength: 5000-PSI minimum at 28 days.

3. Air Content: 4 percent minimum.
 4. Cementitious Materials: Minimum of 564-lbs/cu yd.
 5. Course Aggregates: ASTM C33. Sound, Crushed, Angular Granite Stone only. Smooth or rounded stone will not be used.
 6. Fine Aggregates: ASTM C33. Free from organic impurities.
 7. Chemical Admixtures: ASTM C494. Calcium chloride or admixtures containing calcium chloride will not be used.
 8. Air Entraining Admixtures: ASTM C260.
- B. Reinforcing Steel: ASTM A615 grade 60 deformed bar, ASTM A82 wire, or ASTM A185 welded wire fabric.
- C. Lift Loops:
1. ASTM A416 steel strand.
 2. Lifting loops made from deformed bars are not allowed.
- D. Flexible Joint Sealants:
1. Butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO-198, Type B-Butyl Rubber and maximum of 1 percent volatile matter.
 2. Suitable for application temperatures between 10 and 100 degrees F.
- E. Epoxy Gels:
1. 2-component, solvent-free, moisture-insensitive, high modulus, high strength, structural epoxy paste adhesive.
 2. Must meet requirements of ASTM C-881, Type I and II, Grade 3, Class B and C, epoxy resin adhesive.

2.5 VAULT COMPONENTS

- A. Lifting inserts, holes and devices to comply with OSHA Standard 1926.704. Size lift holes and inserts for precision fit with lift devices and will not penetrate through structure wall. Precast manufacturer will provide lifting devices.
- B. Internally seal joints between tongue and groove; additionally, seal around external perimeter of the joint as follows:
1. External seals to consist of polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 6-inches wide applied to outside perimeter of joint.

2. Internal seals to consist of plastic or paper-backed butyl rubber rope no less than 14 feet long and having cross-sectional area no less than annular space times height of joint.
 3. At option of Contractor, internal seals on round joints may consist of O-ring gasket conforming to ASTM C443, installed according to Precast Manufacturer's recommendation.
- C. Precast base Sections will be cast monolithically without construction joints or with approved galvanized or PVC water stop cast in the cold joint between base slab and walls.
- D. Wall and inside slab finish resulting from casting against forms standard for industry will be acceptable. Form ties through the wall are not allowed. Exterior slab surfaces below grade will have float finish. Small surface holes, normal color variations, normal form joint marks and minor depressions, chips and spalls will be tolerated. Dimensional tolerances will be as set forth in appropriate references.
- E. Conduit openings will not extend into corners of structures, but may extend across joint with Contracting Officer's approval.
- F. Knockout panel dimensions will be as required by structural design at their maximum burial depth using design loads specified.
- G. Design components in accordance with ACI, ASTM C890 and the following loads:
1. Horizontal load on walls and knockout panels will be load of 80 psf per foot of burial depth (using a burial depth of 20-feet) plus a live lateral surcharge due to HS20 traffic load of 80 psf.
 2. Vertical load on below grade adaptor slabs and tops will be fill height of 20-feet assuming soil unit weight of 100 lbs/ft, plus live HS20 traffic load.
 3. Vertical load on covers supported around perimeter will be live HS20 traffic load.
- H. Rectangular sub-grade components to be designed and manufactured in conformance with ASTM C913 and as follows:
1. Joints between precast components will be keyways or tongue and groove. Joints to accept cast iron frames will be flat and no less than 5-inches wide.
 2. Construct access vault structures to sizes and elevations shown on Drawings.
 3. Manholes and Hardware:
 - a. Each manhole will be provided with one galvanized 3/4-inch rebar x 16-inches wide bolt-on ladder, mounting pads and mounting hardware. Rungs will be at 12-inches centers. Side rails will be 2-inches x 5/16-inches flat bar.
 - b. Each manhole entrance will be supplied with one galvanized 3/4-inch x 16-inches wide bolt-on manhole step.

I. Pull-In Irons:

1. Each wall of each vault will have a 7/8-inch hot-dipped galvanized pull-in iron centered under the new and future duct line openings. Pull-in irons will be McGraw-Edison, Joslyn, or Oliver.

J. Vault Cable Rack Hardware:

1. Cable Rack: Chance #1225
2. Cable Rack Hooks: Chance #1231
3. Cable Rack Insulators: Chance #1121

K. Grade Rings:

1. Rings, covers and frames will be Class 35 gray iron. Covers and frames will be equal to Neenah Foundry #R-1530 manhole frame Type B non-rocking lid.

2.6 HANDHOLES

- A. Housing: Polyester pre-mix with calcium carbonate and polyester resins interlaced with fiber fiberglass and ultraviolet inhibitors with an H-20 traffic rating.
- B. Extension Rings: Capable of accepting up to 18-inches of extension rings to adapt to re-leveling of grade during Phase 2 construction (see site plans for phased site construction) with an H-20 traffic rating.
- C. Lid: Reinforced concrete with concrete leading lid same size as opening of housing for as much hand space as possible for cable access with an H-20 traffic rating.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Requirements for Precast Concrete Vaults: Coordinate delivery of precast concrete manhole components to jobsite with manufacturer. Handling of materials will be done in accordance with ASTM C891 and manufacturer's recommendations. Handle and store components on job site using methods that will prevent damage.
- B. Cleaning Vaults: Vaults will be clean and left free of debris, silt and rocks from installation work.

3.2 VAULTS

- A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.
- B. Set base plumb and level.

- C. Provide minimum 18-inches of pea gravel below pull vault for stability and drainage.
- D. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll butyl sealant rope directly against spigot or keyway. Leave protective wrapper attached until sealant is entirely unrolled. Do not stretch. Overlap from side to side, not top to bottom.
- E. When recommended by manufacturer, fill void between horizontal joint surfaces with sand cement grout around the outside perimeter.
- F. After joining Sections, apply butyl sealant sheet around outside perimeter of joint.
- G. Lift holes leaving less than 2-inches of wall thickness will be plugged from outside using sand cement mortar then covered with butyl rubber sheet. Lift holes penetrating wall will be additionally sealed with epoxy gel on interior.
- H. Set frames or tops to required elevation sealing joints with butyl sealant rope and sheet.
- I. Provide pulling-in irons opposite and above each conduit entrance.
- J. Provide cable racks in each vault for support of conductors.
- K. Provide 3/4-inch by 10-foot copper ground rod at each vault.

3.3 VAULT COVERS

- A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.
- B. Install per manufacturer's instructions and recommendations.

3.4 PRECAST VAULT CONCRETE MATERIALS

- A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.
- B. Install per manufacturer's instructions and recommendations.

3.5 VAULT COMPONENTS

- A. Reference 3.01, General Installation Requirements and 3.02, Vaults, above.
- B. Install per manufacturer's instructions and recommendations.

3.6 HANDHOLES

- A. Excavate to required depth and remove materials that are unstable or unsuitable for good foundation. Prepare level, compacted foundation extending 6-inches beyond base. Some vaults may be piling supported. Check structural drawings and details.
- B. Set base plumb and level.
- C. Provide minimum 12-inches of pea gravel below handhole for stability and drainage.

- D. Turn conduits up into handhold with required bend radius per guidance in 27 05 28, Pathways for Communications Systems; and TIA/EIA standards for fiber optic cabling.
- E. Engrave cover of handhole to identify its purpose (examples: "Power," "Emergency Power," "Signal," "Fire Alarm").

END OF SECTION

SECTION 27 11 00 - COMMUNICATION EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Telecommunications Backboards
2. Equipment Racks
3. Wall Mount Cabinets
4. Free Standing Cabinets
5. Horizontal Wire Managers
6. Telecommunications Grounding
7. Ladder Rack Cable Runway

- B. The telecommunications equipment room is intended to house racks, cabinets and equipment necessary for the support of the voice and data cabling infrastructure as well as other low-voltage systems.

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Use this Section in conjunction with the other Division 27, Communications Sections and related Contract Documents to establish the total general requirements for the project technology systems and equipment.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Shop Drawings that include, but are not limited to, the following: Telecommunication Room layout, Telecommunication Room wall elevations, equipment rack elevations, cable routing, cable connecting diagrams, termination pin outs, supporting hardware

details, block diagrams, riser diagrams and cable pathways. Work may not begin until shop drawings are approved. Note: Intent of submitting shop drawings is for contractors to display a conceptual understanding of the issued Contracting Officer drawings. Do not submit Contracting Officer Drawings on your title block.

2. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA-606-A.
3. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. The communications room distribution subsystem refers to the passive components used to terminate cabling subsystems and distribute technology services. This subsystem includes but is not limited to installations in the Main Equipment Room (MER), Telecommunications Rooms (TR) and Entrance Facility (EF).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Telecommunications Backboards:
 1. Reference 2.02A for requirements.
 2. Or approved equivalent.
- B. Equipment Racks:
 1. Chatsworth
 2. B-Line
 3. Hoffman
 4. Or approved equivalent.
- C. Wall Mount Cabinets:
 1. Chatsworth

2. B-Line
 3. Hoffman
 4. Or approved equivalent.
- D. Free Standing Cabinets:
1. Chatsworth
 2. B-Line
 3. Hoffman
 4. Or approved equivalent.
- E. Horizontal Wire Managers:
1. 19-inches wide, two rack units high:
 - a. Chatsworth
 - b. Panduit
 - c. B-Line
 - d. Or approved equivalent.
 2. 19-inches wide, one rack unit high.
 - a. Chatsworth
 - b. Panduit
 - c. B-Line
 - d. Or approved equivalent.
- F. Telecommunications Grounding:
1. Telecommunications Main Grounding Busbar (TMGB):
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
 2. Telecommunications Grounding Busbar (TGB):
 - a. Chatsworth

- b. B-Line
 - c. Or approved equivalent.
- 3. Telecommunications Ground Accessories:
 - a. One Hole Ground Terminal Block:
 - 1) Chatsworth
 - 2) Or approved equivalent.
 - b. Two Hole Ground Terminal Block:
 - 1) Chatsworth
 - 2) Or approved equivalent.
 - c. Two Hole Grounding Lug:
 - 1) Chatsworth
 - 2) Or approved equivalent.
 - d. Cable Runway Ground Strap Kit:
 - 1) Chatsworth
 - 2) Or approved equivalent.
- G. Ladder Rack Cable Runway:
 - 1. Cable Runway:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
 - 2. Runway Wall Angle Support:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
 - 3. Runway to Rack Mounting Bracket:
 - a. Chatsworth

- b. B-Line
 - c. Or approved equivalent.
- 4. Cable Runway Junction-Splice Kit:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
- 5. Cable Runway Butt-Splice Kit:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
- 6. Cable Runway Triangle Support Bracket:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
- 7. Cable Runway Radius Drop:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
- 8. Cable Runway Radius (Stringer):
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.
- 9. Cable Runway Foot Kit:
 - a. Chatsworth
 - b. B-Line
 - c. Or approved equivalent.

2.2 TELECOMMUNICATIONS BACKBOARDS

- A. 3/4-inch minimum thickness, A/C grade or better, void-free plywood, fire treated backboard.

2.3 EQUIPMENT RACKS

- A. 7-foot high, 19-inches wide, free-standing rack, UL listed, black finish.

2.4 WALL MOUNT CABINETS

- A. 24-inches high, 24-inches deep, 24-inches wide, wall mounted cabinet with solid hinged door.

2.5 FREE STANDING CABINETS

- A. 84-inches high, 30-inches deep, 24-inches wide, free standing cabinet with hinged door.

2.6 HORIZONTAL WIRE MANAGERS

- A. 19-inches wide, two rack units high.
- B. 19-inches wide, one rack unit high.

2.7 TELECOMMUNICATIONS GROUNDING

- A. Telecommunications Main Grounding Busbar (TMGB): Solid copper busbar kit, 20-inches long, 1/4-inch thick, wall mounted with standoffs.
- B. Telecommunications Grounding Busbar (TGB): Solid copper busbar kit, 10-inches long, 1/4-inch thick, wall-mounted with standoffs.
- C. Telecommunications Ground Accessories:
 - 1. One hole ground terminal block, holds two wires up to size #4.
 - 2. Two hole ground terminal block, holds two wires up to size 2/0.
 - 3. Two hole grounding lug.
 - 4. Cable runway ground strap kit.

2.8 LADDER RACK CABLE RUNWAY

- A. Cable Runway: 12-inches wide, 10-foot lengths, steel construction.
- B. Runway wall angle support.
- C. Runway to rack mounting bracket.
- D. Cable runway junction-splice kit.
- E. Cable runway butt-splice kit.

- F. Cable runway triangle support bracket.
- G. Cable runway radius drop.
- H. Cable runway radius (stringer).
- I. Cable runway foot kit.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Provide all components of the telecommunications system from a single manufacturer.
- B. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.
- C. Seismic installations require additional bracing of cabinets and overhead cable runways to building structure, as advised by and certified by a licensed Contracting Officer.
- D. Ladder Rack Cable Tray:
 - 1. Provide cable tray as shown in drawing package. The locations shown may need to be adjusted slightly in the field to assure proper placement.
 - 2. Field cut to length tray Sections with a minimum number of splice points. Make field cuts using the manufacturers recommended equipment.
 - 3. Deburr and file rough edges on cable tray.
 - 4. Provide seismic bracing for installed cable trays.
- E. Labeling:
 - 1. Label racks with the equipment room number and a unique identifier beginning with the telecom room number and the number one, i.e. TR1-1.
 - 2. Label the telecommunications grounding busbar and bonding conductor with the equipment room number and a unique identifier, beginning with the number one, i.e. TGB-SVR1. The designation for the Telecommunications Main Ground Busbar begins with TMGB.
 - 3. Submit labeling schemes to the Contracting Officer for approval prior to testing and labeling.

3.2 TELECOMMUNICATIONS BACKBOARDS

- A. Mount plywood backboard vertically, 4-inches from floor, minimum of two walls covered within each telecommunications space.

- B. Mount backboards with the smooth "A" surface facing away from the wall. Paint the backboard with two coats of fire resistant paint prior to mounting.
- C. Install boards plumb, level and secured to studs or solid concrete or masonry walls. Use a minimum of six appropriate fasteners for every 16 SF of backboard. Anchors for attaching equipment boards include:
 - 1. Material/Substrate: Anchor type.
 - 2. Concrete/Masonry: Expansion anchors; wedge type with washer located on the backside of the board.
 - 3. Gypsum Wallboard: Togglebolts; use pan head type.
- D. Powder drive anchors, molly bolts and tappets are not allowed.

3.3 EQUIPMENT RACKS

- A. Fasten free-standing equipment racks to the telecom room floor using a minimum of four 1/2-inch concrete anchors. Secure racks mounted on raised floors to the concrete floor below.
- B. Position equipment racks according to drawings with a minimum of 3-feet of clearance in front and back. Field verify the dimensions of the room prior to installation of racks and report any discrepancies to the Contracting Officer.
- C. Provide proper seismic bracing and wire management from backboard to freestanding equipment rack, per IBC.

3.4 WALL MOUNT CABINETS

- A. Provide all components of the cabinet system (cabinet, mounting rails, cable managers, power strips and accessories) from a single manufacturer.
- B. Attach cabinet to the wall so the front door can be opened fully without obstruction by other building, storage or architectural components. Follow the manufacturer's installation instructions when securing the cabinet to the wall and backboard. Do not attach the cabinet to sheetrock (gypsum wall board). Attach cabinet directly into studs through a 3/4-inch plywood backboard. Reference 2.02 for additional information. Cabinet may be attached to a masonry wall when the installer provides hardware. Use included hardware or the appropriate hardware as defined by local code or the Contracting Officer.
- C. Cables to enter/exit the cabinet through conduit knockouts in the sides and/or bottom of the cabinet through a rectangular cutout in the back of the cabinet.
- D. Install and adjust to position all accessories, including cable managers, power strips, equipment-mounting rails, fan kits, etc. prior to installing equipment into the cabinet. Test fans and power strips/outlets prior to installing equipment.
- E. Install per manufacturer's instructions and recommendations.

3.5 FREE STANDING CABINETS

- A. Provide all components of the cabinet system (cabinet, mounting rails, shelves, cable managers, PDUs or power strips, environmental sensors and thermal management accessories) from a single manufacturer.
- B. Install and adjust to position all accessories, including vertical cable managers, vertical PDUs or power strips, equipment-mounting rails and airflow baffles using the manufacturer's installation instructions prior to baying and/or placing the cabinet for attachment to the building. Install shelves, horizontal cable managers and panel fillers after the cabinet is placed.
- C. Secure cabinets to the structural floor using manufacturer's installation instructions and appropriate hardware as defined by local code or the Contracting Officer. Installers to provide installation hardware. When placed over a raised floor, secure cabinet to the structural floor through the raised floor panels using threaded rod.
- D. When used in a multi-cabinet bay, attach cabinets side-by-side using included baying kits according to the manufacturer's instructions.
- E. Attach overhead ladder rack or cable tray to the ceiling, independent of the cabinet. Maintain a 3-inch minimum clearance between the top of the cabinet and the bottom of the ladder rack/cable tray. Position ladder rack/cable so it does not interfere with hot air exhaust through the cabinet's top panel. Use radius drops where cable enters/exits the ladder rack/cable tray. Alternately, attach ladder rack/cable tray to the top of the cabinets using an elevation kit, so the ladder rack/cable tray is a minimum of 3-inches above the cabinet.
- F. Securely bond cabinets to the Telecommunications Grounding Busbar (TGB). Attach a bonding conductor, sized in accordance with TIA 607-B. Attach the bonding conductor to the cabinet using included hardware, according to the manufacturer's installation instructions. Installer to provide the the bonding conductor and other necessary hardware required to make the connections between the cabinet and the Telecommunications Grounding Busbar.

3.6 HORIZONTAL WIRE MANAGERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.7 TELECOMMUNICATIONS GROUNDING

- A. Bond equipment racks and ladder racking to each equipment room TGB (one per equipment room minimum) with #6 AWG or larger, stranded copper conductor.
- B. Connect each TGB to the TMGB and building steel using a 3/0 AWG or larger, stranded copper conductor.

- C. Connect each TMGB and TGB to the main electrical main distribution panel and building steel using a 3/0 AWG or larger, stranded copper conductor. Coordinate exact routing and connection points with the electrical contractor.
- D. Two hole lugs are required on all ground cable connecting to the TMGB and TGB.

3.8 LADDER RACK CABLE RUNWAY

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work included:
 - 1. Copper Backbone Cable
 - 2. Fiber Optic Backbone Cable
 - 3. Copper Termination Hardware
 - 4. Fiber Optic Termination Hardware
 - 5. Fiber Patch Cords
 - 6. Splice Cases

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of NFPA 780, Standards for Installation of Lightning Protection Systems.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA- 606-A.
 - 2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Contracting Officer will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.
 - 2. Provide a warranty on the physical installation.
 - 3. Furnish necessary documentation required by the manufacturer immediately following 100 percent testing of cables.
 - 4. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Contracting Officer from the manufacturer. Ensure that the manufacturer provides the Contracting Officer with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

- A. Provide a standards-based cable system to serve backbone communication systems requirements as specified in these specifications and shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards which apply to backbone communication systems.
- B. Install intrabuilding backbone cables from existing or ERs to TRs through raceway systems as shown on Drawings.
- C. Install interbuilding (OSP) backbone cables from existing or EF to ERs through existing raceway systems as shown on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Copper Backbone Cable:
 - 1. Belden
 - 2. CommScope
 - 3. Corning - fiber optic only
 - 4. Leviton/Berk-Tek
 - 5. Ortronics/Superior Essex

6. Panduit /General
7. Siemon
8. Or approved equivalent.

B. Fiber Optic Backbone Cable:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit /General
7. Siemon
8. Or approved equivalent.

C. Copper Termination Hardware:

1. General:
 - a. Belden
 - b. CommScope
 - c. Corning - fiber optic only
 - d. Leviton/Berk-Tek
 - e. Ortronics/Superior Essex
 - f. Panduit /General
 - g. Siemon
 - h. Or approved equivalent.
2. Communication Entrance Protection:
 - a. Circa
 - b. Systimax
 - c. Porta System
 - d. Or approved equivalent.

D. Fiber Optic Termination Hardware:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit /General
7. Siemon
8. Or approved equivalent.

E. Fiber Patch Cords:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit /General
7. Siemon
8. Or approved equivalent.

F. Splice Cases:

1. Copper UTP:
 - a. Preformed
 - b. 3M
 - c. Or approved equivalent.
2. Fiber Optic:
 - a. Preformed
 - b. Corning
 - c. 3M

- d. Or approved equivalent.

2.2 COPPER BACKBONE CABLE

- A. Interbuilding: 100 ohm, CAT5e 22 AWG, OSP PE-39 or PE-89 unshielded twisted pair with an overall shield and a single sheath. Shielding must be Steel Aluminum Black Polyethylene (STALPETH).
- B. Intrabuilding or Interbuilding Indoor/Outdoor, UL listed for use indoors. Unshielded twisted pair, 100 ohm, 4-pair:
 - 1. Category 6A, Mohawk P/N M58772.
 - 2. Category 5e, Mohawk P/N M58762.
- C. Intrabuilding or Interbuilding Indoor/Outdoor, UL listed for use indoors. Category 5e, 100 ohm, 25-pair unshielded twisted pair with an overall shield: Mohawk P/N M58783.

2.3 FIBER OPTIC BACKBONE CABLE

- A. Intrabuilding Singlemode Riser: 24 strand, 8.3 micron, high performance low water peak distribution cable.
- B. Interbuilding Singlemode: 24 strand, 8.3 micron, high performance low water peak loose tube cable.

2.4 COPPER TERMINATION HARDWARE

- A. Category 6A Modular Patch Panels:
 - 1. 24 port, 8-position modular jack panel, high density, 6 port modules, Category 6, IDC terminals, T568A/B wiring scheme.
 - 2. 48 port, 8-position modular jack panel, high density, 6 port modules, Category 6, IDC terminals, T568A/B wiring scheme.
 - 3. 24 port, 8-position modular jack panel, high density, 8 port modules, Category 6, IDC terminals, T568A/B wiring scheme.
 - 4. 48 port, 8-position modular jack panel, high density, 8 port modules, Category 6, IDC terminals, T568A/B wiring scheme.
- B. Category 5e Modular Patch Panels:
 - 1. 24 port, 8-position modular jack panel, high density, 6 port modules, Enhanced Category 5e, IDC terminals, T568A/B wiring scheme.
 - 2. 48 port, 8-position modular jack panel, high density, 6 port modules, Enhanced Category 5e, IDC terminals, T568A/B wiring scheme.
 - 3. 24 port, 8-position modular jack panel, high density, 8 port modules, Enhanced Category 5e, IDC terminals, T568A/B wiring scheme.

4. 48 port, 8-position modular jack panel, high density, 8 port modules, Enhanced Category 5e, IDC terminals, T568A/B wiring scheme.

C. Voice Field Pre-Terminated Patch Panels:

1. 24 port, 8-position modular jack panel, high density, 6 or 8 port modules, Amphenol connector, one pair per port.
2. 48 port, 8-position modular jack panel, high density, 6 or 8 port modules, Amphenol connector, one pair per port.

D. Wall-Mount Termination Fields:

1. Wall-mounted 110-style termination frames with legs.
2. Rack-mounted 110-style termination frames without legs. Provide associated rack mounting hardware.

E. Communication Entrance Protection: Wall-mount 5-pin circuit protector blocks. Provide multi-pair tails or 110-style input/output terminations per application. Provide 5-pin, solid state surge arresters for each position on circuit protection panel.

2.5 FIBER OPTIC TERMINATION HARDWARE

A. High Density Fiber Termination Shelf:

1. 7-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 12 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors.
 - a. 19-inch rack mount, 13-inches deep.
 - b. 19-inch rack mount, 19-inches deep.
2. 3.5-inch high shelf designed for mounting in 19-inch equipment racks and capable of accepting 6 adapter panels. The shelf will contain built-in slack management and be accessible from the front or rear with locking doors.
 - a. 19-inch rack mount, 13-inches deep.
 - b. 19-inch rack mount, 19-inches deep.
3. Fiber Adapter Panels:
 - a. Adapter panel for high density termination shelf with 6 LC multimode phosphor-bronze alignment sleeves.
 - b. Adapter panel for high density termination shelf with 6 duplex SC multimode phosphor-bronze alignment sleeves.
4. Preloaded Fiber Termination Shelf:

- a. 1.75-inch high shelf designed for mounting in 19-inch equipment racks with 24 LC multimode phosphor-bronze alignment sleeves. The shelf will contain built-in slack management and be accessible from the front or rear.
 - B. Singlemode LC Connector:
 - 1. Ceramic tip LC style capable of being terminated on 8.3/125 fiber with 900 micron buffer.
- 2.6 FIBER PATCH CORDS
- A. Singlemode Fiber Optic Jumpers:
 - 1. Factory terminated double ended, two strand singlemode cordage with LC connectors on each end, length as defined by the Contracting Officer.
- 2.7 SPLICE CASES
- A. Copper UTP: Provide as close as practicable (within 50-feet) of where OSP cable enters building in a duct or conduit system. Size splice case(s) to accommodate pair count of the cable(s) entering building. Splice case must be capable of bonding to the Telecommunications Main Grounding Bus Bar (TMGB). Complete with end caps to properly seal cable from expanding water blocking gel. Use 25-pair 3M splice modules for splice connections.
 - B. Fiber Optic: Provide as close as practicable (within 50-feet) of where OSP cable enters building in a duct or conduit system. Size splice cases(s) to accommodate strand count of the cable(s) entering building. Splice case must be capable of bonding to the Telecommunications Main Grounding Bus Bar (TMGB). Complete with end caps to properly seal cable from expanding water blocking gel.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, underground vault racking, bullet bonds, gel blocking kits, pull rope and other miscellaneous hardware for a complete and operable system.
- B. Provide like items from one manufacturer, such as cable, patch panels, connectors, and equipment connection cords.
- C. Communications Backbone Cabling includes cables, connectors, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers, tie wraps and D-rings.
- D. Furnish and install materials necessary for a complete and working system.
- E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.

- F. Perform work in a neat and workmanlike manner.
- G. Firestopping: Install all firestop systems in accordance with manufacturer's recommendations. Firestop systems to be completely installed and available for inspection by local inspection authorities prior to cable system acceptance.
- H. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.
- I. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned:
 - 1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
 - 2. Swab any additional enclosed raceway and innerduct systems.
- J. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.
- K. Install cable ties and other cable management clamps via hand so they fit snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.
- L. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
- M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.
- N. If a J-hook or trapeze system is used to support cable bundles, support cables at a maximum of 48 to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.
- O. Install cable above fire-sprinkler systems and ensure the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware so it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- P. Do not attach cables to ceiling grid or lighting fixture wires. Where support for cable is required, install appropriate carriers to support the cabling.
- Q. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Contracting Officer.
- R. Unshielded Twisted Pair Cable Installation Practices:
 - 1. Install cable in accordance with manufacturer's recommendations and best industry practices.
 - 2. Do not exceed the cable's minimum bend radius and maximum pulling tension.

3. Install unshielded twisted pair cable so there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- S. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
1. Open or Nonmetal Communications Pathways:
 - a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.
 - b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48-inches from large electrical motors or transformers.
 2. Grounded Metal Conduit Communications Pathways:
 - a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.
- T. Determine requirements for plenum rated cable and devices. When doubt exists, seek prior determination in writing by Contracting Officer.
- U. Seal conduits entering from outside the building and install listed firestop material in conduits and sleeves to satisfy NEC and local codes.
- V. Unshielded Twisted Pair Termination:
1. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document, manufacturer's recommendations and best industry practices.
 2. Maintain the cable jacket within 1-inch of the termination point.
 3. Do not exceed 0.5-inch of pair untwist at the termination point.
 4. Do not exceed 4 times the outside diameter of the cable in the termination area for bend radiance compliance.

5. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair cables as follows:
 - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test cabling using a Level IV test unit for Category 6 performance compliance as specified in ANSI/TIA/EIA-568-C.
 - b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and re-test the cable prior to final acceptance.
 - c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multi-pair cables, record the shortest pair length as the length for the cable.
4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation

- d. NEXT (Near end crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay skew
 - i. PSNEXT (Power sum near-end crosstalk loss)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss)
6. Provide test results in electronic format, with the following minimum information per cable:
- a. Circuit ID
 - b. Test result, "Pass" or "Fail"
 - c. Date and Time of test
 - d. Project Name
7. Fiber Test Documentation: Provide electronic CD disk and hard copy test reports from ANSI/TIA/EIA-526-14A Method B Standards. Calculate a "Loss Budget" for each cable length based on cable length and connectors. Provide as a minimum, OTDR test results in the form of a printed waveform and text table for both 850 nm and 1300 nm for multimode fiber and 1350 nm and 1510 nm for singlemode fiber. Test fibers and connector systems for end-to-end attenuation. Provide a power meter test on fiber optic strands at both wavelengths A to B, B to A and OSPL (OSPL is as defined as $L_a - L_b$). Include the results of unsatisfactory tests, with an explanation of how the problem was corrected. Clearly label connector and fiber loss on test waveforms.
8. Provide an electronic copy of the test results, in the native tester software format, to the Contracting Officer along with the printed test results.
9. Provide a fully functional version of the tester software for use by the Contracting Officer in reviewing the test results.

3.2 COPPER BACKBONE CABLE

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.
- C. Install backbone cables separately from horizontal distribution cables.
- D. Install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

- E. Where cables are installed in conduits, install the backbone and horizontal cables in separate conduits.
- F. Where cables are installed in an air-return plenum, install riser-rated cable in metallic conduit.
- G. Where backbone cables and distribution cables are installed in a cable tray, install backbone cables first, and bundle them separately from the horizontal distribution cables.
- H. Securely fasten all backbone cables to the sidewall of the TR on each floor.
- I. Labeling:
 - 1. Label cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
 - 2. Labels to denote to and from with room names and numbers.
 - 3. Provide the final cable ID matrix to the Contracting Officer for approval one week prior to cable installation.
 - 4. Note labeling information on the As-Built Drawings.

3.3 FIBER OPTIC BACKBONE CABLE

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.
- C. Place fiber optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or ten times the cable diameter, whichever is larger.
- D. Place fiber optic cable runs in innerduct. Use care when handling fiber optic cable. Carefully monitor pulling tension so as not to exceed the limits specified by the manufacturer.
- E. Terminate fiber optic cable in rack-mounted fiber optic termination units at each end using standard SC, ST, or LC style bulkhead connectors.
- F. Splicing of fiber optic cable is prohibited.
- G. Labeling:
 - 1. Label cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
 - 2. Labels to denote to and from with room names and numbers.
 - 3. Provide the final cable ID matrix to the Contracting Officer one week prior to cable installation.
 - 4. Note labeling information on the As-Built Drawings.

3.4 COPPER TERMINATION HARDWARE

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.
- C. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.
- D. Pair untwist at the termination is not to exceed 0.125-inch.
- E. Bend radius of the cable in the termination area is not to exceed four times the outside diameter of the cable.
- F. Dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle, separated and dressed back to the point of cable entrance into the rack or frame.
- G. Maintain the cable jacket to the termination point.

3.5 FIBER OPTIC TERMINATION HARDWARE

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.
- C. Neatly coil fiber slack within the fiber space tray or enclosure.
- D. Individually attach each cable to its respective fiber enclosure by mechanical means. Securely attach the cable strength member to the cable strain-relief bracket in the enclosure.
- E. Clearly label each cable at the entrance to the enclosure. Cables labeled within the bundle will not be accepted.

3.6 FIBER PATCH CORDS

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.
- C. Provide sufficient duplex fiber optic patch cords at each fiber termination point to cross-connect one-half the number and type of fibers terminated there. Assume a minimum of two duplex fiber optic jumpers per termination point for a 6-strand optical fiber. Provide lengths for a neat appearance not to exceed 15-feet. Coordinate connector requirements with Contracting Officer.
- D. Field terminated patch cords are not allowed.

3.7 SPLICE CASES

- A. Install per manufacturer's instructions and recommendations.
- B. Reference 3.01, General Installation Requirements.

END OF SECTION 27 13 00

SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Station Cabling
2. Modular Outlets
3. Work Area Outlets
4. Termination Blocks
5. Patch Panels
6. Patch Cords

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
 2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

- B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Contracting Officer will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.
 - 2. A warranty on the physical installation.
 - 3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.
- C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Contracting Officer from the manufacturer. Ensure that the manufacturer provides the Contracting Officer with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

- A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.
- B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications rooms (TRs) to telecommunications outlets (TOs) located at individual work areas and consists of the following:
 - 1. Category 6A 100 ohm, 4-pair, unshielded twisted pair cables from the telecom rooms to the outlets.
 - 2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
 - 3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.
 - 4. Furnish and install materials necessary for a complete and working system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Station Cabling:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

B. Modular Outlets:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

C. Work Area Outlets:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit

7. Siemon
8. Or approved equivalent.

D. Termination Blocks:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

E. Patch Panels:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit
7. Siemon
8. Or approved equivalent.

F. Patch Cords:

1. Belden
2. CommScope
3. Corning - fiber optic only
4. Leviton/Berk-Tek
5. Ortronics/Superior Essex
6. Panduit

7. Siemon
8. Or approved equivalent.

2.2 STATION CABLING

A. Category 6A Unshielded Twisted Pair:

1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.
2. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMR rated jacket, color blue.

B. Category 5e Unshielded Twisted Pair:

1. 100 ohm, Category 5e 24 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.
2. 100 ohm, Category 5e 24 AWG, 4-pair unshielded twisted pair, CMR rated jacket, color blue.

2.3 **OD** **O**T ETS

A. Category 6A Modular Outlets:

1. Eight-position modular outlet, Category 6A, IDC terminals, T568A/B wiring scheme
2. Each jack must be stamped or have icons to identify it as CAT 6A.
3. Coordinate color with building finishes.

2.4 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. One-port faceplate with mounting lugs for wall phone, constructed from high impact thermo-plastic, mounts within a single-gang wall box.
2. One, Two, Three, or Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields; mounts within a single-gang wall box as indicated on the drawings.
3. Coordinate faceplate color with building finishes. Submit to Contracting Officer for approval prior to installation.

B. Flush Mounted Stainless Steel Faceplates:

1. One, Two, Three, or Four-port stainless steel faceplate, with recessed label fields; mounts within a single gang wall box as indicated on the drawings.

C. Surface Mounted Outlet Boxes:

1. Two, Four, or Six-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.
2. Coordinate surface box colors with building finishes. Submit to Contracting Officer for approval prior to installation.

D. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.5 TERMINATION BLOCKS

A. Category 6 110-style Blocks:

1. Category 6, 288 pair, 110-style, with mounting legs, wall-mount.
2. Category 6, 96 pair, 110-style, with mounting legs, wall-mount.
3. Category 6, 288 pair, 110-style, without mounting legs, rack-mount.
4. Category 6, 96 pair, 110-style, without mounting legs, rack-mount.

B. Enhanced Category 5e 110-style Blocks:

1. Enhanced Category 5e, 300 pair, 110-style, with mounting legs, wall-mount.
2. Enhanced Category 5e, 100 pair, 110-style, with mounting legs, wall-mount.
3. Enhanced Category 5e, 300 pair, 110-style, without mounting legs, rack-mount.
4. Enhanced Category 5e, 100 pair, 110-style, without mounting legs, rack-mount.

C. Connecting Blocks:

1. 3 pair 110-style connecting blocks.
2. 4 pair 110-style connecting blocks.
3. 5 pair 110-style connecting blocks.

D. Wiring Troughs:

1. Horizontal trough for routing of patch cords and cross-connect wire, with mounting legs.
2. Horizontal trough for routing of patch cords and cross-connect wire, without mounting legs.

E. 110 Block Labels:

1. Clear plastic holder for 110 blocks with paper inserts, for blocks with legs
2. Clear plastic holder for 110 blocks with paper inserts, for blocks without legs

F. Mounting Brackets: 19-inch rack-mount brackets for 200 pair 110 termination blocks and wiring troughs.

2.6 PATCH PANELS

A. Category 6A Modular Patch Panels:

1. 24 port, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
2. 48 port, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
3. 24 port, Angled, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.
4. 48 port, Angled, eight-position modular jack panel, high density, 6 port modules, Category 6A, IDC terminals, T568A/B wiring scheme.

2.7 PATCH CORDS

- ### A. Category 6A Modular Patch Cords: Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair, color, blue. 3-feet, 5-feet, 7-feet, 9-feet, 15-feet, 20-feet, and 25-feet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. All network cabling to be run in conduit for the entire length of pathway.
- B. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.
- C. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.
- D. Horizontal cabling includes cables, jacks, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
- E. Furnish and install materials necessary for a complete and working system.
- F. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.
- G. Perform work in a neat and workmanlike manner.
- H. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.
- I. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.
 1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.

2. Swab any additional enclosed raceway and innerduct systems.
- J. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.
 - K. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.
 - L. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.
 - M. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
 - N. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 - O. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
 - P. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Contracting Officer.
 - Q. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Contracting Officer prior to ordering. Without written confirmation from the Contracting Officer, Contracting Officer to assume that a plenum rating is required.
 - R. Unshielded Twisted Pair Cable Installation Practices:
 1. Install cable in accordance with manufacturer's recommendations and best industry practices.
 2. Install cables in continuous lengths from origin to destination (no splices).
 3. Do not exceed the cable's minimum bend radius and maximum pulling tension.
 4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
 5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.
 - S. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
 1. Open or Nonmetal Communications Pathways:
 - a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.

- b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48-inches from large electrical motors or transformers.
- 2. Grounded Metal Conduit Communications Pathways:
 - a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.

T. Unshielded Twisted Pair Termination:

- 1. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.
- 2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.
- 3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.
- 4. Maintain the cable jacket within 1-inch of the termination point.
- 5. Do not exceed 0.5-inch of pair untwist at the termination point.
- 6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.
- 7. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

U. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair Cables as Follows:
 - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 5e or 6 performance compliance as specified in ANSI/TIA/EIA-568 C.
 - b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.
 - c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.
4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester. The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation
 - d. NEXT (Near-end Crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay

- h. Delay Skew
 - i. PSNEXT (Power Sum Near-end Crosstalk Loss)
 - j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)
6. Provide test results in electronic format, with the following minimum information per cable:
 - a. Circuit ID
 - b. Test Result, "Pass" or "Fail"
 - c. Date and Time of Test
 - d. Project Name
 7. Provide an electronic copy of the test results, in the native tester software format, to the Contracting Officer along with the printed test results.
 8. Provide a fully functional version of the tester software for use by the Contracting Officer in reviewing the test results.

V. Labeling:

1. Label horizontal cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
2. Label patch panel ports and TO ports with the cable identifier.
3. Labels to be Telecom Room number, patch panel number and patch panel port number. Provide the final cable ID matrix to the Contracting Officer for approval one week prior to cable installation.
4. Note labeling information at each outlet on the record drawings.

- W. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Contracting Officer.

3.2 STATION CABLING

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 **OD** **O**T ETS

- A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's instructions and recommendations.

3.4 WORK AREA OUTLETS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 TERMINATION BLOCK

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.6 PATCH PANELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.7 PATCH CORDS

- A. Field terminated patch cords and jumpers are not allowed. At a minimum, provide equipment connection cords for one-half the total number of cables installed at each termination point. For example: A telecommunications outlet with four Category 6 cables installed would require two Category 6 equipment connection cords at the work area outlet and two Category 6 equipment connection cords in the telecommunications equipment room for a total of four Category 6 equipment connection cords.

END OF SECTION 27 15 00

SECTION 27 41 16 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment Mounting Hardware
2. Audio Source Equipment
3. Audio Distribution Equipment
4. Audio Amplification
5. Loudspeakers
6. Wire and Cable
7. Assistive Listening Equipment

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. In addition, reference Section 11 52 13, Projection Screens.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. BICSI/INFOCOMM AV Design Reference Manual.
 2. ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Screen shots for touch panel user-interface.

2. Shop drawings showing installation instructions, block wiring diagrams, component interconnections, custom faceplate layouts with labeling, device locations and literal descriptions.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. A minimum of five years experience in the design, installation, testing and maintenance of commercial audio-video systems.
 2. Employ at least one full-time InfoCOMM Certified Technology Specialist (CTS) who is involved in reviewing work performed by Contractor on this project.
 3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment Mounting Hardware:
 1. Equipment Racks:
 - a. Middle Atlantic
 - b. Lowell Manufacturing
 - c. Or approved equivalent.
 2. Equipment Cabinet Accessories:
 - a. Blank Rack-Panels:
 - 1) Middle Atlantic
 - 2) Lowell Manufacturing
 - 3) Or approved equivalent.
 - b. Vent Panels:

- 1) Middle Atlantic
 - 2) Lowell Manufacturing
 - 3) Or approved equivalent.
3. In-Wall Equipment Racks:
 - a. Middle Atlantic; SRSR-2-24.
 - b. Or approved equivalent.
- B. Audio Source Equipment:
 1. CD Player:
 - a. Tascam; CD-200.
 - b. Or approved equivalent.
 2. CD Player with iPod Dock:
 - a. Tascam; CD-200i.
 - b. Or approved equivalent.
 3. Wireless Microphone Receivers:
 - a. Shure
 - b. Sennheiser
 - c. Audio-Technica
 - d. Or approved equivalent.
 4. Hand-Held Wired Microphones:
 - a. Shure
 - b. Sennheiser
 - c. Audio-Technica
 - d. Or approved equivalent.
 5. Boundary Wireless Microphones:
 - a. Shure
 - b. Sennheiser

- c. Audio-Technica
 - d. Or approved equivalent.
- 6. Desktop Microphones:
 - a. Shure
 - b. Sennheiser
 - c. Audio-Technica
 - d. Or approved equivalent.
- C. Audio Distribution Equipment:
 - 1. DSP Audio Matrix Mixer:
 - a. Biamp Systems; AudiaFLEX.
 - b. Biamp Systems; AudiaSOLO.
 - c. Or approved equivalent.
 - 2. DSP Audio Matrix Mixer Accessories:
 - a. Two-Channel Balanced Microphone/Line-Level Input Module:
 - 1) Biamp Systems; IP2.
 - 2) Or approved equivalent.
 - b. Two-Channel Balanced Microphone/Line-Level Output Module:
 - 1) Biamp Systems; OP2e.
 - 2) Or approved equivalent.
 - c. Two-Channel Wide-Band Acoustic Echo Cancellation Input Card:
 - 1) Biamp Systems; AEC-2HD.
 - 2) Or approved equivalent.
 - 3. DSP Audio Matrix Mixer:
 - a. Biamp Systems
 - b. Or approved equivalent.
- D. Audio Amplification:

1. QSC Audio; CX302V.
 2. Or approved equivalent.
- E. Loudspeakers:
1. Flush Ceiling-Mount Passive Loudspeaker:
 - a. JBL, Inc.; Control 26CT.
 - b. Or approved equivalent.
 2. Flush Wall-Mount Passive Loudspeaker:
 - a. Loudspeaker:
 - 1) JBL, Inc.; Control 126WT.
 - 2) Or approved equivalent.
 - b. Rough-In Frame:
 - 1) JBL, Inc.; MTC-126RIF.
 - 2) Or approved equivalent.
 3. Surface-Mount Passive Loudspeaker:
 - a. Loudspeaker:
 - 1) JBL, Inc.; Control 28T-60-WH.
 - 2) Or approved equivalent.
 - b. Mounting Hardware:
 - 1) Vertical Column Orientation:
 - (a) JBL, Inc.; MTC-28V.
 - (b) Or approved equivalent.
 - 2) Horizontal Splay Orientation:
 - (a) JBL, Inc.; MTC-28V.
 - (b) Or approved equivalent.
 - 3) Ceiling-Mount Adapter:
 - (a) JBL, Inc.; MTC-28/25CM.

(b) Or approved equivalent.

F. Wire and Cable:

1. Crestron
2. Belden
3. Liberty Wire & Cable
4. West Penn Wire
5. Or approved equivalent.

G. Assistive Listening Equipment:

1. Listen Technologies; LS-03 or LS-04.
2. Or approved equivalent.

2.2 EQUIPMENT MOUNTING HARDWARE

A. Wall Mount Equipment Cabinet:

1. Type: 19-inch wide, 19-inch deep, 45-inch high EIA/TIA compliant equipment rack.
2. Designed to be installed flush in wall cavity or void with sliding rail and 90-degree pivot rotation for maintenance purposes.
3. Black powder-coat finish.

2.3 AUDIO SOURCE EQUIPMENT

A. CD Player:

1. Plays audio CDs, MP3 CDs and WAV file CDs.
2. RCA unbalanced line output.
3. Coaxial and optical S/PDIF digital output.
4. 1/4-inch stereo headphone output.
5. Wireless remote control.

B. CD Player with iPod Dock:

1. Plays audio CDs, MP3 CDs and WAV file CDs.
2. Dock connector for Apple iPod charging and playback.
3. Composite and S-video outputs for iPod video playback

4. RCA unbalanced line output.
 5. Coaxial and optical S/PDIF digital output.
 6. 1/4-inch stereo headphone output.
 7. Wireless remote control.
- C. Wireless Microphone Receivers:
1. UHF band operation.
 2. 960 operating frequencies across 24 MHz of bandwidth.
 3. Auto frequency selection.
 4. Detachable 1/4-wave antennas.
 5. 1/4-inch and XLR audio outputs.
 6. Multifunction LCD display.
 7. Provide with combination pack which includes a hand-held dynamic microphone and a body-pack with lavalier microphone.
- D. Hand-Held Wired Microphones:
1. Dynamic (moving coil) type microphone.
 2. 50-Hz to 16-kHz frequency response.
 3. Super-cardioid polar pattern, rotationally symmetrical about microphone axis, uniform with frequency.
 4. Die-cast metal casing with spherical steel mesh grille.
- E. Boundary Wireless Microphones:
1. Condenser (electret bias) type microphone.
 2. Cardioid polar pattern (at 1-kHz).
 3. Up to 100-foot operating range.
 4. Powered by two AA batteries, 8-hour battery life.
- F. Desktop Microphones:
1. Microphone Base:
 - a. Logic enabled for LED and mute control.

- b. Programmable mute switch (push-to-mute, push-to-talk, logic, local).
 - c. Low-cut filter.
 - d. 20-foot, attached microphone cable with 5-pin male XLR termination.
- 2. Microphones:
 - a. Gooseneck construction, 10-inch length.
 - b. Condenser (electret bias) type microphone.
 - c. 50-Hz to 17-kHz frequency response.
 - d. Cardioid polar pattern.
 - e. Bi-color status indicator.

2.4 AUDIO DISTRIBUTION EQUIPMENT

A. DSP Audio Matrix Mixer:

- 1. Up to 24-input/output modular design.
- 2. Software programmable features include:
 - a. Standard, automatic and matrix mixers.
 - b. Graphic and parametric equalization.
 - c. Dynamic Processing: Compression, limiting and ducking.
 - d. Digital delay up to 2000-ms.
- 3. Bi-directional RS-232 control port for control via third-party control systems.
- 4. Ethernet-ready network port for network control and monitoring.

B. DSP Audio Matrix Mixer Accessories:

- 1. Two-channel balanced microphone/line-level input module: Software controllable mute, level, signal-invert and full-scale output reference.
- 2. Two-channel balanced microphone/line-level output module: Software controllable gain/peak indication, plus 48V phantom power, mute, level and signal invert.
- 3. Two-channel wide-band acoustic echo cancellation input card: Onboard DSP, suppression of steady-state background noise, assignable reference point for each AEC input.

C. DSP Audio Matrix Mixer:

1. 8-input/8-output, 12-input/4-output, or 4-input/12-output design.
2. Software programmable features include:
 - a. Standard, automatic and matrix mixers.
 - b. Graphic and parametric equalization.
 - c. Dynamic Processing: Compression, limiting and ducking.
 - d. Digital delay up to 2000-ms.
3. Bi-directional RS-232 control port for control via third-party control systems.
4. Ethernet-ready network port for network control and monitoring.

2.5 AUDIO AMPLIFICATION

A. Audio Power Amplifier:

1. Two-channel, 250-W per channel (70-volt, 1-kHZ, 0.05-percent total harmonic distortion).
2. 20-Hz to 20-kHz frequency response, plus or minus 2-dB.
3. 3-pin XLR and 3-pin detachable terminal block input connectors.
4. Short circuit, open circuit, thermal, ultrasonic and RF protection.
5. On/off muting, DC-fault power supply shutdown.
6. 70-volt isolation transformer.

2.6 LOUDSPEAKERS

A. Flush Ceiling-Mount Passive Loudspeaker:

1. 6.5-inch coaxial woofer and 3/4-inch tweeter.
2. 89-dB SPL nominal sensitivity (1-W at 1 meter).
3. 150-W continuous program power capacity.
4. 70-Volt Multi-Tap Transformer: 60-W, 30-W, 15-W and 7.5-W taps.
5. 110-degree nominal dispersion, conical coverage.
6. Formed steel, UL-listed back can.
7. Include mounting hardware and paintable grille.

B. Flush Wall-Mount Passive Loudspeaker:

1. 6.5-inch woofer and 1-inch tweeter.
2. 88-dB SPL nominal sensitivity (1-W at 1 meter).
3. 100-W continuous program power capacity.
4. 70-Volt Multi-Tap Transformer: 30-W, 15-W, 7.5-W and 3.7-W taps.
5. Supply with rough-in frame.

C. Surface-Mount Passive Loudspeaker:

1. 8-inch woofer and 1-inch tweeter.
2. 70-Volt Multi-Tap Transformer: 60-W, 30-W, 15-W and 7.5-W taps.
3. 102-dB SPL nominal sensitivity (15-W tap at 1 meter).
4. 175-W continuous program power capacity.
5. 90-degree horizontal and 90-degree vertical nominal coverage angle.
6. Weather-resistant enclosure and transducers.
7. Surface mounting assembly and hardware.
8. Include additional mounting hardware where applicable:

2.7 WIRE AND CABLE

A. Cable and Adapter Types:

1. Microphone-level and line-level audio cable 22 AWG, stranded conductors, shielded. Plenum-rated.
2. Loudspeaker-level cable, 18 AWG, stranded, two conductors. Plenum-rated.
3. High resolution RGBHV cable, 25 AWG, five coaxial conductors. Plenum-rated.
4. Combination audio/RGBHV cable, pre-terminated with 3.5 mm audio and HD15 male to HD15 female connectors, 6-foot length. Plenum-rated.
5. Control cable for RS-232 communications applications with quantity of conductors as required by manufacturer's specifications for each controlled device. Plenum-rated.
6. Control cable for electric projection screen. Comply with screen and control system manufacturer's specifications. Plenum-rated.
7. High-performance HDMI cable, 22 AWG minimum, supports data rates up to 4.95 Gbps; HDMI 1.3 Category 2 compliant, pre-terminated with male connectors. Plenum-rated.

8. High-performance HDMI-to-DisplayPort crossover cable. Plenum-rated.
9. Pre-terminated VGA cable, 6-foot length. Plenum-rated.
10. Shielded Cat6A for HDBASE-T applications. To be installed by Division 27, Section 27 15 00, Communications Horizontal Cabling, provider.
11. Quiktron RapidRun Digital Runner cable. Length as required per distance between termination points.
12. Quiktron RapidRun Digital HDMI flying lead. Provide active flying lead for runs greater than 50-feet.
13. Quiktron RapidRun Digital DVI and 3.5 mm audio flying lead. Provide active flying lead for runs greater than 50-feet.
14. Quiktron RapidRun PC Runner cable. Length as required per distance between termination points.
15. Quiktron RapidRun HD15 and 3.5 mm audio flying lead.

2.8 ASSISTIVE LISTENING EQUIPMENT

A. RF Wireless Assistive Listening System:

1. Two-channel FM transmitter,
2. Remote antenna.
3. Three or Four wireless three-channel FM receivers
4. Assistive listening signage kit.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Examination: Examine areas and conditions under which audio-video equipment will be installed. Notify Contracting Officer of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
- B. Install complete system in strict accordance with manufacturer's recommendations. Complete electrical connections to all system components.
- C. Install wiring in conduit for entire run from telecom room to outlet.
- D. Install equipment so it is held firmly in place. This includes racks, rack equipment, loudspeakers, control equipment, conduit, etc.

- E. Label switches, jacks, outlets, etc. in a logical and readable manner. Labels are to correspond with connection designations on shop drawings.
- F. Do not install electronic equipment in any space until other work within the space has been completed, to prevent dust, dirt, debris, etc. from damaging equipment.
- G. Mount modules for modular equipment in strict accordance with manufacturer's specifications.
- H. Store loose devices and cables in rack-mounted drawers, cabinets, or Contracting Officer-approved location. Notify Contracting Officer of location of loose devices and cables during training.
- I. Wiring:
 - 1. Provide system wiring in accordance with good engineering practices as established by Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA) and NEC. Meet established state and local electrical codes.
 - 2. Isolate cabling within rack by signal type. Maintain at least 4-inch separation from electrical power cables.
 - 3. Dress cables in rack in a neat and workmanlike manner with velcro ties, cables bundled by signal type.
- J. System Programming:
 - 1. Programming of the control systems and user interfaces is the responsibility of the A-V Contractor. Program the user interface using manufacturer supplied configuration software and templates.
 - 2. Program the control system and user-interface to provide novice-level functionality with features including, but not limited to, the following:
 - a. Display power on/off.
 - b. Source selection of audio and video devices.
 - c. Volume control of all audio sources.
 - d. Power on/off and source selection of video displays.
 - e. Display system and device status.
 - f. Control of dimmable lighting zones.
 - g. Control of projection screens and motorized shades.
- K. Performance Requirements:

1. Coordinate with Division 26, Electrical for installation of electrical service, raceways, conduit, back boxes and the like, necessary to support the systems specified.
2. Conceal wiring in walls and ceiling spaces during construction.
3. Determine requirements for plenum-rated cable. When doubt exists, seek determination in writing by Contracting Officer prior to ordering.

L. Inspection and Testing Upon Completion:

1. Verify that projectors are adjusted such that the projected image fills the projection screen at the center of its zoom range.
2. Warranty materials and installation to be free of defects in material and workmanship after final acceptance of installation and test per Division 01, General Requirements.
3. Upon completion of the installation, furnish copies of complete operational instructions, complete with record drawings. Include part numbers and names, addresses and telephone numbers of parts source. One hard copy and two digital copies on CD required for materials.
4. Nothing contained in this specification to be construed to relieve the Contractor from furnishing a complete and acceptable system in all its categories. The Contracting Officer will reject any materials or labor that are or may become detrimental to the accomplishment of the intents of these Specifications.

M. Training:

1. Provide Contracting Officer with manufacturer's operating instructions.
2. Provide representatives to instruct the Contracting Officer's personnel in the operation of each system, its components and equipment.
3. Demonstrate to the Contracting Officer all system features and operations.
4. Provide comprehensive training for the Contracting Officer for the operation, maintenance and troubleshooting of the systems. Provide two copies of configuration data file for control systems and touch-panel user interfaces on CD.

N. Clean-Up:

1. Remove unused materials and debris from the work and storage areas. Leave areas in an undamaged and acceptable condition.
2. Save the shipping boxes for the Contracting Officer in case of need to return product for service.

3.2 EQUIPMENT MOUNTING HARDWARE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Fasten free-standing equipment racks to the floor using a minimum of four 3/8-inch concrete anchors. In raised floor areas, secure equipment racks to the concrete floor below.
- D. Position free-standing equipment racks according to the Drawings with a minimum of 3 feet clearance in front. Report any discrepancies to the Contracting Officer.
- E. Mount equipment within rack as shown in rack elevations on Drawings.
- F. Fill unused rack space with blank rack panels.

3.3 AUDIO SOURCE EQUIPMENT

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 AUDIO DISTRIBUTION EQUIPMENT

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 AUDIO AMPLIFICATION

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Furnish and install amplifiers that will supply sufficient power to speakers without exceeding 70% of the amplifier's maximum rated output power
- D. Audio Signal Routing: Furnish and install required signal routing mixers, equalizers, or processors such that the user can produce and route an audio signal to any location or equipment within the system.
- E. Speakers: Furnish and install flush mounted ceiling speakers of professional commercial grade. Locate speakers as noted on drawings.

3.6 LOUDSPEAKERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.7 WIRE AND CABLE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide system wiring in accordance with good engineering practices as established by Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA) and NEC. Meet established state and local electrical codes.
- D. Isolate cabling within rack by signal type. Maintain at least 4-inch separation from electrical power cables.
- E. Dress cables in rack in a neat and workmanlike manner with velcro ties, cables bundled by signal type.
- F. Label cables using a machine printed label, at each end of the cable within 12-inches of the termination point. Handwritten labels are not permitted. Labels to correspond with cable designations on shop drawings.

3.8 ASSISTIVE LISTENING EQUIPMENT

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Furnish and install an assistive listening system located as indicated on the drawings.
- D. Ensure User signal is clearly receivable at any point within the room where the transmitter is located.
- E. Provide the minimum number of assistive listening user headsets or neck loops required by Code or 4 per building assistive listening user headsets or neck loops.

END OF SECTION

SECTION 27 51 29 - EMERGENCY RESPONDER RADIO COVERAGE SYSTEM (ERRCS)

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification describes performance criteria for deploying a Distributed Antenna System (DAS) capable of supporting the Public Safety Network (PSN).
- B. The contractor shall provide all components necessary to ensure a fully operational and code compliant Emergency Responder radio Coverage system.
- C. This specification does not dictate product selection, it only suggests manufacturers that provide equipment that meets typical ERRCS RF and code performance standards. Contractor shall select appropriate equipment solutions to meet RF coverage levels and that also meet Code and reference standard requirements.
- D. DAS components include, but are not limited to:
 - 1. Bi-Directional Amplifiers (BDA)
 - 2. Fiber Optic Transceiver Unit
 - 3. Fiber Optic Remote Repeaters
 - 4. Donor Antennas,
 - 5. Coverage Antennas,
 - 6. Coaxial Cable and Coax Connectors
 - 7. Splitters, Combiners, and Couplers, Surge Arrestors
 - 8. Battery Backup units
 - 9. Alarming Components and Annunciation

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Division 26 Electrical Generators and Backup Systems
 - 2. Section 27 05 28, Pathways for Communications Systems
 - 3. Section 27 13 00, Communications Backbone Cabling
 - 4. Section 28 31 00, Fire Detection and Alarm

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NFPA 70 2019
 - 2. NFPA 72 2019
 - 3. NFPA 1221 2019
 - 4. NFPA 5000 2015
 - 5. Federal Communications Commission (FCC) - Title 47 of the Code of Federal Regulations, Part 90
 - 6. Federal Communications Commission (FCC) Rules, Parts 15 and 22
 - 7. ANSI/TIA-568.3-D-1: Optical Fiber Cabling Components Standards - General Updates 2019
 - 8. ANSI/TIA-568.3-D: Optical Fiber Cabling Components Standards (October 2016)
 - 9. ANSI/TIA-569-E: Commercial Building Standard for Telecommunications Pathways and Spaces (May 2019)
 - 10. ANSI/TIA-606-C: The Administration Standard for the Telecommunications Infrastructure of Commercial Building (July 2017)
 - 11. ANSI/TIA-J-STD-607-D: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (July 2019)
 - 12. BICSI Information Transport Systems Installation Methods Manual, 6th Edition
 - 13. BICSI Telecommunications Distribution Methods Manual, 14th Edition

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Submittal Requirements Prior to Start of Construction
 - 1. Certificates:
 - a. An FCC-issued general radio operators license (GROL) for the ERRCS Integrator.
 - b. A certificate from the manufacturer of the equipment to be installed stating that the ERRCS Integrator is trained/qualified on the equipment.

2. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.
3. Floor plans showing the location of system components.
4. Final RF link budget.
5. Detail Drawings for donor antenna and grounding.
6. RF propagation modeling (heat maps).
7. Product data sheets for each type of equipment to be installed.
8. Permit drawings as required by the Contracting Officer to include:
 - a. Three sets of Shop Quality plans, 1/8-inch scale minimum.
 - b. One product submittal packet.
9. Test Equipment:
 - a. Submit certificates indicating that staff is certified on required test equipment.
 - b. Submit current calibration data for test equipment to be used.
 - c. Submit certificates indicating that staff is certified on required test equipment including by not necessarily limited to:
 - 1) Signal Generators
 - 2) Spectrum Analyzers
 - 3) PIM Testers

C. Submittal Requirements at Close Out:

1. Drawings: Submit as-built drawings indicating:
 - a. Cable routing, splitters, couplers and coverage antenna locations
 - b. Active component locations, layout and configuration
2. Test Reports:
 - a. PSN: Submit Accepted ATP reports confirming the requirements of Section 1.4 have been met.
 - b. Cable Test Reports: Submit cable test results for all cable segments. Testing shall include Return Loss (RL), Distance to Fault (DTF) and Passive Intermodulation (PIM).

3. Operation and Maintenance Data: Submit hardware and software manuals for all active components.
4. Acceptance Certificate or Document from the Contracting Officer.
5. Warranty Documents:
 - a. Submit for all manufactured components specified in this Section.
 - b. Submit Contractor's System Warranty.
 - c. Submit Manufacturer's Extended Warranty.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Contracting Officer, and marked for intended use.
 2. The work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. Bidders for work described in this Section shall be or will subcontract with established DAS/RF communications contractors. The contractor shall have direct access to all tools and test equipment required to complete the work prior to submitting a bid.
 3. Requirements set forth by first-responder code, ordinance, or the PSN Contracting Officer shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the DAS complies with local code, ordinances or requirements established by the PSN Contracting Officer.
 4. PSN Approval
 - a. When approval of the DAS deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the Contracting Officer approval(s) per the requirements of the code or ordinance.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 1. Manufacturer Warranty:

- a. Splitters, Couplers and Coverage Antennas: 5-year limited warranty from date of system acceptance.
- b. Fiber Optic and Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
- c. Active Components: The earliest of 1-year limited warranty from date of system installation or 15 months from date of shipment.

1.7 SYSTEM DESCRIPTION

- A. Services: Upon Acceptance Testing, the DAS shall provide coverage for the PSNs listed below on all frequencies currently being used by the designated PSNs in the given market.
- B. Separate Infrastructures. The PSN DAS shall be deployed on a cabling and antenna infrastructure that is segregated from the components supporting Cellular, paging and facility radio system.
- C. Services Supported. The DAS infrastructure shall be designed to support the services described in Table 1 below.

1. Table 1 - Services Supported on the DAS

- a. Sample table shown below. ERRCS Integrator to coordinate all required frequencies of the system with the local Contracting Officer.

Service	Uplink, MHz	Downlink, MHz
700MHz PSN Band	793 - 805	763 - 775
800 Band	806 - 824	851 - 869

- D. PSN Coordination/Approval:
 - 1. The Contractor shall propose and deploy a DAS system capable of receiving approval of the PSN Contracting Officer.
 - 2. The Contactor shall coordinate and submit all documentation required for Contracting Officer approval.
 - 3. If the Contracting Officer requires, the contractor shall confirm with Contracting Officer and include the required documentation for Contracting Officer approval that shall include a coverage survey for existing conditions (without the DAS) and with the DAS.
- E. Broadband Active Distribution: Single-mode fiber-optic cable will be used for active distribution. In-line amplifiers are not allowed.
- F. System Management:
 - 1. SMS: The DAS shall have a Systems Management System (SMS) capable of alarm, monitor, configuration and control of all Active Components.

1.8 PERFORMANCE REQUIREMENTS

A. Public Safety Network (PSN) DAS:

1. Contractors shall state the assumed channel count for the PSN Frequency Bands identified above with submittal of bid response. Prior to installation, contractors shall confirm the channel count and all frequencies required within a jurisdiction with the Contracting Officer, and shall guarantee coverage for these channels per the criteria stated above.
2. The ERRCS DAS shall deliver coverage per the criteria in Table 2 throughout 95 percent of all occupied building spaces and 99 percent in critical areas as defined in NFPA 1221.
3. Although NFPA 1221 only requires testing to DAQ of 3.0, the system must also meet the minimum RSSI of -95dBm as measured by a calibrated spectrum analyzer.

B. Table 2 - System Parameters PSN

Parameters	Units	Public Safety 800 MHz
Minimum Downlink RSL	DBM	-95

1. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.

1.9 ABBREVIATIONS

- A. AGC: Automatic Gain Control
- B. ATP: Acceptance Test Plan
- C. BBU: Baseband Unit
- D. BDA: Bi-Direction Amplifier
- E. BOM: Bill-of-Material
- F. CW: Continuous Wave
- G. DAS: Distributed Antenna System
- H. dBm: Decibel Milliwatts
- I. ERRCS: Emergency Responder Radio Coverage System
- J. ESMR: Enhanced Specialized Mobile Radio
- K. FCC: Federal Communications Commission
- L. GROL: General Radio Operators License

- M. GUI: Graphical User Interface
- N. LMR: Land Mobile Radio
- O. MTBF: Mean Time Between Failure
- P. NFPA: National Fire Protection Association
- Q. NMS: Network Management System
- R. PSN: Public Safety Network
- S. RoF: Radio-over-Fiber
- T. RoHS: Restriction of Hazardous Substances
- U. RRU: Remote Radio Unit
- V. RSSI: Received Signal Strength Indicator
- W. RSL: Received Signal Level
- X. SISO: Single-Input, Single-Output
- Y. SMR: Specialized Mobile Radio
- Z. SMS: Short Message Service
- AA. SNIR: Signal-to-Noise Interference Ratio
- BB. SNMP: Simple Network Management Protocol
- CC. SOW: Statement of Work
- DD. VSWR: Voltage Standing Wave Ratio

1.10 DEFINITIONS

- A. Acceptance: Expressed approval by the customer
- B. Active: DAS components that require AC/DC power for operation
- C. Carrier Approval: Expressed approval to interconnect to the WSP macro network
- D. Channel: A path for an RF transmission between two points
- E. Component: A main system element of the DAS
- F. Contractor: The prime contractor bidding the project
- G. Passive: DAS components that do not require AC/DC power for operation

1.11 MAINTENANCE

- A. The Contractor shall provide a maintenance service contract, covering the system for a period of one-year with options up to five years: preventative maintenance, system monitoring, spares, fault mitigation, equipment repair, and response time.
- B. Annual Testing
 - 1. As required by Code, the system shall be tested annually beginning one year from the date of final acceptance testing. The contractor or systems integrator shall provide a price for an additional service contract to include the required annual testing as described in Part 3 below.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. ADRF
 - 2. Comba
 - 3. CommScope
 - 4. DAS Alert
 - 5. SOLiD
 - 6. Times Microwave
 - 7. Westell
 - 8. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The contractor shall design, install, commission and test the ERRCS DAS in accordance with the manufacturer's instructions and recommendations.
- B. All ERRCS cabling shall be installed in survivable pathway complying with the survivability requirements of the 2019 NFPA 72/1221.
- C. Locate equipment, antennas and splitters at locations shown on the contract drawings.
- D. Extend cabling from the Fiber Optic Remote Units or BDA to the splitters in a neat and orderly manner per the routing indicated on the contract drawings. Support cabling in compliance with NEC chapter 8 requirements and manufacturers recommendations.

- E. Maintain a 6-inch minimum distance from the ERRCS DAS cabling and other cabling for parallel runs. Do not install coaxial cabling open in any areas where the cabling will subject to physical damage.
- F. Install antennas in or above ceilings per the mounting details shown in the contract documents
- G. Provide 24-hour UPS/battery backup per code unless connected to an onsite generator that has a minimum 24-hour run time.

3.2 EQUIPMENT MOUNTING

- A. Install equipment in spaces as indicated on plans in accordance with manufacturer's instructions and seismic requirements.
- B. Install Public Safety Headend equipment - Bidirectional Amplifier, Fiber Optic Transceiver, DC Power Supply in equipment cabinet in space indicated on the drawings. Fasten to the floor per manufacturer's instructions and provide seismic bracing if required in compliance with local codes.
- C. Install BBU per manufacturer's instructions.
- D. Install RRU per manufacturer's instructions.
- E. Install donor antennas per details shown on the contract documents.

3.3 COORDINATION WITH OTHER TRADES

- A. Field coordinate the installation of the headend equipment and remotes to ensure that each location is provided with the following:
 - 1. A 120V, 20A circuit served from the life/safety generator system for each UPS and each NEMA 4 enclosure compressor.
 - 2. (2) strands of single mode fiber from the head end location to each remote location terminated in SC APC connectors at the Headend and LC-APC at the remote.
 - 3. 14/2 AWG from the DC power supply to each remote.
 - 4. Grounding per NEC and TIA standards.
 - 5. Coordinate Alarm and Monitoring points with the Fire Alarm contractor.

3.4 EXAMINATION

- A. The contractor must examine areas and conditions under which DAS components are to be installed and notify the Contracting Officer, in writing of those conditions which are, in the Contractor's opinion, potentially detrimental to proper completion of the work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contracting Officer.

- B. Examine pathway elements intended for cable, check raceways, cable trays and other elements for compliance with space allocations, installations tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Specific items of examination shall include, but shall not necessarily be limited to, the following:
 - 1. Locations for all new ERRCS antennas, cable and splitter equipment.
 - 2. Adequate space, power, and environment conditions to support installation.

3.5 TESTING

- A. Acceptance testing will be performed confirming the requirements have been met.
- B. The contractor shall complete the acceptance testing as prescribed in the approved Acceptance Test Plan (ATP) submittal. The DAS system shall be tested by a person or persons who are holders of a FCC General Radio Operator's License (GROL) or by the Contracting Officer or their designees.
- C. Testing Procedure (PSN):
 - 1. Test Location
 - a. Each floor of the building shall be divided into a grid of 20 approximately equal test areas. For large floor areas exceeding 128,000SF, follow guidelines prescribed in 2015 NFPA 5000, Annex F.3.9.3.
 - b. Downlink received signal level measurements will be recorded in the coverage area using a live signal or test tone from a signal generator injected into the BDA at the same level as the measured off air signal. Measurements will be collected using a spectrum analyzer and a dipole antenna.
 - c. Failure of a maximum of two nonadjacent test areas shall not result in failure of the test.
 - d. In the event that three of the test area fail the test, in order to be more statistically accurate, the floor shall be divided into 40 equal test areas. Failure of a maximum of four non adjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90 percent coverage.
 - e. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.
 - 2. Equipment Requirements

- a. Test equipment shall be allowed to stabilize in test environment prior to calibration for a minimum of thirty minutes. Any change in temperature can void the calibration.
 - b. Signal generator must be connected to the Head end downlink (TX) interface via tested and approved coaxial cabling and connectors.
 - c. Signal generator transmits frequency (MHz) and Power (dBm) must be preapproved by project Contracting Officer prior to testing. The control channel from the base station can be used as a signal source as well.
 - d. Verify that all remote units for the area under test are ON.
 - e. Test frequency/control channel and power must be recorded corresponding to the date and time of each site walk measurement.
 - f. Spectrum analyzer with unity gain (0dB, frequency specific) dipole receive antenna must be preapproved by the project Contracting Officer.
 - g. Site walk screen shots shall be saved with frequency span +/- 20 MHz relative to the center/measured frequency.
3. Documentation
- a. Exact location of measurement must be marked on the grid print.
 - b. Screen shots must be taken in all designated grid spaces. If more than one reading is saved per grid zone, saved results shall be distinguished from one another using Grid##"A", Grid## "B" etc.
 - c. Results of testing are reported to project Contracting Officer for analysis and reporting.
4. Proof of Performance and Testing Methodology:
- a. Test requirements specified in this document shall be successfully completed prior to issuance of a Certificate of Occupancy and yearly thereafter. Also testing with a successful result shall occur whenever a design change is made to the system, which changes the technical performance or coverage of the system. All tests shall be coordinated 10 days in advance with the Contracting Officer. Results of the test shall be reported in writing to the Contracting Officer.

3.6 TECHNICAL TRAINING

- A. The Contractor shall be responsible for organizing a structured demonstration of acceptance tests to ensure organized and efficient testing.
- B. The Contractor shall provide written notice to the Contracting Officer at least thirty (30) calendar days in advance of the initiation of final system acceptance testing. Included in the

advance notice shall be three copies of the approved test plans and procedures to ensure acceptance test monitoring personnel are familiar with the tests, procedures and the expected results.

- C. It is the responsibility of the Contractor to notify the Contracting Officer at appropriate times to permit visual inspections of all DAS components. No Installation work shall be covered until a visual inspection has been completed.
- D. Provide the Contracting Officer with the opportunity to witness all testing. On reasonable request and with ten working days' notice, the Contractor shall demonstrate that the test procedure competently identifies the parameter being demonstrated or the fault condition being tested.
- E. The Contractor shall provide a Certificate of Compliance signed by a responsible company representative after completion of the site installation. This document shall certify that each element of the installed system and wiring complies with the requirements of the Contract Documents and the certification shall be included with the final acceptance report.
- F. The Contractor shall provide training for elements of the ERRCS DAS. Such training shall include management, operational and maintenance levels and shall be provided to individuals (maximum of 3) to be designated by the Contracting Officer.
- G. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, software, and over all operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The Contractor shall provide all necessary training aids and materials, which shall include written handouts.
- H. All training shall be completed prior to Final Acceptance.

3.7 TRAINING

- A. Retain the Systems Integrator to instruct the Contracting Officer's Maintenance Personnel on the proper operation of the system including alarms.
- B. Provide time for one training session for three hours.
- C. Refer to Division 01 Section for Demonstration and Training.

END OF SECTION

SECTION 27 53 20 - CABLE TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Line Extenders
2. Cables
3. Connectors
4. Splitters
5. Taps
6. Wall Plates
7. Passives

1.2 RELATED SECTIONS

- ##### A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Shop Drawings:

- a. Submit block and riser diagrams identifying system components and interconnection requirements. Include manufacturer's product and part numbers.
- b. Submit detailed interconnection diagrams for field terminated connections.
- c. Submit layout drawings showing location of installed devices and cable pathways.

2. Assurance/Control Submittals:

- a. Test Reports: Provide an outline of tests to be performed before, during and after installation. Include, as a minimum, equipment functionality, cable continuity,

cable shorts and picture quality.

- b. Manufacturer's Instructions: Provide copies of manufacturer's product specification sheets, Record Drawings, operations manuals and maintenance manuals to Contracting Officer upon completion of work.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Acceptable Installers: Provide evidence of having been actively engaged in the business of installing and maintaining broadband/television cabling for at least 5 years.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

- A. Furnish and install wiring, CATV interface equipment, taps, etc. as shown on Drawings and necessary for complete and operational system.
- B. Performance Requirements:
 - 1. Provide the ability to receive available CATV channels as provided by the local CATV franchise via standard cable-ready television sets (Contracting Officer-supplied) and/or set-top converters.
 - 2. Comply with FCC regulations and conform to ANSI/IEEE 802.7 standard for broadband cable systems.
 - 3. Provide equipment capable of operating over the frequency range from 0 to 850 MHz at a minimum.
 - 4. Provide system that allows users to tune to designated channels 2 through 71 on cable-ready television sets (supplied by Contracting Officer) to view programs and other broadcast information as provided by the local cable television franchise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Line Extenders:
 - 1. Blonder Tongue
 - 2. Magnavox

3. Scientific Atlanta
 4. Or approved equivalent.
- B. Cables:
1. CommScope
 2. Toner
 3. Or approved equivalent.
- C. Connectors:
1. Gilbert
 2. LRC
 3. Blonder Tongue
 4. Or approved equivalent.
- D. Splitters:
1. Blonder Tongue
 2. Toner
 3. Or approved equivalent.
- E. Taps:
1. Blonder Tongue
 2. Toner
 3. Or approved equivalent.
- F. Wall Plates:
1. Blonder Tongue
 2. Toner
 3. Or approved equivalent.
- G. Passives:
1. Blonder Tongue
 2. Toner
 3. Regal

4. Or approved equivalent.

2.2 LINE EXTENDERS

A. Low-split bi-directional amplifier similar to Blonder Tongue. Frequency range 53 to 870 MHz.

2.3 CABLES

A. Distribution: 1/2-inch, riser or plenum rated as required.

B. Drop: Riser or plenum rated Series 6.

2.4 CONNECTORS

A. Pin-type for 0.5-inch cable, F-type for drop cable.

2.5 SPLITTERS

A. Rated for operation to 1 GHz.

2.6 TAPS

A. Multiport taps with interchangeable faceplates to adjust isolation level. Rated for operation to 1 GHz.

2.7 WALL PLATES

A. Provide F-type barrel connectors for insertion in faceplates provided by telephone/data supplier where faceplates are shared with telephone/data drops and similar faceplates with F-type barrel connectors at remaining locations, as shown on the Drawings. Coordinate color and finish with Contracting Officer.

2.8 PASSIVES

A. Provide 5-1000 MHz rack mountable pasive RF combiners for use in a head end to combine the output of up to 32 single-channel devices such as modulators and processors.

B. 1 - RU Chassis

C. 20 db front panel test port

D. RFI Shield

E. 32 port headend passive combiner

F. 5-1000 MHz

G. Test Port (db) 20 +/-0.5

H. Basis-of-Design: Blonder Tongue HPC-32

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of system with the local CATV supplier.
- B. All cabling to run in metal conduit, minimum 3/4-inch for its entire pathway.
- C. Location: Install line extender and associated passives on wall brackets at the location of telephone/CATV terminal board. Verify the space requirements and exact location with Contracting Officer.
- D. Install taps and outlets at locations designated on Drawings. Coordinate exact placement with Contracting Officer. Ensure taps are accessible to the Contracting Officer without special tools or requirements.
- E. Test complete functional operation of system. Repair and/or replace any part of system that fails to perform properly or meet the specifications at no cost to Contracting Officer.
- F. Document cable runs and wire terminations. Label cable terminations per ANSI/EIA/TIA 606 and provide documentation to Contracting Officer as described under Submittals.
- G. Field Quality Control:
 - 1. Site Tests: Provide Contracting Officer with detailed test reports as outlined through submittal process.
 - 2. Inspection: Provide access to Contracting Officer for inspection of installation quality at any time during or upon completion of system installation.
- H. Adjusting/Cleaning: Provide any adjustments or cleaning necessary to system upon completion of construction.
- I. Demonstration and Training: Demonstrate complete operation of system in presence of Contracting Officer at a time selected by Contracting Officer for final acceptance of system and provide training for efficient operation by Contracting Officer's personnel.

3.2 LINE EXTENDERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 CABLES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 CONNECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 SPLITTERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.6 TAPS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.7 WALL PLATES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.8 PASSIVES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION 27 53 20

SECTION 28 00 00 - ELECTRONIC SAFETY AND SECURITY BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 28 00 00, Electronic Safety and Security Basic Requirements applies to Division 28, Electronic Safety and Security work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Contracting Officer's use of electronic safety and security systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 01, General Requirements, Drawings, Addenda, and Contracting Officer's Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or approved equal: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Contracting Officer for consideration, in accordance with Division 01, General Requirements, and approved by the Contracting Officer prior to submitting bids for substituted items.

1.2 RELATED SECTIONS

- A. Contents of Section apply to Division 28, Electronic Safety and Security Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Contracting Officer Agreement
 - e. Codes, Standards, Public Ordinances and Permits

- C. Contents of Division 26, Electrical apply to this Section.
- D. Comply with related products/systems requirements for Internet Protocol Communication devices located in Division 27:
 - 1. Section 27 13 00, Communications Backbone Cabling.
 - 2. Section 27 15 00, Communications Horizontal Cabling.

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 01, General Requirements, individual Division 28, Electronic Safety and Security Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. IBC - International/California Building Code
 - 2. IEBC - International Existing Building Code
 - 3. IMC - International Mechanical Code
 - 4. IPC - International Plumbing Code
 - 5. NEC - National Electrical Code
 - 6. IECC - International Energy Conservation Code
 - 7. CA Title 24 Part 6 California Energy Code
 - 8. IFC - International Fire Code
 - 9. NFPA 101 Life Safety Code
 - 10. CA Title 24 Part 8 California State Historic Building
 - 11. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - a. ABA - Architectural Barriers Act
 - b. ADA - Americans with Disabilities Act
 - c. ANSI - American National Standards Institute
 - d. ASCE - American Society of Civil Engineers
 - e. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

- f. ASHRAE Guideline 0, the Commissioning Process
 - g. ASME - American Society of Mechanical Engineers
 - h. ASTM - ASTM International
 - i. CFR - Code of Federal Regulations
 - j. EPA - Environmental Protection Agency
 - k. ETL - Electrical Testing Laboratories
 - l. FM - FM Global
 - m. ISO - International Organization for Standardization
 - n. NEC - National Electric Code
 - o. NEMA - National Electrical Manufacturers Association
 - p. NFPA - National Fire Protection Association
 - q. OSHA - Occupational Safety and Health Administration
 - r. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association
 - s. UL - Underwriters Laboratories Inc.
12. See Division 28, Electronic Safety and Security individual Sections for additional references.
13. SUBMITTALS
- a. See Division 01, General Requirements for Submittal Procedures.
 - b. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
 - c. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 - d. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending

order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Contracting Officer on all transmissions/submissions.

- e. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety and Security Sections.
- f. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - 1) Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - 2) Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference individual Division 28, Electronic Safety and Security specification Sections for specific items required in product data submittal outside of these requirements.
 - 3) See Division 28, Electronic Safety and Security individual Sections for additional submittal requirements outside of these requirements.
- g. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Contracting Officer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
- h. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Contracting Officer's comments. Identify Contracting Officer's comments and provide an individual response to each of the Contracting Officer's comments. Cloud changes in the submittals and further identify changes which are in response to Contracting Officer's comments.
- i. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

- j. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety and Security Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.
- k. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
- l. Substitutions and Variation from Basis of Design:
 - 1) The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - 2) If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equal," a substitution request must be submitted to Contracting Officer for approval prior to purchase, delivery or installation.
 - 3) Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.
- m. Shop Drawings:
 - 1) Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 28, Electronic Safety and Security specification Sections for additional requirements for shop drawings outside of these requirements.
 - 2) Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
- n. Samples: Provide samples when requested by individual Sections.
- o. Resubmission Requirements:

- 1) Make any corrections or change in submittals when required by Contracting Officer's review comments. Provide submittals as specified. The Contracting Officer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
- 2) Resubmit for review until review indicates no exception taken or "make corrections noted."
- 3) When submitting drawings for Contracting Officer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

p. Operation and Maintenance Manuals, Contracting Officer's Instructions:

- 1) Reference individual Division 28, Electronic Safety and Security Specification Sections for additional requirements for operations and maintenance manuals.
- 2) Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - (a) Include copy of approved submittal data along with submittal review letters received from Contracting Officer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - (b) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes and quantities relevant to each piece of equipment.
 - (c) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
 - (d) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Sections.

- (e) Include product certificates of warranties and guarantees.
 - (f) Include copy of start-up and test reports specific to each piece of equipment.
 - (g) Include commissioning reports.
 - (h) Contracting Officer will return incomplete documentation without review.
 - (i) Contracting Officer will provide one set of review comments in Submittal Review format. Arrange for additional reviews; Bear costs for additional reviews at Contracting Officer's hourly rates.
- 3) Thoroughly instruct Contracting Officer in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 00, Electronic Safety and Security Basic Requirements Article titled "Demonstration."
 - 4) Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
- q. Record Drawings:
- 1) Maintain at site at least one set of drawings for recording "as-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.
 - 2) Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.
 - 3) At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
 - 4) See Division 28, Electronic Safety and Security individual Sections for additional items to include in Record Drawings.

14. QUALITY ASSURANCE

- a. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code

requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

- b. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
- c. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g. cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- d. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Contracting Officer in writing before starting work.
- e. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- f. Provide products that are UL listed.

15. WARRANTY

- a. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- b. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

16. COORDINATION DOCUMENTS

- a. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades

(including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence. Unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, Division 28, Electronic Safety and Security to combine information furnished by other trades onto master coordination documents.

- b. Prepare Drawings as follows:
 - 1) Drawings in CAD Format. CAD format release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
 - 2) Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
 - 3) Indicate fittings, hangers, access panels, and elevation of bottom of cable tray above finished floor.
 - 4) Drawings to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork.
 - 5) Incorporate Addenda items and change orders.
 - 6) Provide additional coordination as requested by other trades.
- c. Advise Contracting Officer in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Contracting Officer of conflict.
- d. Verify in field exact size, location, and clearances of existing material, equipment and apparatus, and advise Contracting Officer of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- e. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to panels, devices and equipment unless otherwise specified in individual Division 28, Electronic Safety and Security Sections.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or FM approved or have adequate approval or be acceptable by state, county, and city authorities.
- B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- C. Hazardous Materials:
 - 1. Comply with local, State of California, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Contracting Officer. Hazardous materials will be removed by Contracting Officer under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Contracting Officer prior to proceeding with installation.

This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.
2. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 28 Electronic Safety and Security Sections.
- B. Earthquake resistant designs for Electronic Safety and Security (Division 28) equipment to conform to regulations of Contracting Officer.
- C. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment

and distribution systems to withstand a force in direction equal to value defined by Contracting Officer.

- D. Provide means to prohibit excessive motion of safety and security equipment during earthquake.

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Notify Contracting Officer, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit and wire installation prior to backfilling.
 - 2. Prior to covering walls when electrical, safety and security systems installation is started.
 - 3. Prior to ceiling cover/installation.
 - 4. When main systems, or portions of, are being tested and ready for inspection by Contracting Officer.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements in Division 01, General Requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
 - 1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new system, verify that every item is thoroughly prepared. Install new wiring to point of connection.
 - 3. Coordinate transfer time to new service with Contracting Officer. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum. If overtime is necessary, there will be no allowance made by Contracting Officer for extra expense for such overtime or shift work.
 - 4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching Requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
1. Proposed floor cutting/core drilling/sleeve locations to be approved by Contracting Officer. Submit proposed locations to Contracting Officer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Contracting Officer for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Contracting Officer.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Contracting Officer.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with the individual Division 28, Electronic Safety and Security Sections and the following:
1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust.
 2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

3. Protect devices, panels and similar items until in service.
4. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Contracting Officer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Contracting Officer's Staff as specified in Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Contracting Officer, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Contracting Officer that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28 Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 28 00 00, Electronic Safety and Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports required for installation of equipment, conduit and wiring.

3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e. hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. In electrical and mechanical room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Contracting Officer.
 3. See individual equipment Specifications for other painting.
 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Contracting Officer.

3.12 ACCEPTANCE

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
1. System cannot be considered for acceptance until work is completed and demonstrated to Contracting Officer that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Cleaning
 - b. Operation and Maintenance Manuals
 - c. Training of Operating Personnel
 - d. Record Drawings
 - e. Warranty and Guaranty Certificates
 - f. Start-up/test Documents and Commissioning Reports

3.13 FIELD QUALITY CONTROL

- A. Confirm requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
 - 1. Tests:
 - a. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.
 - b. During site evaluations by Contracting Officer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

- A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement in the letter that electronic safety and security systems were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in operating and maintenance manuals.

END OF SECTION

SECTION 28 08 01 - COMMISSIONING AND TESTING OF SECURITY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. General Description: This section covers the provision of preliminary testing, acceptance testing, burn-in performance testing, and the commissioning of various access control systems.

B. Definitions:

1. Commissioning Authority: Commissioning Agent, representing the Contracting Officer and directing commissioning activities.

1.2 RELATED SECTIONS

A. Contents of Division 28, Electronic Safety and Security and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 01 91 13, General Commissioning Requirements
2. Section 26 08 00, Commissioning of Electrical
3. Section 28 00 00, Electronic Safety and Security Basic Requirements

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

B. In addition, meet the following:

1. Perform Inspections and tests in accordance with applicable codes and standards including the most current versions of NEC, ANSI, IEEE, NFPA, NEMA and OSHA.
2. International Electrical Testing Association, Acceptance Testing Specifications (NETA ATS), latest edition.

1.4 SUBMITTALS

A. Submittals as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

B. In addition, provide:

1. Four bound copies of the certified test reports to the Contracting Officer within seven days after the completion of the work. The final report to be signed and include the following information:
 - a. Summary of the project.
 - b. Description of the equipment tested.
 - c. Visual inspection report
 - d. Description of the tests
 - e. Pre-Acceptance and Final Acceptance Test results
 - f. Conclusions and recommendations
 - g. Appendix including appropriate test forms
 - h. Identification of the test equipment used
 - i. Full contact information for company and person performing any testing on the system.
- C. Reference Section 01 91 13 General Commissioning Requirements, for other specific Commissioning submittal requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- B. In addition:
 1. Provide Testing to assure that electrical equipment and wiring is operational, within industry and manufacturers tolerances and is installed in accordance with other sections of these specifications.
 2. Conduct tests in the presence of the Contracting Officer and the Commissioning Agent for the purpose of demonstrating the equipment or systems' compliance with specifications. Demonstrate electrical and mechanical tests to the Contracting Officer and the Commissioning Agent that the entire installation is functioning properly and that circuits, including power, control, instrumentation, relaying, integration and communication, will function properly and as specified.
 3. Furnish, install and maintain tools, instruments, material, test equipment, test connections and power. Furnish personnel including supervision and "stand-by" labor required for the testing, setting, and adjusting of electrical facilities and component parts including putting the above into operation.

4. Make tests with proper regard for the protection of equipment and personnel.
5. Protect equipment from subsequent testing of other equipment and systems after equipment has been tested, checked for operation, and accepted by the Contracting Officer.
6. Record test values of equipment, giving both "as-found" and "as-left" for existing conditions.
7. The witnessing of any test by the Contracting Officer does not relieve the Contractor of warranties for material, equipment, and workmanship, as specified in the General Conditions. Check circuits for conformance with the wiring diagrams furnished by manufacturers.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.7 COORDINATION

- A. Coordination as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- B. In addition, reference the following:
 1. Section 01 91 13 General Commissioning Requirements for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish labor, instruments, products, temporary power, and sufficient materials required for testing at each test.
- B. Correct deficiencies found as a result of tests and make replacements or repairs to tested products that are damaged as the result of the tests. This includes Burn In Performance report reviews
- C. Schedule tests at a time convenient to witnesses of tests or persons affected by the tests.
- D. Provide 14-day advance written notification prior to tests to the Contracting Officer for test procedures.

- E. Make records of all tests in a neat and legible form. Identify the equipment or system tested and the test data.
- F. Check control, instrumentation, and power cables and conductors for proper connections, workmanship and identification.
- G. Test disconnect switches through an open and closed cycle for proper operation, alignment and contact.
- H. Additional tests required as outlined under the various Sections of Division 26 and 28.
- I. Submit to the Contracting Officer certified reports on all tests indicating full compliance with test requirements.

3.2 COORDINATION

- A. Provide the work in accordance with Section 28 00 00, Electronic Safety and Security Basic Requirements.

3.3 WORKMANSHIP

- A. Provide the work in accordance with Section 28 00 00, Electronic Safety and Security Basic Requirements.

3.4 PRELIMINARY INSPECTION & TESTING

- A. Coordination: Coordinate testing of components of the system in cooperation with other trades.
- B. Verification: Prior to performing Preliminary Testing, inspection, and/or final testing procedures, ensure the following:
 - 1. Safe and proper operation of all components, devices or equipment, and the absence of extraneous or interfering signals.
 - 2. Proper grounding of devices and equipment.
 - 3. Integrity of signal and electrical system ground connections.
 - 4. Proper powering of devices and equipment.
 - 5. Integrity of insulation, shield terminations and connections.
 - 6. Integrity of soldered connections and absence of solder splatter, solder bridges, debris of any kind.
 - 7. Proper dressing of wire and cable with labels matching as-build documents.
 - 8. "Wire-checking" of circuitry, including phase and continuity.
 - 9. Preliminary targeting and setup of video camera assemblies.

10. Mechanical integrity of support and positioning provisions, i.e. as provided for video cameras, monitors and any other equipment.
 11. Sequencing: If applicable, determine and record the sequence of energizing systems to minimize the risk of damage from improper startup.
 12. Proper operation of devices and systems in accordance with specified performance requirements.
 13. System is programmed for alarm reporting of each device and associated with the graphical maps.
 14. Verify system programming is defined.
 15. Verify Contracting Officer designations for devices.
- C. Perform a Preliminary Inspection and Test to determine the operating status of components and systems prior to Functional Performance Testing. Verify graphical maps have been installed for the system. Each device to be displayed as an alarm icon on the graphical map, and in a textual description on the alarm reporting screen.
1. Testing Electronic Access Control Security Terminal Cabinets:
 - a. Test each equipment enclosure for tamper alarm.
 - b. Test each power supply battery for power loss alarm reporting.
 - c. Test each STC for 120VAC power loss alarm.
 - d. Test each STC for communication loss with server reporting.
 2. Testing Electronic Access Control Doors:
 - a. Test Doors with Door Position Switch (DPS) and Request to Exit device (REX) for:
 - 1) Door Forced Open alarm is generated when door is opened from unsecured side.
 - 2) Door Held Open alarm is generated when door is held open past its preprogrammed duration after valid REX event.
 - 3) REX shunts alarm on egress.
 - 4) REX does not shunt forced door alarm.
 - b. Doors with Electrified Exit Device, DPS and REX:
 - 1) Door is locked in secure mode.

- 2) Door is unlocked by manual command from system workstation.
- 3) Door is unlocked by time zone.
- 4) Door Forced Open alarm is generated during secure mode only.
- 5) Door Held Open alarm is generated during secure mode only.
- 6) REX shunts alarm on egress during secure mode, for the preprogrammed duration.
- 7) Door relocks immediately when door closes after valid passage (does not wait for preprogrammed duration).
- 8) REX does not unlock door.
- 9) REX does not bypass forced door alarm.
- 10) Door relocks on time zone.
- 11) Door relocks during day mode on manual command from system workstation.

c. Doors with Automatic Door Operators:

- 1) Door is locked in secure mode.
- 2) Door is unlocked by manual command from system workstation during secure mode.
- 3) Door is unlocked by time zone.
- 4) Door Forced Open alarm is generated during secure mode only.
- 5) Door Held Open to long alarm is generated during secure mode only.
- 6) REX shunts alarm on egress during secure mode.
- 7) REX does not unlock door.
- 8) Door relocks on time zone.
- 9) Door relocks during day mode on manual command from system workstation.

d. Doors or Gates with Card Reader:

- 1) Door unlocks by use of the card reader for programmed unlock time and does not alarm when door is opened.
- 2) Door is locked in secure mode.

- 3) Door is unlocked by manual command from system workstation.
- 4) Door is unlocked by time zone.
- 5) Door Forced Open alarm is generated during secure mode.
- 6) Door Held Open alarm is generated during secure mode.
- 7) REX shunts alarm on egress during secure mode.
- 8) Door relocks immediately when door closes after valid passage (does not wait for preprogrammed duration).
- 9) REX for door does not unlock door.
- 10) REX for gates does not unlock gate.
- 11) Door relocks on time zone.
- 12) Door relocks during day mode on manual command from system workstation.

3. Testing Video Surveillance System:

a. Live Viewing:

- 1) Verify each camera live viewing at the monitoring workstation is in focus.
- 2) Verify each camera live viewing at Central Command Post is in focus.
- 3) During an alarm event verify camera and pre-programmed views associated with alarm event are displayed at the viewing location(s).
- 4) Verify camera identification match Contracting Officer defined description.

b. Recorded Images:

- 1) Verify each camera viewing of recorded images at the monitoring workstation.
- 2) Verify each camera viewing of recorded images at Central Command Post.
- 3) Verify alarm event is recorded.

4. Testing Emergency Phone System:

a. Local Device:

- 1) Verify indicator is 'on' solid.
- 2) Verify indicator 'flashes' when operated.

- 3) Verify audio communication with monitoring station.
 - b. Remote Monitoring:
 - 1) Verify audio communication with remote station.
 - 2) Verify alarm generated on EACS system.
 - 3) Verify Video Surveillance System is activated 'calling' camera(s) to view location.
 5. Duress Switch - Intrusion Detection System:
 - a. Verify switch activation reports to IDS control panel.
 - b. Verify switch activation reports to monitoring station.
 6. Security Communications Local Intercom System:
 - a. Verify each switch remote station reports to the monitoring station and resets when restored.
 - b. Verify each remote station reports as Contracting Officer defined room number.
 - c. Verify audio is free from static and is has sufficient volume for communication.
 7. Wireless Alarm System:
 - a. Verify wireless transmitters are activated by their associated alarm devices.
 - b. Verify transmitted alarms report their individual ID's to their associated alarm receivers from various locations around the area of coverage.
 - c. Verify each wireless transmitter supervision reports its individual identification to the system.
 - D. Adjustments and Documentation: After successfully energizing and testing the systems, make adjustments and document the setting of controls, configurations, as applicable. Tabulate data along with an inventory of test equipment, a description of testing conditions and a list of test personnel. Copies of preliminary test data to accompany copies of performance testing data as part of the Operating and Maintenance submittal.
- 3.5 PREPARATION FOR ACCEPTANCE (PRIOR TO FINAL INSPECTION)
- A. Temporary facilities and utilities to be properly disconnected, removed, and disposed of off-site.
 - B. Systems, Equipment, and Devices: In full and proper adjustment and operation, and properly labeled and identified.
 - C. Materials to be neat, clean and unmarred, and parts securely attached.

- D. Replace or properly repair broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc., and debris cleaned up and appropriately discarded.
- E. Deliver and store extra materials as specified at the premises as directed by the Contracting Officer at the completion of each Building.
- F. Provide preliminary test reports of each system and each system component and Project Record Documents. Make available for inspection and delivery upon completion of each Building as directed by Contracting Officer.

3.6 FUNCTIONAL PERFORMANCE TESTING AND ADJUSTING PROCEDURES

- A. Purpose: Conduct testing and adjusting procedures to realize and verify the performance criteria specified and identified in preliminary testing procedures listed above. Successfully demonstrate the acceptable performance of each specified system in the presence of the Commissioning Agent and Contracting Officer.
- B. Scope: Conduct performance testing, adjustment and documentation procedures to verify and realize compliance with the performance specifications herein. Make available at least one Contracting Officer familiar with this work, and all required test equipment for the duration of performance testing verification, at the convenience of the Commissioning Agent.
- C. Functional Performance Testing Readiness: Functional performance testing will be performed after the system is installed and pre-tested completely.
 - 1. Successfully test the system prior to scheduling formal acceptance testing and provided forms with each test for each portal. Correct deficiencies found at that time.
 - 2. Acceptance testing will be conducted in accordance with the approved Acceptance Testing Plan with a minimum of testing listed in Preliminary Testing section.
 - 3. Deliver equipment, devices and materials required for the access control work to the site at least 14 working days prior to the scheduled Completion Date.
 - 4. Install, test and ready all of the access control work for final Functional Performance Testing of the Installation 10 working days prior to the Completion Date.
- D. Functional Performance Testing Schedule: Confirm in writing to the Commissioning Agent when the system is ready for acceptance testing. Schedule a complete Functional Performance Test at the convenience of the Commissioning Agent.
- E. Functional Performance Testing:
 - 1. Test and verify the performance of all equipment, systems, interfaces and peripheral equipment in the presence of the Contracting Officer, Commissioning Agent, and Contracting Officer.

2. Perform tests in accordance with the requirements of individual systems as specified herein and in related specification sections. Incorporate testing described in preliminary inspection and testing.
 3. Furnish communication equipment between the field testing team and the monitoring team.
 4. Furnish testing forms for each location.
- F. An Observation Report will be generated by the Commissioning Agent.
- G. Correction of Jobsite Observation Report Items: Perform remedial work to correct inadequate performance or unacceptable conditions of, or relating to any of this work, as determined by the Commissioning Agent within 10 working days of the completion date. Perform corrective work at no additional cost to the Contracting Officer. Provide a written report each week of repairs made and plan to complete repairs in progress.
- H. Test Documentation: Document all acceptance testing, calibration and correction procedures described with the following information:
1. Performance date of the procedure.
 2. The names of personnel conducting the procedure.
 3. The equipment used to conduct the procedure.
 4. Type of procedure and description.
 5. Condition during performance of procedure.
 6. Parameters measured and their values, including values measured prior to calibration or correction as applicable.

3.7 BURN-IN PERFORMANCE PERIOD

- A. Prior to Final Acceptance by the Contracting Officer, perform testing and inspections, as specified herein, to verify that the installation equipment and materials are performing in compliance with the specifications.
- B. Upon satisfactory completion of Functional Performance Testing and inspection, the Contracting Officer will notify the Contractor, and the Burn-In Performance Period will commence.
- C. Obtain weekly reports of alarm events related to this project and make system repairs or corrections to minimize false alarms. Provide a report to the Contracting Officer indicating corrections required and locations corrected. Contracting Officer may provide additional comments to the report for contractor to review and provide corrective action.

- D. A Performance Period of thirty consecutive calendar days of operating without fault in accordance with the specifications, subsequent to testing and inspection, shall constitute a successful Performance Period.
- E. Upon successful completion of the Performance Period, the Contracting Officer and design team will meet to confirm Acceptance, and the Final Acceptance Form shall be executed.
- F. If a successful Performance Period cannot be accomplished within 90 consecutive calendar days after commencement of the first Performance Period, the Contracting Officer reserves the right to find the Contractor in default, and terminate the Contract. In that event, the Contractor shall remove the equipment, and the Contracting Officer will not be responsible for any payment whatsoever to the Contractor, except for any materials (i.e., wiring) left in place and elected to be reused by the Contracting Officer.
- G. Obtain system alarm and event reports at a minimum of four times during the burn in period. Review reports with Contracting Officer and repair system equipment and/or adjust system parameters as requested by the Contracting Officer or required for system performance.

END OF SECTION

SECTION 28 10 00 - ACCESS CONTROL AND INTRUSION DETECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. Security Management System (SMS)
2. Access Control System Main Control Panel
3. Access Control System Door Control Panel
4. Card Reader
5. Access Control Cards
6. Door Position Switch/Contact
7. Request to Exit Device (REX)
8. Electric Latch or Strike (provided by others - see Architectural door hardware schedule)
9. Magnetic Lock
10. Power Supply
11. Intrusion Main Control Panel
12. Motion Detector
13. Keypad
14. Glass Break Detector
15. Cable and Wire
16. Door Entry Video Intercom System

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 28, Electronic Safety and Security and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- ##### B.
- In addition, meet the following:

1. Federal Information Processing Standard Publication 201-1, Personal Identity Verification (PIV) of Federal Employees and Contractors. (FIPS 201-1)
2. Homeland Security Presidential Standard Directive 12: Policy for a Common Identification Standard for Federal Employees and Contractors. (HSPD-12)

1.4 SUBMITTALS

- A. Submittals as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Security Management System (SMS):
 1. Honeywell
 2. AMAG
 3. S2 Security
 4. Or approved equivalent.
- B. Access Control System Main Control Panel:
 1. Honeywell
 2. AMAG
 3. S2 Security
 4. Or approved equivalent.
- C. Access Control System Door Control Panel:
 1. Honeywell
 2. AMAG

3. S2 Security
 4. Or approved equivalent.
- D. Card Reader:
1. HID
 2. Or approved equivalent.
- E. Access Control Cards:
1. HID
 2. Or approved equivalent.
- F. Door Position Switch/Contact:
1. Sentrol
 2. Or approved equivalent.
- G. Request to Exit Device (REX):
1. Bosch
 2. Or approved equivalent.
- H. Electric Latch or Strike: Provided by others; see Architectural door hardware schedule.
- I. Magnetic Lock: Provided by others; see Architectural door hardware schedule.
- J. Power Supply:
1. Altronix
 2. Or approved equivalent.
- K. Intrusion Main Control Panel:
1. Honeywell
 2. Bosch
 3. Or approved equivalent.
- L. Motion Detector:
1. Honeywell
 2. Bosch

3. Or approved equivalent.
- M. Keypad:
1. Bosch
 2. Honeywell
 3. Or approved equivalent.
- N. Glass Break Detector:
1. Honeywell
 2. Bosch
 3. Or approved equivalent.
- O. Cable and Wire:
1. West Penn Wire
 2. Or approved equivalent.
- P. Door Entry Video Intercom System:
1. Video Door Entry Station with Card Reader:
 - a. Aiphone, Model AX-DVF.
 - b. Or approved equivalent.
 2. Video Door Entry Station:
 - a. Aiphone, Model AX-DV.
 - b. Axis A8004-VE (use with A9801 Security Relay).
 - c. Or approved equivalent.
 3. Master Station:
 - a. Aiphone, Model AX-8MV.
 - b. Or approved equivalent.
 4. Central Exchange Unit (CEU):
 - a. Aiphone, Model AX-084C.
 - b. Or approved equivalent.

2.2 SECURITY MANAGEMENT SYSTEM (SMS)

A. Furnish and install the Following:

1. An SMS that is capable of controlling and monitoring the access control system and the intrusion alarm system and that has an interconnection with the video surveillance system. See Section 28 23 00, Video Surveillance if the Video Management System is going to fulfill these functions.
2. An SMS that is designed to control and/or interface with industry standard OEM equipment.
3. An SMS that uses modular architecture to allow easy integration of the following capabilities/equipment:
 - a. Access Control
 - b. Intrusion detection
 - c. Elevator control.
 - d. Time and attendance.
 - e. CCTV system integration.
 - f. Alarm receiver interface.
 - g. Badging capabilities.
 - h. Employee and visitor database.
4. Provide one server license and four client licenses.
5. All SMS software to reside within the controller and be through a standard web browser.
6. Up to 25 users to able to operate, monitor and control the entire system with a user ID and password.
7. Software will have the following:
 - a. User rights setup and password assignment.
 - b. Centralized access control and alarm transactions monitoring.
 - c. Remote control functions for access control, arming/disarming of alarm points and on/off controls.
 - d. Card database administration.
 - e. Report generation of transactions.

2.3 ACCESS CONTROL SYSTEM MAIN CONTROL PANEL

A. Furnish and install the Following:

1. A main access control system control panel that has the overall system intelligence, any required additional input/output boards and the communications controllers required for remote monitoring and control.
2. An access control system main panel that is modular and can have optional systems and functionality added per project requirements.
3. Control Panel Requirements:
 - a. 32-bits CPU.
 - b. Minimum speed of 500MHZ.
 - c. Must support standard RS 232, Ethernet and remote dial in via modem.
 - d. Minimum 512Mb of flash memory.
 - e. Minimum 512Mb of RAM.
 - f. Supports up to 64 channels for alarm monitoring and 64 channels of voltage free relays for alarm signaling.
 - g. The TO consist of at least one CPU board, two card readers, controller board, one eight channel input and output board, AC line filter, regulated power supply unit with online battery charger.
 - h. Control panel board to support four industry standard Wiegand compatible reader interface ports, provide digital input interfaces to door status sensors and form-C relay output interfaces to door strikes.

2.4 ACCESS CONTROL SYSTEM DOOR CONTROL PANEL

- A. The local door controller to consist of a scalable architecture, allowing the monitoring and control of single or multiple doors per controller.
- B. Door controller to utilize on-board microprocessors and database storage to allow for off-network door control capabilities.
- C. Door controller to be connected and managed through Ethernet, RS-232, RS-485 or wireless communications.
- D. Door controller is to match the brand manufacturer of the main access control panel and operate in conjunction with that system.

2.5 CARD READER

- A. Furnish and install card readers at locations indicated on the Drawings. Mounting height to be 48-inches unless noted otherwise on the Drawings.
- B. Furnish and install a single gang size, wall mount proximity card reader or mullion mount card reader on store front applications.
- C. Card Readers to be suitable for indoor or outdoor use.
- D. Card Readers to be ADA compliant.

2.6 ACCESS CONTROL CARDS

- A. 13.56 MHz Proximity Cards.

2.7 DOOR POSITION SWITCH/CONTACT

- A. Furnish and install recessed door position switches designed to be compatible with and operate with the access control and intrusion system, in the locations indicated on the Drawings.
- B. In situations where a recessed switch cannot be used, utilize a surface mount switch (roll-up door).
- C. Coordinate switch type and installation with architectural door hardware schedule and requirements.

2.8 REQUEST TO EXIT DEVICE (REX)

- A. Furnish and install a REX at each door indicated on the Drawings.
- B. Coordinate with the door hardware schedule for type of device required.
- C. If the REX is not built into the door hardware, install a surface mount passive infrared sensor (PIR) type device per Contracting Officer's direction.

2.9 ELECTRIC LATCH OR STRIKE

- A. Provided by others; see Architectural door hardware schedule.

2.10 MAGNETIC LOCK

- A. Provided by others; see Architectural door hardware schedule.

2.11 POWER SUPPLY

- A. Furnish and install power supplies for the access control panels, intrusions panels and other system devices that has an integral battery for backup.

- B. Power supply converts 115VAC/60Hz input into eight independently controlled 12VDC or 24VDC fail safe and/or fail secure outputs with a total of 6 amp continuous supply current. Power supply has built in charger for backup batteries.
- C. Back up battery is 12V, 0.7 amp rechargeable, sealed and maintenance free with a two hour run time.
- D. Size power supply(s) so there is 20 percent spare capacity for future devices.
- E. Install in a UL listed enclosure.

2.12 INTRUSION MAIN CONTROL PANEL

- A. Furnish and install an intrusion main control panel concurrent with the access control installation, locate with the other security system components.
- B. The Main Panel Includes:
 - 1. Up to 255 events.
 - 2. 50 user passcodes.
 - 3. 43 programmable outputs.
 - 4. 48 points.
 - 5. On board Ethernet port for alarm communication and remote programming.
 - 6. On board USB for on-site programming.
 - 7. Email and text messaging notification for Android and iOS mobile devices.
 - 8. Programmable keypad shortcuts.
 - 9. Supports four keypads.
- C. Furnish and install Ethernet, telephone, or other submitted communications equipment for reporting and monitoring purposes.

2.13 MOTION DETECTOR

- A. Furnish and install motion detectors in the locations indicated on the Drawings.
- B. Furnish and install a ceiling mounted, 360 degree, dual-technology detector that is compatible with the intrusion alarm system.
- C. Motion Detector to be dual-technology, (microwave and PIR) with a 360-degree, 60-foot diameter coverage pattern, three sensitivity settings and visible LED lights to indicate a trouble condition.
- D. Motion Detector enclosure to be constructed of high impact ABS plastic.

2.14 KEYPAD

- A. Vacuum fluorescent display.
- B. Ten numeric keys and five function keys
- C. Audible tones for warning with adjustable volume. Tones include intrusion signal, entrance warning, exit warning, invalid key, trouble and keypad encoding.

2.15 GLASS BREAK DETECTOR

- A. Furnish and install glass break detectors in the locations indicated on the Drawings.
- B. Install a glass break detector that is compatible with the intrusion alarm system.

2.16 CABLE AND WIRE

- A. Copper:
 - 1. Power: 18 AWG, 2 pair, unshielded twisted pair.
 - 2. RS-232: 18 AWG, 4 conductor, shielded.
 - 3. Category 6 cabling to match that installed by the telecom contractor in Division 27, Communications.
 - 4. Indicate all other wire required by manufacturer installation instructions on submittal Drawings and diagrams.
 - 5. All cabling to be plenum rated where required.
- B. Connectors:
 - 1. Modular connector.
 - 2. 24 V Power: Screw-down on spade lug.

2.17 DOOR ENTRY VIDEO INTERCOM SYSTEM

- A. Provide a complete system which integrates with the SMS, with all components sourced from a single manufacturer.
- B. Video Door Entry Station:
 - 1. Vandal-resistant, flush-mount, stainless steel faceplate.
 - 2. Integral intercom call-button, microphone and speaker.
 - 3. Integral color video camera with protective lens cover.

4. Power and communication signal over single Cat5e cable connection to Central Exchange Unit.

C. Master Station:

1. Door station selector buttons with LED indicator for up to eight doors.
2. Selective door release, scan monitor, line transfer and intercom call buttons with LED indicators.
3. Intercom microphone, speaker and volume controls.
4. 3-1/2-inch color LCD screen.
5. Communication signal over single Cat5e cable connection to Central Exchange Unit.
6. Provide with desktop mount.

D. Central Exchange Unit (CEU):

1. Capable of connecting to up to four master stations and eight door stations over Cat5e cable. Standard RJ45 type jacks.
2. Local NTSC video outputs.
3. Relay outputs for connection to SMS for door release.
4. Power supplies to provide 24V power to remote door entry stations.
5. RS-232C log/setting port.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. All cabling is to be installed in metal conduit, minimum 3/4-inch for its entire pathway.
- B. This specification is to be used in conjunction with the Drawings. There may be circumstances where a device listed here is not present or required on the project Drawings.
- C. Contractor to coordinate conduit installation with the electrical contractor.
- D. Preparation:
 1. Order required parts and equipment upon notification of award of the work.
 2. Bench test equipment prior to delivery to the job site.
 3. Verify the availability of power where required. If a new source of power is required, a licensed electrician is required to install it.

4. Arrange to obtain programming information including access times, free access times, door groups, operator levels, etc.
- E. Carefully follow the instructions in the manufacturer's Installation Manual to ensure steps have been taken to provide a reliable, easy to operate system.
- F. Perform work as indicated in the Drawings and Specifications.
- G. Install 3/4-inch conduit to designated card readers, door contacts, request-to-exit devices and electric lock at each door. Install all cabling in conduit for entire run from security panel to device.
- H. Ensure minimum separation requirements are met between communications cables and power circuits.
- I. Integrate card readers with power assisted doors so that the door will not function without a valid card read while in secure mode.
- J. Double doors that are electronically controlled will unlock one leaf upon valid card read and unlock both leaves during programmed time to be unlocked.
- K. Execute adequate testing of the system to ensure proper operation.
- L. Training Requirements:
 1. Provide adequate training of the system users to ensure adequate understanding to prevent operating errors.
 2. Provide eight hours of training of operational instruction and two hours of maintenance instruction. Training seminars are to be hands-on instruction held at Contracting Officer's facility.
 3. Provide Contracting Officer with manufacturer's operating instructions.
 4. Provide factory trained representatives to instruct Contracting Officer's personnel in the operation of system equipment.
 5. Provide Contracting Officer with training plan and training checklist two weeks before planned training according to manufacturer's instructions.
 6. Provide comprehensive training for Contracting Officer for operation, maintenance and troubleshooting of system. Attend training session and video tape by Commissioning Authority.
 7. Security contractor will fully explain and demonstrate operation, function and override of system including, but not limited to: Software operation, remote access, programming, priority levels and monitoring station.
- M. Workmanship:

1. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
 2. Perform work with persons experienced and qualified to produce workmanship specified.
 3. Maintain quality control over suppliers and Subcontractors.
- N. Equipment Pretest: Bench test prior to delivery to job site and prior to installation. Bench test per manufacturer's installation instructions.
- O. Fire-Rated Doors and Frames: Do nothing to modify a UL rated door or frame that would void the UL label or fire rating.
- P. Grounding: Provide earth-grounding of equipment as required by equipment manufacturer. Earth ground to be connected to ground rod or approved cold water pipe. Do not use electrical or telephone ground connections as earth grounds. Do not use connections to mounting posts or building structural steel as earth grounds.
- Q. Cutting and Patching: Responsible for cutting, fitting or patching that may be required to complete the work.
- 3.2 SECURITY MANAGEMENT SYSTEM (SMS)
- A. Reference 3.01, General Installation Requirements.
 - B. Install per manufacturer's instructions and recommendations.
 - C. Program per Contracting Officer's requirements.
- 3.3 ACCESS CONTROL SYSTEM MAIN CONTROL PANEL
- A. Reference 3.01, General Installation Requirements.
 - B. Install per manufacturer's instructions and recommendations.
- 3.4 ACCESS CONTROL SYSTEM DOOR CONTROL PANEL
- A. Reference 3.01, General Installation Requirements.
 - B. Install per manufacturer's instructions and recommendations.
- 3.5 CARD READER
- A. Reference 3.01, General Installation Requirements.
 - B. Install per manufacturer's instructions and recommendations.
- 3.6 ACCESS CONTROL CARDS
- A. Reference 3.01, General Installation Requirements.

- B. Provide 200 access control cards to the Contracting Officer. 100 cards are to be programmed per Contracting Officer requirements.

3.7 DOOR POSITION SWITCH/CONTACT

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.8 REQUEST TO EXIT DEVICE (REX)

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.9 ELECTRIC LATCH OR STRIKE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provided by others; see Architectural door hardware schedule.

3.10 MAGNETIC LOCK

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.11 POWER SUPPLY

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Power to Security Equipment:
 - 1. Power equipment from 120 VAC circuit dedicated for security use, except as noted. Mark panel circuit breakers with labels worded "Security Equipment - Do Not Operate," or equivalent.
 - 2. Locate plug-in transformers at the security control panels. Secure low-voltage plug-in transformers to outlet with screw or strap. Clearly label transformers to identify purpose and use.
- D. Install power supplies for electric locks in central locations where they will not interfere with other operations.

3.12 INTRUSION MAIN CONTROL PANEL

- A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's instructions and recommendations.

3.13 MOTION DETECTOR

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.14 KEYPAD

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.15 GLASS BREAK DETECTOR

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.16 CABLE AND WIRE

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Design, layout, size and plan new wire and cable runs as required.
- D. Wire and cable from the processors to devices at each door “home-run” unless otherwise specified.
- E. Wire and cable installed in conduit or surface metal raceway, except as follows: Wire or cable, in lengths of less than 10-feet, that is “fished” within walls, ceilings and door frames.
- F. Wire and cable passing through metalwork to be sleeved by an approved grommet or bushing.
- G. Avoid splicing conductors. Make splices in junction boxes (except at equipment). Make splices with an approved crimp connection. Do not use wire nuts on any low-voltage wiring.
- H. Identify wire and cable at terminations and at every junction box. Make identification with an approved permanent label, Brady or equal.
- I. Cable and Wire Terminations:
 - 1. Identify inputs and outputs on terminal strips with permanent marking labels.
 - 2. Neatly dress and tie all wiring. The length of conductors within enclosures to be sufficient to neatly train the conductor to the terminal point with no excess. Run wire and cable parallel or normal to walls, floors and ground.
 - 3. Install connectors as required by equipment manufacturers.

4. Make terminations so that there is no bare conductor at the terminal. Conductor insulation to bear against the terminal or connector shoulder.
 5. Do not obstruct equipment controls or indicators with wire or cable. Route wire and cable away from heat producing components such as resistors and regulators.
- J. Install the appropriate cable from the CPU to card readers, door contacts, request-to-exit devices and electric locks at each door.

3.17 DOOR ENTRY VIDEO INTERCOM SYSTEM

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 28 23 00 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Video Management System (VMS)
2. Video Recording System
3. Cameras and Lenses
4. Camera Enclosures and Mounts
5. Cable, Wire and Accessories

1.2 RELATED SECTIONS

- ##### A.
- Contents of Division 28, Electronic Safety and Security and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- ##### A.
- References and Standards as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.4 SUBMITTALS

- ##### A.
- Submittals as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- ##### B.
- In addition, submit questionnaire for Contracting Officer programming requirements.

1.5 QUALITY ASSURANCE

- ##### A.
- Quality assurance as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

1.6 WARRANTY

- ##### A.
- Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Video Management System (VMS):

1. Salient

2. Genetec
3. ONSSI
4. Or approved equivalent.

B. Video Recording System:

1. Salient
2. Genetec
3. ONSSI
4. Or approved equivalent.

C. Cameras and Lenses:

1. Axis
2. Samsung
3. Panasonic
4. Or approved equivalent.

D. Camera Enclosures and Mounts:

1. Axis
2. Samsung
3. Panasonic
4. Or approved equivalent.

E. Cable, Wire and Accessories:

1. West Penn Wire
2. Or approved equivalent.

2.2 VIDEO MANAGEMENT SYSTEM (VMS)

- A. VMS not required if the Security Management System (SMS) indicated in Section 28 10 00, Access Control and Intrusion Detection, is capable of all of the VMS required functions listed below.
- B. Provide a video management system with the following:
 1. Complete video surveillance solution that is scalable from one to any number of cameras required in the project, any of which can be added on a unit-by-unit basis.

2. Accepts all video streams supplied from Internet Protocol (IP) cameras that are digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet or JPEG2000 compression formats and recorded simultaneously in real time.
3. Interface with IP cameras from multiple manufacturers.
4. Ability to set each camera's bit rate, frame rate and resolution independently from other cameras in the system, the altering of which will not affect the recording and display settings of other cameras.
5. Requires no proprietary recording hardware, hardware multiplexer, or time-division technology for video or audio recording and monitoring.
6. Based on a true open architecture that allows for use of non-proprietary PC storage hardware that does not limit the storage capacity and allows for gradual upgrades of recording capacity.
7. Able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including cameras of various manufacturers' brands, including their pan, tilt, zoom (PTZ) functionalities.
8. Allows users to activate live viewing controls and standard camera switching and automation functions of a CCTV keyboard using a standard PC keyboard.
9. Digitally sign recorded video using 248-bit RSA public/private key cryptography and the user has the capability of changing the encryption key.
10. Encrypted control channel using SSL.
11. Consists of server software modules (SSM) and client software applications (CSA).
12. Possible to install both the SSM and CSA on a single workstation or on separate workstations.

2.3 VIDEO RECORDING SYSTEM

A. Network Video Recorder (NVR):

1. System to support an integrated IP capable Digital Video Management recording solution (software) that provides following features and capabilities:
 - a. Seamless integration with entire security system.
 - b. Use of IP based camera hardware for live (surveillance only) viewing through network. System to be used to configure, view and administer each camera individually.
 - c. Modular architecture that is able to support an unlimited number of cameras.
 - d. Simultaneously record and display live video and recorded video.

- e. Supports both event based and continuous recording.
- f. Video events to be linked to system events in system database and only one database to be acceptable for this interface.
- g. Independent camera setup for:
 - 1) Compression rate.
 - 2) Brightness.
 - 3) Contrast.
 - 4) Additional factory requirements.
- h. Network interface to allow remote access of NVR from anywhere on end user's LAN/WAN.
- i. Ability to play back stored video over the LAN/WAN for remote access of video clips and to not allocate more than 2 Mbps of network bandwidth per digital video server.
- j. Any alarm/event in system to have ability to be associated with digital video clip in real time.
- k. Supports user defined pre and post roll.
- l. Support CCTV PTZ control via system video interface if PTZ cameras are present on system.
- m. Supports an advanced matrix view of on-line cameras. Up to 16 channels to be able to be simultaneously displayed in video matrix. 16 channels to be any combination of live or recorded video.
- n. Storage server to be sized and programmed per the following:
 - 1) 12 hour/day event video.
 - 2) 30-day storage.
 - 3) H.264 compression rate.
 - 4) Capacity for 50 cameras.
 - 5) 2-megapixel cameras.

2.4 CAMERAS AND LENSES

A. IP cameras will have following capabilities and functions:

- 1. Camera to be IEEE 802.3af compliant. IP cameras are only to be utilized as part of CCTV Network and should not be integrated with standard analog or digital CCTV

System equipment.

2. Utilized for interior or exterior purposes.
 3. Category 6 cable will be primary source for carrying signals up to 300-feet from network switch or server. If any camera is installed greater than 300-feet from controlling device then the following will be required:
 - a. Local or remote 12 VDC or 24 VAC power source will be required from Class 2, UL compliant power supply.
 - b. Signal converter will be required to convert from Category cable to fiber optic cable. Signal will then be converted back to a Category cable at converter at controlling device.
 4. Have both an IP output and monitor output which produces picture equivalent to an analog camera and allows simultaneous output of both.
 5. Have programmable IP address that allows for installation of multiple units in same Local Area Network (LAN) environment.
 6. Incorporate minimum of Transmission Control Protocol (TCP)/IP, User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Real-Time Transport Protocol (RTP), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), Simple Mail Transfer Protocol (SMTP), Internet Group Management Protocol (IGMP) and Differentiated Service Code Point (DSCP) protocols for various network applications.
- B. Lenses: Install in manner that provides maximum coverage of area being monitored by camera.
1. Lens Components:
 - a. 1/3-inch to fit CCD fixed camera.
 - b. All glass with coated optics.
 - c. Mounts that are compatible with camera selected.
 - d. Packaged and supplied with camera.
 - e. Maximum f-stop of f/1.3 for fixed lenses and maximum f-stop of f/1.6 for variable focus lenses.
 - f. Equip with an auto-iris mechanism.
 - g. Sufficient circle of illumination to cover image sensor evenly.
 - h. Do not use on camera with an image format larger than lens is designed to cover.
 - i. Provide with pre set capability.

2. Types of lenses for both interior and exterior fixed cameras:

a. Manual Variable Focus:

- 1) Utilized in large areas that are being monitored by camera.
- 2) Allow for setting virtually any angle of field, which maximizes surveillance effects.

b. Auto-iris fixed.

- C. Cameras to have appropriate lens installed for the environment where they will be located. If information cannot be obtained from drawings and specifications regarding site conditions, a site visit will be required.
- D. Cameras to be either dome style or installed in dome enclosure unless drawings indicate differently.

2.5 CAMERA ENCLOSURES AND MOUNTS

- A. This Section pertains to interior and exterior enclosures, domes and applicable wall, ceiling, corner, pole and rooftop mounts associated with camera. Enclosures and mounts to match type of cameras used and be provided by same manufacturer as camera.
- B. Cameras and lenses are to be housed in tamper resistant enclosures. Any additional mounting hardware required to install camera at its specified location to be provided with enclosure.
- C. Install camera enclosures that are appropriate for environment where they are being installed.
- D. Install exterior enclosures with following capabilities, components and functions:
1. Designed in manner that provides condensation free environment.
 2. Will operate in 100 percent condensing humidity atmosphere.
 3. Visible humidity indicator.
 4. Contain camera mounts or supports as needed to allow for correct positioning of camera and lens.
 5. Enclosure and sunshield are to match architectural requirements as to finish.
- E. Indoor Enclosures and Mounts:
1. Ceiling Mounted Cameras and Enclosures:
 - a. Install in finished or suspended ceiling. Any installation in situations where there is no finished ceiling and camera is installed attached to structure will require prior coordination with Contracting Officer for acceptable mounting technique and conduit routing.

- b. Install cameras and enclosures in suspended ceilings with a tile bridge or other factory manufactured device that does not rely on tile grid for support. Secure all enclosures to structure.
 - c. Interior dome camera installations to be installed with lowest profile option available.
- 2. Interior Wall-Mounted Cameras and Enclosures:
 - a. Install enclosure in manner that matches existing architectural finishes.
 - b. Install at height that maintains greatest possible coverage but is not accessible to public.
- 3. Interior Dome Cameras and Enclosures:
 - a. Interior dome camera can be pendant mounted, ceiling mounted, surface mounted, or corner mounted equipment. Coordinate with Contracting Officer when determining which mount to use.
 - b. Install dome enclosures that have smoked or tinted acrylic covers with light attenuation factor of no more than 1 f-stop.
- 4. Pan, Tilt, Zoom Capable Dome Camera:
 - a. Install dome with integral electronic pan/tilt capabilities complete with wiring, wiring harness, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to fully provide fully functional pan/tilt dome.
 - b. Install PTZ domes with following characteristics:
 - 1) Constructed of heavy duty bearings and hardened steel gears.
 - 2) Permanently lubricated to ensure smooth and consistent movement of all parts throughout life of product.
 - 3) Equipped with motors that are thermally or impedance protected against overload damage.
 - 4) 360 degrees pan and minimum plus or minus 90 degrees tilt.
 - 5) Pan speed minimum of 10 degrees per second.

F. Exterior Dome Camera and Enclosures.

- 1. Install exterior dome cameras and enclosures that meet, as minimum, requirements listed out for interior dome cameras above.
- 2. Install enclosures that are constructed to be dust and water tight and fully operational in 100 percent condensing humidity.

3. Exterior Wall-Mounted Camera:
 - a. Install mount with an adjustable head for mounting camera.
 - b. Install mount constructed of aluminum, stainless steel, or steel with corrosion-resistant finish.
 - c. PTZ minimum requirements:
 - 1) Plus or minus 90 degrees of pan.
 - 2) Plus or minus 45 degrees of tilt.
 - 3) Installed at height that allows for maximum coverage of area being monitored.

2.6 CABLE, WIRE AND ACCESSORIES

- A. Install electrical and signal cables required for correct operations in conduit from controller or network switch to camera.
- B. Copper Cabling:
 1. 4 pair Category 6 shielded twisted pair for IP/POE camera installations. Match brand manufacturer of telecom cable installed under Division 27, Communications.
 2. 24V Power: 16 AWG twisted pair construction, or as otherwise noted by camera manufacturer.
- C. All cabling to run in conduit for its entire pathway.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. All cabling is to be installed in metal conduit, minimum 3/4-inch for its entire pathway.
- B. Provide new cameras per Drawings.
- C. Position cameras according to Drawings. Once project begins, confirm each camera location and field of view with signature from Contracting Officer before camera mount is secured in place.
- D. Headend video surveillance equipment: Rack mounted with equipment positioned according to Drawings. Once project begins, confirm equipment location(s) with signature from Contracting Officer before being mounted in place. Position equipment and racks to allow for most secure and convenient access for operation and service.
- E. Provide service loops at headend and camera equipment locations for each cable run. Neatly dress and tie wrap cabling. Label cables with laser, inkjet or machine printed labels. Do not use handwritten labels.

- F. Testing Requirements: Perform electrical and mechanical tests recommended by equipment manufacturer and required in this specification. Bench settings are not acceptable. Hold final tests and acceptance in presence of Contracting Officer and manufacturer's representative. Supply personnel and required auxiliary equipment for this test without additional cost to Contracting Officer. Allow 5-day "burn-in" time prior to preliminary testing.
- G. Training Requirements:
 - 1. Provide eight hours of training of operational instruction and two hours of maintenance instruction. Training seminars are to be hands-on instruction held at Contracting Officer's facility.
 - 2. Provide Contracting Officer with manufacturer's operating instructions.
 - 3. Provide factory trained representatives to instruct Contracting Officer's personnel in the operation of system equipment.
 - 4. Provide Contracting Officer with training plan and training checklist two weeks before planned training according to manufacturer's instructions.
 - 5. Provide comprehensive training for Contracting Officer for operation, maintenance and troubleshooting of surveillance system. Attend training session and video tape by Commissioning Authority.
 - 6. Security contractor will fully explain and demonstrate operation, function and override of surveillance system including, but not limited to: Camera sequencing, software operation, remote access, programming, priority levels and monitoring station.
- H. Cutting and Patching: Responsible for cutting, fitting or patching that may be required to complete work.

3.2 VIDEO MANAGEMENT SYSTEM (VMS)

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 VIDEO RECORDING SYSTEM

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 CAMERAS AND LENSES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 CAMERA ENCLOSURES AND MOUNTS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.6 CABLE, WIRE AND ACCESSORIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION

SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fire Alarm Control Units
2. Notification Appliance Circuit Panels
3. Fire Alarm Transmitters
4. Fire Alarm Annunciators
5. Manual Pull Stations
6. Fixed Temperature Heat Detectors
7. Rate-of-Rise and Fixed Temperature Heat Detectors
8. Photoelectric Type Detectors
9. Duct-Mounted Smoke Detectors
10. Relay Modules
11. Control Modules
12. Input Modules
13. Fault Isolation Modules
14. Combination Horn/Strobes
15. Strobes
16. Horns
17. Weatherproof/Surface Backboxes
18. Protective Guards
19. Circuit Conductors
20. Surge Protection
21. Batteries
22. Locks and Keys
23. Document Storage Cabinet

24. Instruction Charts
25. Framed Floor Map

B. Scope:

1. Provide a new fire alarm system.
2. Provide a new fire alarm transmitter communication system.

C. In addition, provide design for the following as required in these Contract Documents:

1. Fire Alarm System
2. Fire Alarm Transmitter Communication System

D. System Design:

1. Design Criteria: Design systems utilizing equipment, appliance, and device layouts depicted in the contract documents and as required by code.
 - a. In addition to code requirements, provide the following:
 - 1) Smoke detection in all spaces throughout all buildings. Detection to be spaced and comply with NFPA 72 spacing requirements.
 - 2) Manual pull stations at exits.
 - 3) Audible fire alarm notification throughout buildings. Provide visible notification in public and common use areas.
 - b. Fire Alarm Sequence of Operation: Activation of manual fire alarm box, automatic fire detector, or fire extinguishing system causes system to enter "alarm" mode including the following operations:
 - 1) Local English language annunciation of device location, address and condition and audible and visual alarm signal at control panel and remote annunciators.
 - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible alarm signal, visual signal remains displayed until initiating alarm is cleared.
 - 3) Transmit "alarm" signal to off-premises equipment, i.e., to local fire department or Contracting Officer's selected vendor. Provide necessary connections to transmitter.
 - 4) Activate fire alarm notification appliances.
 - 5) Activate Emergency Control Functions as required by code.

- (a) Transmit signal to fire/smoke dampers.
 - (b) Transmit signal to initiate shutdown of air handling equipment.
 - (c) Transmit signal to release fire doors.
 - (d) Transmit signals to elevator control equipment to initiate elevator recall and shunt trip.
- c. Supervisory Sequence of Operation: Fire sprinkler tamper or supervisory pressure switch activation, or duct-mounted smoke detector activation causes system to enter "supervisory" mode including the following operations:
 - 1) Local English language annunciation of device location, address and condition and audible and visual supervisory signal at control panel and remote annunciators.
 - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible supervisory signal, visual signal remains displayed until initiating supervisory is cleared.
 - 3) Transmit "supervisory" signal to off-premises equipment.
 - 4) Transmit signal to fire/smoke dampers (duct detector only).
 - 5) Transmit signal to initiate shutdown of air handling equipment (duct detector only).
- d. Trouble Sequence of Operation: System trouble, including single ground or open of supervised circuit, or power or system failure, causes system to enter "trouble" mode including the following operations:
 - 1) Local English language annunciation of device location, address and condition and audible and visual trouble signal at control panel and remote annunciators.
 - 2) Manual "acknowledge" function at control panel and remote annunciators to silence audible trouble signal, visual signal remains displayed until initiating trouble is cleared.
 - 3) Transmit "trouble" signal to off-premises equipment.
- 2. Design of Fire Alarm Transmitter Communication System: Provide design of the fire alarm transmitter communication system as required by code.

1.2 RELATED SECTIONS

- A. Contents of Division 28, Electronic Safety and Security and Division 01, General Requirements apply to this Section.
- B. Division 26, Electrical requirements apply to this section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NFPA 72, National Fire Alarm and Signaling Code, adopted edition.
 - 2. NFPA 70, National Electrical Code, adopted edition.

1.4 SUBMITTALS

- A. Submittals as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Shop drawings to include the following:
 - a. Provide system designer NICET III certification number or Contracting Officer's signature and seal on shop drawings, as required by Contracting Officer.
 - b. Provide system installer's certification, as required in Section 1.5 C.
 - c. Identification of system designer and evidence of qualification or certification of designer as required by Contracting Officer.
 - d. Floor plans indicating walls, doors, partitions, room descriptions, device/component locations.
 - e. Ceiling height and ceiling construction details.
 - f. A symbol legend with device catalog number, description, back box size and mounting requirements.
 - g. Detailed riser diagram.
 - h. Device address adjacent to each device symbol. Notification appliance circuit and number adjacent to each notification appliance symbol.
 - i. Point to point wiring indicating the quantity and gauge of the conductors and size of conduit/raceway used.
 - j. Wiring connection diagrams for control equipment, annunciators, power supplies, chargers, initiating devices, notification appliances, components being connected to the system and interfaces to associated equipment.
 - k. Battery calculations for each battery backed fire alarm control unit.

- l. Voltage drop calculations for each notification appliance circuit, indicating individual appliance current draw, conductor run length and size.
 - m. Complete sequence of operation.
2. Prior to final acceptance, submit a letter confirming that inspections have been completed and system is installed and functioning in accordance with Specifications. Include manufacturer representative's certification of installation and letter of warranty.
3. Operation and Maintenance Manuals. Provide manuals containing the following:
 - a. Catalog Cut Sheets
 - b. System Components, Initiating Devices and Notification Appliances' Installation Sheets
 - c. Manufacturer's Installation, Operation and Maintenance Manual
 - d. Program Data File
 - e. Record Drawings
 - f. One year warranty agreement including parts and labor. Warranty period begins upon date of completion.
 - g. Record of Completion
 - h. Test Reports
 - i. Instruction Chart

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.
- B. In addition, meet the following:
 1. City of Santa Monica, California requirements, ordinances and amendments.
 2. National Parks Service requirements, ordinances and amendments.
- C. Installer Qualifications:
 1. State or municipal certified/licensed fire alarm contractor.
 2. Qualified by manufacturer.
 3. NICET Level II.
 4. As approved by Contracting Officer.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units:

1. Basis of design: Notifier
2. EST
3. Silent Knight
4. Or approved equal.

B. Notification Appliance Circuit Panels:

1. Same manufacturer as fire alarm control equipment.
2. Alarmsaf
3. Altronix
4. Federal Signal
5. Wheelock
6. Or approved equal.

C. Fire Alarm Transmitters:

1. Same manufacturer as fire alarm control equipment.
2. Telguard
3. Or approved equal.

D. Fire Alarm Annunciators:

1. Same manufacturer as fire alarm control equipment.
2. No substitutions permitted.

E. Manual Pull Stations:

1. Same manufacturer as fire alarm control equipment.
2. No substitutions permitted.

- F. Fixed Temperature Heat Detectors:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- G. Rate-of-Rise and Fixed Temperature Heat Detectors:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- H. Photoelectric Type Detectors:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- I. Duct-Mounted Smoke Detectors:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- J. Relay Modules:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- K. Control Modules:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- L. Input Modules:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- M. Fault Isolation Modules:
 - 1. Same manufacturer as fire alarm control equipment.
 - 2. No substitutions permitted.
- N. Combination Horn/Strobes:
 - 1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.

2. Same manufacturer as fire alarm control equipment.
3. Federal Signal
4. Gentex
5. System Sensor
6. Wheelock
7. Or approved equal.

O. Strobes:

1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.
2. Same manufacturer as fire alarm control equipment.
3. Federal Signal
4. Gentex
5. System Sensor
6. Wheelock
7. Or approved equal.

P. Horns:

1. Must be compatible with fire alarm control equipment and notification appliance circuit panels.
2. Same manufacturer as fire alarm control equipment.
3. Federal Signal
4. Gentex
5. System Sensor
6. Wheelock
7. Or approved equal.

Q. Weatherproof/Surface Backboxes:

1. Same manufacturer as fire alarm detection devices or notification appliances.
2. Or approved equal.

R. Protective Guards:

1. Wire Guard:
 - a. Same manufacturer as fire alarm control equipment.
 - b. American Wire Guards
 - c. Chase Security Systems
 - d. Safety Technology International
 - e. Shaw-Perkins
 - f. Or approved equal.
 2. Protective Cover:
 - a. Safety Technology International
 - b. Or approved equal.
- S. Circuit Conductors:
1. Allied Wire and Cable
 2. Belden
 3. CCI
 4. West Penn Wire
 5. Or approved equal.
- T. Surge Protection:
1. Ditek
 2. Transtector
 3. Or approved equal.
- U. Batteries:
1. Same manufacturer as fire alarm control equipment.
 2. Power-Sonic
 3. Werker
 4. Or approved equal.
- V. Locks and Keys:
1. Same manufacturer as fire alarm control equipment.

2. Or approved equal.

W. Document Storage Cabinet:

1. Same manufacturer as fire alarm control equipment.
2. Meir Products
3. Space Age
4. Or approved equal.

X. Instruction Charts: Confirm make and model with Contracting Officer prior to ordering.

Y. Framed Floor Map: Confirm make and model with Contracting Officer prior to ordering.

Z. Substitutions:

1. For other acceptable manufacturers of specified control units, submit product data showing equivalent features and compliance with Contract Documents.
2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

AA. Equipment to be supplied by a certified manufacturer representative.

2.2 FIRE ALARM CONTROL UNITS

A. Basis of Design: Notifier NFS2-3030.

B. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

C. Multiprocessor Based: Configurable as an addressable, point identified system.

D. Central Processing Unit (CPU):

1. CPU continuously monitors the communications and data processing cycles of microprocessor. CPU failure generates an audible and visual trouble signal on control panel and remote annunciators.
2. House the CPU in fire alarm cabinet with sufficient space to allow maximum system expansion and to enclose alphanumeric display.
3. Retain basic life safety software in field programmable non-volatile memory. Provide CPU with minimum capacity of 50 addressable points.
4. Equip CPU with software to provide a control-by-event feature, whereby receipt of an alarm point is programmed to operate control points within system. Provide control-by-event actions for life safety functions in programmable non-volatile memory. CPU

software programming for control of systems defined in this Section is installed as part of this Section.

E. System Capabilities:

1. System capable of addressing and operating smoke detectors, manual pull stations, open contact devices and addressable auxiliary control relays on the same communication loop.
2. System capable of displaying value of each smoke detector, address and condition of fire alarm monitoring points.

F. Program Software:

1. Field configuration program provides programmable operating instructions for system. Store resident program in non-volatile memory.
2. Programmed control point activation includes selective control of HVAC, fire door release, elevator recall, elevator shunt trip, and other fire safety and auxiliary functions.
3. Devices meet criterion specified under materials.
4. Verification and display of sensitivity of each addressable smoke detector can be read using the operating software. Replace devices with readings outside of allowed value at time of system check out.

G. Control Panel Display Modules:

1. Provide keyboard display module 80-character backlit LCD. Each alarm/trouble condition appears in English language with description and location of alarm/supervisory/trouble.
2. Alarm/supervisory/trouble may be acknowledged, silenced and system reset from control panel or remote annunciator(s).

H. Power Supply: Provide power supply(s), adequate to serve control panel modules, remote annunciators, addressable devices, notification appliances and other connected devices.

I. Power Requirements:

1. Loss of 120VAC power automatically causes system to transfer to battery power. Indicate battery power operation by yellow lamp and audible annunciation at control panel and remote annunciator panels. Upon return of 120VAC power, unit recharges batteries to full capacity and maintains battery on float charge. Provide trickle charge adequate capacity to maintain battery fully charged with automatic rate charge.
2. Provide batteries in locking cabinet manufactured for purpose.

J. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each function in this portion of the Specifications and for equipment interconnections required under electrical and

mechanical specifications.

K. Auxiliary Switches: Provide auxiliary equipment control switches with labeled status indicating lights for each switch.

L. System Reset:

1. Key-accessible control function returns system to normal, non-alarm state, if initiating circuits have cleared.
2. Provide reset on both main fire alarm control panel and remote annunciators.

M. Addressing: Provide each initiating device with its own discrete address.

2.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

A. Provide power supply(s), adequate to serve modules, remote annunciators, initiating devices, notification appliances and other connected devices or appliances.

B. Provide batteries in locking cabinet manufactured for purpose.

2.4 FIRE ALARM TRANSMITTERS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Electrically supervised, capable of transmitting alarm, supervisory and trouble signals over Cellular lines to off-premises receiver. Signal transmitter interfaces fully with receiver station of local fire department or Contracting Officer's selected vendor.

C. Verify requirements and provide call sequence and message as directed by Contracting Officer.

2.5 FIRE ALARM ANNUNCIATORS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Alphanumeric Remote Annunciator with Controls: Back lit LCD alphanumeric annunciator 80 characters long. Provide under locking cover test switch, alarm and trouble buzzer, buzzer silence switch and buzzer silence message and reset switch, flush mount with finished cover, vandal-resistant UV stabilized Lexan (or approved equal) overlay and required modules, control panel, etc., to drive annunciator. Self-contained, suitable for wet location where located exterior.

2.6 MANUAL PULL STATIONS

A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.

B. Semi-flush, red finish, nongrasping operation; maximum pull strength as allowed per ADA criteria.

- C. Stations do not allow closure without keyed reset.

2.7 FIXED TEMPERATURE HEAT DETECTORS

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Rated 135 degrees F or 190 degrees F as required by space use.
- C. Provide off-white, low-profile detectors.

2.8 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Responding to 15 degrees F temperature rise per minute and to 135 degrees F fixed temperature as required by space use.
- C. Provide off-white, low-profile detectors.

2.9 PHOTOELECTRIC TYPE DETECTORS

- A. Provide flush mounted units where installed in finished areas; in unfinished areas, surface mounted units are acceptable, unless otherwise noted.
- B. Panel adjustable sensitivity, LED source, multiple cell, 360 degree smoke entry, visual latching operation indicator, insect screen, functional test switch, two-wire operation and vandal-resistant locking feature.

2.10 DUCT-MOUNTED SMOKE DETECTORS

- A. Photoelectric type. Duct sampling tubes extending width of duct, visual indication of detector actuation, direct housing mount. Detector powered from control panel, power on indicator light. Detector rated for air velocity, humidity and temperature of duct and environment where installed.

2.11 RELAY MODULES

- A. Signaling line circuit interface module that connects to other building systems for control of fire/life safety functions, e.g., air-handler shutdown, fire/smoke damper closure, elevator recall.
- B. Module powered from control panel.

2.12 CONTROL MODULES

- A. Signaling line circuit interface module that provides notification appliance circuits or system control outputs.
- B. Module powered from control panel.

2.13 INPUT MODULES

- A. Signaling line circuit interface module that provides initiating device circuits for connection to contact closure initiating devices.
- B. Module powered from control panel.

2.14 FAULT ISOLATION MODULES

- A. Signaling line circuit interface modules that provide isolation of wire-to-wire shorts on a signaling line circuit with automatic reconnection upon correction of short circuit.
- B. Provide module with status indicator LED.

2.15 COMBINATION HORN/STROBES

- A. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
- B. Provide horn/strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.

2.16 STROBES

- A. Multi-candela, flush wall and ceiling mount, white finish, insect-proof.
- B. Provide strobes that meet the latest requirements of NFPA 72, ANSI 117.1 and UL 1971. Candela rating as required by NFPA 72.

2.17 HORNS

- A. Flush wall and ceiling mount, white finish, insect-proof.
- B. Provide horns that meet the latest requirements of NFPA 72.

2.18 PROTECTIVE GUARDS

- A. Wire Guard: Steel wire guard.
- B. Protective Cover: Polycarbonate construction.

2.19 CIRCUIT CONDUCTORS

- A. Copper or optical fiber; color code and label. Type FPL, FPLR and FPLP. Cable type as required by the NEC and the manufacturer.
- B. Minimum signaling line circuit and initiating device circuit wire size: AWG18.
- C. Minimum notification appliance circuit wire size: AWG14, or as approved by Contracting Officer.
- D. Fiber optic cable as required by manufacturer.

- E. Provide two hour rated pathway or two hour rated circuit integrity cabling for all wiring used to activate or monitor smoke control equipment.

2.20 SURGE PROTECTION

- A. In accordance with IEEE C62.41 B3 combination waveform and NFPA 70; except for optical fiber conductors.

2.21 BATTERIES

- A. Provide additional cabinet, if required due to space limitations in control panels.

2.22 LOCKS AND KEYS

- A. Deliver keys to Contracting Officer.
- B. Provide same standard lock and key for each key operated switch and lockable panel and cabinet; provide five keys of each type.

2.23 DOCUMENT STORAGE CABINET

- A. Suitable for as-built drawings, operation and maintenance manual, system data file disk and tools.
- B. Constructed from steel with baked enamel finish; size adequate for full size drawings, operation and maintenance manual, spare parts and tools.

2.24 INSTRUCTION CHARTS

- A. Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory and trouble); easily readable from normal operator's station.
- B. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

2.25 FRAMED FLOOR MAP

- A. Provide framed floor plan of facility.
- B. Frame: Stainless steel or aluminum with polycarbonate or glass cover.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain Contracting Officer's approval of locations of devices, appliances and annunciators before installation.
- B. Circuits:
 - 1. Signaling Line Circuits (SLC): Class B
 - 2. Notification Appliance Circuits (NAC): Class B.

- C. Spare Capacity:
 - 1. Notification Appliance Circuits: Minimum 25 percent spare current capacity. Utilize UL maximum current draw values for notification appliances. Maximum 10 percent voltage drop.
 - 2. Signaling Line Circuit: Minimum 25 percent spare capacity.
- D. Power Sources:
 - 1. Primary: Dedicated branch circuits of facility power distribution system.
 - 2. Secondary: Storage batteries.
 - 3. Capacity: Sufficient to operate fire alarm system under normal supervisory condition for 24 hours and operate alarm signals for five minutes at end of standby period.
- E. Obtain approval of system design from Contracting Officer prior to installation. Do not begin installation without approval from Contracting Officer and submittal review comments from Contracting Officer.
- F. Install in accordance with applicable codes, NFPA 72, NFPA 70 and the Contract Documents.
- G. In accordance with manufacturer's instructions, provide wiring, conduit and outlet boxes required for the erection of a complete system as described in these specifications, as shown on Drawings and as required by Contracting Officer.
- H. Conceal wiring, conduit, boxes and supports where installed in finished areas.
- I. Provide raceway system for cabling concealed in walls and hard ceilings and in locations where cabling is exposed. Where exposed, provide surface raceway in finished areas and surface mounted EMT in non-finished areas.
- J. Provide cabling and conduits system suitable for wet locations for below grade systems.
- K. At junction boxes and termination points, provide identification tags on wires and cables.
- L. Route wiring to avoid blocking access to equipment requiring service, access, or adjustment.
- M. Fire Safety Systems Interfaces:
 - 1. Provide conduit, wiring, boxes and terminations from fire alarm system to monitored components.
 - a. Alarm Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
 - 1) Fire sprinkler water flow switches.
 - 2) Fire sprinkler dry-pipe alarm pressure switches.

- 3) Kitchen hood fire suppression activation.
 - 4) Other alarm inputs.
 - b. Supervisory Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
 - 1) Fire sprinkler water control valve tamper switches.
 - 2) Fire sprinkler dry-pipe system low air pressure switches.
 - 3) Elevator shunt trip power monitoring circuit.
 - 4) Other supervisory inputs.
 - c. Trouble Inputs: Provide connection in accordance with NFPA 72 for the following systems and components:
 - 1) Other trouble inputs.
2. Fire Safety Functions: Provide power and control conduit, wiring, boxes and terminations to power devices and interface to fire alarm system.
 - a. Doors:
 - 1) Provide smoke detectors and addressable control relays to release magnetic hold open devices and roll-down fire doors and door locks. Verify requirements and quantities prior to bidding.
 - 2) Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door.
 - 3) Electronic Locks or Electromagnetic Door Locks on Egress Doors: Unlock smoke zone egress doors upon activation of any alarm initiating device or suppression system in smoke zone.
 - 4) Overhead Coiling Fire Doors: Release upon activation of smoke detectors on either side of door.
 - b. Elevators:
 - 1) Provide elevator recall smoke detectors, addressable control relays and connection to elevator equipment per NFPA 72 and as required by the Contracting Officer.
 - 2) Provide elevator shunt trip heat detectors, addressable control relays for shunt trip operation, addressable input module for monitoring shunt trip power and connection to elevator equipment per NFPA 72 and as required by the Contracting Officer.

- 3) Elevator Lobby and Machine Room Smoke Detectors: Elevator recall for fire fighters' service.
- 4) Elevator Machine Room Heat Detector: Shut down elevator power prior to Elevator Machine Room sprinkler activation.

c. HVAC Systems:

- 1) Fire/Smoke Dampers and Smoke Dampers:
 - (a) Provide required smoke detectors, relays, wiring and the like.
 - (b) Connect control and power wiring to dampers per manufacturer's instructions.
 - (c) Verify quantities, location and requirements of dampers with Division 23, HVAC Drawings and Specifications and mechanical system installer.
- 2) Air Moving Systems:
 - (a) Provide duct-mounted smoke detectors on air systems with air flow rates exceeding 2000 CFM. Coordinate with Division 23, HVAC.
 - (b) Install duct-mounted smoke detector(s) on return side of air system.
 - (c) Provide control wiring from addressable relay contacts to air handling equipment controller. Connect to controller so that when duct-mounted smoke detector is activated, the air handling equipment is shut down.
 - (d) Provide duct-mounted smoke detectors rated for air velocity, temperature and humidity of duct. Verify quantities, locations and requirements with Division 23, HVAC Drawings and mechanical system installer.
 - (e) Where duct-mounted smoke detectors are mounted in inaccessible building void spaces provide access hatch. Provide access hatch with fire rating equivalent to rating of wall, ceiling, or shaft being penetrated.

N. Inspection and Testing for Completion:

1. System testing and commissioning to be performed by a certified manufacturer representative.
2. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

3. Document audibility measurements and verify intelligibility for each space on record drawings.
4. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction and adjustments.
5. Provide tools, software and supplies required to accomplish inspection and testing.
6. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required to test system.
7. Correct defective work, adjust for proper operation and retest until entire system complies with Contract Documents.
8. Notify Contracting Officer seven days prior to beginning completion inspections and tests.
9. Notify Contracting Officer and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
10. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
 - a. Record all system operations and malfunctions.
 - b. If a malfunction occurs, start diagnostic period over after correction of malfunction.
 - c. Contracting Officer will provide attendant operator personnel during diagnostic period; schedule training to allow Contracting Officer personnel to perform normal duties.
 - d. At end of successful diagnostic period, complete and submit NFPA 72 "Inspection and Testing Form."

O. Contracting Officer Personnel Instruction:

1. Provide the following instruction to designated Contracting Officer personnel:
 - a. Hands-On Instruction: On-site, using operational system.
 - b. Classroom Instruction: Contracting Officer furnished classroom, on-site or at other local facility.
2. Basic Operation: One-hour sessions for attendant personnel, security officers and engineering staff; combination of classroom and hands-on:
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.

3. Detailed Operation: Two-hour sessions for engineering and maintenance staff; combination of classroom and hands-on:
 - a. Initial Training: One session pre-closeout.
 - b. Refresher Training: One session post-occupancy.
4. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data and record drawings available during instruction.
5. Provide means of evaluation of trainees suitable to type of training given; report results to Contracting Officer.

P. Closeout:

1. Closeout Demonstration:
 - a. Demonstrate proper operation of functions to Contracting Officer.
 - b. Be prepared to conduct any of the required tests.
 - c. Have at least one copy of operation and maintenance data, copy of project record drawings, input/output matrix and operator instruction chart(s) available during demonstration.
 - d. Have authorized technical representative of control unit manufacturer present during demonstration.
 - e. Demonstration may be combined with inspection and testing required by Contracting Officer. Notify Contracting Officer in time to schedule demonstration.
 - f. Repeat demonstration until successful.
2. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - a. Specified diagnostic period without malfunction has been completed.
 - b. Approved operating and maintenance data has been delivered.
 - c. Spare parts, extra materials and tools have been delivered.
 - d. All aspects of operation have been demonstrated to Contracting Officer.
 - e. Final acceptance of the fire alarm system has been given by Contracting Officer.
 - f. Occupancy permit has been granted.
 - g. Specified pre-closeout instruction is complete.
3. Perform post-occupancy instruction within three months after date of occupancy.

3.2 FIRE ALARM CONTROL UNITS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide control units with 120VAC dedicated circuit per NFPA requirements.
- D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.
- E. Provide instruction charts at each control unit where system operations are performed. Obtain approval from the Contracting Officer prior to mounting.
- F. Perform system programming at the fire alarm control panel. Program the system without shutting the system down. Programming is done off line. Update and maintain hard copy and CD-ROM copy of program at the site.
- G. Room Name Labeling: Control unit schedules, programming and labeling for electrical equipment, to use the room names and room numbers that the Contracting Officer adopts at the date of substantial completion of construction. This work is to be done at no added cost to the Contracting Officer.
- H. Programmable Function Keys: Provide control panel accessible function keys for the notification bypass, fire drill, fire door bypass, elevator control bypass, and supervising station bypass.

3.3 NOTIFICATION APPLIANCE CIRCUIT PANELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide notification appliance circuit panel power supplies with 120VAC dedicated circuit per NFPA requirements.
- D. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

3.4 FIRE ALARM TRANSMITTERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide conduit and wiring for connections to the transmitter as required for fire alarm system off site supervision.

3.5 FIRE ALARM ANNUNCIATORS

- A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's instructions and recommendations.
- C. Verify location with Contracting Officer before installation.

3.6 MANUAL PULL STATIONS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.7 FIXED TEMPERATURE HEAT DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.8 RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.9 PHOTOELECTRIC TYPE DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.10 DUCT-MOUNTED SMOKE DETECTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.11 RELAY MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.12 CONTROL MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.13 INPUT MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.

3.14 FAULT ISOLATION MODULES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed address labels on addressable devices. Labels to be visible from the floor without magnification.
- D. Provide Fault Isolator Modules for signaling line circuit per code requirements and manufacturer instructions.

3.15 COMBINATION HORN/STROBES

- A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.16 STROBES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide wire guards or protective covers where device is subject to abuse and where required by Contracting Officer.

3.17 HORNS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide machine printed labels on notification appliances with appliance circuit number and sequence. Labels to be visible from the floor without magnification.
- D. Provide protective guard where device is subject to abuse and where required by Contracting Officer.

3.18 WEATHERPROOF/SURFACE BACKBOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide manufacturer's weatherproof backbox listed for use in areas where the device or appliance is subject to humidity in excess of listed rating. Provide manufacturer surface backboxes where devices cannot be installed recessed.

3.19 PROTECTIVE GUARD

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Wire Guard.
- D. Protective Cover.

3.20 CIRCUIT CONDUCTORS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Provide Type FPLR cable when in a riser application or FPLP cable when installed in plenums.

3.21 SURGE PROTECTION

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350V(ac), line-to-neutral and 350V(ac), line-to-line; do not use fuses.

3.22 BATTERIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.23 LOCKS AND KEYS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Deliver to Contracting Officer.

3.24 DOCUMENT STORAGE CABINET

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide document storage cabinet adjacent to fire alarm control panel.

3.25 INSTRUCTION CHARTS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Install chart adjacent to fire control unit.

3.26 FRAMED FLOOR MAP

- A. Reference 3.01, General Installation Requirements.

- B. Install per manufacturer's instructions and recommendations.
- C. Provide framed floor plan of facility adjacent to the annunciator panel identifying room names/numbers, device/addresses or fire zone number and description as utilized on the annunciator panel, as required by local Contracting Officer. Check with the local fire department for size and approved mounting location.

END OF SECTION 28 31 00

SECTION 31 10 00 – EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Additional information concerning earthwork may be found in the geotechnical investigation report by Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountain National Recreation Area SAMO, Los Angeles County, California, June 25, 2021, prepared by Kleinfelder. All requirements of this report shall be followed unless noted otherwise.
- C. Stormwater Pollution Prevention Plan (SWPPP) prepared by the Contractor.

1.2 SUMMARY

- A. This Section Includes:
 - 1. Temporary erosion and sedimentation control measures.
- B. Related Sections:
 - 1. Section 01 57 23 TEMPORARY STORM WATER POLLUTION PREVENTION
 - 2. Section 31 20 00 – EARTH MOVING

1.3 REFERENCES

- A. ASTM: Standards of the American Society for Testing and Materials (ASTM) apply where cited in this Section. Use applicable year of adoption or revision as published in the 2022 “Annual Book of ASTM Standards”.
- B. Earthwork materials and methods of construction shall be in accordance with referenced sections of the latest revision of the Standard Specifications of the State of California Department of Transportation (Caltrans), 2018 edition.

1.4 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of subsoil and weeds, roots, sticks, construction debris, toxic materials, or other non-soil materials.

1.5 SUBMITTALS

- A. Submittals will be required for all materials listed here:
 - 1. Silt Fence
 - 2. Inlet Protection
 - 3. Filter Fabric
 - 4. Hard Surface Guard
 - 5. Fiber Rolls
 - 6. Any product substitutions

1.6 SITE CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing and earthwork operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the City of Los Angeles
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by the City of Los Angeles
- B. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL PRODUCTS

- A. Basis of Design Products: Use products specified on the Erosion Control Plan and Project's SWPPP.
 - 1. Silt Fence: Ertec S-Fence or approved equal
 - 2. Hard Surface Guard: Ertec Hard Surface Guard or approved equal
 - 3. Inlet Protection: Ertec GR8 Guard or approved equal

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Erosion Control Plan, specific to the site, that complies with California Water Quality Control Board requirements or authorities having jurisdiction, whichever is more stringent.
- B. Contractor shall refer to Stormwater Pollution Prevention Plan (SWPPP) for the Project.

- C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established and Project is complete.
- D. Remove erosion and sedimentation controls and accumulated silt. Silt may be mixed with subsoil in softscape areas as an alternative to removing it from the site. Restore and stabilize areas disturbed during removal.

3.2 CLEARING AND GRUBBING

- A. Refer to Landscape Plans and Specifications for clearing and grubbing instructions.
- B. Holes resulting from the removal of trees, underground structures, or improvements that extend below the finish grades should be cleared thoroughly. If the holes do not extend below the bearing elevation of footings, they should be backfilled with suitable material compacted per Section 31 20 00, or as required by the Geotechnical Engineer.

END OF SECTION 31 10 00

SECTION 31 22 19 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes landscape finish grading complete, as shown, and as specified.
- B. Unit Pricing: Per square foot.

1.2 PROJECT/SITE CONDITIONS

- A. Existing Conditions and Tree Protection: The Contracting Officer to take measures to preserve and protect-in-place any existing tree that is observed to have its dripline or major roots within the limit of work. Contact Landscape Architect and owner if existing trees are observed within or overhanging Limit of Work Line shown on the plans. In no instance should any soil or other materials or equipment be stockpiled, stored or transported within the dripline of existing trees. The exception are trees with a trunk diameter of less than 4-in. as measured at 6 inches above the ground.
- B. Dust Nuisance: Assume full responsibility for alleviation or prevention of dust as a result of grading work.

PART 2 - PRODUCTS

- A. Not Applicable

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that the following items have been completed prior to commencement of finish grading:
 - 1. Installation of topsoil and soil preparation including debris removal.
 - 2. Incorporation of soil amendments.

3.2 INSTALLATION

- A. Finish Grading:
 - 1. Provide all grades for natural runoff of water without low spots or pockets. Accurately set flow line grades at 2 percent minimum gradient unless otherwise noted in Drawings.
 - 2. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface. Slope uniformly between given spot elevations.
 - 3. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or catch basins.
 - 4. Tops and toes of all slopes shall be rounded to produce a gradual and natural-appearing transition between relatively level areas and slopes.

B. Tolerances:

1. All planting areas, shall be true to grade within 1 in. when tested with a 10 ft. straightedge.
2. Hold finished grades below top of adjacent pavement, headers, curbs, or walls as follows:
 - a. Planting area: 2 inches.

END OF SECTION

SECTION 31 23 16 – STRUCTURE EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Excavating, subgrade preparation, and backfilling for foundations.
- B. Related Sections include the following:
 - 1. Section 03 30 00, Cast-in-Place Concrete.

1.2 REFERENCES

- A. Geotechnical Report “Geotechnical Investigation Report Proposed Paramount Ranch Rebuild Santa Monica Mountain National Recreation Area SAMO Los Angeles County, California”, dated June 25, 2021, and updated August 31, 2021 by Kleinfelder.
 - 1. Soil conditions are expected to consist of sandy clay and clayey sand.

1.3 DEFINITIONS

- A. Excavation: Removal of material encountered above subgrade elevations or removal of unsatisfactory material prior to placement of engineered fill.
- B. Engineered Fill: Satisfactory soil materials used for fill or backfill.
- C. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill.

1.4 SUBMITTALS

- A. Engineered fill materials.
- B. Inspection and compaction testing reports.

1.5 QUALITY ASSURANCE

- A. Provide the services of a geotechnical engineer to sample and test backfill material and engineered fill, and to observe subgrade preparation and backfill compaction in progress to verify compliance with requirements.
- B. If borrow materials are required for backfill, such materials shall be obtained from a source approved by the Contracting Officer to be weed-free.

1.6 PROJECT CONDITIONS

- A. Examine the site to become familiar with existing conditions.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil: Material shall be nearly free of organics (less than 3% by weight per ASTM D 2974) or other deleterious debris and less than 3 inches in maximum dimension. Oversize particles (larger than 3 inches) should be screened from excavated on-site soil prior to use as engineered backfill. See geotechnical report Table 5.3-1 for Soil Materials Test Procedures and maximum sieve size. Soil materials shall have a Liquid Limit less than 40 and Plasticity Index of 25 or less. Excavated soil from the excavations shall be assumed to be satisfactory soil and may be used for fill and backfill. Remove organic materials and oversize particles. On site soil may require drying or the addition of moisture prior to compaction.
- B. Unsatisfactory Soils: Soils not meeting the above criteria.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 1 to 3 percent of optimum moisture content at time of compaction.
- C. Engineered Fill: Satisfactory soil materials.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clear and grub to remove organic material at areas to be over-excavated to prepare for foundations.
- B. Remove disturbed soils associated with demolition of existing structures and utilities, loose soils, undocumented fills, and soils disturbed by burrowing animals.
- C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials and enclosures as necessary.
- D. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne.

3.2 EXCAVATION

- A. Excavate building pads to firm, undisturbed native soils, extending excavation 3 feet beyond the building pad at all sides.

- B. At foundations, provide additional excavation to indicated minimum depth for foundations if needed. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Scarify, moisture condition, and recompact subgrade at foundations as described in the Geotechnical Report.
- C. At slab on grade areas, scarify, moisture condition, and recompact subgrade described in the Geotechnical Report.
 - 1. Fill at slab on grade areas shall meet the requirements for engineered fill. Fill shall be moisture conditioned and compacted as indicated in Table 5.3-2 of the Geotechnical Report. Assume that 95% compaction will be required.
 - 2. Do not place engineered fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.3 APPROVAL OF SUBGRADE

- A. Notify Contracting Officer when subgrade preparation is to occur. Provide inspection of subgrade and compaction testing of each lift as indicated.
- B. If unsatisfactory material is present, continue excavation and replace with compacted engineered fill material as directed.

3.4 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Contracting Officer.

3.5 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and over-wetting.
 - 1. Stockpile soil materials away from edge of excavations.

3.6 BACKFILL

- A. Place engineered fill material in lifts not to exceed 8 inches in loose thickness, moisture condition to near optimum moisture content, and compact each lift to 95 percent relative compaction.
 - 1. Do not place engineered fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by more than 3 percent and is too wet to compact to specified percentage of maximum dry unit weight.

3.7 FIELD QUALITY CONTROL

- A. Provide inspection and testing of fill and backfill placement. Test each lift once for each 500 square feet of area.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, organic material, trash, and debris, and legally dispose of it off the property.

END OF SECTION 31 23 16

SECTION 31 23 33 - UTILITY TRENCHING AND BACKFILLING

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. Additional information concerning earthwork may be found in the geotechnical investigation report by Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountain National Recreation Area SAMO, Los Angeles County, California, June 25, 2021, prepared by Kleinfelder. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. Section includes:
 - 1. Trench Excavation
 - 2. Bedding Material
 - 3. Select Backfill Material
 - 4. Foundation Rock Fill Material
 - 5. Geotextile Filter Fabric
- B. Section excludes:
 - 1. Drainage fill material and placement around subdrains.
 - 2. Power, telecommunications, and low voltage scope of work.
- C. Related Sections:
 - 1. Section 31 30 00 - EARTHWORK AND GRADING
 - 2. Section 33 10 00 - WATER UTILITIES FOR POTABLE AND NONPOTABLE
 - 3. Section 33 30 00 - SANITARY SEWER
 - 4. Section 33 40 00 - STORM DRAINAGE UTILITIES
- D. Definitions
 - 1. Backfill: Material used to fill an excavation.
 - 2. Bedding: Well-draining material placed on the excavated subgrade in a trench upon which pipes or other elements of the Work is placed.
 - 3. Drain Rock: Coarse, well-draining rock used to fill over-excavated areas, particularly in soft soils or where groundwater may be present, to bring the grade up to indicated elevation.

4. Imported Fill: Suitable material that must be transported to the site due to inadequate availability of suitable native fill.
5. Over-Excavation: Removal of unsuitable material below the design depth of the excavation.
6. Pipe Zone: The area within a pipe trench wherein the pipe is considered to be particularly vulnerable to external forces. Generally, the pipe zone is described as from the bottom of the bedding layer to approximately an equal distance above the pipe. Upper and lower limits of the pipe zone are indicated on the Drawings and varies depending upon the size and material of the pipe. Where not otherwise indicated, pipe zone extends to one (1) foot above the top of pipe.
7. Rock Excavation: Solid rock material that cannot be excavated using conventional methods.
8. Select Material: Non-expansive soil material that is free from organic matter, debris and clumps, stones or clods larger than 3 inches as described in this Specification.
9. Subgrade: Uppermost surface of an excavation of the top surface of a fill or backfill upon which base or subbase material or constructed works are placed.

1.3 REFERENCES

A. ASTM International (ASTM)

1. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
2. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
3. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
5. ASTM E329 - Standard Specification for Agencies Engaged in the Inspection, Testing, or Special Inspection.

B. Caltrans Standard Specifications

C. CAL/OSHA, Title 8

D. Uniform Soil Classification System

1.4 SUBMITTALS

A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES

B. Submit material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds the specified requirements.

C. Samples for Verification: For each type of material, provide 1-quart sample (in jar or heavy duty ziplock bag).

- D. Submittals for bedding and backfill materials shall consist of certified documentation including soil analysis by the supplier that the materials to be furnished conform to the requirements of this section. Certification must be no less than 6 months old.

1.5 QUALITY ASSURANCE

- A. Contractor shall keep logs of trenching and backfilling activity. Logs will include date, depth, material, means of compaction, moisture content, compaction achieved and any other relevant information to verify satisfactory completion of the Work in accordance with these Specifications.
- B. The log shall be signed off by the Supervisor of the Work each day that trenching and backfilling occurs.
- C. Testing Agency: The supplier's certification will be acceptable as verification that the soil material provided by that supplier meets the requirements specified above. If the material properties are in dispute, the Contractor shall engage a qualified testing agency to evaluate soils properties. It is the Contractor's responsibility to provide materials that meet specification and to provide certified validation of the same.
- D. All material not placed in accordance with the Plans, these specifications and the recommendations set forth in the geotechnical reports, in the opinion of the Geotechnical Engineer shall be removed and properly replaced, at the Contractor's expense.
- E. All costs of re-testing, if required, shall be borne by the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. On-site excavated and imported materials shall be stockpiled at a location or locations designated by the Contracting Officer, so as not to damage existing improvements, landscaping or trees, or interfere with traffic and pedestrians. All soils materials, stockpiled on site shall be protected from excessive moisture, including from rain or surface sources.
- B. All soils materials stockpiled on site shall be protected from erosion and discharge to drainage structures. Soils shall also be protected from wind erosion.
- C. Stockpiled materials of different types shall be maintained separately and not allowed to mix.
- D. All excavated soil materials that are judged unsuitable for use as backfill in accordance with the provisions of this section, or as fill as specified in Section 31 30 00 - EARTHWORK AND GRADING, shall become the property of the Contractor and disposed of offsite.

1.7 PROJECT CONDITIONS

- A. Prior to commencement of trenching and excavation, the Contractor shall become thoroughly familiar with site conditions, in particular with all obstructions or constraints that may affect pipe or structure installation.

- B. If unforeseen above or below-ground conditions that could potentially affect the design or function of the project are encountered during performance of the work, Contractor shall investigate fully and submit a detailed, written report to the Contracting Officer before proceeding with any work in the vicinity of the unforeseen conditions. Contractor's operations shall be rescheduled as required to avoid unnecessary delays.
- C. Weather and Groundwater
 - 1. Contractor shall review the geotechnical report and any other available sources to understand the potential depth to groundwater and the need for subsurface dewatering.
 - 2. Surface water runoff shall not be allowed to enter any open trench and groundwater shall be continuously controlled as required to maintain dry conditions for pipe or structure installation. If the accumulation of water results in conditions that adversely affect the integrity of the trench bottom, trench bedding or trench backfill such that requisite compaction cannot be achieved in the opinion of the Contracting Officer, Contractor shall remove all affected bedding or backfill to competent subgrade and re-establish sufficiently dry conditions before proceeding with installation as described below under Execution.
 - 3. Provide adequate temporary drainage in the vicinity of pipe or structure installation to prevent erosion.
- D. Locate active utilities within the vicinity of the proposed work and protect from damage throughout project construction.
 - 1. The best available depiction of underground utilities and existing conditions has been provided on the Drawings, but no guarantee is made that this depiction is accurate or complete. The Contractor is advised to use the provided information with caution and to conduct their own investigation to confirm this information and/or identify any additional conflicts that may exist prior to commencement of the Work.
 - 2. It is the Contractor's responsibility to supplement the utility information shown on the plans by performing its own investigations and by engaging one or more utility locating services to field locate all existing utilities before beginning construction.
 - 3. Where existing utilities to remain in service conflict with or could potentially be damaged by proposed construction, Contractor shall locate by hand digging prior to performing major excavation.
 - 4. Where existing utilities not shown on the Plans are encountered; support, shore, and protect them and immediately notify the Contracting Officer. Existing utility services may be interrupted only with the Contracting Officer's written approval.
- E. Take all means necessary to control dust and noise on and near the project site in accordance with Los Angeles County requirements.
- F. The sequence of operations must be submitted to the Engineer for review prior to commencement of any Work by the Contractor.
- G. Safety
 - 1. It is the Contractor's responsibility to employ adequate and appropriate shoring of trenches.

2. It is the Contractor's responsibility to safeguard their employees and the public from hazards related to open trenches, per the requirements of Division 01.
3. Establish temporary traffic control and detours, for both vehicles and pedestrians, when trenching is performed in public rights-of-way or in areas open to public access. Relocate controls and reroute traffic as required during progress of work.
 - a. Do not advance open trenches more than 200 feet ahead of installed pipe.

PART 2 - MATERIALS

2.1 SUITABLE SOIL MATERIALS

- A. For projects outside of California, tables in PART 2 will need to be revised based on Local DOT Standards
- B. All soil materials shall be subject to acceptance by the Geotechnical Engineer. Descriptions below may be overridden by the Geotechnical Engineer.
- C. Bedding Material
 1. Bedding material shall be clean and free of organic material, debris, clay, cement or other contaminants.
 2. Bedding material for all plastic pipe and any type of pipe less than 4 inches in diameter shall be clean poorly graded coarse sand per Caltrans Standard Section 19-3.02F free of clay or organic material, meeting the following gradation requirements:

Coarse Sand	
Sieve size	% Passing
No. 4	90-100
No. 200	0-5

3. Bedding material for non-plastic pipes shall be ¾" Class 2 Aggregate Base per Caltrans Standard Section 26-1.02B. Material shall be crushed or angular stone that can be compacted to a firm well-draining base. Material shall have a minimum R-value of 78. Material shall meet the following grading analysis:

Class 2 Ag Base	
Sieve size	¾" Max
	% Passing
2"	-
1-1/2"	-
1"	100
¾"	87-100
No. 4	30-65
No. 30	5-35
No. 200	0-12

D. Pipe Zone Backfill:

1. Within the pipe zone, backfill material shall be clean, well-draining, poorly graded material free of clay, silt, organic material or debris.
2. Acceptable pipe zone backfill material includes the following:
 - a. Clean Coarse Sand as specified for pipe bedding for plastic pipe and pipes smaller than 4 inches in diameter.
 - b. 3/8-inch Pea Gravel for non plastic pipes: Clean, hard, semi-rounded stone, free from clay or organic material with the following gradation requirements:

3/8" Pea Gravel	
Sieve size	3/8"
	% Passing
1"	100
3/8"	95-100
4	0-30
200	0-2

E. Trench Zone Backfill:

1. Acceptable Trench Zone Backfill shall consist of clean, non-expansive, compactable soil, being free of clay, organic matter, debris and any clods, stones or other matter larger than 3 inches in diameter.
2. Trench Zone Backfill must meet the requirements of the Geotechnical Engineer, whether specified in the geotechnical report or any other means. No material rejected by the Geotechnical Engineer shall be incorporated into the trench.
3. Trench zone backfill may be suitable native fill or imported fill, provided it meets the requirements of this Specification and is acceptable to the Geotechnical Engineer.

F. Final Backfill:

1. Unless otherwise indicated on the Drawings, the final (top) 12 inches of fill to finished grade is deemed to be the final backfill zone.

G. Drain Rock:

1. Drain Rock: Drain Rock shall consist of Caltrans Class 2 Permeable Material.

2.2 UNSUITABLE MATERIALS

A. Unsuitable materials include the following:

1. Any material rejected by the Geotechnical Engineer;
2. Any material classified as CH, MH, OL or OH as defined by the Uniform Soil Classification System.
3. Any material containing debris, organic matter, large clods, rubble or stones.
4. Any expansive material or material containing clumps of clay.

2.3 UNDERGROUND PIPE MARKER AND IDENTIFICATION TAPE

A. Provide tape on 3-inch minimum width rolls with "CAUTION, BURIED (intended service) LINE BELOW" or similar wording printed continuously over the entire tape length. Color and printing shall be permanent, unaffected by moisture or soil.

1. Warning Tape Color Codes:

- a. Red: Electric.
- b. Yellow: Gas, Oil, Steam
- c. Orange: Telephone and Other Communications.
- d. Blue: Water Systems.
- e. Green: Sewer and Storm Systems.
- f. Purple: Reclaimed Water, Irrigation

2. Warning Tape for Metallic Piping:

- a. Acid and alkali-resistant polyethylene plastic tape.
- b. Minimum thickness of tape shall be 0.004 inches
- c. The tape tensile strength is in accordance with ASTM D882-80A and will not be less than 4100 MD (longitudinal direction) and 3650 TD (transversal direction).
- d. Elongation properties are in accordance with ASTM D882-80A and are less than 550% at break point.

3. Detectable Warning Tape for Non-Metallic Piping:

- a. Polyethylene plastic tape.
- b. Minimum thickness of the tape shall be 0.004 inches
- c. The tape tensile strength is in accordance with ASTM D882-80A and will not be less than 7800 PSI.
- d. Elongation properties are in accordance with ASTM D882-80A and are less than

- e. 150% at break point.
- f. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 36 inches deep.

PART 3 - EXECUTION

3.1 GENERAL

- A. The following procedures shall be followed by the Contractor in sequencing the Work:
 - 1. No more than one hundred fifty (150) feet of trench shall be left open at any time.
 - 2. The entire trench shall be backfilled, in accordance with this Section, to within fifty (50) feet of the end of pipe or structure at the end of each day.
 - 3. The trench shall not be backfilled until the Contracting Officer has found it to be acceptable.
 - 4. The Contractor shall have a Safety Plan in place that includes protection of workers and the public from falling into the trench, walking or placing equipment or materials close to the edge of an open trench, and provisions for dewatering or shoring as necessary. All Safety measures are the responsibility of the Contractor.
- B. Prior to placement in a trench, all pipe, fittings and appurtenances shall be inspected by the Contractor and any defective material shall be rejected.
- C. The Contractor shall prepare a clean, protected location for placement of all suitable excavated material. The Contractor shall maintain stockpiles in such a manner to prevent mixing of soil types and to prevent wash, erosion or discharge of soils to surface waters, drainage channels or adjacent properties, whether by water or wind erosion.
- D. Trench walls within the pipe zone shall be excavated to be as vertical as possible given the soil conditions.
- E. When utility piping is to be installed in fill areas, the fill shall be placed and compacted according to project requirements, then trench is excavated to install pipe. Minimum height of fill shall be placed and compacted to:
 - 1. Finished grade where wheeled equipment is used for compaction of fill material and utility piping is installed with less than 48 inches of cover.
 - 2. Finished grade where hand held equipment is used for compaction of fill material and utility piping is installed with 18 inches of cover or less.
 - 3. 48 inches above top of pipe (when installed) where wheeled equipment is used for compaction, and
 - 4. 18 inches above top of pipe where hand held equipment is used for compaction.
- F. Conform to Caltrans Standard Specifications Section 19 as modified by the Contract Documents.
- G. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

- H. The use of explosives will not be permitted.

3.2 TRENCH EXCAVATION

A. Obstructions:

1. Obstructions that do not require replacement shall be removed and discarded by the Contractor without additional compensation. Such obstructions may include tree roots, stumps or other organic material, abandoned piping, construction debris, etc.
2. For obstructions that must be left in place, the Contractor shall provide location and nature of the obstruction to the Engineer, who may authorize alternative alignment, provided it does not adversely affect the Work. Such obstructions may include footings of buildings to remain, trees to be protected, active utility lines, etc.

B. Trench Width:

1. Trenching operations shall be excavated to the width tolerances indicated in the drawings.
2. Minimum width of trench as indicated shall be maintained in all cases, regardless of size or type of pipe, soil conditions, depth of excavation or method of compaction.
3. Multiple pipes may only be installed in a common trench under the following conditions:
 - a. When installed in a benched trench as detailed in the drawings, and backfilled as indicated;
 - b. When backfilled with Controlled Density Fill, care must be taken to anchor the pipe in place to maintain correct vertical alignment.
4. Under all conditions, the trench width must be such that proper installation of the pipe can be achieved, including:
 - a. Elimination of point loadings on the pipe,
 - b. Maintenance of design line and grade,
 - c. Hollowing out sufficient areas for joints, bells, fittings and appurtenances, and
 - d. Adequate compaction of backfill beneath the haunch of the pipe.
5. Existing Portland Cement Concrete (PCC) or Asphalt Concrete (AC) areas: Cut PCC or AC to full depth at a minimum distance of 6 inches beyond the edge of the trench.

C. Trench Depth:

1. Unless otherwise noted on the Drawings, all utility piping shall be installed with a minimum 36 inches of cover.
2. Where it is not possible to achieve the minimum cover described above, the Contractor shall submit a proposed design for bridging/protecting the pipe.
3. Trench shall be excavated to a depth sufficient to install the pipe to established grade with adequate compacted bedding provided, per Drawing details and requirements identified by the Geotechnical Engineer.

4. If the Geotechnical Engineer requires over excavation below established grade or alternative or different bedding than identified in the Drawings, the requirements of the Geotechnical Engineer will govern. See the paragraph below on over-excavation.

D. Over-Excavation:

1. If the soil conditions at the trench bottom are found to be unsuitable to support the pipe, whether due to presence of water, soft soils, roots or rock protrusions, the Contractor may be required by the Geotechnical Engineer to over-excavate to remove sufficient amounts of unsuitable material to provide sound pipe bedding.
2. Replacement fill material and compaction requirements shall be as directed by the Geotechnical Engineer.
3. The Contractor will not be compensated for excavation beyond the limits specified in the Drawings unless directed to do so by the Engineer in writing and provided with specific limits of the over-excavation.

3.3 CONTROL OF WATER AND DEWATERING

- A. Contractor to be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of the Geotechnical Consultant until backfilling is completed.
- B. Dewater during backfilling operation so that groundwater is maintained at least one foot below level of compaction effort.
- C. Obtain the Geotechnical Consultant's approval for proposed control of water and dewatering methods.
- D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- E. Maintain dewatering system in place until dewatering is no longer required.

3.4 BRACING AND SHORING

- A. Conform to State and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

- C. Contractor to be solely responsible for all bracing and shoring and, if requested, submit details and calculations to the Contracting Officer. The Contracting Officer may forward the submittal to the Geotechnical Consultant, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Contracting Officer.
- D. Contractor to be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.5 BEDDING

- A. Unless otherwise specified, all buried utility piping shall be placed on bedding as shown in the Drawings.
- B. Bedding shall be placed to the depth indicated on the drawings (in no event less than 4 inches).
- C. Bedding shall be compacted to 95% relative density prior to placement of pipe.
- D. At the location of bells, flanges, fittings, or appurtenances, the bedding shall be hand excavated to accommodate the shape of the fitting and to allow the full length of the pipe to rest firmly on the bedding or trench bottom.
- E. Where native soils are suitable and direct placement of pipe trench bottom is permitted, the trench bottom shall be:
 - 1. Undisturbed native soil or compacted fill;
 - 2. Smooth and flat and excavated to established grade;
 - 3. Free of obstructions or protrusions or sharp edges, remove any obstructions;
 - 4. Completely free of roots or other organic material;
 - 5. Hand excavate the trench bottom at the location of bells, flanges, fittings, etc. to assure the full length of the pipe is in contact with and supported by the trench bottom.

3.6 PIPE INSTALLATION

- A. Install pipe, fittings and appurtenances per relevant Specification Section and in accordance with manufacturer's recommendations.
- B. Provide support for the pipe as needed to prevent movement and maintain line and grade during placement, installation, testing and backfill. Use non-degradable materials for supporting the pipe if it is to be left in place.

3.7 INSPECTION PRIOR TO BACKFILL

- A. The Contractor shall provide adequate opportunity for the Engineer to observe all welds, coatings, polyethylene sleeves, installation of all appurtenances, wall penetrations, vaults and manholes and all other items connected to buried pipelines prior to backfill.
- B. Provide minimum 72-hour notice to the Engineer of when pipe installation shall occur.
- C. Whenever possible, the installed pipe shall be backfilled the same day that it is installed. Any trench that is not backfilled prior to end of the work day shall be secured with barricades and covering sufficient to bear a minimum of 600 lbs. live load.

3.8 PIPE ZONE BACKFILL

- A. Carefully place backfill material on each side of the pipe. Do not drop backfill material directly on pipe.
- B. Backfill in low lifts and on both sides of the pipe to prevent shifting the pipe out of alignment. Make sure all voids are filled under the pipe, vibrating or hand compacting material in small lifts as appropriate.
- C. Bring backfill material up to the springline on both sides of pipe and carefully compact evenly on both sides of pipe before backfilling above springline.
- D. Complete backfilling within pipe zone, as shown on Drawings, by carefully placing backfill material on either side of pipe in low lifts and hand compacting until backfill of pipe zone is complete.

3.9 TRENCH ZONE BACKFILL

- A. Once backfill is complete within the pipe zone, trench zone backfilling shall commence.
- B. Trench zone backfill shall consist of any suitable fill material that can be compacted to 90% relative density.
- C. Backfill shall be gently placed in maximum 8" lifts and compacted by hand methods until 36 inches of cover has been achieved.
- D. Once 36 inches of cover has been achieved, compaction may be completed in the trench zone using wheeled equipment.

3.10 FINAL BACKFILL

- A. The final backfill, as indicated in the Drawings, consists of the top 12-inch layer of soil or material to achieve finished grade.
- B. In landscape areas, topsoil shall be placed for the top 12 inches, or as indicated in the Landscape Drawings.

- C. In paved areas, the final lift of soil shall be compacted to minimum 95% relative density. Sub-base and base material as indicated in the Drawings shall be placed and compacted and indicated pavement placed to finish grade.

3.11 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Contracting Officer.

END OF SECTION 31 23 33

SECTION 31 30 00 - EARTHWORK AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Additional information concerning earthwork may be found in the geotechnical investigation report by Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountain National Recreation Area SAMO, Los Angeles County, California, June 25, 2021, prepared by Kleinfelder. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil Materials
 - 2. Excavation
 - 3. Backfilling and Compacting
 - 4. Grading
- B. Related Sections:
 - 1. Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
- C. Definitions:
 - 1. Backfill: Material used to fill an excavation.
 - 2. Dewatering: Removal of all standing water as well as water seeping into an excavation to maintain conditions suitable to continue the Work. Dewatering activities normally include over-excavation and placement of drain rock within an excavation to support required activities and/or equipment. The Contractor is responsible to maintain conditions suitable for the ongoing work.
 - 3. Foundation Rock Fill: Coarse, well-draining rock used to fill over-excavated areas, particularly in soft soils or where groundwater may be present, to bring the grade up to indicated elevation. Also referred to as "Drain Rock".
 - 4. Imported Fill: Suitable material that must be hauled in from off-site borrow areas.
 - 5. Engineered Fill: Soil excavated from site or imported which conform to the requirements for fill material contained in geotechnical report for this project.
 - 6. Subgrade: Top of the excavated or filled ground surface immediately below hardscape pavement sections, which include the aggregate base and/or drain rock layers underlying the surface pavement.

7. Suitable Material: Soil material that meets the required specifications for its intended purpose as described in this Specification and on the Drawings.
8. Native Backfill: Native Soil that has been excavated on-site, identified as meeting the requirements for use as a backfill material. It has had all organic material, rocks of unacceptable size, and any other deleterious material removed, and protected from contamination while being stockpiled on site.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.
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 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 (2,700 kN-m/m³).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
7. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Division 1 - GENERAL REQUIREMENTS. Submittals will be required for all imported materials to be used in the prosecution of work described in this Section. No imported materials shall be brought on site prior to approval by the Engineer. On-site borrow materials suitable for use on this project will be identified in the field by the Engineer.
- 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 fill materials suppliers.
- D. Submittals for engineered fill borrow material shall consist of a representative sample of the proposed material for evaluation by the Engineer, and a certified gradation analysis.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with:

1. State of California Business and Transportation Agency, California Department of Transportation (CDT, Caltrans) "Standard Specifications" (Caltrans Standard Specification)
2. State of California Code of Regulations (CCR)
3. State of California Construction Safety Orders, Latest Edition (CAL/OSHA) Los Angeles County Department of Public Works, Standards and Specifications and Drawings, latest edition.

B. Soil Testing:

1. A Geotechnical Engineer will be retained by the Contractor to provide compaction testing and inspection as needed to ensure proper material placement during all earthwork operations,
2. Test results will be distributed in compliance with Division 01 Specifications.

C. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. On-site excavated and imported materials shall be stockpiled at a location or locations designated by the Contracting Officer, so as not to damage existing improvements, landscaping or trees, or interfere with traffic and pedestrians. All soils materials, stockpiled on site shall be protected from excessive moisture, including from rain or surface sources.

B. All soils materials stockpiled on site shall be protected from erosion and discharge to drainage structures. Soils shall also be protected from wind erosion.

C. Stockpiled materials of different types shall be maintained separately and not allowed to mix.

D. Take all means necessary to control dust and noise on and near the project site in accordance with applicable requirements of the local authority having jurisdiction.

E. Surplus Materials:

1. All excavated soil materials that are judged unsuitable for use as engineered or non-engineered fill, as well as all suitable material not needed for fill or slope modifications, shall become the property of the Contractor and be disposed of offsite.
2. All construction materials and debris encountered in preparing the project site for filling and grading shall become the property of the Contractor, who shall properly dispose of them offsite

1.7 PROJECT CONDITIONS

A. Review the project geotechnical report for the following:

1. The material to be used for the proposed work.
2. Ground water elevations.

B. Environmental Requirements:

1. Comply with the project SWPPP.
2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by grading and surface compaction as necessary to avoid collection of water.
3. Provide adequate temporary drainage to prevent erosion.
4. After interruption, reestablish specified compaction in last layer placed before resuming work.

C. Locate active utilities within the vicinity of the proposed work and protect from damage throughout project construction.

1. Where existing utilities not shown on the Plans are encountered; support, shore, and protect them and immediately notify the Contracting Officer. Existing utilities may be interrupted only with the Contracting Officer's written approval.
2. It is the Contractor's responsibility to supplement the utility information shown on the Plans by scheduling the field location of all existing utilities by a utility locating service before beginning construction.
3. Where existing utilities conflict with or could potentially be damaged by proposed construction, Contractor shall locate by hand digging prior to performing major excavation.

D. Protections of open excavations

1. It is the Contractor's responsibility to safeguard his employees and the public from hazards related to open trenches or excavations, per the requirements of Division 01.

E. Protection of Subgrade

1. Do not allow construction equipment to pump or rut prepared subgrade, stripped areas, or footing excavations. Consult Geotechnical Engineer for allowable temporary measures as needed.

F. The sequence of operations must be reviewed and approved by the Engineer prior to commencement of any work by the Contractor. Coordinate operations with other construction activities, such as relocation of existing utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Requirements:

1. All soil materials shall be subject to acceptance by the Geotechnical Engineer.

2. Notify the Contracting Officer at least 7 days in advance of any imported fill material that requires testing from the borrow area.
- B. Base Course: Aggregate base for use under asphalt pavements, standard concrete paths, and concrete structures shall be Caltrans Standard Specification Section 26, Class 2 Aggregate Base rock, 3/4" size. Aggregate base materials shall consist of virgin rock aggregates only from an established quarry, unless certification can be provided that any proposed recycled materials are free of hazardous and/or deleterious contaminants. The Contractor should provide written certification and supporting test data from a licensed environmental professional stating that the recycled materials are free of hazardous and/or deleterious contaminants.
 - C. Drain Rock: shall consist of Caltrans Class 2 Permeable Material Local Jurisdiction's permeable material designation and DOT.
 - D. Engineered Fill Material: On-site excavated subsoil (not topsoil) or imported soil that is predominantly granular and non-expansive, free of debris, waste, frozen materials, vegetation or deleterious matter; and meeting the following criteria:
 - E. 1. Satisfy the following gradation:

<u>U.S. Sieve Size</u>	<u>Percentage Passing (Dry Weight Composition)</u>
3-inch	100
No. 4	35-100
No. 30	20-100
 2. Organic Content (ASTM D-2974) shall be less than 2 percent.
 3. Plasticity Index not exceeding 15
 - F. Imported Fill: Imported fill shall be non-expansive granular soil, free of organic matter and debris, and have a maximum Plasticity Index of 25 and a maximum Liquid Limit of 40 as determined by ASTM D4318.
 - G. Native Fill: Approved native materials shall have a plasticity index between 5 and 25 input, an expansion index not exceeding 41 as determined by UBC Specification 29-2, and a particle size not exceeding 3 inches as determined by ASTM D422.
 - H. Topsoil: Where the composition of imported topsoil is not specified on the Plans or in the landscape specifications, it shall consist of a uniform mix of sand, silt and viable organic matter. On-site topsoil shall consist stockpiled material obtained from excavation of the upper 6-inches of soil within vegetated areas on the existing site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.

- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify subgrade surface to depth of 8 inch.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

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, and site structures.
- C. Slope banks with machine to angle of repose or less until shored
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Trim excavation. Remove loose mat
- G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
- H. Notify Contracting Officer of unexpected subsurface conditions.
- I. Correct areas over excavated with suitable material and as directed by Contracting Officer.
- J. Remove excess and unsuitable material from site.
- K. Repair or replace items indicated to remain, damaged by excavation.

3.3 BACKFILLING AND COMPACTING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place material in continuous layers as follows
 - 1. Maximum 8 inch compacted depth.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Do not backfill against unsupported foundation walls.

- G. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.
- H. Make gradual grade changes. Blend slope into level areas.
- I. Remove surplus backfill materials from site.
- J. Leave fill material stockpile areas free of excess fill materials.
- K. Compact as required in geotechnical report.

3.4 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - QUALITY REQUIREMENTS: Field inspecting, testing, and adjusting
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698, or AASHTO T180, as applicable
- C. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
- D. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D6938, whichever is applicable
 - 2. Moisture Tests: ASTM D6938.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Frequency of Tests as determined by Geotechnical Engineer:

3.6 PROTECTION

- A. Protect newly graded areas from traffic and erosion. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer's recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completion of construction. Keep free of trash and debris.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION 31 30 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Additional information concerning earthwork may be found in the geotechnical investigation report by Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountain National Recreation Area SAMO, Los Angeles County, California, June 25, 2021, prepared by Kleinfelder. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. Section Includes:
 - 1. Asphalt materials.
 - 2. Aggregate materials for asphalt mix.
 - 3.
 - 4. Asphalt paving overlay.
 - 5. .
 - 6. Surface Slurry.
- B. Related Sections:
 - 1. Section 31 22 00 - EARTHWORK AND GRADING

1.3 REFERENCE

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
- B. Asphalt Institute (AI):
 - 1. MS-2 (2015) - Asphalt Mix Design Methods.
- C. ASTM International (ASTM):
 - 1. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).

2. ASTM D3666 - Specifications for Minimum Requirements for Agencies Testing and Inspecting Road Paving Mixtures.
3. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
4. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications (2018):

1. Section 26: Aggregate Bases.
2. Section 39: Asphalt Concrete.
3. Section 92: Asphalt Binders.
4. Section 94: Asphaltic Emulsions.
5. Section 96: Geosynthetics.

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each asphalt concrete mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

- A. Mixing Plant: Certified by Caltrans.
- B. Obtain materials from same source throughout.
- C. Perform Work in accordance with Caltrans.
- D. Maintain one copy of each document on site.
- E. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Ambient conditions control facilities for product storage and installation.
- C. Environmental Limitations:
 1. Prime Coat: Minimum surface temperature of 60 deg F at application.
 2. Tack Coat: Minimum surface temperature of 60 deg F at application.

3. Asphalt Concrete: Minimum atmospheric temperature of 50 deg F and when base is dry at application.
4. Reinforcing Fabric: Air temperature is 50 deg F and rising and pavement temperature is 40 deg F and rising.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Asphalt Materials:

1. Asphalt Binder: Performance Graded in accordance with Caltrans Standard Specification Section 92, PG64-10.
2. Prime Coat: Caltrans Standard Specification Section 92, MC-70.
3. Tack Coat: Caltrans Standard Specification Section 94, SS1 or SS1h.

B. Aggregate Materials:

1. Aggregate gradation per Caltrans Standard Specifications Section 39 - 2.02B(4)(b).
 - a. Provide single course and use ½" gradation for pavement thickness up to 2-½"
 - b. Provide double course for pavement greater than 2-½" thickness.
 - 1) Use ½" for wearing coarse
 - 2) Use ¾" gradation for binder coarse

2.2 MIXES

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Paving Mixtures: Designed in accordance with Caltrans Type A Hot Mix Asphalt (HMA) with maximum 30 percent by weight reclaimed asphalt pavement.

2.3 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene. Mirafi 500X or approved equivalent. Geotextile fabric to conform to Caltrans Standard Specifications Section 96.
- B. Sealant: ASTM D6690; hot applied type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 73 40 - EXECUTION : Requirements for installation examination.

- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify compacted subgrade and subbase is dry and ready to support paving and imposed loads.
- D. Verify gradients and elevations of base are correct.
- E. Verify gutter drainage grilles and frames, manhole frames, and utility structures are installed in correct position and elevation.

3.2 PREPARATION

- A. Prepare subbase in accordance with Section 31 30 00 - EARTHWORK AND GRADING.

3.3 DEMOLITION

- A. Saw cut and notch existing paving as indicted on Drawings.
- 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. Primer
 - 1. Apply primer in accordance with Caltrans Standard Specification Section 39.
- B. Tack Coat:
 - 1. Apply tack coat in accordance with Caltrans Standard Specification Section 39
 - 2. Apply tack coat to contact surfaces of curbs, gutters and all other vertical surfaces.
 - 3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.
- C. Double Course Asphalt Paving (2-½" or greater)
 - 1. Place asphalt binder course within 24 hours of applying primer or tack coat.
 - 2. 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.
 - 3. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
 - 4. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- D. 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.

E. 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. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch
- C. Variation from Indicated Elevation: Within 1/2 inch.
- D. Pavement Surface Gradients:
 1. Pavement gradients shall not exceed accessibility code requirements for maximum longitudinal and cross-slopes per the Plan.
 2. Pavement gradients shall not be less 1%.
 3. Contractor shall notify Contracting Officer's Representative if minimum and/or maximum slopes cannot be achieved as indicated on the Drawings prior to further pavement installation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will select a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

3.7 PROTECTION

- A. Section 01 73 40 - EXECUTION: Protecting finished work.
- B. Immediately after placement, protect paving from mechanical injury for 48 hours or 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 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. Additional information concerning earthwork may be found in the geotechnical investigation report by Geotechnical Investigation Report, Proposed Paramount Ranch Rebuild, Santa Monica Mountain National Recreation Area SAMO, Los Angeles County, California, June 25, 2021, prepared by Kleinfelder. All requirements of this report shall be followed unless noted otherwise.

1.2 SUMMARY

- A. Section Includes:
 - 1. Reinforcement
 - 2. Concrete materials
 - 3. Concrete mixes
 - a. Concrete parking areas and roads.
 - 4. Joint Sealers
- B. Related Requirements:
 - 1. Section 31 30 00 - EARTHWORK AND GRADING.

1.3 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 Welded Deformed Steel Bar Mats for Concrete Reinforcement.

2. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. ASTM C33 - Standard Specification for Concrete Aggregates.
5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
9. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
10. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
11. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
12. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
13. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
14. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
15. ASTM D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
16. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications (2018):

1. Section 26: Aggregate Bases.
2. Section 40: Concrete Pavement
3. Section 90: Concrete.

1.4 SUBMITTALS

A. Submittal procedure shall be as outlined in Division 1 - GENERAL REQUIREMENTS.

B. Product Data, including but not limited to:

1. Aggregate base course.
2. Reinforcement
3. Concrete materials
4. Concrete mixes
 - a. Concrete sidewalks.
 - b. Concrete integral curbs and gutters.
 - c. Concrete parking areas and roads.
5. Joint
 - a. Filler
 - b. Bond breaker backer rod
 - c. Sealant

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.
 - b. Set accelerators and set retarders.
2. Compression test data (field experience method) or results of testing (trial batch method) used to establish mix proportions
3. Identify mix ingredients and proportions, including admixtures.
4. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship

1. Build a 4' x 4' mockup on site. If location not indicated, as directed by Contracting Officer.
2. Notify Contracting Officer seven days in advance of dates and times when mockups will be constructed.
3. Obtain approval from Contracting Officer before starting mockup construction.
4. Demolish and remove approved mockups from site when directed by Contracting Officer.

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

1.5 QUALITY ASSURANCE

- A. Perform Work according to ACI 301.
- B. Obtain cementitious materials from same source throughout.
- C. Perform Work in accordance with Caltrans Standard Specifications.
- D. Maintain one copy of each document on site.

1.6 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 approved by manufacturer.

1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

- B. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS: Ambient conditions control facilities for product storage and installation.
- C. Environmental Limitations:
 - 1. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
 - 2. Do not place concrete with travel time which exceeds 90 minutes from mixing plant to the construction site.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS:

- A. Cement: ASTM C150, Type II - (Modified) Portland type per Caltrans Standard Specification Sections 90-2.02B
- B. Aggregates: ASTM C33, ½" max combined aggregate gradation per Caltrans Standard Specifications Section 90 - 1.02C(4)(d).
- C. Water: ASTM C94/C94M; potable, conforming to Caltrans Standard Specifications Section 90-2.03 for mixing and curing portland cement concrete and washing aggregate.
- D. Air Entrainment: ASTM C260.
- E. Chemical Admixture: ASTM C494/C494M.
- F. Fly Ash: ASTM C618 Class F.
- G. Color Pigment: Per Landscape Architect.

2.2 CONCRETE MIXES

- A. Concrete Mix:
- B. Performance / Design Criteria:
 - 1. Mix concrete according to ACI 304. Deliver concrete according to ASTM C94/C94M.
 - 2. Provide concrete to the following criteria:
 - a. Materials per Caltrans Specifications Section 90-1.02.
 - b. Compressive Strength: 3500 psi at 28 days.
 - c. Slump: 3 to 5 inches ASTM C143/C143M.
 - d. Maximum Water/Cement Ratio: 0.45.
 - 3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

- a. Air Content: 4-percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size per ASTM C173/C173M.
- 4. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing admixture, water-reducing and retarding admixture in concrete, as required, for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.3 REINFORCEMENT

- A. Deformed Reinforcing: Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.

2.4 JOINTS

- A. Unless noted otherwise herein or on the Drawings expansion joint width shall be as follows:
 - 1. Curbs, Curb Ramps, Sidewalks, Driveways and Gutter Depressions: 3/8-inch.
 - 2. Gutter Lining, Ditch Lining and Channel Lining: 1/2-inch.
 - 3. Structures: As indicated.
- B. Joint Fillers: Material for expansion joints in Portland cement concrete improvements shall be pre-molded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.
- C. Bond Breaker Backer Rods:
 - 1. Material shall be compressible closed cell polyethylene and shall have diameter of 25-30% larger than joint width or per manufacturer's recommendations.
- D. Use Type 1 sealant rated 50 percent extension at 0 degrees F (minus 18 degrees C) for moderate climates. Use Type IV sealant rated 200 percent extension at minus 20 degrees F (minus 29 degrees C) for very cold climates. Use Type II or Type III sealants rated 50 percent extension at minus 20 degrees F (minus 29 degrees C) for other climates.
- E. Joint Sealers: ASTM D6690, Type I; hot applied type.

2.5 SOURCE QUALITY CONTROL

- A. Provide mix design per Section 01 33 23 SUBMITTAL PROCEDURES 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.
 - 1. Test samples according to ASTM C94/C94M and ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify compacted subgrade and subbase is dry and ready to support paving and imposed loads.
 - 1. Verify gradients and elevations of base are correct.
- B. Verify gutter drainage grilles and frames, manhole frames, and utility structures are installed in correct position and elevation.

3.2 PREPARATION

- A. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.
- B. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

- A. Base Course:
 - 1. Aggregate Base Course: Install as specified in Section 31 30 00 - EARTHWORK AND GRADING.
- B. 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.
- C. Reinforcement:
 - 1. Place reinforcing as indicated on Drawings.
 - 2. Place dowels and reinforcing to achieve paving and curb alignment as detailed.
- D. Placing Concrete:
 - 1. Place concrete according to Caltrans Standard Specifications Section 40: Concrete Paving.
- E. Joints

1. Unless otherwise shown on plans, at vertical curbs, flush curbs, and curb and gutters, provide expansion joints at 20 foot intervals, beginning and end of curves, and adjacent to structures. Align curb, gutter, and sidewalk joints.
 - a. Place joint filler between paving components and building or other appurtenances.
 - b. Recess top of filler 1/4 inch for sealant installation, unless otherwise shown on Drawings.
 - c. Expansion joints shall be 3/8" wide
2. Unless otherwise shown on plans, at vertical curbs, flush curbs, curb and gutters, and between sidewalks and curbs provide control joints at 10 foot intervals. Align curb, gutter, and sidewalk joints.
 - a. 1/4 the thickness of the concrete in depth.
 - b. 1/8-inch maximum width.
3. Provide keyed joints as indicated.

F. Finishing:

1. Sidewalk Paving: Light broom.
2. Median Barrier: Light broom.
3. Curbs and Gutters: Light broom.
4. Direction of Texturing: Transverse to predominant travel direction in pavement.
5. Exposed Stairs: Scratched.
6. Place curing compound on exposed concrete surfaces immediately after finishing.

G. 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. Cure surfaces according to Caltrans Standard Specifications Section 90-1.03B.

3.4 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- B. Maximum Variation from True Position: 1/4 inch.
- C. Pavement Surface Gradients:
 1. Pavement gradients shall not exceed accessibility code requirements for maximum longitudinal and cross-slopes per the Plan.
 2. Pavement gradients shall not be less 0.5% unless otherwise shown in Drawings.
 3. Contractor shall notify Contracting Officer if minimum and/or maximum slopes cannot be achieved as indicated on the Drawings prior to further pavement installation.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will select a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Contracting Officer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Contracting Officer.
- E. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

3.6 PROTECTION

- A. Section 01 73 40 - EXECUTION : Protecting finished work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 15 00- AGGREGATE SURFACING

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 aggregate surfacing, complete, as shown, and as specified for the following:
 - 1. stabilized DG aggregates, exposed at the surface.

1.3 REFERENCES

- A. Standard Specifications - Standard Specifications of the US Department of the Interior.
- B. ASTM - American Society for Testing and Materials.

1.4 DEFINITIONS

- A. Percent Compaction: ASTM D1557, percentage of the maximum in-place dry density of the same material as determined by Soils Engineer.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's current catalog cuts and specifications for the following:
 - 1. Product data for all loose aggregates, stones, cobbles, river rocks, chip seal paving top course and loose topping, etc. Indicate all sizes, colors, and finishes.
 - 2. Organic-Lock™ organic binder
 - 3. Base aggregate materials as necessary.
- B. Samples:
 - 1. One gallon for each type, size, and color range of all aggregate surfacings as shown in the drawings.
- C. Test Reports: Certified copies of field tests of compressive strengths of stabilized aggregate surfacing.

1.6 QUALITY ASSURANCE

- A. Qualifications: Submit certified documentation of successful experience of no less than three 3 years in the installation of similar aggregate surfacing.

- B. Mock-Up: One 1 - 4 ft. x 4 ft. x thickness shown on Drawings for each aggregate surfacing type, to remain at job site until Final Acceptance. Include all accessories including any base materials and gravel retainment system as applicable.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect aggregate from contamination with foreign materials. Isolate stockpiles to prevent mixing of different aggregate grades. Prevent contamination with organic materials.
- B. Store headers on pallets Protect wood from dampness. Bent, kinked or gouged steel header will be rejected.
- C. Deliver perishable materials in original, unopened packaging. Protect from dampness.

1.8 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Do not install Crushed aggregate during rain or while subbase is wet from rain. Do not apply soil sterilant when winds exceed 10 mph or during or after rain.
- B. Existing Conditions: For protection of existing plants to remain, see Division 2, Section “Tree Protection and Trimming”.

1.9 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install work under this section prior to acceptance of subgrade preparation under another section.
- B. Coordination: Coordinate with other trades to insure the following:
 - 1. Concrete Paving: To be installed prior to aggregate surfacings.

1.10 MAINTENANCE

- A. Service: Immediately repair all damage to the work as the result of weather or traffic conditions. Report all damage resulting from work of other trades after acceptance of aggregate surfacing work. Repair to match adjacent undisturbed work.

PART 2 - PRODUCTS

2.1 Materials

- 1. Comply with MTO OPSS 1010 – “Material Specification for Aggregates – Granular A, B, M and Select Subgrade Material” specification for Granular A material.
- A. Crushed Aggregate Materials:
 - 1. Crushed Aggregate Material shall consist of sound, angular, durable particles.
 - 2. Gradation, in accordance with ASTM C136:

Sieve	Sieve Size (mm)	Percent Passing
1/2"	12.7	100
3/8"	9.51	90-100
4	4.76	50-100
30	0.595	25-55
100	0.149	10-25
200	0.074	5-18

- Aggregate color shall be selected from a pre-approved material pallet from Gail Materials 951-667-6106, www.gailmaterials.net.

B. Organic Binder:

- Organic-Lock™ self-healing organic binder provided by Gail Materials, Corona, CA; phone 951-667-6106; fax 951-667-6102; www.gailmaterials.net.
- Requests for substitutions will be considered in accordance with provisions of section 01 25 00 "Substitution Procedures"
- Mix rate of Organic-Lock depends on the selected material as well as the application and shall be determined by Gail Materials.

E. Accessories:

- Water: Free from contaminants that would discolour or be deleterious to stabilized aggregate paving.

PART 3: EXECUTION

3.1 Examination

- Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

3.2 Preparation of Subgrade

- Excavate to depth required so that finish grade can be established as noted on plans.
- Compact subgrade to 95 Modified Proctor Density. Excavate soft and unstable areas of subgrade that cannot be compacted to standard noted, fill and compact with approved granular material.

3.3 Base Course

- Place base course material over subgrade to depths and dimensions shown on drawings in maximum (6") lifts compacted to 95% Modified Proctor Density.

3.4 Pre-blended Organic Lock™ Aggregate Surfacing

- For areas of vehicular use or equal install Organic Lock™ Aggregate Paving to a compacted depth of 6 inches.

- E. For areas of vehicular use of compacted depths of 6 inches or greater shall be installed at 3 inch compacted lifts. Estimated compacted max density is +/- 129 lbs/cu. ft. The moisture percentage in the prewetted Organic Lock Aggregate Paving will be determined by Gail Materials and will depend on selected aggregate.
- F. For applications that are not prewetted by Gail Materials the Organic Lock Aggregate Paving will be delivered dry. Gail Materials will calculate the required gallons of water to be added per ton of selected material in order to reach the ideal moisture percentage for installation. In order to ensure that water is being applied correctly the Organic Lock Aggregate Paving shall be bucket blended or equal prior to spreading. Gail Materials does not recommend installing Organic Lock Aggregate Paving in place and then watering in either lifts or from the surface down.
- G. Depending on weather conditions, the time required to allow the material to set-up before it can be compacted varies. Generally, this time period is between 6 and 48 hours. The top layer should be firm and not sticky. Compaction can begin when you can walk on the material without significantly sinking in and material does not feel muddy. If material sticks to the roller during compaction, allow the material to further dry. Do not allow the material to completely dry out.
- H. Make 4-6 passes using a 1-10 ton double or single static drum roller, or equivalent. Do not use a vibratory compactor or vibratory setting on the compactor. The Contracting Officer shall select the proper size roller for the appropriate application.
- I. After final compaction, the surface shall be true to elevation and shall not vary by more than (1/4") tested with a straight edge at any location on the surfaces. Surfaces can either be crowned at a minimum of 2" and/or installed with a cross slope of minimum 1%.
- J. Compaction testing shall not be conducted until the Organic Lock Aggregate Paving has been allowed to thoroughly dry and cure.

3.5 Adjust and Clean

- A. All paved areas or adjacent surface shall be brushed clean and excess materials shall be removed from the work site and disposed of in an approved dump location.

3.6 Protection

- A. Do not allow traffic on stabilized crushed aggregate paving after placement or until compacted stabilized crushed aggregate paving has fully cured. This time may vary depending on weather conditions.
- B. Protect stabilized crushed aggregate paving surface from damage until Project completion. Repair damaged areas to match specified requirements.

3.7 Maintenance Repairs

- A. Loose aggregate will appear on the surface over time and is a natural occurrence. If excess material becomes loose, redistribute the material over the surface, water thoroughly and re-compact with a minimum 1-ton drum roller.
- B. To repair, excavate damaged area and scarify exposed stabilized crushed aggregate paving. Pre-blend replacement crushed aggregate material with Organic-Lock™ Aggregate Paving at the specified rate. Apply material to the excavated area and compact. Thoroughly water the material and allow the material to cure, but not completely dry out. Re-compact the material, ensuring that the final grade and crown are maintained. Do not use a vibratory compactor.

2.2 FIELD QUALITY CONTROL

- A. Tests: For each lift, have the testing laboratory verify the degree of compaction. Recompact failed areas until specified compaction is achieved. Testing to be paid for by Contracting Officer.

2.3 PROTECTION

- A. Protect the paving against traffic, injury or defacement, or damage by rain during curing period for cement-stabilized aggregate surfacing and subsequent construction operations until Final Acceptance.

END OF SECTION

SECTION 32 33 00 - SITE FURNISHINGS

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 site and street furnishings, and install complete, including footings, fittings and materials, as shown, and as specified.
- B. Unit Pricing:

<u>Item</u>	<u>Unit Pricing</u>
Prefabricated Item	Each

1.3 REFERENCES

- A. "Standard Specifications" - Standard Specifications of the State of California, Business and Transportation Agency, Department of Transportation, CALTRANS.
- B. ACI - American Concrete Institute Manual of Concrete Practice
- C. ASTM - American Society for Testing and Materials
 - ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - ASTM D 523 – Standard Test Method for Specular Gloss.
 - ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100 Relative Humidity.
 - ASTM D 3359 – Standard Test Methods for Measuring Adhesion by Tape Test.
 - ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
 - ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, and finishing options for the following elements:
 - PTDF Bollard Post
 - Light Post

- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions. Structural Engineer's stamp for the Light Post

- C. Samples: Color and finish for each type of furnishing.

Wood Finish: 1 in. x 4 in. x 8 in. sample with (stain) (clear finish) as specified.

Metal Pole finish to match Pole light housing, See Lighting Drawings and Specifications

- D. Contract Closeout Submittals:

Maintenance Data and schedule:

- a. PTDF Bollard Post
- b. Light Post

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Show not less than five (5) years successful and continuous experience in work of the type(s) shown on the Drawings.

- B. Custom Fabricated Elements Manufacturer's Qualifications:

Provide 5 similar reference projects with direct contact information.

Product Support: Products are supported with complete engineering drawings.

Base Worth: An installed base of products worth in excess of one hundred million dollars.

Insurance: Liability insurance coverage of two million dollars

Manufacturing Lead Time: Manufacturing lead time will be determined at time of order.

Facility Operator: Welders and machine operators are certified for all AWS ASTM standards that apply.

- C. Approved equal must be approved by the Landscape architect before submitting final pricing

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging and Labeling: Furnish materials in manufacturer's unopened, original packaging, bearing original labels showing quantity, description and name of manufacturer. Verify that all materials and components are adequately padded and securely bound in such a manner that no damage occurs to the product during delivery and unloading at the site.

- B. Storage: Damaged materials will be rejected. Remove damaged materials from the job site immediately, and pay cost of replacement. Determination of damage shall be the sole authority of the Owner.

- C. Handling: Lift materials using lifting inserts provided by manufacturer.

- D. Painted Finishes: Provide non-scratching, non-staining, firmly-bound covering for all shop-painted finishes until installed and accepted.

- E. Wood: Protect from all stains.

- F. Process Tooling Storage: Store any and all tooling, fixtures, process plans project files for minimum 10 years after last project phase is complete.

1.7 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install site and street furnishings prior to acceptance by Landscape Architect of area to receive such materials.
- B. Coordination: Coordinate with the work of other sections to insure the following sequence of construction.

Lighting and Electrical Utilities.

Shop Fabricated Items: Install all (sleeves) (anchors), bolts and fittings in appropriate formwork prior to installation of adjacent paving or walls.

Footings and structural base section.

1.8 WARRANTY: Manufacturer's standard warranty.

- A. Warranty Information:

Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.

The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

Product, at the option of manufacturer, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized service representative.

1.9 MAINTENANCE

- A. Maintenance Service:

General: Immediately remove all stains to materials or surrounding site improvements. Do not use cleaning solvents harmful to site materials. Do not permit cleaning agents to contaminate planted areas.

Maintenance of associated Electrical and Lighting components subject to Lighting and Electrical Drawings and Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. PTDF Bollard Post
- B. Light Post

2.2 ACCESSORIES

- A. Lighting and Related Electrical Components and Infrastructure, See Lighting and Electrical Drawings and Specifications.
- B. Footings, reinforcement and structural base section, See Structural Drawings and Specifications.

2.3 MIX FOR CONCRETE FOOTINGS: See Division 3, Section “Cast in Place Concrete”

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations: Verify that all site furnishings can be installed at locations as shown on Drawings.
- B. Conditions: Verify that no defects or errors exist in the work of other sections which would lead to defective installation or latent defects in workmanship and function of items in this section, as follows:

Electrical Service or Other Utilities

3.2 PREPARATION

- A. Protection: Protect from all damage during installation of equipment.

- B. Concrete Pads and Footings:

Layout: Accurately lay out all pads and footings as called for in the Drawings.

Installation: Excavate form as required and fill for pads and footings as specified in (Division 3, Section “Site Concrete”) if available, or Division 32, Section “Landscape Concrete Paving”.

3.3 INSTALLATION

- A. As shown in Drawings and to follow manufacturer’s specifications and guidelines.

3.4 FIELD QUALITY CONTROL

- A. Associated Lighting to be tested after installation prior to acceptance, as per Lighting Specifications.

3.5 ADJUSTMENTS AND CLEANING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Landscape Architect.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Landscape Architect.
- C. Clean products promptly after installation in accordance with manufacturer’s instructions.
- D. Do not use harsh cleaning materials or methods that could damage finish.

3.6 DEMONSTRATION

- A. Demonstrate the operation and maintenance of all equipment to the Owner. Submit final copy of all maintenance manuals at the time of demonstration.

3.7 PROTECTION

- A. Protect installed product to ensure that, except for normal weathering, products will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

cSECTION 32 84 00 - PLANTING IRRIGATION

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 irrigation system complete as shown and as specified.

1.3 QUALITY ASSURANCE:

- A. Permits and Fees: Obtain and pay for all permits required.
- B. Manufacturer's Specifications: Follow Manufacturer's current printed specifications and drawings in all cases where the manufacturers of articles used in the Contract furnish directions covering points not specified or shown in the Drawings.
- C. Ordinances and Regulations: All applicable codes and regulations governing or relating to all portions of this work are hereby incorporated into and made a part of these Specifications. Anything contained in these Specifications shall not be construed to conflict with any of the above codes, regulations, or requirements of the same. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above codes and regulations, the provisions of these Specifications and Drawings shall take precedence.
- D. Explanation of Drawings:
 - 1. Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affecting all of the work and plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities, and architectural features.
 - 2. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in are dimensions exist that might not have been considered in engineering. Bring such obstructions or differences to the attention of the Landscape Architect. In the event this notification is not given, the Contracting Officer shall assume full responsibility for any revision necessary.

1.4 SUBMITTALS

- A. Materials List:
 - 1. Within ten (10) days after the award of the Contract, submit three (3) copies of the complete lists of materials proposed for installation, and obtain the Landscape Architect's written approval thereof before proceeding. Use only accepted materials and items of equipment.
 - 2. List all materials by manufacturer's name and model number.

B. Manuals:

1. Prior to the final acceptance of the irrigation system, furnish three (3) individually bound Service Manuals to the Landscape Architect for use by the Owner. The manuals shall contain complete enlarged drawings, diagrams and spare parts lists of all equipment installed showing manufacturer's name and address. In addition, each Service Manual shall contain the following:
 - a. Index sheet indicating the Contracting Officers name, address and phone number.
 - b. Copies of equipment warranties and certificates.
 - c. List of equipment with names, addresses and telephone numbers of all local manufacturer's representatives.
 - d. Complete operating and maintenance instructions in sufficient detail to permit operating personnel to understand, operate and maintain all equipment.

C. Record Drawings:

1. Dimension from two (2) permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:
 - a. Connection to existing water lines.
 - b. Connection to electrical power.
 - c. Gate valves.
 - d. Routing of sprinkler pressure lines.
 - e. Remote control valves.
 - f. Routing of control valves.
 - g. Quick coupling valves.
 - h. Other related equipment as directed by Landscape Architect.
 - i. All sleeve locations, if sleeving is required.
2. Deliver a reproducible Record Drawing to the Landscape Architect within seven (7) working days before the date of Final Inspection. Delivery of the record drawings shall not relieve the Contracting Officer of the responsibility of furnishing required information in the future.

D. Controller Plan:

1. Permanently install one 'bubble diagram' controller plan in each controller housing. The plan shall show the area controlled by each valve and any major permanent structure, such as buildings and roads.
2. These charts to be waterproof and install as accepted by the Landscape Architect at the coverage test of the irrigation system.

E. Maintenance Material - Supply the following tools to the Owner;.

1. Three (3) sets of specialized tools required for removing, disassembling and adjusting each type of sprinkler, valve or other equipment supplied on this project.
2. Two (2) keys for each type of equipment enclosure.
3. Two (2) keys for each type of automatic controller.
4. Two (2) quick-coupler keys and matching hose swivels for each type of quick coupling valve installed.
5. Two (2) five foot valve keys for operation of gate valves.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Furnish and deliver materials in manufacturer's packaging, bearing and original legible labeling.

- B. Handle and store all equipment in accordance with manufacturer's current printed specifications.

1.6 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install main line trenching prior to acceptance by Landscape Architect of rough grades completed under another Section.
- B. Coordination: Coordinate with the work of other sections to insure the following sequence of events.
 - 1. Sleeves and Conduits: Installation of all sleeves and conduits to be located under paving (and through walls) prior to placement of those materials.

1.7 WARRANTY

- A. Provide a Warranty for the irrigation system in accordance with the attached warranty form, and file with the Owner or his representative prior to acceptance of the irrigation system.
- B. Include a copy of the warranty form in the Operations and Maintenance Manual.
- C. Retype the warranty form onto the Contracting Officer's letterhead and contain the following information:

1.8 MAINTENANCE

- A. Routine: Inspect and adjust all spray valves and control valves including raising or lowering of spray valve heights to accommodate plant growth, to achieve uniform irrigation at all times. Verify correct operating pressure.
- B. Controller: Inspect regularly for power interruption and reset clock as required. Adjust station timing to accommodate changes in plant growth.
- C. System Failure: Perform all repairs within one (1) operating period. Replacements to match removed products and materials in all respects. Report promptly all damage not resulting from Contracting Officer's operations. Repair all damage caused by Contracting Officer at no expense to Owner.
- D. Climate Change: Do not run the irrigation system during the rainy season. Set and program automatic controllers in response to seasonal requirements and requirements of newly - planted materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Use only new materials of brands and types noted on Drawings or substitutes accepted by Landscape Architect.

- B. Water Meters: Provided and installed by others according to the codes of the utility. Costs will be paid by the Owner and are not part of this Contract.

2.2 PIPE

- A. Pressure Main Line Pipe and Fittings: All PVC fittings shall bear the manufacturer's trademark name, material designation, size, applicable I.P.S. schedule and NSF seal of approval.
 - 1. PVC pressure rated pipe: ASTM D2241 NSF approved Type I, Grade I, PVC. All pipe must meet Federal Specifications pS-22-70, with an appropriate standard dimension ratio (S.D.R.)
 - 2. PVC scheduled pipe: ASTM D1785 NSF approved Type I, Grade I, PVC. All pipe must meet Federal Specifications PS-21-70.
 - 3. PVC solvent-weld fittings: ASTM D2466 Schedule 40, 1-2, II-I NSF approved.
 - 4. Solvent cement and primer for PVC solvent-weld pipe and fittings: Type and installation methods prescribed by the manufacturer.
 - 5. Connections between main lines and RCVs: Schedule 80 PVC (threaded both ends) nipples and fittings.
 - 6. Galvanized pipe: ASTM A-53 and A120-84, ANSI B1.20.1 and B36.10 Seamless standard weight steel.
 - 7. Copper pipe: ASTM B 42-84 or as specified by local plumbing code, Type L or K copper water pipe.
- B. PVC Non-Pressure Lateral Line Piping and Sleeving:
 - 1. PVC pressure rated pipe: ASTM D2241 NSF approved Type I Grade I, PVC and Federal Specification PS-22-70, with an appropriate standard dimension ratio (S.D.R.).
 - 2. PVC scheduled pipe: ASTM D1785 NSF approved Type I Grade I, PVC and Federal Specification PS-21-70.
 - 3. PVC solvent - weld fittings: ASTM D2466 Schedule 40, 1-2, II-I NSF approved.
 - 4. Flexible PVC: ASTM D-2287 Algae-resistant flexible PVC.
 - 5. Polyethylene: ASTM D2237-83, 80 PSI.
 - 6. Copper: ASTM B-42-84 Type L or K.

2.3 CONTROLLER ENCLOSURES

- A. Type: Use one of the following (or as noted on the Drawings):
 - 1. Stainless steel, NEMA type 4, with back panel, padlocking hasp and padlock. See detail for pedestal construction.
 - 2. Le Meur, (714) 822-5100.
 - 3. "Strong Box", by TED Sales, (714) 837-4730.

2.4 CONTROLLER(S)

- A. Type: Model No. as shown on Drawings.

2.5 CONTROL WIRES

- A. Type: Copper with UL approval for direct burial, size 14-1. Common ground wire with white insulating jacket; individual control wires with insulating jacket of color other than white.
- B. Splices: 'DBY' by 3M.

2.6 BOXES FOR REMOTE CONTROL VALVES

- A. Type: Rectangular plastic valve box - Ametek, Brooks, Christy or accepted equal.
- B. Color: green (black).

2.7 ISOLATION VALVES:

- A. Valves 2-1/2 inches and smaller: 125-pound WSP bronze gate valve with union bonnet, non-rigging stem and solid wedge disc.
- B. Gate valves 2-1/2 inches and larger: 125 point WSP, iron body, bronze mounted, non rising stem, solid wedge disc.
- C. Box: 10" round plastic, Ametek, Brooks, Christy or accepted equal.
- D. Color: Green.

2.8 MISCELLANEOUS INSTALLATION MATERIALS:

- A. Solvent cement and primers for solvent weld joints: Make and type approved by manufacturer(s) of pipe and fittings. Maintain cement proper consistency throughout use.
- B. Pipe joint compound: Permatex 51-D. Do not use on sprinkler inlet port.
- C. Coatings for below grade steel pipe and fittings: Koppers Bitumastic 300-M coal tar epoxy and wrapped with 50-mil polyethylene tape to 6" above finish grade.

2.9 MISCELLANEOUS EQUIPMENT/ACCESSORIES

- A. Concrete Pads, Poured-in-Place Concrete Boxes and Vaults, Thrust Blocks: See (Division 2, Section "Cement Concrete Pavement") (Division 3, Section "Site Concrete")
- B. Paint for Controller Enclosure:
 - 1. Wall Mounted: Match color of wall.
 - 2. Free-Standing: Dark green.
- C. Enclosure for Backflow Preventer:
- D. Sleeves and Conduits: See Drawings.
- E. Key(s) for Quick-Coupling Valves:
 - 1. Type: Same manufacturer as Quick-Coupling valve.

2. Quantity: One (1) key per 5 quick-coupling valves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Sleeves and Conduits: Verify that all installed sleeving and conduits are undisturbed and are free of defects or errors introduced by the work of other sections.
- B. Water Meter/Water Pressure: Test and verify that installation of irrigation water meter by others has generated level of water pressure specified on Drawings.
- C. Mechanical Room: Inspect and verify acceptability of room in building designated to receive automatic controller(s).
- D. Stub-outs: Verify that all stub-outs to be provided under another contract are correctly sized, located and installed as noted on Drawings.
- E. Notification: Submit written notification to Landscape Architect within ten (10) working days of above inspections describing all acceptable and non-acceptable site conditions.

3.2 INSTALLATION

- A. Conduits and Sleeves:
 1. Coordination:
 - a. Sleeving will be existing only when installed under another subcontract. Inspect as specified above.
 - b. For all other installations, provide conduit and sleeve materials and coordinate installation with other trades.
 2. Extent: Install conduits and sleeves where control wires and pipes pass under paving or through walls. Extend 12 in. beyond edges of paving and walls and cap ends until ready for use.
- B. Excavating and Trenching:
 1. Trenches: Dig trenches wide enough to allow a minimum of 6 in. between parallel pipe lines. Provide a minimum cover from finish grade as follows:
 - a. (18 in.) (24 in.) (30 in.) Deep: Over pipe on pressure side of irrigation control valve, control wires and quick-coupling valves.
 - b. (12 in.) (18 in.) Deep: Over pipe on non-pressure side of irrigation control valve.
 - c. (6 in.) (12 in.) Deep: Over poly pipe on non-pressure side of irrigation control valve.
 - d. Direct Burial PVC Piping Under Pavement: Provide a minimum of 4 in. of sand backfill on all sides and 24 in. cover to bottom of paving.
 - e. 24 in. Deep: Control Wire (and Flow Sensor Cable).
- C. Irrigation Water Meter(s): Install per the requirements of the National Parks Service, Federal Lands, and water district, if applicable. Costs will be paid by (Contracting Officer).

- D. Pressure Reducing Valve: Install according to local codes. House in a rectangular concrete box with 6 in. minimum clearance all around to easily allow repair or replacement of unit.
- E. Backflow Prevention Device: Install according to local codes and manufacturer's current printed instructions. (Install enclosure as specified)
- F. Pipe Line Assembly:
 - 1. General:
 - a. Install pipes and fittings in accordance with manufacturer's current printed Specifications.
 - b. Clean all pipes and fittings of dirt, scales and moisture before assembly.
 - 2. Solvent-Welded Joints for PVC Pipes:
 - a. Solvents: Use solvents and methods specified by pipe manufacturer.
 - b. Curing Period: Minimum of 1 hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure.
 - 3. Threaded Joints for Plastic Pipes:
 - a. Tape: Use Teflon tape on threaded PVC fittings.
 - b. Joining: Use strap-type friction wrench only. Do not use metal-jawed wrench.
 - 4. Threaded Joints for Galvanized Steel Pipes:
 - a. General: Use only factory-made nipples.
 - b. Joining Compound: Use pipe joint compound applied to male threads only.
 - 5. Joints for Polyethylene Pipes:
 - a. Clamped: Double-clamp all mainline connections and all lateral connections 1-1/4 in. diameter and greater.
 - b. Threaded: Make all connections between polyethylene pipes and metal valves or pipes with threaded fittings using male adapters.
 - 6. Laying of Pipe:
 - a. Bedding On-grade: Remove from trench all rocks or clods. Bed pipes in at least 2 in. of soil excavated from trench. Backfill on all sides of piping to provide a uniform bearing.
 - b. Snaking: Snake pipe from side to side of trench bottom to allow for expansion and contraction. Minimum allowance for snaking is one (1) additional ft. per 100 ft. of pipe.
 - c. Moisture Restrictions: Do not lay PVC pipe when there is water in the trench. Do not assemble PVC pipe unless the pipe is perfectly dry.
 - 7. Concrete Thrust Blocks:
 - a. Location: Install where the rubber-gasketed irrigation main changes direction at ells and tees and where the rubber-gasketed main terminates and at backflow preventer sub-surface joints.
 - b. Pressure Test: Do not pressure test for a period of 36-48 hours following the completion of pouring of blocks.
 - c. Size and placement: Install in accordance with the pipe manufacturer's current printed Specifications.
- G. Gate Valves: Group valves together, aligned in a row where grouped, and locate in planted areas. Install box flush with finish grade, not necessarily level.
- H. Control Valves:
 - 1. Install in valve boxes where shown on Drawings and group together where practical. Install box flush with finish grade, not necessarily level.

2. Where two or more valves are installed adjacent to each other, provide at least six (6) in. separation. Align boxes in a row.
 3. Permanently mark valve box lid with valve number and controller letter.
- I. Sprinkler Heads:
1. Rotary Pop-up Heads:
 - a. Place all full-circle rotary pop-up sprinkler heads in lawn areas on temporary risers with top of heads 4 in. above finish grade.
 - b. Place part-circle rotary pop-up sprinkler heads 6 in. from edge of and flush with top of adjacent walks, header boards, curbs, and mowing bands, or paved areas at time of installation.
 2. Staking:
 - a. Stake on-grade shrub and impact sprinkler head risers.
 - b. Set shrub and impact heads 6 in. above grade in groundcover areas or as required by height of plant material, and 6 in. from back of curb or edge of pavement.
 - c. Place adjacent to walls. Stake heads prior to backfilling trenches. Stakes to be parallel to riser.
- J. Automatic Controller:
1. General: Install per local code and manufacturer's current printed Specifications.
 2. Connection to Valves: Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.
 3. Labeling: Affix controller name (i.e., "CONTROLLER A") on inside of controller cabinet door with minimum of 1 in. high permanent letters.
 4. Irrigation Diagram: Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two plastic sheets, 20 mil. minimum thickness. Use a reduced copy of the Record Drawing, for the irrigation diagram clearly showing all valves operated by the controller, station number, valve size, and type of planting irrigated.
- K. Control Wiring:
1. General: Install control wires in common trenches with sprinkler mains and laterals wherever possible. Lay to the bottom side of pipe line. Provide looped slack at valves. Snake wires in trench to allow for contraction of wires. Tie wires in bundles at 10 ft. intervals.
 2. Extra Length: Provide 30 in. extra control wire at each remote control valve splice to facilitate the removal of the remote control bonnet to finish grade without cutting wires.
 3. Spare: Install one unconnected spare control wire running from the controller through each intermediate control valve box.
 4. Size: Minimum size of wire is to be determined strictly by the manufacturer's current printed specifications for remote control valves, but not smaller than 14.
 5. Detection Wire: Install a bare copper wire 12 or greater on top of the PVC supply line for the purpose of possible future mine detection search as the control wires are being installed on the bottom of the PVC supply line with electrical tape every ten (10) feet.
 6. Splicing: Crimp control wire splices at remote control valves. Seal with specified splicing materials. In-line splices will be allowed only on runs exceeding 2500 ft.
- L. Flow Monitor: Wall mount within controller enclosure and connect to 120 volt power source.
- M. Flow Sensor Fitting: Install fitting on irrigation main line on discharge side of backflow preventer, prior to any remote control valve assemblies. Install fitting on a straight portion of main line with

a minimum of 4 feet of straight pipe on each side of fitting. Provide access to fitting with a remote control valve box.

- N. Mastic and Tape: Install mastic and tape on all below grade metallic piping. Install per manufacturer's current printed specifications extending mastic and tape to 6 inches above finish grade.
- O. Closing of Pipe and Flushing of Lines:
 - 1. Capping: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.
 - 2. Flushing: Thoroughly flush out all water lines before installing heads, valves and other hydrants.

3.3 FIELD QUALITY CONTROL

- A. Adjustment of the System:
 - 1. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings.
 - 2. Set all sprinkler heads set perpendicular to finished grades unless otherwise noted on the Drawings.
- B. Testing of Irrigation System:
 - 1. In the presence of the Landscape Architect test all pressure lines under hydrostatic pressure of 125 pounds per square inch, and prove watertight.
 - 2. Sustain pressure in lines for not less than two (2) hours. If leaks develop, repair and repeat test until entire system passes.
 - 3. When the landscape sprinkler system is completed, perform a coverage test in the presence of the Landscape Architect, to determine if the water coverage for planting areas is adequate.
 - 4. Test controllers individually in the presence of the Owner's Representative and the Landscape Architect. Demonstrate that all control valves operate electrically. Provide vehicles and radio equipment as necessary to expedite this process.
 - 5. Demonstrate to Landscape Architect that irrigation scheduling programmed into controller is adequate for plant requirements without causing runoff, and that scheduling capacities of controller are utilized.

3.4 BACKFILL AND COMPACTING

- A. General: After system is operating and required tests and reviews have been made, backfill excavations and trenches with clean soil, free of debris.
- B. Backfill For All Trenches: Regardless of the type of pipe covered, compact to minimum 95 percent density under pavements, and 85 percent under planted areas.
- C. Backfill at Existing Underground Pipes: Use only backfill material which has been screened to eliminate all materials larger than 3/8 in. when backfilling adjacent to existing underground pipe lines.

- D. Compacting: Compact trenches in areas to be planted by thoroughly flooding the backfill. Jetting process may be used in those areas.
- E. Finishing: Dress off all areas to finish grades.

3.5 MAINTENANCE

- A. The entire sprinkler irrigation system shall be under full automatic operation for a period of two (2) days prior to any planting.
- B. The Landscape Architect reserves the right to waive or shorten the operation period.

3.6 CLEAN-UP

- A. Clean-up as each portion of work progresses. Remove refuse and excess dirt from the site. Paving shall be broomed or washed down. Repair damages incurred on the work of others and restore to original conditions.

3.7 REVIEWS PRIOR TO ACCEPTANCE:

- A. Notify the Landscape Architect in advance for the following reviews, according to the time indicated:
 - 1. Pre-construction conference - 7 days.
 - 2. Supply line pressure test and control wire installation - 72 hours.
 - 3. Coverage and controller test - 72 hours.
 - 4. Final review - 7 days.
- B. No reviews will commence without record drawings. In the event the Contracting Officer calls for a review without record drawings, without completing previously noted corrections, or without preparing the system for review, he shall be responsible for reimbursing the Landscape Architect at the rate of two and one-half times the normal office hourly rate per hour portal to portal (plus transportation costs) for the inconvenience. No further reviews will be scheduled until this charge has been paid.

3.8 FINAL REVIEW

- A. Operate each system in its entirety for the Landscape Architect at time of final review. Any items deemed not acceptable by the Landscape Architect shall be reworked to the complete satisfaction of the Landscape Architect.
- B. Provide evidence to the Landscape Architect that the Owner has received all accessories and equipment as required before final review can occur.

END OF SECTION

WARRANTY FOR IRRIGATION SYSTEM

We hereby warrant that the irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the Drawings and Specifications, ordinary wear and tear and unusual abuse, or neglect expected. We agree to repair or replace all defects in material or workmanship which may develop during the period of one (1) year from date of acceptance and also to repair or replace any damage resulting from the repairing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefor upon demand.

PROJECT:

LOCATION:

CONTRACTING OFFICER:

Company

License

ADDRESS:

PHONE: ()

DATE OF FINAL ACCEPTANCE:

Name

Signed

Date

SECTION 32 91 13 - SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes soil and soil amendments products, including all imported topsoil as required to make up deficiencies in quantity of soil available on site. Execute all labor to achieve soil preparation, complete, as shown and as specified.
- B. Unit Pricing: Price for all accessories and components shall be included in the unit price of that item for which it is furnished.

<u>Item</u>	<u>Unit Pricing</u>
Drainage Fabric	Square Foot
Organic Amendments	Cubic Yard
Soil Mixes	Cubic Yard
Imported Topsoil	Cubic Yard

1.2 DEFINITIONS

- A. Existing Soil: Area of undisturbed native soil where no rough grading is to be performed. Surface cultivation and soil amending are included in this Section. See Drawings.
- B. Subgrade: Soil level resulting from the rough grading work under another Section. Cultivation of all subgrade areas prior to placement of topsoil is included in this Section.
- C. Topsoil: Soil stockpiled for spreading over prepared subgrade.
 - 1. Stockpiled Native Topsoil: Topsoil stripped from the site prior to rough grading work under another Section, to be spread and amended as work under this Section.
 - 2. Imported Topsoil: Off site topsoil imported and stockpiled under this Section, to be spread and amended as work under this Section.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's current catalog cuts and specifications of the following:
 - 1. Fertilizer
 - 2. Nitrogen-treated sawdust
 - 3. Peat moss
 - 4. Herbicide
 - 5. Filter Fabric
- B. Quality Control Submittals:
 - 1. Testing Agency: Wallace Laboratories, El Segundo, CA, phone 310-615-0116. or approved equal.
 - 2. Test Reports:
 - a. Existing soil: Test for agricultural suitability, parasitic nematodes and herbicide contamination. Report to include amendment recommendations.

- b. Stockpiled Native Topsoil: Test for agricultural suitability, parasitic nematodes and herbicide contamination. Report to include amendment recommendations.
- c. Imported Topsoil: Test for agricultural suitability, parasitic nematodes and herbicide contamination. Report to include amendment recommendations to meet or exceed amended existing soil.
- d. Nitrogen-treated Sawdust: Test for physical and chemical properties.
- 3. Certificates: Certify strict compliance with accepted soil mixes and amendments, including rate of application.

1.4 PROJECT/SITE CONDITIONS

- A. Existing Conditions: For protection of existing plants to remain, see Division 2, Section "Temporary Tree and Plant Protection."

1.5 QUALITY ASSURANCE

- A. Composition: All off-site or import soil needed to bring levels of landscape areas up to rough or finish grades, fill planters and tree wells or shall be friable, fertile, within the following ranges:
 - 1. 30 Clay
 - 2. 30 Silt
 - 3. 50 Sand
- B. Condition: Soil shall be free from chemicals, debris and trash, rocks and other material larger than one inch in diameter. Supply test results from independent testing agency as described herein, including from which soil was taken, and agricultural crops grown on that site for the previous two years.
- C. Restrictions: Do not obtain topsoil from poorly drained sites such as bogs or marshes. Do not obtain topsoil from zone deeper than one foot below existing finish grade of borrow area.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stockpiled Native Topsoil:
 - 1. Quantity: The approximate quantity of stockpiled native top-soil will not be known until demolition and rough grading have been completed under Civil work.
 - 2. Composition: Fertile, friable, well-drained soil, of uniform quality, free of stones over 1 in. diameter, sticks, oils, chemicals, plaster, concrete and other deleterious materials.
 - 3. Analysis: Obtain an agricultural suitability analysis of the proposed topsoil from an accepted, accredited Testing Agency at the Contracting Officer's cost.
 - 4. Test Results: Request Testing Agency to send one 1 copy of test results direct to the Landscape Architect and one 1 copy to the Owner. Imported topsoil shall be amended per soils analysis report.

B. Imported Topsoil:

1. Quantity: Import topsoil as soon as an insufficient quantity of native soil is verified. Quantity of topsoil to complete the work shall be calculated by the Contracting Officer.
2. Stockpiling: Stockpile on site as directed by Owner.
3. Composition: To match or exceed in quality, accepted native stockpiled topsoil.
4. Analysis: Obtain an agricultural suitability analysis of the proposed topsoil from an accepted, accredited Testing Agency at Contracting Officer's cost.
5. Review: The Landscape Architect reserves the right to take samples of the imported topsoil delivered to the site for conformance to the Specifications.
6. Rejected Topsoil: Immediately remove rejected topsoil off the site at the Contracting Officer's expense.

2.2 ACCESSORIES

A. Fine Sand:

1. Physical Properties by dry weight basis :

<u>Percent Passing</u>	<u>Sieve Size</u>
100	4.76 mm 4, 4 mesh
95 - 100	1.00 mm 18, 16 mesh
65 - 100	500 micron 35, 32 mesh
0 - 50	250 micron 60, 60 mesh
0 - 20	105 micron 140, 150 mesh
0 - 5	53 micron 270, 270 mesh
2. Chemical Properties: by Saturation Extract Method :
 - a. Soluble Salts/Salinity: Maximum conductivity of 3.0 millimhos/cm at 25 degrees C.
 - b. Boron: Maximum concentration of 1.0 ppm.
 - c. Sodium Absorption Ratio SAR : Maximum 6.0.

B. Pre-emergence Weed Control: "Rout" by Scotts [800] 492 8255 "Treflan 5G", by Dow Elanco, 800 352-6776, or equal.

C. Water: Clean, fresh and potable, as available from Owner. Transport as required.

2.3 ORGANIC COMPONENTS

A. General: The following information has been provided for bid only. Final materials and organic components shall follow the recommendation of the required soil analysis report.

B. Peat Moss:

1. Type: Finely-shredded, brown in color, suitable for horticultural purposes and frequently referred to in the trade as "greenhouse" or "coarse grind".
2. Measurement: Measure peat in air dry condition, containing not more than 35 moisture by weight on an "as-received" basis. Ash content shall not exceed 10 .
3. Physical Properties:

<u>Percent Passing</u>	<u>Sieve Size</u>
------------------------	-------------------

95 - 100	9.51 mm 3/8 in.
0 - 40	500 micron 35, 32 mesh

4. Organic Content dry weight basis : 90-100
5. Chemical Properties:
 Nitrogen dry weight basis : 0.6-3.0
 Salinity/Soluble Salts: Saturation extract conductivity 0.0-3.0 millimhos/cm 25 degrees C.
 pH: 3.0-4.5
6. Acceptable Substitute: Ground redwood bark, per specifications for peat moss.

C. Nitrogen-Treated Sawdust:

1. Type: Derived from redwood, fir or cedar wood sawdust.
2. Physical Properties:

<u>Percent Passing</u>	<u>Sieve Size</u>
95 - 100	6.35 mm. 1/4 in.
80 - 100	2.38 mm. 8, 8 mesh
0 - 30	500 micron 35, 32 mesh

3. Chemical Properties:
 - a. Nitrogen content dry weight basis :
 - 1) Wood of Redwood 0.4 - 0.6
 - 2) Wood of Fir/Cedar 0.56 - 0.84
 - b. Iron content dry weight basis : 0.08 iron as metallic, minimum.
 - c. Salinity/Soluble salts: Maximum 3.5 millimhos/cm 25 degrees C. as determined by saturation extract method.
 - d. Ash dry weight basis : 0 - 6.0 percent maximum.
4. Nitrogen Treating Process: Thoroughly bulk-blend Urea Formaldehyde with any of the following available sawdust types :

<u>Sawdust</u>	<u>Per Cubic Yard</u>
Hardwood	4 lbs.
Redwood	2 lbs.
Fir or Cedar	4-1/2 lbs.

D. Treated Fir/Pine Bark (if needed):

1. Physical Properties dry weight basis :

<u>Percent Passing</u>	<u>Sieve Size</u>
95 - 100	6.35 mm 1/4 in.
80 - 100	2.38 mm 8, 8 mesh
0 - 30	500 micron 35, 32 mesh

2. Organic Content dry weight basis : 94 percent minimum as determined by ash analysis.
3. Chemical Properties:
 - a. Nitrogen Content dry weight basis : 0.8 percent minimum.

- b. Soluble Salts/Salinity: Maximum Saturation Extract Conductivity 3.0 millimhos/cm at 25 degrees C, by method.
- c. Iron dry weight basis : 0.08 percent minimum.
- d. pH: 6.5 - 7.5
- 4. Wettability:
 - a. When applied to a cup or small beaker of water 70 degrees F. in the amount of 1 teaspoon, the air-dry product shall become completely wet in a period not exceeding 2 minutes.
 - b. All wetting agents to be non-phytotoxic at rate used.

E. Yard Waste Compost:

- 1. Physical Properties:
 - a. Gradation: A minimum of 90 of the material by weight shall pass a ½” screen. Material passing the ½” screen shall meet the following criteria:

<u>Percent Passing</u>	<u>Sieve Designation</u>
85 - 100	9.51 mm 3/8"
50 - 80	2.38 mm No. 8
0 - 40	500 micron No.35

- b. Organic Content: Minimum 50 based on dry weight and determined by ash method. Minimum 250 lbs. organic matter per cubic yard of compost.
- c. Carbon to Nitrogen Ratio: Maximum 35:1 if material is claimed to be nitrogen stabilized.
- d. pH: 5.5 - 8.0 as determined in a saturation extract.
- e. Soluble Salts: Sodium should account for less than 25 of the total salinity level. The addition of the compost shall result in a final ECe of the amended soil of less than 4.0 ds/m 25 degrees C as determined in a saturation extract.
- f. Moisture Content: 35 - 60
- g. Contaminants: The compost shall be free of contaminants such as glass, metal and visible plastic.
- h. Maturity: Physical characteristics suggestive of maturity include:
 - 1) Color: Dark brown to black.
 - 2) Odor: No odors, soil-like, musty, and moldy are acceptable. Sour, ammonious, or putrid is unacceptable.
 - 3) Particle Characterization: Identifiable wood pieces are acceptable, but the balance of material should be soil-like without recognizable grass or leaves.
- i. Approved Compost Sources:

Soil Conditioner, Synagro Professional Organic Soil Products;
Agromend, Agromin Horticultural Products;
Humic Compost ½”, Greenway Compost;
Superior Blend Compost, Artesia Sawdust Products, Inc.;
Compost, EarthWorks Soil Amendments, Inc.;
Contractor’s Blend, Recycled Wood Products (RWP);
#SSA-CST Supreme Organic Soil Amendment, Plants Choice, Inc.;
 -or other approved provider.
- j. Use one source throughout the project.

2.4 COMMERCIAL FERTILIZERS

- A. General: The following information has been provided for bid only. Final materials and organic components shall follow the recommendation of the required soil analysis report.
- B. Pre-Plant Fertilizer:
 - 1. Type: Mixed by a commercial fertilizer supplier and consisting of the following percent by weight: 6-20-20 N-P-K.
 - 2. Manufacturer: J.R Simplot Company - 1 800 992-6066.

2.5 CHEMICAL COMPONENTS: The following additives may or may not be used depending on the outcome of the soils report.

- A. General: The following information has been provided for bid only. Final materials and organic components shall follow the recommendation of the required soil analysis report.
- B. Ground Limestone: Agricultural limestone containing not less than 85 of total carbonates, ground to such fineness that 50 will pass 100 sieve and 90 will pass 20 sieve.
- C. Dolomite Lime: Agricultural grade mineral soil conditioner containing 35 minimum magnesium carbonate and 49 minimum calcium carbonate, 100 passing 65 sieve.
- D. Gypsum: Agricultural grade product containing 80 minimum calcium sulphate.
- E. Iron Sulfate: Supplied by a commercial fertilizer supplier, containing 20 to 30 iron and 35 to 40 sulphur.
- F. Sulphate of Potash: Agricultural grade containing 50 to 53 of water-soluble potash.
- G. Single Superphosphate: Commercial product containing 20 to 25 available phosphoric acid.
- H. Ammonium Sulphate: Commercial product containing approximately 21 ammonia.
- I. Ammonium Nitrate: Commercial product containing approximately 34 ammonia.
- J. Calcium Nitrate: Agricultural grade containing 15-1/2 nitrogen.
- K. Urea Formaldehyde: Granular commercial product containing 38 nitrogen.
- L. I.B.D.U. Iso Butyldiene Diurea : Commercial product containing 31 nitrogen.
- M. Soil Sulfur: Agricultural grade sulfur containing a minimum of 96 sulfur.

PART 3 - EXECUTION

3.1 SOIL MOISTURE CONTENT

- A. General: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily.

Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting.

- B. Range: Maintain within 2 percent above or below optimum moisture content at all times during the work.

3.2 CLEARING AND CULTIVATION

- A. Clearing: Clear all planting areas of stones 2 in. diameter and larger, weeds, debris and other extraneous materials prior to soil preparation work.
- B. Cultivation of Existing Soil:
 - 1. Cultivation: Rip or cultivate areas of existing soil to receive planting to a depth of 6 inches immediately prior to applying soil amendments.
 - 2. Trees to Remain: Hand cultivate within the dripline of existing trees to remain. Depth of cultivation shall not exceed 2 in. Cultivate immediately prior to amending existing soil.
- C. Cultivation of Subgrade:
 - 1. Verification:
 - a. Verify that subgrades for installation of topsoil have been established under rough grading. Do not spread topsoil prior to acceptance of subgrade work.
 - b. Depth: Verify that subgrades are 6 in. minimum below finished grades, 1 in. Report all variations.
 - 2. Cultivation: Rip or cultivate subgrade in planting areas to a depth of 6 inches immediately prior to spreading topsoil.

3.3 SPREADING OF TOPSOIL

- A. General: Spread Stockpiled topsoil over accepted subgrade prior to incorporating amendments.
- B. Restrictions: Do not commence spreading of topsoil prior to acceptance of soil cultivation above. Do not place topsoil under muddy or frozen conditions.
- C. Topsoil Depth: Minimum depth of 6 inches after natural settlement and light rolling conforming to finished grades shown on Drawings.

3.4 SOIL AMENDMENT

- A. Intent: The below amendments and quantities are approximate and are for bidding purposes only. Following an on-site topsoil analysis by Testing Agency, composition of amendments may change. Contract Price will be adjusted accordingly.
- B. Amending of Existing Soil:
 - 1. Preparation: Do not commence amending of existing soil prior to acceptance of soil cultivation above. Do not work soils under muddy or frozen conditions.

2. Soil Amendments per 1,000 Square Feet: Incorporate thoroughly with top six 6 in. of all existing planting areas:
 - a. 5 cubic yards organic amendment as specified
 - b. 50 pounds preplant fertilizer - 6-20-20 N-P-K
 - c. Chemical additives per soils report, if any

C. Amending of Spread Topsoil:

1. Soil Amendments per 1,000 square feet: Incorporate thoroughly with top six 6 in.:

6 cu.yd	Nitrogen-treated Sawdust
30 lbs.	6-20-20 Commercial Fertilizer
50 lbs.	Dolomite Lime
10 lbs.	Iron Sulfate
15 lbs.	Polymer Amendment

3.5 PRE-EMERGENT HERBICIDE

- A. Apply pre-emergent weed control to all areas to receive woody, non-lawn ornamental planting after incorporating soil amendments, as recommended by report.
- B. Apply strictly according to manufacturer's current printed specifications.

3.6 FIELD QUALITY CONTROL

- A. Tests: Right is reserved to take samples of soil mixes for testing for conformity to Specifications.
- B. Rejected Materials: Remove off site at The Contracting Officer's cost. Pay cost of testing of materials, not meeting Specifications.

END OF SECTION

SECTION 32 93 00 - PLANTING

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 planting complete, as shown and as specified.
- B. Allowances:
 - 1. Procedure: Submit a written change order for expenditures of cash allowance in accordance with Division 1 - Section 'Allowances'. Credit to Owner unexpended portion of cash allowance in the final project cost accounting.
- C. Unit Pricing: Cost of all products used in installation shall be included in the unit price of the item for which they are furnished.

<u>Item</u>	<u>Unit Pricing</u>
Plants	Each plug

1.3 SUBMITTALS

- A. Product Data: Manufacturer's current catalog cuts and specifications of the following:
 - 1. Mulch, if applicable
 - 2. Supplemental Planting Additive
- B. Samples:
 - 1. Mulch, if applicable: One 1 pint, each type.
- C. Representative photos of actual plant materials, and name and contact of nursery or other provider.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Do not deliver to the site diseased or insect-infested plant materials.
- B. Labeling: Furnish standard products in manufacturer's standard containers bearing original labels legibly showing quantity, analysis, genus/species and name of manufacturer/grower.
- C. Storage: Protect metal containers from sun during summer months with temperatures above 80 degrees F. Keep plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.

- D. Handling: Do not lift or handle plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.

1.5 PROJECT/SITE CONDITIONS

- A. Protection of Existing Plants to Remain:
 - 1. Operations: Do not store materials or equipment, permit burning, or operate or park equipment under the branches of all existing plants to remain.
 - 2. Barriers: Provide barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.
 - 3. Notification: Give written notification if other construction activities threaten to damage existing plants to remain.
- B. Replacement of Damaged Plants:
 - 1. Replace existing plants to remain that are damaged by Contracting Officer during construction with accepted plants of the same species and size as those damaged at no additional cost to Owner.
 - 2. Landscape Architect will determine extent of damage and value of damaged plants.

1.6 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install plant materials prior to acceptance of finish grades and main line trenching/installation of irrigation system.
- B. Coordination: Coordinate with work of other sections to insure the following sequence of events:
 - 1. General: Sprinkler system to be installed and operable prior to installation of plant materials. Schedule hand watering of all plant materials installed prior to sprinkler irrigation system.

1.7 WARRANTY

- A. Warrant that all plants planted under this Contract will be healthy and in flourishing condition of active growth one 1 year from date of Final Acceptance. Similarly warrant groundcover for a period of six 6 months from date of Final Acceptance.
- B. Correct Species: Warrant that all plant materials are true to species and variety.
- C. Delays: Delays caused by the Contracting Officer in completing planting operations that extend the planting into more than one planting season shall extend the Warranty Period correspondingly.
- D. Condition of Plants: Plants shall be free of dead or dying branches and branch tips, with foliage of normal density, size and color.
- E. Replacements: As soon as weather conditions permit, replace, without cost to Owner all dead plants and all plants not in a vigorous, thriving condition, as determined by Landscape Architect during and at the end of Warranty Period.
- F. Exclusions: Contracting Officer shall not be held responsible for failures due to neglect by Owner, vandalism, and natural disaster, during Warranty Period. Report such conditions.

1.8 MAINTENANCE PERIOD AND FINAL ACCEPTANCE

- A. See Division 2 - Section 'Landscape Establishment'.

1.9 REPLACEMENTS

- A. Failed Materials:
 - 1. Repair and/or replace at no cost to the Owner all plant materials exhibiting conditions which are determined as unacceptable due to workmanship by the Contracting Officer.
 - 2. Closely match replacements to adjacent specimens of the same species. Apply requirements of this Specification to replacements.
 - 3. Contracting Officer shall be held responsible for a maximum of same area of groundcover planting after final acceptance during warranty period.
- B. Incorrect Materials:
 - 1. During Warranty Period, replace at no cost to Owner plants revealed as being untrue to name and species.
 - 2. Provide replacements of a size and quality to match the planted materials at the time the mistake is discovered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plant Materials:
 - 1. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project.
 - 2. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions that would prevent thriving growth.
- B. Condition of Root System: Samples must prove to be completely free of circling, kinked or girdling trunk surface and center roots and show no evidence of a pot-bound condition. Upon inspection by Landscape Architect at the job site, if five 5 percent or more of the plants of each species are found to contain kinked, circling or girdling roots, all plants of that species will be rejected.
- C. Measurements:
 - 1. Size Range: If a range of size is given, do not use plant materials less than the minimum size. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.
 - 2. Substitutions: Substituted plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted. Use of such plants shall not increase Contract price. If larger plants are accepted, increase the ball of earth in proportion to the size of the plant. Plants overgrown for their container size will be rejected.

2.2 MIXES

- A. Backfill Mix for Plant Pits: See Drawings.
- B. Commercial Fertilizers:

1. Top-dress Fertilizer: Complete fertilizer, 16-6-8 (N-P-K). 50 percent of the nitrogen to be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone or tankage. Potash shall be derived from muriate of potash containing 60 percent potash:
- C. Supplemental Mycorrhizal Inoculum:
 1. Mycorrhizal Inoculum granular supplement:
 - a. Product: Tri –C Myco Endo 120 or Approved Equal. Apply at a rate as shown in the drawings and follow manufacturer’s guidelines and specifications.

2.3 ACCESSORIES

- A. Water:
 1. Clean, fresh and potable, furnished by Owner and paid for by Contracting Officer.
 2. Transport as required.

2.4 SOURCE QUALITY CONTROL

- A. Review: Submit a written request for review of plant materials and quantity at place of growth at least thirty 30 days after award of contract. Right is reserved to refuse review at this time if, a sufficient quantity of quality plants are not available.
- B. Distant Material: Submit photographs with a person adjacent to each plant type for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.
- C. Unavailable Material: If proof is submitted that a specified plant is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Substantiate such proof in writing no later than 30 days after award of contract.
- D. Special Conditions: The above provisions shall not relieve Contracting Officer of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 1. Finish Grades: Finish grades for planting areas shall have been established in another Section. Verify that all grades are within 1 in. plus or minus of required finish grade.
 2. Soil Preparation: Do not commence planting work prior to completion and acceptance of soil preparation.
 3. Irrigation: Verify that irrigation system has been installed and accepted.

3.2 PREPARATION

- A. Layout and Staking: Lay out plants at locations shown on Drawings. Outline shrub and groundcover beds with lime.

- B. Review: Locations of plants will be checked in the field and will be adjusted to exact position before planting begins. Right is reserved to refuse review at this time if, in the Landscape Architect's opinion, an insufficient quantity of plants is available.
- C. Containerized Plant Pits: Excavate square plant pits to depth of rootball as shown in Drawings.

3.3 DRAINAGE TEST OF PLANT PITS/OBSTRUCTIONS

- A. Testing: Immediately after completion of excavation, test drainage of plant pits by filling with water twice in succession. Give written notification of conditions permitting the retention of water in plant pits for more than twenty-four 24 hours.
- B. Correction: Submit for acceptance a written proposal and cost estimate for the correction of poor drainage conditions before proceeding with planting.
- C. Obstructions: If rock, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits, acceptable alternate locations may be used at direction of Landscape Architect.
- D. Percolation Test Pit:
 - 1. Location: At four 4 locations as determined by the Landscape Architect on site.
 - 2. Restrictions: Do not perform test on a rainy day. Repeat all tests interrupted by rain or cold.
 - 3. Procedure:
 - a. Fill test pit with water to within 1 ft. of the finish grade. Immediately record water level on the stake.
 - b. After 3 hours, record water level again. Repeat recording of water level once each hour for the succeeding five hours.
 - 4. Documentation: Submit written documentation of all test pit results, dated and signed by the tester.
 - 5. Acceptable Rate: 2 in./hr. or more. Marginal Rate: 1 in. to 2 in./hr. Unacceptable Rate: 1 in./hr. or less.

3.4 SHRUB / GRASS PLUG PLANTING

- A. Handling and De-potting of Plant Materials:
 - 1. Damage: Avoid damage to containers and rootballs. If rootball is cracked or broken during handling and de-potting, plant will be rejected. Do not remove plant from container prior to completion of plant pit preparation.
- B. Installation:
 - 1. Scarification:
 - a. Plant Rootball: After removing plant from container, scarify the sides of the rootball to a depth of 1 in. at four to six equally-spaced locations around the perimeter of the ball or at 12 in. intervals on sides of boxed materials. Cut and remove circling roots over 3/8 in. diameter.
 - 2. Positioning: Backfill plant pit to allow setting of shrub 1 in. above finish grade. Thoroughly foot tamp all backfill. Position plant in planting pit, maintaining plumb condition. Maintain throughout all planting operations.

3. Backfilling:
 - a. Use backfill mix to backfill plant pits as shown on Drawings. Brace each plant plumb and rigidly in position until planting soil has been tamped solidly around the ball and roots.
 - b. When plant pits have been backfilled approximately 2/3 full, water thoroughly and saturate rootball, before installing remainder of the backfill mix to top of pit, eliminating all air pockets. Edit paragraph below

A. Supplemental Mycorrhizal Inoculum:

1. Place evenly distributed in plant pits when backfilled 2/3 according to the following schedule or per Manufacturer's latest specifications.
 - a. Rate: ½" teaspoon of granular supplement per 4" plug

B. Watering: Immediately water all plants after completion of planting operations.

3.5 GROUNDCOVER PLANTING

- A. Top-dress Fertilizer: Immediately after completion of planting, apply fertilizer at the rate of 5 pounds per 1,000 square feet.
- B. Watering: Immediately water groundcover areas after fertilizer application to wash fertilizers from leaves of plants.

END OF SECTION

SECTION 33 14 16 - WATER UTILITIES FOR POTABLE AND NON-POTABLE 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. Pipes and Fittings for Potable and Fire Water systems
 - a. From connection with public water main on Cornell Road to blind flange near existing bridge east abutment
 - b. From blind flange near existing bridge west abutment to within five feet from face of the building.
 - c. Design of water lateral piping support from existing bridge is deferred submittal by the contractor.
 - 2. Valves.
 - 3. Backflow Prevention Assembly.
 - 4. Fire Hydrants.
 - 5. Restraint Systems.
- B. Related Sections:
 - 1. Section 02 41 00 - SELECTIVE DEMOLITION
 - 2. Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING
 - 3. Section 31 30 00 - EARTHWORK AND GRADING
- C. Definitions:
 - 1. ID: Inner Diameter.
 - 2. NPS: Nominal Pipe Size.
 - 3. OD: Outside Diameter.

1.3 REFERENCE STANDARDS

- A. ASTM International (ASTM)
 - 1. ASTM A53 / 53M (2020) - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

2. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
3. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
4. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
5. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA)

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
2. AWWA C502 - Dry-Barrel Fire Hydrants
3. AWWA C504 - Rubber-Seated Butterfly Valves
4. AWWA C507 - Ball Valves, 6 In. Through 60 In.
5. AWWA C508 - Swing-Check Valves for Waterworks Service 2-in Through 24-in NPS
6. AWWA C509 - Resilient-Seated Gate Valves for Water Service
7. AWWA C510 - Double Check-Valve Backflow Prevention Assembly
8. AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
9. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances
10. AWWA C651 - Disinfecting Water Mains
11. AWWA C900 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. American National Standards Institute (ANSI)

1. ANSI A21.10 (2003) - Ductile-Iron and Gray-Iron Fittings
2. ANSI A21.11 (2017) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
3. ANSI A21.4 (2008) - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
4. ANSI A21.5 (2010) - Polyethylene Encasement for Ductile-Iron Pipe Systems
5. ANSI A21.50 (2008) - Thickness Design of Ductile-Iron Pipe
6. ANSI A21.51 (2009) - Ductile-Iron Pipe, Centrifugally Cast
7. ANSI B16.1 (2020) - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800

D. Manufacturer's Standardization Society (MSS)

1. MSS SP-60 (2017) - Connecting Flange Joints Between Tapping Sleeves and Tapping Valves

E. Los Virgenes Water District Standards (most current edition)

F. Applicable sections of the 2019 California Plumbing Code

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES.

B. General:

1. Include construction details, material descriptions, dimensions of individual components, and finishes for pipes, fitting, and valves.
2. Include certification of factory testing conducted, indicating that the product meets or exceeds specified requirements of manufacture and performance, including factory applied finish or coating.
3. Include rated capacities, operating characteristics, and furnished specialties and accessories.
4. Include product name, manufacturer and specifications of all coatings, protective finishes and encasement materials used as corrosion protection on pipes, fittings and appurtenances.

C. Product Data for, including but not limited to:

1. Pipes and Fittings (Potable/Domestic, Fire Water, Non-Potable)
2. Valves.
3. Backflow Prevention Assembly.
4. Fire Hydrants.
5. Restraint Systems.

D. Fire Shop Drawings

1. Signed and stamped shop drawings for all underground fire mains and services shall be prepared and submitted for approval by Local Fire Marshal having jurisdiction
2. Shop drawings shall include all above ground fire equipment including backflow, fire department connections, fire hydrants and fire pumps as applicable.
3. Drawings shall adhere to all applicable CFC and NFPA standards
4. Installation shall be included to within 5-ft of face of building.

E. Water Service On Bridge Drawings

1. Signed and stamped drawings for potable and fire water mains suspended from existing bridge shall be submitted for approval to Contracting Officer and Local Fire Marshal having jurisdiction.

F. Hydrostatic Test Reports

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Do not store plastic pipe and fittings in direct sunlight.
- C. Store pipe materials with adequate support to prevent sagging and bending.

- D. Protect pipe, fittings, and seals from dirt and damage.
- E. Protect flanges, fittings and metal specialties from moisture and dirt.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Potable/Domestic Water and Non-Potable Service: Do not interrupt service to facilities occupied by Contracting Officer or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Contracting Officer no fewer than two days in advance of proposed interruption of service on Contracting Officer's property.
 - 2. For service to others, obtain user's written permission no fewer than two days in advance of proposed service interruption and coordinate all shut downs with utility provider.
- B. Interruption of Existing Fire Water Service: Do not interrupt service to facilities whether occupied or not by Contracting Officer or others unless appropriate fire suppression measures have been provided including:
 - 1. Notify Contracting Officer no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without the <City, County> Fire Marshal's written permission.
 - 3. Appropriate alternate fire suppression measures approved by the Fire Marshal have been provided such as fire watch or other.
- C. Coordination: Coordinate connections to existing water and fire service mains with Los Virgenes Water District.

PART 2 - PRODUCTS

2.1 CONNECTION TO PUBLIC WATER MAIN

- A. TAPPING SLEEVE

2.2 BACKFLOW PREVENTION ASSEMBLY

- A. Backflow prevention assembly shall be provided where indicated and as detailed in the Drawings. Backflow prevention devices are subject to the approval of the local water provider and fire marshal.
- B. Backflow prevention devices shall be double check valve type, as listed and approved by the USC Foundation for Cross-Connection Control and Research.

1. Potable/Domestic Water: Backflow prevention devices shall be lead-free Reduce Pressure Principle Assemblies (RPPA) with ductile iron body, stainless steel internals, fasteners, and springs. Zurn/Wilkins Model 375 or approved equal.
 2. Fire Water: Backflow prevention devices shall be Double Check Detector Assemblies (DCDA) with ductile iron body, stainless steel internals, fasteners, and springs. Zurn/Wilkins Model 350DA or approved equal.
- C. Conform to AWWA C510 and C511, with a 200 psi (minimum) working pressure rating.

2.3 PRESSURE REDUCING STATION

- A. Existing pressure reducing station on Cornell Road to be protected in place.

2.4 POTABLE WATER PIPES AND FITTINGS

- A. Polyvinylchloride (PVC): 4-inch diameter and larger.
1. Certifications: AWWA C900-16 conforming to CSA B137.3, NSF 14 & NSF 16 and UL 1285.
 2. Pressure Class
 - a. Water main shall be : Class 235.
 - b. Color
 - 1) Fire and potable water: Blue.
 - c. Joints: Bell and spigot, push-on joints per ASTM 3139 with locking elastomeric restraint rubber gasket meeting ASTM F477 and AWWA C111 requirements.
 - d. Manufacturers: JM Eagle, North American Pipe or approved equal.
- B. Ductile Iron pipe, Pressure Class 350: 4-inch diameter and larger.
1. DI conforming to AWWA C151/ANSI A21.5 with restrained joints
 - a. Unless otherwise noted on the drawings, all Ductile Iron pipe shall be designed and manufactured in accordance with the following minimum design parameters: a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi and 10 percent minimum elongation.
 - b. Lining: Provide factory applied mortar cement lining and full asphalt coating inside and out in compliance with AWWA C404 and ANSI A21.4
 - c. Corrosion protection: If installed in a corrosive environment, DI or Cast Iron pipe and fittings must be polyethylene encased in conformance with ANSI A21.5
 2. Joints:

- a. Push-on Joints Ductile Iron Fittings: Joints shall be restrained, push-on, rubber gasket type, conforming to ANSI/AWWA C111/A21.11. Restraint shall be provided by elastomeric gaskets with embedded metal wedging or by mechanical locking devices that engage adjoining pipe segments. Restraint provided shall match the pressure rating of the pipe.
 - b. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. with ductile- or gray-iron glands, rubber gaskets, and steel bolts meeting AWWA C111.
 - c. Manufacturer: U.S. Pipe TR-flex, American Cast Iron Pipe Co. Fastite, or approved equal.
- 3. All above ground water pipe shall be ductile iron. Transition from PVC to DIP at the nearest joint below the point at which the pipe exits the ground.
 - a. Provide a blind flange at the point of termination, 6-inches above finished grade, for connection to and continuation by plumbing.
 - b. Transition fittings to PVC, HDPE or DIP water lines as approved by Contracting Officer.
- C. Fittings: Ductile Iron mechanical joint conforming to ANSI/AWWA C153/A21.53, 350 psi pressure rating.
 - 1. Cement lining in accordance with ANSI/AWWA C104/A21.4.
 - 2. Asphalt coated inside and out in accordance with ANSI/AWWA C104/21.4.
 - 3. US Pipe, Tyler Union or approved equal.
- D. Water lines less than 4" in diameter: Copper for potable building water service lines smaller than 4-inches for all below and above ground installations
 - 1. Type K copper pipe and fittings for exterior use, conforming to Federal Specification WW-T 7996 and ASTM B-75, B-88 and B-68, with lead free soldered joints
- E. Tapping Saddles for water line connections smaller than 4-inch shall be as submitted by the Contractor compatible with the piping materials, subject to Engineer's review and approval.
- F. Corporation Stops:
 - 1. Corporation stops shall be brass, conforming to ANSI/AWWA C-800 with end connections as appropriate for the pipe type, as manufactured by Mueller Co or equal.
 - 2. Corp stops at each building shall be installed in a meter box, Christy Fibrelyte FL 9 or approved equal, with reinforced concrete lids marked "WATER."

2.5 FIRE WATER PIPES AND FITTINGS

- A. Polyvinylchloride (PVC): for , 4-inch diameter and larger.
 - 1. Certifications: AWWA C900-16 conforming to CSA B137.3, NSF 14 & NSF 16 and UL 1285.
 - 2. Pressure Class

- a. Fire water main, fire hydrant services and building sprinkler supply lines: Class 305.
 - b. Color
 - 1) Fire and potable water: Blue.
 - c. Joints: Bell and spigot, push-on joints per ASTM 3139 with locking elastomeric restraint rubber gasket meeting ASTM F477 and AWWA C111 requirements.
 - d. Manufacturers: JM Eagle, North American Pipe or approved equal.
3. Ductile Iron pipe, Pressure Class 350
- a. DI conforming to AWWA C151/ANSI A21.5 with restrained joints
 - 1) Unless otherwise noted on the drawings, all Ductile Iron pipe shall be designed and manufactured in accordance with the following minimum design parameters: a minimum tensile strength of 60,000 psi, a minimum yield strength of 42,000 psi and 10 percent minimum elongation.
 - 2) Lining: Provide factory applied mortar cement lining and full asphalt coating inside and out in compliance with AWWA C404 and ANSI A21.4
 - 3) Corrosion protection: If installed in a corrosive environment, DI or Cast Iron pipe and fittings must be polyethylene encased in conformance with ANSI A21.5
 - b. Joints:
 - 1) Push-on Joints Ductile Iron Fittings: Joints shall be restrained, push-on, rubber gasket type, conforming to ANSI/AWWA C111/A21.11. Restraint shall be provided by elastomeric gaskets with embedded metal wedging or by mechanical locking devices that engage adjoining pipe segments. Restraint provided shall match the pressure rating of the pipe.
 - 2) Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. with ductile- or gray-iron glands, rubber gaskets, and steel bolts meeting AWWA C111.
 - c. Manufacturer: U.S. Pipe TR-flex, American Cast Iron Pipe Co. Fastite, or approved equal.
4. All above ground water pipe shall be ductile iron. Transition from PVC to DIP at the nearest joint below the point at which the pipe exits the ground.
- a. Provide a blind flange at the point of termination, 6-inches above finished grade, for connection to and continuation by plumbing.
- B. Fittings: Ductile Iron mechanical joint conforming to ANSI/AWWA C153/A21.53, 350 psi pressure rating.
- 1. Cement lining in accordance with ANSI/AWWA C104/A21.4.
 - 2. Asphalt coated inside and out in accordance with ANSI/AWWA C104/21.4.

3. US Pipe, Tyler Union or approved equal.

2.6 VALVES

A. Buried Valves

1. Unless otherwise indicated, all buried valves shall be iron body, bronze mounted, double disc parallel seat type gate valves, opening to the left (counter clockwise), with a two inch square standard operating nut, and a non-rising stem, as manufactured by Mueller Company, James B. Clow & Sons, Inc., M & H Valve Company, or an approved equal.
2. Valves shall be furnished with a protective coating consistent with the soil conditions in the immediate vicinity of the specific valve.
3. All valves shall conform to the requirements of AWWA Specification C500, "Gate Valves for Ordinary Water Works Service," and shall bear the name of the manufacturer with steam and water rating cast into the valve body in raised letters.
4. Valve ends shall be mechanical joint unless otherwise specified on the Drawings.
5. Valves shall be fusion-bond epoxy coated, inside and out.
6. The Contractor shall supply the Engineer with a manufacturer's certificate of compliance with AWWA C500 for the valve type approved for use by the Engineer.
7. All water distribution system valves, water supply valves, and fire system supply valves are to be rated to a minimum working pressure of 200 psi.
8. Valve Box: Pre-cast concrete valve box with steel or cast iron traffic cover marked "WATER." H20 rated. Christy Model G5 with G5C cover or approved equal.
9. Above ground valves for domestic and non-potable water lines shall be bronze, lead-free ball valves conforming to NSF/ANSI 61/372-8, as manufactured by NIBCO or approved equal.
10. Above ground valves for fire services shall be non-risen stem gate valve meeting the requirements of ANSI/AWWA C515, UL Listed and Flanged end drilling per ASME/ANSI B16.1 Class 125, rated for 350 psi pressure as manufactured by Mueller A-2361-6 or approved equal.
11. Confirm appropriate details for air release, air/vacuum, combination air valves, and blow-off valves are provided in plans if required.

B.

2.7 FIRE HYDRANTS

- A. Fire hydrants shall be U.L. listed, wet barrel type with a 6" inlet, one 4-1/2 in. steamer outlet and one 2-1/2 in. hose outlet, working pressure of 200 psi, Clow Model 2060 or equal and as approved by Contracting Officer for appearance. All outlets shall have National Standard Hose Threads and shall be protected with grey cast iron caps chained to the hydrant. Fire hydrants shall be wet barrel fire hydrants complying with ANSI/AWWA C503 and shall provide break off check valve with fire hydrant assembly. Interior coating shall meet AWWA C550 for epoxy coating. Provide gate valve with valve box at connection of hydrant piping to the main water line. Fire hydrants shall be painted yellow, with two coats factory applied paint over primer.

- B. Hydrant to be furnished shall be in conformance with AWWA C502 and in compliance with California Fire Code.
- C. If there is a conflict between the standards referenced above, the more stringent requirements shall govern.

2.8 RESTRAINT SYSTEMS

- A. Concrete thrust blocks shall be provided at all tees, fittings, end caps and bends greater than 10 degrees, in accordance with the detail on the Drawings. Thrust blocks shall be provided per NFPA 24 Standards and have a minimum compressive strength of 2500 psi.
- B. Mechanical restraints may also be used to connect all fittings and valves to the adjoining pipe sections. Restraints shall be EBAA Iron Model 15MJ00 or approved equal with factory applied coating to prevent corrosion.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Where pipe is to be installed through walls for vaults and manholes, examine roughing-in to verify actual locations of piping connections before equipment or fixture installation.
- B. Examine each pipe section and component prior to installation for damage or deterioration or suitability for installation. Reject any component that is not in compliance with quality requirements, is missing the gasket, is broken or cracked, is the wrong size or length, or contains any unsatisfactory characteristic, paying particular attention to pipe ends. Any rejected component shall be removed from the project site as expeditiously as possible.
- C. Notify Contracting Officer immediately if rejection of materials or components may impact schedule.
- D. Proceed with installation only after unsatisfactory conditions have been corrected, and all materials to be incorporated into the Work are free of defects.

3.2 INSTALLATION

- A. Trench Excavation: Excavate pipe trenches as specified under Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING and in accordance with details in the drawings.
- B. Bedding: Provide and compact pipe bedding as indicated in drawings and in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
- C. Installation of pipe:

1. Survey and stake pipe line and grade as necessary to assure proper installation per the drawings.
 2. Layout and install pipe in straight line runs between nodes.
 - a. Where change in vertical alignment is required to avoid existing or proposed buried utilities, adjustment shall be made by routing the water line under the crossing pipe using 45 degree bends, unless otherwise noted on the Drawings, or if the crossing pipe is a sewer line.
 - b. Domestic and fire water lines shall always be routed above sanitary or non-potable/recycled water lines.
 - c. All adjustments to vertical alignment shall maintain minimum cover as indicated below.
 3. Maintain minimum separation of 12-inches between water lines and any crossing utilities unless otherwise noted on the Drawings.
 4. Remove appropriate amount of bedding at bell joints, fittings and appurtenances to assure pipe lays flat with the full length and weight of the pipe material distributed evenly along the length of each pipe section and without excess pressure on joints.
 5. Establish pipe elevation with minimum cover of three (3) feet unless otherwise indicated on the profiles included in the Drawings.
 6. Provide mechanical or concrete block thrust restraint at all fittings as directed in Paragraph 2.9 above.
 7. Provide appropriate fittings to accommodate pressure testing, cleaning, flushing and disinfection of pipe as required.
- D. Joint construction: Make pipe joints according to the following:
1. PVC and Ductile Iron: Install push-on pipe joints in accordance with manufacturer's written instructions. For HDPE: Thermo-welded butt joints per manufacturer's recommendations, flange joints where indicated.
 2. Dissimilar Materials Piping Joints: Use approved adapters compatible with both piping materials, with OD, and to meet minimum system working pressure.
- E. Backfill:
1. Backfill pipe trench in pipe zone as described in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING, hand compacting below the haunch of the pipe and over the pipe.
 2. Install pipe marker as shown in drawings for appropriate type of pipe material and type of utility as indicated above.
 3. Perform hydraulic test of pipeline as described below prior to completion of backfill operation.
 4. As soon as practical after the pipeline has passed the hydraulic testing, complete trench backfill according to Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING and as shown in the drawings.
- F. Equipment Installation: Install backflow preventers and associated facilities in accordance with the manufacturer's instructions.

G. Valves and Hydrants:

1. Set valves on compacted bedding.
2. Valve Box:
 - a. Center and plumb valve box over valve.
 - b. Set box cover flush with finished grade.
3. Set hydrants plumb. Locate pumper nozzle perpendicular to and facing roadway.
4. Hydrant installation shall conform to requirements of local fire protection agency.

H. Service Connections:

1. Make service connections to existing and proposed buildings in accordance with the details on the Drawings and as directed by the Contracting Officer.
2. Install tapping sleeve, saddle or valve according to manufacturer's recommendations.
3. Install isolation valves as shown on drawings.
4. Install meter and backflow prevention assembly as shown on drawings.

3.3 TESTING AND ACCEPTANCE

- A. All fire water piping must be inspected by representatives of the Fire Marshal unless specifically excepted. The contractor shall give 72 hours' notice before backfilling.
- B. Hydrostatic test for each pressurized water system according to AWWA C600 and following:
1. Test Pressure:
 - a. Potable Water: Not less than 150 psig or 50 psi in excess of system working pressure, whichever is greater.
 - b. Fire Water: Not less than 200 psig or 50 psi in excess of system working pressure, whichever is greater.
 2. Conduct hydrostatic test for at least two hours.
 3. Slowly fill with water section to be tested and expel air from piping by installing corporation cocks at high points.
 4. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.
 5. Observe joints, fittings, and valves under test. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage and retest.
 6. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
 7. Maintain pressure within plus or minus 5 psi of test pressure.
 8. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 9. Compute maximum allowable leakage using following formula:
 - a. $L = SD \times \sqrt{P}/C$.

- 1) L = testing allowance, gph.
- 2) S = length of pipe tested, feet.
- 3) D = nominal diameter of pipe, inches.
- 4) P = average test pressure during hydrostatic test, psig.
- 5) C = 148,000.

b. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

10. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
11. Correct visible leaks regardless of quantity of leakage.

- C. System or specified components of the system will be considered defective if it does not pass tests and inspections.
- D. The Contractor shall submit test and inspection reports for all field testing for which the Contractor is responsible.

3.4 CLEANING, DISINFECTION AND FLUSHING

- A. Upon the completion of pressure testing and backfilling, flush pipelines with potable water until discharge water appears clean.
- B. Disinfect pipelines and appurtenances in accordance with AWWA C651 - Disinfecting Water Mains.
- C. Discharge disinfection water as directed by the Contracting Officer. Heavily chlorinated discharge water shall not be discharged to the environment, sewer or storm drain without first being appropriately dechlorinated. After dichlorination, provide chlorine residual test results and obtain approval of local authorities prior to discharge.

END OF SECTION 33 14 16

SECTION 33 30 00 - SANITARY SEWER

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 (within five feet of buildings unless otherwise noted):
 - 1. Gravity flow pipe and fittings
 - a. From connection with public sewer main within sewer easement to blind flange near existing bridge East abutment
 - b. From blind flange near existing bridge west abutment to within five feet from face of the building.
 - c. Design of sewer lateral piping support from existing bridge is a deferred submittal by the contractor.
 - 1. Flexible couplings
 - 2. Cleanouts.
 - 3. Maintenance Holes.
 - 4. Cast-In-Place Concrete
- B. Related Sections:
 - 1. Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING
 - 2. Section 31 30 00 - EARTHWORK AND GRADING
- C. Definitions:
 - 1. ID: Inner Diameter.
 - 2. NPS: Nominal Pipe Size.
 - 3. OD: Outside Diameter.
 - 4. Maintenance Hole: Term previously known as "Manhole".

1.3 REFERENCE STANDARDS

- A. ASTM International (ASTM)
 - 1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe
 - 3. ASTM C12 - Standard Practice for Installing Vitrified Clay Pipe Lines

4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Maintenance holes
7. ASTM C655 - Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
8. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
9. ASTM C891 - Standard Specification for Installation of Underground Precast Concrete Utility Structures
10. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Maintenance Hole Structures, Pipes, and Laterals
11. ASTM C1244 - Test Method for Concrete Sewer Maintenance holes by Negative Air Pressure (Vacuum) Test
12. ASTM C1628 - Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets
13. ASTM D698 - Standard Tests for Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
14. ASTM D1557 - Standard Tests for Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)
15. ASTM D2122 - Standard Specification for Determining Dimensions of Thermoplastic Pipe Fittings
16. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
17. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
18. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
19. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
20. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
21. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
22. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings (for Diameter 18" to 60")

B. American Water Works Association (AWWA)

1. AWWA C111 - Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
2. AWWA C150/151 (2002) - Thickness Design of Ductile-Iron Pipe
3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution

C. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.

D. Los Virgenes Water District Standards (most current edition)

E. Applicable sections of the 2019 California Plumbing Code.

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES.
- B. General:
 - 1. Include construction details, material descriptions, dimensions of individual components, and finishes for pipes, fitting, and valves.
 - 2. Include certification of factory testing conducted, indicating that the product meets or exceeds specified requirements of manufacture and performance, including factory applied finish or coating.
 - 3. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 4. Include product name, manufacturer and specifications of all coatings, protective finishes and encasement materials used as corrosion protection on pipes, fittings and appurtenances.
- C. Product Data, including but not limited to:
 - 1. Gravity flow pipe and fittings.
 - 2. Flexible couplings.
 - 3. Cleanouts.
 - 4. Maintenance Holes.
 - 5. Cast-In-Place Concrete.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Do not store plastic pipe and fittings in direct sunlight.
- C. Store pipe materials with adequate support to prevent sagging and bending.
- D. Protect pipe, fittings, and seals from dirt and damage.
- E. Protect flanges, fittings and metal specialties from moisture and dirt.
- F. Handle maintenance holes and catch basins according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

- A. Interruption of existing sanitary sewer service: Do not interrupt sanitary sewer service to upstream users. Bypass piping/pumping shall be subject to local authority coordination and approval.

PART 2 - PRODUCTS

2.1 GRAVITY FLOW PIPE AND FITTINGS

A. HDPE Pipe:

1. HDPE pipe shall conform to ASTM F714-94, "Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter," or ASTM D3035-93 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.").
2. HDPE pipe shall have a Plastic Pipe Institute (PPI) material designation of PE 3408, a cell classification of PE 345434C per ASTM D3350, and have an established hydrostatic design basis of 1600 psi at 73 degrees F.
3. All HDPE fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe, and shall be fully pressure rated.

B. Ductile Iron Pipe (DIP)

1. Conforms to AWWA C150/151 and ASTM A746.
2. Gravity flow Ductile Iron Pipelines shall be lined with ceramic epoxy coating, such as Protecto 401 Ceramic Epoxy or approved equal.
3. For buried installation in corrosive soils, where indicated by the geotechnical report, pipe shall be encased in loose polyethylene sleeve for the full length (including appurtenances and fittings) for which it is buried.
4. Joints shall be push on type with rubber gasket per AWWA C111.
5. Pipe shall be marked on each length of pipe with manufacturer's mark, country of manufacture, year produced, and the letters "DI" or "Ductile".
6. As manufactured by U.S. Pipe, American Cast Iron Pipe Company, McWane International, or approved equal.

2.2 FLEXIBLE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Use unshielded flexible couplings for same or minor difference OD pipes.
- C. Use unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
- D. Use ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2.3 CLEANOUTS

A. Box Types:

1. Christy G5C or approved equal.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, water-tight brass cover with the word "SEWER" or "S.S." on the cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.4 MAINTENANCE HOLES

A. Standard Precast Concrete Maintenance Holes:

1. Shall conform to ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Cover: 24 inches clear opening and shall be marked "SANITARY SEWER"
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into maintenance hole walls, for each pipe connection.
9. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of maintenance hole to finished grade is less than 60 inches.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of maintenance hole frame and cover, and height as required to adjust maintenance hole frame and cover to indicated elevation and slope.
11. Interior concrete surfaces shall be coated with Xypex Concentrate or approved equivalent.

B. Maintenance Holes Frames and Covers

1. ASTM A 536, Grade 60-40-18, ductile iron designed for A-16/H20, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover, using wording equivalent to "SANITARY SEWER"

2.5 CAST-IN-PLACE CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Concrete Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 1064185/A 1064185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 73 40 - EXECUTION : Requirements for installation examination.
- B. Verify that trench cut 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 01 73 40 - EXECUTION : Requirements for installation examination.
- B. Correct over-excavation with suitable fill material per 31 30 00 - EARTHWORK AND GRADING.
- 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.

3.3 INSTALLATION

- A. Excavation and Bedding:
 1. Excavate pipe trench as specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
 2. Hand trim excavation for accurate placement of piping to indicated elevations.
 3. Place bedding material at trench bottom.
 4. Level materials in continuous layer not exceeding 8 inches.
 5. Maintain optimum moisture content of bedding material to attain required compaction density.
- B. Piping:
 1. Install thermoplastic pipes, fittings, and accessories according to ASTM D2321.
 2. Install VCP pipes, fittings, and accessories according to ASTM C12.

3. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
4. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
5. Seal joints watertight.
6. Place pipe on minimum 6-inch-deep bedding as specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
7. Install aggregate at sides and over top of pipe.
8. Install top cover to minimum compacted thickness of 36 inches, unless otherwise specified in Drawings.
9. Backfilling and Compaction:
 - a. As specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
 - b. Do not displace or damage pipe while compacting.
10. Pipe Markers:
 - a. Install warning tape continuous buried 12 inches below finish grade, above piping.
 - b. As specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
11. Install site sewer system piping to within 5 feet of building.

C. Maintenance holes:

1. Install maintenance holes, complete with appurtenances and accessories indicated.
2. Install precast concrete maintenance hole sections with sealants according to ASTM C891.
3. Where specific maintenance hole construction is not indicated, follow maintenance hole manufacturer's written instructions.
4. Set tops of frames and covers flush with finished surface of maintenance holes that occur in pavements unless otherwise indicated in Drawings. Set tops 3-inch above finished surface elsewhere unless otherwise indicated in Drawings.

3.4 TOLERANCES

- A. Section 01 73 40 - EXECUTION: Construction layout.
- B. Maximum Variation from Indicated Pipe Slope: 1/4 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Request inspection by Contracting Officer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Compaction Test:
 - a. Comply with the Geotechnical Engineer's recommendations and ASTM D1556 or D1557.
 - b. Frequency of tests as determined by the Geotechnical Engineer.
3. Gravity-Flow Sewer Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soil-tight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
4. Maintenance hole Testing:
 - a. Vacuum Test: In accordance with ASTM C 1244.

C. Video Inspection

1. A video inspection shall be performed and paid for by the Contractor following the completion of the cleaning, deflection test and the corrections to any defects detected during the deflection test.
2. Prior to performing the video inspection on a segment of pipe, Water shall be poured into the upstream structure and allowed to flow to the next downstream structure so that any ponding can be observed.
3. Defects observed during the inspection which will require correction include the following:
 - a. Alignment: Less than full diameter of pipe is visible between structures, joints are offset, or separated by over 1/4 inch.
 - b. Ponding greater than 10% of the pipe diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - f. Debris or foreign objects in the piping.
 - g. Other obvious deficiencies as determined by Contracting Officer.
4. Provide 2 (two) copies of the video and logs to the Contracting Officer.

3.6 PROTECTION

- A. Section 01 73 40 - EXECUTION: Protecting finished work.

- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.7 CLEANING

- A. Video inspect and clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 30 00

SAMO - 303051

33 30 00 - 10
SANITARY SEWER

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

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 (up to five feet from buildings unless otherwise noted):

1. Gravity flow pipe and fittings
2. Cleanouts
3. Catch basins and Junction Boxes
4. Cast-In-Place Concrete

- B. Related Sections:

1. Section 31 23 33 - UTILITY TRENCHING AND BACKFILL
2. Section 31 30 00 - EARTHWORK AND GRADING

- C. Definitions:

1. ID: Inner Diameter.
2. NPS: Nominal Pipe Size.
3. OD: Outside Diameter.
4. Maintenance Hole: Term previously known as "Manhole".

1.3 REFERENCE STANDARDS

- A. ASTM International (ASTM)

1. ASTM A536 - Standard Specification for Ductile Iron Castings
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
3. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
4. ASTM A716 - Standard Specification for Ductile Iron Culvert Pipe
5. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
6. ASTM C1133 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
7. ASTM C33 - Standard Specification for Concrete Aggregates

8. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
9. ASTM C150 - Standard Specification for Portland Cement
10. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Maintenance Holes, Using Rubber Gaskets
11. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Maintenance Holes
12. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
13. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
14. ASTM C891 - Standard Practice for Installation of Underground precast Concrete Utility Structures
15. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Maintenance Hole Structures, Pipes, and Laterals
16. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
17. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Maintenance Holes, and Precast Box Sections Using Performed Flexible Joint Sealants
18. ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems
19. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
20. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)
21. ASTM D3034 - Standard Specifications for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
22. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
23. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil -Aggregate by Nuclear Methods (Shallow Depth)
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
25. ASTM F2306 - Standard Specification for 12 to 60 in. Annular Corrugated Profile-Wall Polyethylene (PE) Pipe Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

B. American Water Works Association (AWWA)

1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems
2. AWWA C110 - Ductile Iron and Gray Iron Fittings
3. AWWA C111 - Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
4. AWWA C150/151 (2008) - Thickness Design of Ductile-Iron Pipe
5. AWWA C153 - Ductile Iron Compact Fittings

C. AASHTO

1. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 12-60 in. Diameter
2. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe

- D. Los Angeles County Standards (Current version)

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES.
- B. General:
 - 1. Include construction details, material descriptions, dimensions of individual components, and finishes for pipes, fitting and valves.
 - 2. Include certification of factory testing conducted, indicating that the product meets or exceeds specified requirements of manufacture and performance, including factory applied finish or coating.
 - 3. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- C. Shop Drawings:
 - 1. Catch basins: Include Drawings, elevations, sections, details (including reinforcement), frames, and covers.
- D. Product data, including but not limited to:
 - 1. Gravity flow pipe and fittings
 - 2. Cleanouts
 - 3. Catch basins and Junction Boxes
 - 4. Cast-In-Place Concrete

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Do not store plastic pipe and fittings in direct sunlight.
- C. Store pipe materials with adequate support to prevent sagging and bending.
- D. Protect pipe, fittings, and seals from dirt and damage.
- E. Protect flanges, fittings and metal specialties from moisture and dirt.
- F. Handle maintenance holes and catch basins according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 GRAVITY-FLOW PIPE AND FITTINGS

A. PVC Piping:

1. Pipe shall conform to ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings shall conform to ASTM D 3034, PVC with bell ends.
3. Gaskets shall conform to ASTM F 477, elastomeric seals.

2.2 CLEANOUTS

A. Box Types:

1. Christy G5C or approved equal.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, water-tight brass cover with the word "STORM" or "S.D." on the cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Medium Duty in Foot-traffic/landscape areas, Heavy Duty in vehicle-traffic areas.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 CATCH BASINS AND JUNCTION BOXES

A. Standard Precast Concrete Catch Basins and Junction Boxes:

1. Description: ASTM C 913, precast, reinforced concrete, of depth indicated, with provision for sealant joints, square in shape.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
5. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- 6.

B. Catch Basin Frames and Grates:

1. ASTM A 536, Grade 60-40-18, ductile iron designed for A-16/H20, structural loading. Include flat grate with small square or short-slotted drainage openings.
2. All grates and covers must be match-marked so they fit snugly in the frame and do not rock upon completion.
3. All grates and covers within the path of travel must be heel proof and ADA compliant.
4. Grate Free Area: Approximately 50 percent unless otherwise indicated.

5. Catch basins shall be permanently labeled "NO DUMPING DRAINS TO CREEK".
 - 6.
- C. Junction Boxes are to conform to Standard Precast Concrete Catch Basin above with steel checkered plate marked "STORM DRAIN" instead of grate.

2.4 CAST-IN-PLACE CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 1064185/A 1064185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive Work of this Section.
- B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Correct over-excavation with suitable fill material per 31 30 00 - EARTHWORK AND GRADING.
- B. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- C. Protect and support existing storm lines, utilities, and appurtenances.

3.3 INSTALLATION

- A. Excavation and Bedding:
1. Excavate pipe trench as specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
 2. Hand trim excavation for accurate placement of piping to indicated elevations.

3. Place bedding material at trench bottom.
4. Level materials in continuous layer not exceeding 8 inches.
5. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321.
2. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
4. Seal joints watertight.
5. Place pipe on bedding as specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
6. Install aggregate at sides and over top of pipe.
7. Install top cover to minimum compacted thickness of 36 inches, unless otherwise specified in Drawings.
8. Backfilling and Compaction:
 - a. As specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
 - b. Do not displace or damage pipe while compacting.
9. Pipe Markers:
 - a. Install warning tape continuous buried 12 inches below finish grade, above piping.
 - b. As specified in Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING.
10. Install site storm drainage system piping to within 5 feet of building.

C. Catch Basins and Junction Boxes

1. Form bottom of excavation clean and smooth, and to indicated elevation.
2. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.
3. Level top surface of base pad.
4. Sleeve concrete shaft sections to receive storm sewer pipe sections.
5. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
6. Mount lid and frame level in grout, secured to top cone section to indicated elevation.
7. Delete reference to "area drain" or "trench drain" from paragraph below based on section 1.2 Summary.

3.4 TOLERANCES

- A. Section 01 73 40 - EXECUTION: Construction layout.
- B. Maximum Variation from Indicated Pipe Slope: 1/4 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Request inspection by Contracting Officer prior to and immediately after placing aggregate cover over pipe.
- B. Testing:
 - 1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
 - 2. Compaction Test:
 - a. Comply with the Geotechnical Engineer's recommendations and ASTM D1556 or D1557.
 - b. Frequency of Tests as determined by the Geotechnical Engineer.
 - 3. Infiltration Test:
 - a. Comply with ASTM C969.
 - 4. Deflection Test:
 - a. Must allow the passage of ball or cylinder of size equal to or less than 92.5 percent of piping diameter.
 - 5. Pressure Test:
 - a. Comply with ASTM C1103.
- C. Video Inspection
 - 1. A video inspection shall be performed and paid for by the Contractor following the completion of the cleaning, deflection test and the corrections to any defects detected during the deflection test.
 - 2. Prior to performing the video inspection on a segment of pipe, Water shall be poured into the upstream structure and allowed to flow to the next downstream structure so that any ponding can be observed.
 - 3. Defects observed during the inspection which will require correction include the following:
 - a. Alignment: Less than full diameter of pipe is visible between structures, joints are offset, or separated by over 1/4 inch.
 - b. Ponding greater than 10% of the pipe diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.

- d. Infiltration: Water leakage into piping.
- e. Exfiltration: Water leakage from or around piping.
- f. Debris or foreign objects in the piping.
- g. Other obvious deficiencies as determined by Contracting Officer.

4. Provide 2 (two) copies of the video and logs to the Contracting Officer.

3.6 PROTECTION

- A. Section 01 73 40 - EXECUTION: Protecting finished work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.7 CLEANING

- A. Video inspect and clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 40 00

SECTION 33 46 00 - SUBDRAINAGE

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. Perforated pipe and fittings
 - 2. Drain Rock
 - 3. Geotextile fabric

- B. Related Sections:

- 1. Section 31 30 00 - EARTHWORK AND GRADING
 - 2. Section 33 40 00 - STORM DRAINAGE UTILITIES

1.3 REFERENCE STANDARDS

- A. ASTM International (ASTM)

- 1. ASTM F405 (2013) - Standard Specification for Corrugated Polyethylene (PE) Pipe And Fittings.
 - 2. ASTM D2729 (2017) - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.4 SUBMITTALS

- A. Submittal procedure shall be as outlined in Section 01 33 23 SUBMITTAL PROCEDURES.

- B. Product Data, including but not limited to:

- 1. Perforated pipe and fittings
 - 2. Geotextile fabric
 - 3. Filter Fabric

PART 2 - PRODUCTS

2.1 PERFORATED PIPE AND FITTINGS

- A. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.2 DRAIN ROCK

- A. Drain Rock shall consist of Caltrans Class 2 Permeable Material.

2.3 GEOTEXTILE FABRIC

- A. Fabric shall comply with AASHTO M288-06 Class 3.
 - 1. Water pervious type, black, nonwoven with Poly propylene fibers.
 - 2. Use Mirafi 140N or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 73 40 - EXECUTION: Verification of existing conditions before starting work.
- B. Verify trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Remove large stones or other hard matter which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Place drainage pipe on clean cut subsoil free of rocks
- B. Lay pipe to slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Place pipe with perforations facing down. Mechanically join pipe ends.
- D. Install pipe couplings.
- E. Install aggregate at sides, over joint covers and top of pipe. Install top cover compacted thickness as indicated on Drawings.

- F. Place filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations.
- G. Place aggregate in maximum 6 inch lifts, consolidating each lift.
- H. Refer to Section 31 23 33 - UTILITY TRENCHING AND BACKFILLING for compaction requirements. Do not displace or damage pipe when compacting.
- I. Place impervious fill over drainage pipe aggregate cover and compact.
- J. Connect to storm sewer system with unperforated pipe, through installed sleeves.

3.4 FIELD QUALITY CONTROL

- A. Section 01 73 00 - QUALITY REQUIREMENTS: Field inspecting, testing, adjusting, and balancing.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 73 40 - EXECUTION: Protecting installed construction.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION 33 46 00

