

CAPITAL TRANSIT VALLEY TRANSFER STATION

VOLUME II of III

Contract No. BE20-268

File No. 1874



ENGINEERING DEPARTMENT

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SECTION 00853 – STANDARD DETAILS

PART 1 – GENERAL

1.1 STANDARD DETAILS

- A. Whenever references are made to the Standard Drawings or Standard Details in these plans of Specifications the intent is to refer to the current City and Borough of Juneau Standard Details (currently the 4th Edition dated August 2011), copies of which may be purchased from the CBJ Engineering Department.
- B. City and Borough of Juneau Standard Details which specifically apply to the Project include but are not limited to the following:

LIST OF DETAILS

<u>STANDARD DETAIL NO.</u>	<u>NAME OF DETAIL</u>
105	DRIVEWAY CURB CUT
106	ACCESSIBLE SIDEWALK RAMP
111A	CONCRETE SIDEWALK, TYPE I CURB & GUTTER
125	PAVEMENT RESURFACING AND TRENCH DETAIL
127A	SIGN ASSEMBLY SINGLE-POST
203	SANITARY SEWER MANHOLE TYPES I & II
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206A	STANDARD MANHOLE COVER & FRAME
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213	SANITARY SEWER SERVICE LATERAL
216	PRESSURE SANITARY SEWER SERVICE LATERAL
219	RESIDENTIAL PUMP STATION PRESSURE MAIN
304A	TYPE III CATCH BASIN
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419	RESIDENTIAL WATER SERVICE CONNECTION

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SPECIAL PROVISIONS

The Standard Specifications for Civil Engineering Projects and Subdivision Improvements December 2003 Edition, with sixteen Errata, as published by the City and Borough of Juneau, is part of these Contract Documents and shall pertain to all phases of the contract. The Standard Specifications for Civil Engineering Projects and Subdivision Improvements December 2003 Edition is available for a fee from the City and Borough of Juneau Engineering Contracts Office, (907) 586-0800, or you may view them online at: www.juneau.org/engineering.

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SPECIAL PROVISIONS

Add the following Section:

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL

- A. The WORK to be performed under this contract shall consist of furnishing all tools, equipment, materials, supplies, manufactured articles and furnishing all labor, transportation and services, including all fuel, power, water and essential communications and performing all WORK, or other operations required for the fulfillment of the contract in strict accordance with the Contract Documents. The WORK shall be complete, and all WORK, materials, and services, not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR as though originally so indicated, at no increase in cost to the OWNER.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The WORK covered in the Contract Documents generally includes: Construction of a new bus transfer station with a driver breakroom building, rider shelters, a multiuse path and a parking lot. WORK will include new water and sewer services to the breakroom, a new storm drain system, earthwork, concrete flatwork and asphalt paving. WORK will also include coordination with the local utilities to relocate the existing overhead utilities underground.
- B. **SITE OF WORK.** The site of the WORK is adjacent to Mall Road and Riverside Drive in downtown Juneau, Alaska.

1.3 WORK BY OTHERS

- A. The CONTRACTOR's attention is directed to the fact that work may be conducted adjacent to the site by other contractors during the performance of the WORK under this contract. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the WORK of such other contractors, and shall cooperate fully with such contractors to provide continued safe access to their respective portions of the adjacent sites, as required to perform work under their respective contracts.
- B. **Interference with Work on Utilities.** The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.4 CONTRACTOR USE OF PROJECT SITE

SPECIAL PROVISIONS

- A. The CONTRACTOR's use of the Project site shall include construction operations and storage of materials, fabrication facilities, and field offices only in those areas identified on the Drawings.
- B. Use of the Alaska Club parking lot is not be permitted without written approval from the Alaska.

1.5 OWNER USE OF THE PROJECT SITE

- A. The OWNER may utilize all or part of the existing site during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate and coordinate with the ENGINEER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operation at the same time. In any event, the OWNER shall be allowed access to the Project site during the period of construction.

1.6 PROJECT MEETINGS

- A. Pre-Construction Conference
 - 1. Prior to the commencement of WORK at the site, a Pre-Construction Conference will be held at a mutually agreed time and place which shall be attended by the CONTRACTOR's Project Manager, its Superintendent, and its Subcontractors as the CONTRACTOR deems appropriate. Other attendants will be:
 - a. ENGINEER and Inspector.
 - b. Representatives of OWNER.
 - c. Governmental representatives as appropriate.
 - d. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
 - 2. Unless previously submitted to the ENGINEER, the CONTRACTOR shall bring to the Pre-Construction Conference one copy each of the following:
 - a. Plan of Operation.
 - b. Project Overview Bar Chart Schedule.
 - c. Procurement schedule of major equipment and materials and items requiring long lead time.
 - d. Shop Drawing/Sample/Substitute or "Or Equal" submittal schedule.
 - e. Name and telephone number of CONTRACTOR's Project Supervisor.
 - f. Erosion Control Plan with Storm Water Pollution Prevention Plan.
 - 3. The purpose of the Pre-Construction Conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedure for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. The CONTRACTOR should be prepared to discuss all of the items listed below:
 - a. Status of CONTRACTOR's insurance and bonds.
 - b. CONTRACTOR's tentative schedules.

SPECIAL PROVISIONS

- c. Transmittal, review, and distribution of CONTRACTOR's submittals.
 - d. Processing applications for payment.
 - e. Maintaining record documents.
 - f. Critical WORK sequencing.
 - g. Field decisions and Change Orders.
 - h. Use of Project site, office and storage areas, security, housekeeping, and OWNER's needs.
 - i. Major equipment deliveries and priorities.
 - j. CONTRACTOR's assignments for safety and first aid.
4. The OWNER will preside at the Pre-Construction Conference and will arrange for keeping and distributing the minutes to all persons in attendance.
 5. The CONTRACTOR and its Subcontractors should plan on the conference taking no longer than three hours. Items listed in paragraph 3 will be covered as well as a review of the Drawings and Specifications with the ENGINEER and OWNER.

B. Progress Meetings

1. The CONTRACTOR shall schedule and hold regular on-site progress meetings at least weekly and at other times as requested by the ENGINEER, or as required by the progress of the WORK. The CONTRACTOR, ENGINEER, and all Subcontractors active on the site must attend each meeting. The CONTRACTOR may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.
2. The ENGINEER shall conduct the meeting and will arrange for recording and distributing the minutes. The purpose of the meetings will be to review the progress of the WORK, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop. During each meeting, the CONTRACTOR is required to present any issues which may impact the WORK, with a view toward resolving these issues expeditiously.

1.7 DEFINITIONS APPLICABLE TO TECHNICAL SPECIFICATIONS

A. The following words have the meaning defined in the Technical Portions of the WORK:

1. Furnish - means to supply and deliver to the site, to unload and unpack ready for assembly, installation, testing, and start-up.
2. Indicated - is a word used to direct the CONTRACTOR to information contained on the drawings or in the Specifications. Terms such as "shown", "noted", "scheduled", and "specified" also may be used to assist in locating information but no limitation of location is implied or intended.
3. Install - defines operations at the site including assembly, erection, placing, anchoring, applying, shaping to dimension, finishing, curing, protecting, and cleaning, ready for the OWNER's use.

SPECIAL PROVISIONS

4. Installer - a person or firm engaged by the CONTRACTOR or its subcontract, or any Subcontractor, for the performance of installation, erection, or application WORK at the site. Installers must be expert in the operations they are engaged to perform.
5. Provide- is defined as furnish and install, ready for the intended use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Add the following Section:

SECTION 01025 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SCOPE

- A. Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items for WORK being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA) and Occupational Safety and Health Standards of the Alaska Department of Labor, Division of Labor Standards and Safety.
- B. No separate payment will be made for any Pay Item that is not specifically set forth in the Bid Schedule, and all costs therefore shall be included in the prices named in the Bid Schedule for the various appurtenant items of WORK.
- C. In addition to the other incidental items of WORK listed elsewhere in the contract, the following items shall also be considered as incidental to the WORK:
 1. Maintenance of all services to the adjacent properties including power, water, storm and sanitary sewers, garbage pickup, mail delivery, and emergency vehicles.
 2. Repair or replacement of existing adjacent facilities including piping, landscaping, steel, timber, concrete and asphalt items, if damaged by the CONTRACTOR.
 3. Final clean-up and site restoration.
 4. Watering of the site as necessary for dust control.
 5. All fittings required for storm, water and sanitary sewer pipes.
 6. Usable material from excavation placed within the Project site.
 7. All saw cuts of AC pavement and concrete.

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8. Crack sealing all joints following paving operations.
9. Sheeting, shoring, and bracing as required.
10. Removal and disposal of the concrete sign base at ~STA "WE" 10+76, 20' LT.
11. Relocation of the existing 40-ft container at the north end of the Asiana Gardens parking lot.

1.2 MOBILIZATION (Pay Item No. 1505.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for payment for Mobilization will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. Payment for Mobilization will be made at the amount shown on the Bid Schedule under Pay Item No. 1505.1, which payment will constitute full compensation for all WORK described in Section 01505 - Mobilization, as shown on the Drawings and as directed by the ENGINEER.
- C. Partial payments will be made as the WORK progresses as follows:
 1. When 5% of the total original contract amount is earned from other Pay Items, 50% of the amount bid for Mobilization, or 5% of the original contract amount, whichever is lesser, will be paid.
 2. When 10% of the total original contract amount is earned from other Pay Items, 100% of the amount bid for Mobilization, or 10% of the original contract amount, whichever is lesser, will be paid.
 3. Upon completion of all WORK on the Project, payment of any amount bid for Mobilization in excess of 10% of the total contract amount will be paid.

1.3 REMOVAL OF THE EXISTING BUS SHELTER (Pay Item No. 1530.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for payment for Removal of the Existing Bus Shelter will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. WORK under this Pay Item includes removal of the existing bus shelter at ~STA "NS" 10+35, 100' RT, and delivery of the shelter without damage to the Capital Transit facility at 10099 Bentwood Place.
- C. Payment for Removal of the Existing Bus Shelter will be made at the amount shown on the Bid Schedule under Pay Item No. 1530.1, which payment will constitute full compensation for all WORK described in Section 01530 – Protection and Restoration of Existing Facilities, as shown on the Drawings and as directed by the ENGINEER.

1.4 UTILITY UNDERGROUNDING COORDINATION (Pay Item No. 1530.2) PRICE BASED ON LUMP SUM

- A. Measurement for payment for Utility Undergrounding Coordination will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete as

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shown on the Drawings, all in accordance with the requirements of the Contract Documents.

- B. WORK under this Pay Item will include:
1. Coordination of all work by the Utilities associated with relocating the existing overhead utilities along and across Riverside Drive, and along the north boundary of the Project, to underground, including the associated services to Asiana Gardens, Heritage Coffee, the Alaska Club, and NAPA. Utility
 2. Supporting the two existing utility poles as required at ~STA "WE" 11+26.8, 14.4' LT and 11+89.9, 13.6' LT during the preliminary earthwork until the overhead system is demolished by the utilities.
 3. Furnishing 400 tons of Base Course, Grading D-1, to be placed as bedding material by the Utilities. Bedding material required by the Utilities in excess of 400 tons will be measured for payment on Pay Item 2204.1.
 4. All costs associated with demobilizing and mobilizing, as required, for the two 2-week periods identified in the Contract Documents for the utilities to complete the relocation of the existing overhead utilities underground and switching the associated services over to the new system.
 5. Providing construction staking for all utility pedestals (center of structure) and the alignment "WE" at 100-ft intervals upon completion of the preliminary earthwork.
- C. WORK to be performed by the utilities in conjunction with this Pay Item will generally include the installation of a new underground system between Riverside Drive and NAPA and removal of the existing overhead system along the back boundary of the Project site, The work will specifically include the following:
1. Furnishing, installing, and bedding all required conduit for the Riverside Drive crossing. Note: the associated asphalt removal, trenching and backfill shall be performed by the CONTRACTOR.
 2. Furnishing and installing all required conduit and conductors for the underground system along Riverside Drive, and within the CBJ parcel, and the associated trenching from and backfill to original ground or the subcut layer established by the CONTRACTOR.
 3. Installing the CONTRACTOR furnished bedding for all utility conduit.
 4. Furnishing and installing all pedestals, vaults and transformers associated with relocating the existing utilities underground.
 5. Coordination and execution of the service switchovers to the new underground system with Asiana Gardens, Heritage Coffee, the Alaska Club, and Napa.
 6. Demolition of the existing overhead system.
- D. Work performed by the Utilities is not part of this contract.
- E. All WORK to support the Utilities for the Riverside Drive Crossing will be considered part of the WORK under Pay Item 2501.6.
- F. Payment for WORK performed by the CONTRACTOR for Utility Undergrounding Coordination will be made at the amount named in the Bid Schedule under Pay Item No. 1530.2, which payment will constitute full

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compensation for all WORK described in Section 01530 – Protection and Restoration of Existing Facilities, Section 02204.1 - Base Course, as shown on the Drawings and as directed by the ENGINEER.

1.5 TRAFFIC CONTROL (Pay Item No. 1550.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for this Item will be made as a Lump Sum Pay Unit for completion of Traffic Control in accordance with the Contract Documents.
- B. WORK will include, but is not limited to, the preparation and implementation of all temporary traffic control plans and detours both within and around Riverside Drive. Traffic control may also require signs on James Boulevard, Mendenhall Loop Road, Mall Road, Vintage Boulevard, Egan Drive, and other streets as required.
- C. WORK will include all signs and barricades required for the routing of pedestrian and bicycle traffic along or around the Riverside Drive work zones.
- D. Payment for Traffic Control will be made at the amount shown on the Bid Schedule under Pay Item No. 1550.1, which payment will constitute full compensation for all WORK described in Section 01550 – Site Access and Storage, as shown on the Drawings, and as directed by the ENGINEER.

1.6 EROSION AND SEDIMENT CONTROL (Pay Item No. 1570.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for payment for Erosion and Sediment Control will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. WORK under this Pay Item includes all requirements described in Section 01570, including but not limited obtaining all necessary permits for storm water control as required by Alaska Department of Conservation and the Environmental Protection Agency. This includes furnishing, installing and maintaining all measures required by these permits.
- C. The Project area is greater than 1 acre and the WORK will require a Stormwater Pollution Prevention Plan.
- D. Payment for Erosion and Sediment Control will be made at the amount shown on the Bid Schedule under Pay Item No. 1570.1, which payment will constitute full compensation for all WORK described in Section 01570 – Erosion and Sediment Control, as shown on the Drawings and as directed by the ENGINEER.

2.1 CLEARING AND GRUBBING (Pay Item No. 2201.1) PRICE BASED ON LUMP SUM PAY UNIT

SPECIAL PROVISIONS

- A. Measurement for payment for Clearing and Grubbing will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. WORK under this Pay Item includes removal and disposal of all grass, alder and cedar trees within the limits of the Project site. The mountain ash along the west boundary shall be protected in place unless specifically designated for removal.
- C. Removal of the earthen berm along the northern boundary shall be measured for payment under Pay Item 2202.1.
- D. Payment for Clearing and Grubbing will be made at the amount shown on the Bid Schedule under Pay Item No. 2201.1, which payment will constitute full compensation for all WORK described in Section 02201 – Clearing and Grubbing, as shown on the Drawings and as directed by the ENGINEER.

2.2 EXCAVATION (Pay Item No. 2202.1) PRICE BASED ON QUANTITY, CUBIC YARD

- A. Measurement for payment for Excavation will be based on the number of cubic yards of unclassified material excavated, as determined by the average end area method. Where impractical to measure by the average end area method, the ENGINEER may approve other acceptable methods involving three-dimensional measurements. Excavation outside of the subcut limits indicated in the Drawings, or as directed by the ENGINEER will not be measured for payment.
- B. WORK under this Pay Item will include both Muck Excavation and Common Excavation. The estimated quantity of Muck Excavation within the earthen berm along the north boundary of the project is 1,330 cubic yards, and the estimated quantity of Common Excavation is 4,759 cubic yards. Of the Common Excavation an estimated 300 cubic yards is usable on site.
- C. No deduction in the measurement for Excavation will be made for the trenching required for pipe and structure installations above the bottom of, or within the subcut limits as shown on the Sections.
- D. Measurement for payment may be selected by the CONTRACTOR from one of the following methods:
 - 1. From actual cross sections taken by the CONTRACTOR's surveyor with the lower limits determined from the finished grade elevations provided, or as directed by the ENGINEER.
 - 2. The CONTRACTOR may review and utilize the ENGINEER's design earthwork quantity computations in lieu of providing its own quantity determinations.
- E. The following will not be measured for direct payment; the cost of such WORK will be considered incidental to other WORK under the contract:
 - 1. Overburden and other spoil material from borrow sources.

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2. Removal of water by aeration of material to obtain required moisture content.
 3. Any volumes of water or other liquid material.
 4. Slide or slipout material attributable to the carelessness of the CONTRACTOR.
 5. The volume of conserved materials stockpiled at the option of the CONTRACTOR.
 6. Placement of usable, or otherwise suitable material from excavation, as determined by the ENGINEER, into the site as embankment or selected embankment.
- F. Payment for Excavation will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2202.1, which payment will constitute full compensation for all WORK described in Section 02202 - Excavation and Embankment, as shown on the Drawings and as directed by the ENGINEER.
- 2.3 SHOT ROCK BORROW (Pay Item No. 2202.2) PRICE BASED ON QUANTITY, CUBIC YARD
- A. Measurement for payment for Shot Rock Borrow will be based on the number of cubic yards of material in place as determined by the average end area method, and will be determined on a neatline basis. Where impractical to measure by the average end area method, the ENGINEER may approve other acceptable methods involving three-dimensional measurements. Embankment outside of the lines, grades and cross sections indicated in the Drawings or as directed by the ENGINEER will be deducted from borrow quantities for pay purposes.
 - B. No Shot Rock Borrow shall be measured for payment below the lines and grades shown on the Drawings, unless directed by the ENGINEER.
 - C. Payment for Shot Rock Borrow will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2202.2, which payment will constitute full compensation for all WORK described in Section 02202 - Excavation and Embankment, as shown on the Drawings as and as directed by the ENGINEER.
- 2.4 MINING AREA RESTORATION & ROAD CLEANING GUARANTEE (Pay Item No. 2202.3) PRICE BASED ON CONTINGENT SUM PAY UNIT
- A. Measurement for this Item will be made as a Contingent Sum Pay Unit for completion of Mining Area Restoration and Road Cleaning.
 - B. The CONTRACTOR shall be responsible for removal of dirt, mud, rocks and other debris from CBJ and State Right-of-Ways accumulated from the hauling and quarry operations. It is the intent that the traveled public way be kept as clean as practical to minimize dust and to avoid unsafe traffic conditions. If the CONTRACTOR fails to perform necessary road cleaning, the CBJ may hire outside forces to perform the work and deduct the cost from this contingent sum item.

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- C. The CONTRACTOR shall be responsible for restoration of their mining area in accordance to the conditions of the material source used and mining plan submitted. If the CONTRACTOR fails to perform the required mining area restoration, the CBJ may hire outside forces to perform the work and deduct the cost from this contingent sum item.
 - D. Release of final payment for Mining Area Restoration and Road Cleaning Guarantee will be made upon determination of completeness by the ENGINEER after deduction of OWNER incurred costs for necessary road cleaning and/or mining area restoration not completed by the CONTRACTOR.
 - E. Payment for Mining Area Restoration and Road Cleaning Guarantee will be made at the amount named in the Bid Schedule under Pay Item No. 2202.3, which payment will constitute full compensation for all WORK described in section 02202 – Excavation and Embankment, as shown on the Drawings and as directed by the ENGINEER.
- 2.5 SIDESLOPES AND DITCH GRADING (Pay Item No. 2202.4) PRICE BASED ON LUMP SUM
- A. Measurement for payment for Sideslopes and Ditch Grading will be based on the completion of the entire WORK as a Lump Sum Pay Unit, complete, including all placement of usable excavation prior to final surfacing as shown on the Drawings.
 - B. Payment for Sideslopes and Ditch Grading will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2202.4, which payment will constitute full compensation for all WORK described in Section 02202 - Excavation and Embankment, as shown on the Drawings as and as directed by the ENGINEER.
- 2.6 2-INCH MINUS SHOT ROCK w/ BASE COURSE (Pay Item No. 2204.1) PRICE BASED ON QUANTITY, CUBIC YARD
- A. 2-Inch Minus Shot Rock w/ Base Course will be measured by the number of cubic yards of material in place as determined by the average end area method, and will be determined on a neatline basis. Where impractical to measure by the average end area method, the ENGINEER may approve other acceptable methods involving three-dimensional measurements. Material outside of the lines, grades and cross sections indicated in the Drawings, or as directed by the ENGINEER, will be deducted from 2-Inch Minus Shot Rock w/Base Course quantities for pay purposes.
 - B. Base Course, Grading D-1, may be used under the sidewalk and curb as a substitute for 2-Inch Minus Shot Rock w/ Base Course as a no cost change. This material will be measured for payment under this Pay Item.
 - C. Any bedding material required in excess of the estimated 400 tons under Pay Item 1530.2 will be measured for Payment under this Pay Item at a conversion rate of 2.0 tons per cubic yard.

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- D. Water needed for compaction and added to the base material on the grade will be considered incidental.
 - E. The WORK under this Pay Item shall include both the 2-Inch Minus Shot Rock and Base Course, Grading D-1 required to construct the full depth of 2-Inch Minus Shot w/Base Course specified on the Drawings.
 - F. Payment for 2-Inch Minus Shot Rock w/ Base Course, will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2204.1, which payment will constitute full compensation for all WORK described in Section 02204 – Base Course, as shown on the Drawings and as directed by the ENGINEER.
- 2.7 ROCK CHIPS (Pay Item No. 2204.2) PRICE BASED ON QUANTITY, CUBIC YARD
- A. Rock Chips will be measured by the number of cubic yards of material in place as determined by the average end area method, and will be determined on a neatline basis. Where impractical to measure by the average end area method, the ENGINEER may approve other acceptable methods involving three-dimensional measurements. Material outside of the lines, grades and cross sections indicated in the Drawings, or as directed by the ENGINEER, will be deducted from the quantities for pay purposes.
 - B. Payment for Rock Chips will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2204.2, which payment will constitute full compensation for all WORK described in Section 02204 – Base Course, as shown on the Drawings and as directed by the ENGINEER.
- 2.8 SANITARY SEWER SERVICE (Pay Item No. 2401.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Sanitary Sewer Pipe Service will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item will include the 6-inch PVC gravity line beginning at SSMH-1 to the cleanout at “SN” 10+47.9, 17.0’ LT, the cleanout and connection to the 1-1/4” HDPE force main, the 1-1/4” HDPE force main to the residential pump station at “SN” 11+99.4, 15.0’ LT, the residential pump station, and the 4”PVC gravity run and cleanout adjacent to the breakroom. All sewer pipe, toilets, fixtures, and fittings within the break room to the point of connection to the 4”PVC line outside the breakroom wall shall be considered part of the WORK under Pay Item 323300.5.
 - C. WORK under this Pay Item will include all trench excavation, bedding, backfill, warning tape, rigid insulation board, and all fittings as required. Any base course and surfacing material along the trench line will be measured for payment under their respective Pay Items.

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- D. WORK under this Pay Item will include the electrical panel and associated conductors and conduit between the breakroom panel and the residential pump station, and all electrical associated with the pump station.
 - E. WORK under this Pay Item will also include furnishing a second 7' Level Sensing Core (grinder pump) with candy cane discharge to be used as a backup.
 - F. The sanitary sewer concrete manhole SSMH-1 will be measured for payment under Pay Item 2402.1.
 - G. Payment for Sanitary Sewer Service will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2401.1, which payment will constitute full compensation for all WORK described in Section 02401 – Sanitary Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.
- 2.9 SANITARY SEWER MANHOLE, TYPE I (Pay Item No. 2402.1) PRICE BASED ON A LUMP SUM PAY UNIT.
- A. Sanitary Sewer Manhole, Type I will be based upon the completion of the entire WORK as a Lump Sum Pay Unit complete in place, all in accordance with the requirements of the Contract Documents.
 - B. WORK under the Pay Item will include the concrete manhole SSMH-1 with new frame and cover, waterproofing, new adjusting rings, and all earthwork required.
 - C. The WORK will also include field-locating the existing sanitary sewer service for Asiana Gardens, and all fittings and pipe required to connect the new manhole to the existing pipe.
 - D. Payment for Sanitary Sewer Manhole will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2402.1, which payment will constitute full compensation for all WORK described in Section 02402–Sanitary Sewer Manholes and Cleanouts, as shown on the Drawings, and as directed by the ENGINEER.
- 2.10 6-INCH PVC PIPE CULVERT (Pay Item No. 2501.1) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Culvert Pipes, including all coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, will be measured by the staked length in linear feet.
 - B. WORK will include all culvert pipe, including all saddle tees, coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, as well as connections to catch basins as shown on the Drawings.
 - C. Trench excavation, bedding, backfill and imported backfill will not be measured for payment, but will be considered incidental to the WORK.

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- D. Payment for Storm 6-Inch PVC Pipe Culvert will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.1, which payment will constitute full compensation for all WORK described in Section 02501 - Storm Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.
- 2.11 8-INCH HP PVC PIPE CULVERT (Pay Item No. 2501.2) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Culvert Pipes, including all coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, will be measured by the staked length in linear feet.
 - B. Pipes for storm drains shall be measured by the staked length, from center to center of structures or to ends of pipe if no structure is present. No deduction shall be made for footage through inlets, catch basins or manholes.
 - C. Branch connections, coupling adapters and bends will be included in the linear foot measurement for conduit.
 - D. Trench excavation, bedding, backfill and imported backfill will not be measured for payment, but will be considered incidental to the WORK.
 - E. Payment for 8-Inch HP PVC Pipe Culvert will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.2, which payment will constitute full compensation for all WORK described in Section 02501 - Storm Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.
- 2.12 12-INCH HP PVC PIPE CULVERT (Pay Item No. 2501.3) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Culvert Pipes, including all coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, will be measured by the staked length in linear feet.
 - B. Pipes for storm drains shall be measured by the staked length, from center to center of structures or to ends of pipe if no structure is present. No deduction shall be made for footage through inlets, catch basins or manholes.
 - C. Branch connections, coupling adapters and bends will be included in the linear foot measurement for conduit.
 - D. Trench excavation, bedding, backfill and imported backfill will not be measured for payment, but will be considered incidental to the WORK.
 - E. Payment for 12-Inch HP PVC Pipe Culvert will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.3, which payment will constitute full compensation for all WORK described in Section 02501 - Storm Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.

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- 2.13 12-INCH CPP PIPE CULVERT (Pay Item No. 2501.4) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Culvert Pipes, including all coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, will be measured by the staked length in linear feet.
 - B. Pipes for storm drains shall be measured by the staked length, from center to center of structures or to ends of pipe if no structure is present. No deduction shall be made for footage through inlets, catch basins or manholes.
 - C. Branch connections, coupling adapters and bends will be included in the linear foot measurement for conduit.
 - D. Trench excavation, bedding, backfill and imported backfill will not be measured for payment, but will be considered incidental to the WORK.
 - E. Payment for 12-Inch CPP Pipe Culvert will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.4, which payment will constitute full compensation for all WORK described in Section 02501 - Storm Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.
- 2.14 18-INCH CPP PIPE CULVERT (Pay Item No. 2501.5) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Culvert Pipes, including all coupling bands, bends and other items necessary for the proper joining of the culvert pipe sections, will be measured by the staked length in linear feet.
 - B. Pipes for storm drains shall be measured by the staked length, from center to center of structures or to ends of pipe if no structure is present. No deduction shall be made for footage through inlets, catch basins or manholes.
 - C. Branch connections, coupling adapters and bends will be included in the linear foot measurement for conduit.
 - D. Trench excavation, bedding, backfill and imported backfill will not be measured for payment, but will be considered incidental to the WORK.
 - E. Payment for 18-Inch CPP Pipe Culvert will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.5, which payment will constitute full compensation for all WORK described in Section 02501 - Storm Sewer Pipe, as shown on the Drawings and as directed by the ENGINEER.
- 2.15 RIVERSIDE DRIVE CROSSING (Pay Item No. 2501.6) PRICE BASED ON A LUMP SUM PAY UNIT.
- A. Riverside Drive Crossing will be based upon the completion of the entire WORK as a Lump Sum Pay Unit complete in place, all in accordance with the requirements of the Contract Documents.

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- B. WORK will include all labor, and equipment for the work within the Riverside Drive roadway and bike lanes. Specific tasks include asphalt removal, furnishing and installing the 24" CPP cross-culvert SD-1, including the connection to the existing inlet structure at the west edge of the roadway, all trenching and backfill of the utility crossing, the live tap of the 18" ductile iron water main (the actual tap will be performed by the water utility), furnishing, installing, maintaining, and removing the temporary recycled asphalt pavement, and furnishing and installing the Base Course, Grading D-1 and the new Asphalt Cement Pavement both within the roadway and across the asphalt sidewalk on the west side of the roadway.
 - C. WORK will include all traffic control required for the implementation of the night work detours including two changeable sign boards along Egan Drive.
 - D. Removal and disposal of the existing 24" CMP along the approximate alignment of SD-1 shall be considered incidental to this Pay Item.
 - E. All curb and gutter, concrete and asphalt sidewalk, and underlying base course adjacent to the crossing will be measured for payment under their respective Pay Items. All WORK required to construct the utility pedestal pad and 18" CPP storm drain culvert SD-0.5 at ~STA "WE" 10+00, 55' LT will be measured for payment under their respective Pay Items.
 - F. The utility conduits for the crossing will be furnished, installed, and bedded by AEL&P. Excavation and backfill of the trench shall be performed by the CONTRACTOR under this Pay Item, and the bedding for the conduits shall be considered part of the WORK under Pay Item 1530.2.
 - G. Payment for Riverside Drive Crossing will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2501.6, which payment will constitute full compensation for all WORK described in Section 02202 - Excavation and Embankment, Section 02203 - Trenching, Section 02204 - Base Course, Section 02501 - Storm Sewer Pipe, Section 02601 - Water Pipe, Section 02602 - Valves, as shown on the Drawings, and as directed by the ENGINEER.
- 2.16 CATCH BASIN, TYPE III (Pay Item No. 2502.1) PRICE BASED ON QUANTITY, EACH
- A. Catch Basins will be measured per each, complete in place, including all earthwork, frames and grates or covers.
 - B. WORK will include the associated connections to the existing inlet and outlet culverts as required.
 - C. Payment for Catch Basin, Type III will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2502.1, which payment will constitute full compensation for all WORK described in Section 02502 - Storm Sewer Manholes, Inlets and Catch Basins, as shown on the Drawings and as directed by the ENGINEER.

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- 2.17 CATCH BASIN, TYPE IV (Pay Item No. 2502.2) PRICE BASED ON QUANTITY, EACH
- A. Catch Basins will be measured per each, complete in place, including all earthwork, frames and grates or covers.
 - B. WORK will include the associated connections to the existing inlet and outlet culverts as required.
 - C. Payment for Catch Basin, Type IV will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2502.2, which payment will constitute full compensation for all WORK described in Section 02502 - Storm Sewer Manholes, Inlets and Catch Basins, as shown on the Drawings and as directed by the ENGINEER.
- 2.18 WATER SERVICE (Pay Item No. 2605.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment of Water Service, will be based on upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item includes the tapping saddle with corp stop, 2-inch polyethylene leg, tracer wires and splice connectors, warning tape, curb stop, valve box, and any other pipe and fittings required to connect to the breakroom water service as shown on the Drawings and as directed by the ENGINEER.
 - C. Trench excavation, backfill, chlorination and pressure testing, shall be considered incidental to this Pay Item.
 - D. Payment for Water Service will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2605.1, which payment will constitute all WORK described in Section 02605 – Water Services, as shown on the Drawings and as directed by the ENGINEER.
- 2.19 CONSTRUCTION SURVEYING (Pay Item No. 2702.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment of Construction Surveying will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. The WORK required to remove and reset all survey monuments and other survey markers disturbed by construction activities will be considered incidental to the WORK.
 - C. Surveying the bottom of the excavation limits beneath the earthen berm to determine the final excavation quantities for Pay Item 2202.1 will be considered part of the WORK. Where the bottom of excavation can be determined by neatline, re-survey will not be required.

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- D. The WORK required to provide construction staking for the utility companies shall be considered part of the WORK under Pay Item 1530.2.
 - E. Payment for Construction Surveying will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2702.1, which payment will constitute full compensation for all WORK described in Section 02702 - Construction Surveying, as shown on the Drawings and as directed by the ENGINEER.
- 2.20 TOPSOIL (Pay Item No. 2709.1) PRICE BASED ON QUANTITY, CUBIC YARD
- A. Measurement for payment of Topsoil will be based on the number of cubic yards of material in place as determined by the average end area method, and will be determined on a neatline basis. Where impractical to measure by the average end area method, the ENGINEER may approve other acceptable methods involving three-dimensional measurements. Material outside of the lines, grades and cross sections indicated in the Drawings, or as directed by the ENGINEER, will be deducted from Topsoil quantities for pay purposes.
 - B. Organics within the earthen berm along the north boundary will not be considered usable excavation under Pay Item 2202.1 and may be used and measured for payment under this Pay Item provided it meets the requirements for Topsoil. All screening, mixing, supplementing, testing, and all other WORK required to furnish and install Topsoil in accordance with the Contract Documents will be considered incidental to this Pay Item.
 - C. Payment for Topsoil will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2709.1, which payment will constitute full compensation for all WORK described in Section 02709 – Topsoil, as shown on the Drawings and as directed by the ENGINEER.
- 2.21 SEEDING, HYDRAULIC METHOD, TYPE III (Pay Item No. 2710.1) PRICE BASED ON QUANTITY, SQUARE YARD
- A. Seeding by the hydraulic method will be measured for payment by the number of slurry units (to the nearest 1/10 unit) of mixture applied to the designated areas, as directed by the ENGINEER.
 - B. Payment for Seeding, Hydraulic Method, Type III will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2710.1, which payment will constitute full compensation for all WORK described in Section 02710 – Seeding, as shown on the Drawings and as directed by the ENGINEER.
- 2.22 FILTER CLOTH, TYPE A (Pay Item No. 2714.1) PRICE BASED ON QUANTITY, SQUARE YARD
- A. Filter Cloth, Type A will be measured for payment by the number of square yards installed, as directed by the ENGINEER.
 - B. Filter Cloth will be installed beneath the rock chips, as shown on the Drawings.

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- C. Payment for Filter Cloth, Type A will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2714.1, which payment will constitute full compensation for all WORK described in Section 02714 – Filter Cloth, as shown on the Drawings and as directed by the ENGINEER.
- 2.23 SIGN ASSEMBLIES (Pay Item No. 2718.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for Sign Assemblies will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item includes providing new sign assembly panels, posts and hardware in accordance with the Contract Documents.
 - C. Payment for Sign Assemblies will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2718.1, which payment will constitute full compensation for all WORK described in Section 02718 - Sign Assembly, as shown on the Drawings, and as directed by the ENGINEER.
- 2.24 PAINTED TRAFFIC MARKINGS (Pay Item No. 2720.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment for Painted Traffic Markings will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item includes the painted traffic markings as shown on the Drawings.
 - C. Payment for Painted Traffic Markings will be made at the amount shown in the Bid Schedule under Pay Item No. 2720.1, which payment will constitute full compensation for all WORK described in Section 02720 – Painted Traffic Markings, as shown on the Drawings and as directed by the ENGINEER.
- 2.25 ASPHALT CONCRETE PAVEMENT, TYPE II-A, CLASS B (Pay Item No. 2801.1) PRICE BASED ON QUANTITY, TON
- A. Measurement of Asphalt Concrete Pavement will be measured for payment by the ton.
 - B. No measurement will be made for asphalt concrete pavement that exceeds 12% more than the neatline quantity, as determined by the nominal design thickness multiplied by the actual area paved, with a conversion factor of 119 lb per square yard per inch of thickness.
 - C. All resealing of joints with existing pavement, including those resealed after the pavement has cooled to ambient temperatures, will not be measured for payment, but will be considered incidental to other WORK under the contract.

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- D. Tack Coat applied to existing joint surfaces and along edge of gutters prior to placement of A.C. pavement, will be considered incidental to other WORK.
 - E. Asphalt Concrete Pavement required for reconstructed collars around manholes and water valves, if any, will be considered incidental to other WORK under this Section.
 - F. Payment under this Pay Item may include deductions in final price if, after testing, the asphalt pavement does not meet the required specification. Deductions are further described in Section 02801 – Asphalt Concrete Pavement, Part 3 – Execution, Article 3.13, Acceptance Sampling and Testing, Paragraph K.
 - G. Payment for Asphalt Concrete Pavement, Type II-A, Class B, will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2801.1, which payment, after quality deductions, if applicable, will constitute full compensation for all WORK described in Section 02801 - Asphalt Concrete Pavement, as shown on the Drawings and as directed by the ENGINEER.
- 2.26 REMOVE EXISTING ASPHALT SURFACING (Pay Item No. 2806.1) PRICE BASED ON QUANTITY, SQUARE YARDS
- A. Removing asphalt surfacing, including leveling course, will be measured for payment per square yard, complete, except that no measurement will be made for removing asphaltic surfacing less than one-inch-thick.
 - B. Removal of existing asphalt surfacing will be measured per top square yard, which will include the full thickness of all layers of existing asphalt, including leveling courses and underlying pavement.
 - C. No deduction shall be made to the area measured for payment under this Pay Item for the area within the existing road prism that consists of concrete patches. Removal and disposal of concrete roadway patches shall be considered incidental to this Pay Item.
 - D. Payment for Remove Existing Asphalt Surfacing will be made at the Unit Price named in the Bid Schedule under Pay Item No. 2806.1, which payment will constitute full compensation for all WORK described in Section 02806 - Remove Existing Asphalt Surfacing, as shown on the Drawings and as directed by the ENGINEER.
- 3.1 CONCRETE AREA DRAIN (Pay Item No. 3302.1) PRICE BASED ON QUANTITY, EACH
- A. Measurement for Concrete Area Drain will be based upon the actual number of units installed, complete, in accordance with the requirements of the Contract Documents.
 - B. Payment for Concrete Area Drain will be made at the amount named in the Bid Schedule under Pay Item 3302.1, which payment will constitute full compensation

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for all WORK in Section 03302 – Concrete Structures, as shown on the Drawings and as directed by the ENGINEER.

3.2 CONCRETE HEADWALL (Pay Item No. 3302.2) PRICE BASED ON QUANTITY, EACH

- A. Measurement for Concrete Headwall will be based upon the actual number of units installed, complete, in accordance with the requirements of the Contract Documents.
- B. Payment for Concrete Headwall will be made at the amount named in the Bid Schedule under Pay Item 3302.2, which payment will constitute full compensation for all WORK in Section 03302 – Concrete Structures, as shown on the Drawings and as directed by the ENGINEER.

3.3 CONCRETE HEADWALL WITH HINGED TRASH RACK (Pay Item No. 3302.3) PRICE BASED ON QUANTITY, EACH

- A. Measurement for Concrete Headwall With Hinged Trash Rack will be based upon the actual number of units installed, complete, in accordance with the requirements of the Contract Documents.
- B. Payment for Concrete Headwall With Hinged Trash Rack will be made at the amount named in the Bid Schedule under Pay Item 3302.3, which payment will constitute full compensation for all WORK in Section 03302 – Concrete Structures, as shown on the Drawings and as directed by the ENGINEER.

3.4 CONCRETE SIDEWALK, 4-INCHES THICK (Pay Item No. 3303.1) PRICE BASED ON QUANTITY, SQUARE YARD

- A. Measurement of Concrete Sidewalks, 4-Inches Thick will be based on the actual square yards complete in place and accepted.
- B. No deduction will be made for concrete sidewalk areas where the plans call for detectable tile. The additional 2-inches of depth required under ADA ramp runs and landings shall be considered incidental to this Pay Item.
- C. Both 4-inch thick and 6-inch thick concrete sidewalk will be measured for payment under this Pay Item. The 9-inch thick reinforced concrete for each of the three bus shelters shall be considered part of the WORK under Pay Item 323300.3.
- D. Payment for Concrete Sidewalk, will be made at the amount named in the Bid Schedule under Pay Item No. 3303.1, which payment will constitute full compensation for all WORK described in Section 03303 – Sidewalk, Curb and Gutter, as shown on the Drawings and as directed by the ENGINEER.

3.5 CURB AND GUTTER, TYPE I (Pay Item No. 3303.2) PRICE BASED ON QUANTITY, LINEAR FOOT

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- A. Curb and Gutter, Type I, will be measured for payment per linear foot actually installed, complete in place as shown on the Contract Documents. Measurements will be made along the face of the curb and will be continuous across catch basins.
 - B. WORK under the Pay Item will include both standard Type I Curb & Gutter, as well as Type I Spill Curb and Gutter.
 - C. Payment for Curb and Gutter, Type I, will be made at the Unit Price named in the Bid Schedule under Pay Item No. 3303.2, which payment will constitute full compensation for all work described in Section 03303 - Sidewalk, Curb and Gutter, as shown on the Drawings, and as directed by the ENGINEER.
- 3.6 VALLEY GUTTER, TYPE III (Pay Item No. 3303.3) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Valley Gutter, Type III, will be measured for payment per linear foot actually installed, complete in place as shown on the Contract Documents. Measurements will be made along the flowline of the gutter pan and will be continuous across catch basins.
 - B. Payment for Valley Gutter, Type III, will be made at the Unit Price named in the Bid Schedule under Pay Item No. 3303.3, which payment will constitute full compensation for all work described in Section 03303 - Sidewalk, Curb and Gutter, as shown on the Drawings, and as directed by the ENGINEER.
- 3.7 DETECTABLE TILE (Pay Item No. 3303.4) PRICE BASED ON QUANTITY, SQUARE FOOT
- A. Measurement of Detectable Tile will be based on the square foot, complete in place and accepted.
 - B. Measurements will be made to the outside dimensions of the detectable tiles. The concrete adjacent to and underneath will be measured for payment under Pay Item No. 3303.1.
 - C. Payment for Detectable Tile will be made at the Unit Price named in the Bid Schedule under Pay Item No. 3303.4, which payment will constitute full compensation for all WORK described in Section 03303 – Sidewalk, Curb and Gutter, as shown on the Drawings and as directed by the ENGINEER.
- 3.8 REMOVAL OF CURB AND GUTTER (Pay Item No. 3304.1) PRICE BASED ON QUANTITY, LINEAR FOOT
- A. Removal of Curb and Gutter will be measured by the actual linear foot of concrete curb and gutter originally in place, removed and disposed of in accordance with the Contract Documents.
 - B. Payment for Removal of Curb and Gutter will be made at the Unit Price named in the Bid Schedule under Pay Item No. 3304.1, which payment will constitute full compensation for all WORK described in Section 03304 – Remove Existing

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Sidewalk, Concrete Slab or Curb and Gutter, as shown on the Drawings and as directed by the ENGINEER.

26.1 SITE LIGHTING (Pay Item No. 265600.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for payment for Site Lighting will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. WORK under this Pay Item includes all electrical outside of the breakroom building and not explicitly specified under other pay items. This WORK includes the conduit, handholes, wiring, light poles, all exterior lighting, junction boxes, pole-mounted lighting as shown on the Drawings.
- C. Payment for Lighting will be made at the amount shown in the Bid Schedule under Pay Item No. 265600.1, which payment will constitute full compensation for all WORK described in Section 260510 – Basic Electrical Materials and Methods, Section 260519 - Low Voltage Conductors and Cables, Section 260526 – Grounding and Bonding, Section 260533 – Raceways and Boxes for Electrical Systems, Section 262416 – Panelboards, Section 262726 – Wiring Devices, Section 264313 – Surge Protective Devices, and Section 265600 – Exterior Lighting, as shown on the Drawings and as directed by the ENGINEER.

26.2 CAMERA SYSTEM (Pay Item No. 265700.1) PRICE BASED ON LUMP SUM PAY UNIT

- A. Measurement for payment for Camera System will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
- B. WORK under this Pay Item includes furnishing and installing the camera poles, conduit and handholes, and CAT 6 cabling for the cameras, mounting the cameras to the camera poles and the light poles, aiming the cameras, installing the Network Data Recorder (NVR) in the IT rack, setup, and commissioning of the camera system as shown on the drawings and included in the specifications.
- C. The cameras, camera mounting arms, and NVR will be furnished by the OWNER for installation by the CONTRACTOR.
- D. Furnishing and installing the IT rack shall be considered part of the Breakroom Building Pay Item 323300.5. Furnishing and installing the light poles that receive cameras shall be considered part of the Site Lighting Pay Item 265600.1.
- E. WORK under this Pay Item shall include the preparation of a schedule of values that includes, at a minimum, a breakdown for furnishing and installing camera conduit and handholes, camera poles and bases, and CAT 6 cables, as well as installing and commissioning the owner supplied cameras, mounting arms, and NVR.
- F. Payment for Camera System will be made at the amount shown in the Bid Schedule under Pay Item No. 265700.1, which payment will constitute full compensation for all WORK described in Section 260510 – Basic Electrical Materials and Methods, Section 260519 - Low Voltage Conductors and Cables, Section 260526 – Grounding and Bonding, Section 260533 – Raceways and

SPECIAL PROVISIONS

Boxes for Electrical Systems, Section 262416 – Panelboards, Section 262726 – Wiring Devices, Section 264313 – Surge Protective Devices, Section 265700 – IP Based Video Security System, and Section 271300 Telecommunications Cabling, as shown on the Drawings and as directed by the ENGINEER.

- 32.1 BENCHES (Pay Item No. 323300.1) PRICE BASED ON QUANTITY, EACH
- A. Measurement for payment for Benches will be the actual number of units furnished and installed in accordance with the Contract Documents, and as directed by the ENGINEER.
 - B. Payment for Benches will be made at the amount named in the Bid Schedule under Pay Item 323300.1, which payment will constitute full compensation for all WORK in Section 323300 – Site Furnishings, as shown on the Drawings and as directed by the ENGINEER.
- 32.2 BICYCLE LOCKERS (Pay Item No. 323300.2) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment for Bicycle Lockers will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. Payment for Bicycle Lockers will be made at the amount named in the Bid Schedule under Pay Item 323300.2, which payment will constitute full compensation for all WORK in Section 323300 – Site Furnishings, as shown on the Drawings and as directed by the ENGINEER.
- 32.3 BUS TRANSIT SHELTERS (Pay Item No. 323300.3) PRICE BASED ON QUANTITY, EACH
- A. Measurement for Bus Transit Shelters will be based on the actual number of units furnished and installed in accordance with the Contract Documents, and as directed by the ENGINEER.
 - B. The 9-inch thick reinforced concrete foundation for each of the three bus shelters shall be considered part of the WORK under this Pay Item.
 - C. Payment for Bus Transit Shelters will be made at the amount named in the Bid Schedule under Pay Item 323300.3, which payment will constitute full compensation for all WORK in Section 323300 – Site Furnishings, as shown on the Drawings and as directed by the ENGINEER.
- 32.4 TRASH RECEPTACLE WITH ASH TRAYS (Pay Item No. 323300.4) PRICE BASED ON QUANTITY, EACH
- A. Measurement for Trash Receptacle With Ash Trays will be the actual number of units consisting of two ash trays mounted to one trash receptacle furnished and installed in accordance with the Contract Documents, and as directed by the ENGINEER.

SPECIAL PROVISIONS

- B. Payment for Trash Receptacle With Ash Trays will be made at the amount named in the Bid Schedule under Pay Item 323300.4, which payment will constitute full compensation for all WORK in Section 323300 – Site Furnishings, as shown on the Drawings and as directed by the ENGINEER.
- 32.5 BREAKROOM BUILDING (Pay Item No. 323300.5) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for Breakroom Building will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. The camera system components within the Breakroom Building will be considered part of the WORK under Pay Item 265700.1.
 - C. Payment for Breakroom Building will be made at the amount named in the Bid Schedule under Pay Item 323300.5, which payment will constitute full compensation for all WORK in the additional specifications sections for vertical construction, as shown on the Drawings and as directed by the ENGINEER.
- 34.1 VEHICLE CHARGING STATIONS (Pay Item No. 346013.1) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment for Vehicle Charging Stations will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item includes both charging stations, mounting hardware, bases, conduit, cables, breaker panels, and junction boxes.
 - C. Payment for Vehicle Charging Stations will be made at the amount shown in the Bid Schedule under Pay Item No. 346013.1, which payment will constitute full compensation for all WORK described in Section 260510 – Basic Electrical Materials and Methods, Section 260519 - Low Voltage Conductors and Cables, Section 260526 – Grounding and Bonding, Section 260533 – Raceways and Boxes for Electrical Systems, Section 262416 – Panelboards, Section 262726 – Wiring Devices, Section 264313 – Surge Protective Devices, Section 346013 – Electric Vehicle Charging Stations, as shown on the Drawings and as directed by the ENGINEER.
- 34.2 FUTURE BUS CHARGING INFRASTRUCTURE (Pay Item No. 346013.2) PRICE BASED ON LUMP SUM PAY UNIT
- A. Measurement for payment for Future Bus Charging Infrastructure will be based upon the completion of the entire WORK as a Lump Sum Pay Unit, complete, all in accordance with the requirements of the Contract Documents.
 - B. WORK under this Pay Item includes the conduit, vault, handholes, and all other WORK associated with the underground infrastructure to support a future bus charging system to be completed by others.
 - C. Payment for Future Bus Charging Infrastructure will be made at the amount shown in the Bid Schedule under Pay Item No. 346013.2, which payment will constitute

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full compensation for all WORK described in Section 260510 – Basic Electrical Materials and Methods, Section 260519 - Low Voltage Conductors and Cables, Section 260526 – Grounding and Bonding, Section 260533 – Raceways and Boxes for Electrical Systems, Section 262416 – Panelboards, Section 262726 – Wiring Devices, Section 264313 – Surge Protective Devices, Section 346013 – Electric Vehicle Charging Stations, as shown on the Drawings and as directed by the ENGINEER.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION SECTION 01300 – CONTRACTOR SUBMITTALS

PART 1 – GENERAL

1.1 GENERAL

- A. Wherever submittals are required hereunder, all such submittals shall be submitted to the ENGINEER by the CONTRACTOR.
- B. Within 14 Days after the date of commencement as stated in the Notice To Proceed, the CONTRACTOR shall submit the following items to the ENGINEER for review:
 - 1. A preliminary schedule of Shop Drawings, sample, and proposed substitutes or “or-equal” submittals.
 - 2. A list of all permits and licenses the CONTRACTOR shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.
 - 3. A complete progress schedule for all phases of the Project.
 - 4. Material Safety Data Sheets on products used on the Project.
 - 5. A traffic maintenance plan, as required.
 - 6. A plan for temporary erosion control and pollution control, as required.
 - 7. A letter designating the CONTRACTOR’s Superintendent, defining that person’s responsibility and authority.
 - 8. A letter designating the CONTRACTOR’s safety representative and the Equal Employment Opportunity (EEO) Officer and that person’s responsibility and authority.
 - 9. Individual Mining Plan shall be submitted and approved, by CBJ Engineering, prior to any materials extraction from the CBJ/State Lemon Creek Gravel Pit.
- C. No payments shall be made to the CONTRACTOR until all of these items are submitted in their entirety, as determined by the ENGINEER.

1.2 SHOP DRAWING SUBMITTAL

- A. Wherever called for in the Contract Documents, or where required by the ENGINEER, the CONTRACTOR shall furnish to the ENGINEER, for

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review, eight (8) copies of each Shop Drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, Shop Drawings, fabrication drawings, installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, and similar items.

- B. All Shop Drawing submittals shall be accompanied by the CONTRACTOR's standard submittal transmittal form. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will be returned for re-submittal.
- C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER.
- D. Except as may otherwise be provided herein, the ENGINEER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 30 calendar days following receipt of them by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item. The OWNER reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the second submittal. The ENGINEER's maximum review period for each submittal including all re-submittals will be 30 days per submission. In other works, for a submittal that requires two re-submittals before it is complete, the maximum review period for that submittal could be 90 days.
- E. If three (3) copies of a submittal are returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will not be required.
- F. If three (3) copies of a submittal are returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal is not required.
- G. If one (1) copy of the submittal is returned to the CONTRACTOR marked "AMEND-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER.

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- H. If one (1) copy of the submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the ENGINEER.
- I. Fabrication of an item may be commenced only after the ENGINEER has reviewed the pertinent submittal and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the Contract requirements only a Change Order can alter the Contract Price, Contract Time, or Specifications.
- J. All CONTRACTOR Shop Drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the ENGINEER. Each submittal shall be dated, signed, and certified by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of Shop Drawings, each sheet shall be dated, signed, and certified. No consideration for review by the ENGINEER of any CONTRACTOR submittal will be made for any items which have not been so certified by the CONTRACTOR. All non-certified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused by thereby shall be the total responsibility of the CONTRACTOR.
- K. The ENGINEER's review of CONTRACTOR Shop Drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.3 SAMPLES SUBMITTAL

- A. Whenever in the Specifications samples are required, the CONTRACTOR shall submit not less than three (3) samples of each item or material to the ENGINEER for acceptance at not additional cost to the OWNER.
- B. Samples, as required herein, shall be submitted for acceptance a minimum of 21 days prior to ordering such material for delivery to the job site, and shall be submitted in an orderly sequence so that

SPECIAL PROVISIONS

dependent materials or equipment can be assembled and reviewed without causing delays in the WORK.

- C. All samples shall be individually and indelibly labeled or tagged indicating thereon all specified physical characteristics and supplier's names for identification and submitted to the ENGINEER for acceptance. Upon receiving acceptance of the ENGINEER, one (1) set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, and one (1) set of samples will be retained by the ENGINEER, and one (1) set of samples shall remain at the job site until completion of the WORK.

- D. Unless clearly stated otherwise, it is assumed that all colors and textures of specified items presented in sample submittal are from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products or equipment lines, and their selection will require an increase in Contract Time or Contract Price, the CONTRACTOR will clearly indicate this on the transmittal page of the submittal.

1.4 OPERATIONS AND MAINTENANCE MANUAL SUBMITTAL

- A. The CONTRACTOR shall include in the Operations and Maintenance Manuals for each item of mechanical, electrical, and instrumentation equipment, the following:
 - 1. Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
 - 2. Lubrication schedules, including the lubricant SAE grade and type, temperature range of lubricants, and including frequency of required lubrication.
 - 3. Preventive maintenance procedures and schedules.
 - 4. Parts lists, by generic title and identification number, complete, with exploded views of each assembly.
 - 5. Disassembly and reassembly instructions.
 - 6. Name and location of nearest supplier and spare parts warehouse.
 - 7. Recommended troubleshooting and startup procedures.
 - 8. Reproducible prints of the record Drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these Specifications.
 - 9. Tabulation of proper settings for all pressure relief valves, (low/high) pressure switches and other related equipment protection devices.
 - 10. Detailed test procedures to determine performance efficiency of equipment.
 - 11. List of all electrical relay settings including alarm and contract settings.

- B. The CONTRACTOR shall furnish to the ENGINEER five identical sets of technical manuals. Each set shall consist of one or more volumes, each of which

SPECIAL PROVISIONS

shall be bound in a standard size, 3-ring, loose-leaf vinyl plastic hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents shall be provided which indicates all equipment in the technical manuals.

- C. All technical manuals shall be submitted complete and in final form to the ENGINEER prior to the requests for final payment.
- D. Incomplete or unacceptable Operations and Maintenance Manuals shall constitute sufficient justification to withhold payment for WORK completed.

1.5 SPARE PARTS LIST SUBMITTAL

- A. The CONTRACTOR shall furnish to the ENGINEER five (5) identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall be limited to those spare parts which each manufacturer recommends be maintained by the OWNER in the inventory at the plant site. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to facilitate the OWNER in ordering. The CONTRACTOR shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be bound in standard size, 3-ring, loose leaf, vinyl plastic hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches.

1.6 RECORD DRAWINGS SUBMITTALS

- A. The CONTRACTOR shall keep and maintain, at the job site, one record set of Drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the WORK as actually constructed. These master record Drawings, of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by Addenda, Change Orders, and the like shall be maintained up-to-date during the progress of the WORK.

SPECIAL PROVISIONS

- B. In the case of those Drawings which depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by Change Order Drawings or final Shop Drawings, and by including appropriate reference information describing the Change Orders by number and the Shop Drawings by manufacturer, Drawing, and revision numbers.
- C. Record drawings shall be accessible to the ENGINEER at all times during the construction period and shall be delivered to the ENGINEER on the 20th working day of every third month after the month in which the Notice to Proceed is given as well as upon completion of the WORK.
- D. Final payment will not be acted upon until the CONTRACTOR-prepared Record Drawings have been delivered to the ENGINEER.

1.7 PROGRESS SCHEDULES

- A. The progress schedule shall be in Bar Chart or Critical Path Method (CPM) form as required by the ENGINEER.
- B. The progress schedule shall show the order in which the CONTRACTOR proposes to carry out the WORK and the contemplated date on which the CONTRACTOR and their Subcontractors will start and finish each of the salient features of the WORK, including any scheduled periods of shutdown. The schedule shall also indicate any anticipated periods of multiple-shift WORK.
- C. Upon substantial changes to the CONTRACTOR's progress schedule of work or upon request of the ENGINEER, the CONTRACT shall submit a revised progress schedule(s) in the form required. Such revised schedule(s) shall conform with the contract time and take into account delays which may have been encountered in the performance of the WORK. In submitting a revised schedule, the CONTRACTOR shall state specifically the reason for the revision and the adjustments made in his schedule or methods of operation to ensure the completion of all the WORK within the contract time.

1.8 PROPOSED SUBSTITUTES OR "OR-EQUAL" ITEM SUBMITTAL

- A. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and equality required. If the name is followed by the words "or-equal" indicating that a substitution is

SPECIAL PROVISIONS

permitted, materials or equipment of other suppliers may be accepted by the ENGINEER if sufficient information is submitted by the CONTRACTOR to allow the ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the CONTRACTOR.
 2. The ENGINEER will be the sole judge as to the type, function, and quality of any such substitute material or equipment and the ENGINEER's decision shall be final.
 3. The ENGINEER may require the CONTRACTOR, to furnish at the CONTRACTOR's expense, additional data about the proposed substitute.
 4. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.
 5. Acceptance by the ENGINEER of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
 6. The CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the CONTRACTOR's WORK, the WORK of its Subcontractors and of other contractors, and shall effect such changes without cost to the OWNER. This shall include the cost for redesign and claims of other Contractor affected by the resulting change.
- B. The procedure for review by the ENGINEER will include the following:
1. If the CONTRACTOR proposes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application to the ENGINEER on the "Substitution Request Form" for acceptance thereof.
 2. Unless otherwise provided by law or authorized in writing by the ENGINEER, the "Substitution Request Form(s)" shall be submitted within the 21-day period after Notice To Proceed.
 3. Wherever a proposed substitute material or equipment has not been submitted within said 21-day period, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by the ENGINEER, the CONTRACTOR shall provide material or equipment named in the Contract Documents.

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4. The CONTRACTOR shall certify that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.
 5. The ENGINEER will be allowed a reasonable time within which to evaluate each proposed substitute. In no case will this reasonable time period be less than 30 days.
 6. As applicable, no Shop Drawing submittals will be made for a substitute item nor will any substitute item be ordered, installed, or utilized without the ENGINEER's prior written acceptance of the CONTRACTOR's "Substitution Request Form" which will be evidenced by a Change Order.
 7. The ENGINEER will record the time required by the ENGINEER in evaluating substitutions proposed by the CONTRACTOR and in making changes in the Contract Documents occasioned thereby. Whether or not the ENGINEER accepts a proposed substitute, the CONTRACTOR shall reimburse the OWNER for the charges of the ENGINEER for evaluating each proposed substitute.
- C. The CONTRACTOR's application using the "Substitution Request Form" shall contain the following statements and/or information which shall be considered by the ENGINEER in evaluating the proposed substitution:
1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of Substantial Completion on time.
 2. Whether or not acceptance of the substitute for use in the WORK will require a change in any of the Contract Documents to adopt the design to the proposed substitute.
 3. Whether or not incorporation or use of the substitute in connection with the WORK is subject to payment of any license fee or royalty.
 4. All variations of the proposed substitute for that specified will be identified.
 5. Available maintenance, repair, and replacement service and its estimated cost will be indicated.
 6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change.

1.9 MATERIAL CERTIFICATION SUBMITTAL

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- A. The ENGINEER may permit the use, prior to sampling, inspection and testing, of certain materials or assemblies when accompanied by manufacturer's material certifications stating that such materials or assemblies fully comply with the requirements of the Contract. The certification shall be signed by the manufacturer, and will specifically reference the material's compliance with the AASHTO, ASTM and/or CBJ Standards specified in the applicable Contract Documents.
- B. Material certifications shall be submitted to the ENGINEER prior to incorporating the item into the WORK.
- C. Materials or assemblies used on the basis of material certifications may be sampled, inspected and/or tested at any time, and if found not in conformity with these specifications, will be subject to rejection whether in place or not.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

(SUBSTITUTION REQUEST FORM - next page)

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**CBJ Engineering Department
SUBSTITUTION REQUEST FORM**

TO: _____ Project: _____

Contract No.: _____

OWNER: _____

SPECIFIED ITEM:

Section	Page	Paragraph	Description
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The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request. Applicable portions of the data are clearly identified.

The undersigned states that the following paragraphs, unless modified on attachments are correct:

1. The proposed substitution does not affect dimensions shown on Drawings and will not require a change in any of the Contract Documents.
2. The undersigned will pay for changes to the design, including engineering design, detailing, and construction costs caused by the requested substitution which is estimated to be \$_____.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule (specifically the date of substantial completion), or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. The incorporation or use of the substitute in connection with the WORK is not subject to payment of any license fee or royalty.

The undersigned further states that the function, appearance, and quality of the Proposed Substitution are equivalent or superior to the Specified item.

Submitted by CONTRACTOR: _____
 Signature _____
 Firm: _____
 By: _____
 Title: _____
 Date: _____
 Attachments: _____

Reviewed by ENGINEER _____
 Accepted Accepted as Noted
 Not Accepted Received Too Late
 Date: _____
 Telephone: _____

END OF SECTION

SPECIAL PROVISIONS

SECTION 01550 – SITE ACCESS AND STORAGE, PART 1 – GENERAL, Article 1.3, MAINTENANCE OF TRAFFIC, *replace paragraph M with the following:*

- M. The CONTRACTOR shall maintain a pedestrian route of at least 4-ft in width between Vintage Boulevard and James Boulevard along Riverside Drive, except during the Riverside Drive crossing. During WORK for the Riverside Drive crossing, alternate pedestrian routes shall be established.

All pedestrian access routes separated by less than 10-ft from an excavation deeper than 30-inches shall be delineated by pedestrian fencing or a vertical barrier as required.

SECTION 01550 – SITE ACCESS AND STORAGE, PART 1 – GENERAL, *add the following Article:*

1.6 ADJACENT PROPERTY ACCESS

- A. The CONTRACTOR shall notify the ENGINEER and provide Asiana Gardens a schedule for the sanitary sewer and storm drain WORK within their parking lot and across their driveway a minimum of seven (7) days in advance of any WORK.
- B. The CONTRACTOR shall notify the ENGINEER and provide Napa a schedule for the storm drain and earthwork adjacent to their building a minimum of seven (7) days in advance of any WORK.

SECTION 01570 – EROSION AND SEDIMENT CONTROL, PART 1 – GENERAL, Article 1.1, THE REQUIREMENT, *add the following paragraph:*

- D. The area of disturbance for this project is greater than 1 acre.

SECTION 01700 – PROJECT CLOSE-OUT, PART 1 – GENERAL, *Replace the COMPLIANCE CERTIFICATE AND RELEASE FORM with the following forms:*

SPECIAL PROVISIONS

SECTION 00 01700 - COMPLIANCE CERTIFICATE AND RELEASE FORM

PROJECT: Capital Transit Valley Transfer Station
CONTRACT NO: BE20-268

The **CONTRACTOR** must complete and submit this form to the Contract Administrator with respect to the entire contract and submit completed Subcontractor Compliance forms for each Subcontractor used on the Contract and listed on the Subcontractor report.

Completed forms shall be submitted upon completion of the Project. All requirements and submittals must be met before final payment will be made to the **CONTRACTOR**.

I certify that the following and any referenced attachments are true:

- All **WORK** has been performed, materials supplied, and requirements met in accordance with the applicable Drawings, Specifications, and Contract Documents.
- All payments to Subcontractors and Suppliers have been made in accordance with Alaska Statute 36.90.210. If not, please provide written explanation, for each case, why and the specific mutual payment agreement reached with the Supplier or Subcontractor.
- **CHECK ONE:**
 - All Suppliers and Subcontractors have been paid in full with no claims for labor, materials or other services outstanding.
 - The following Suppliers and Subcontractors are due final payment which will be made upon the release of the final payment by the CBJ. List the Suppliers and Subcontractors and the amount they are due below (attach separate sheet if necessary) :

	Supplier or Subcontractor	Amount Owed
1.		\$
2.		\$
3.		\$
4.		\$
5.		\$
6.		\$
7.		\$

SPECIAL PROVISIONS

- All employees have been paid not less than the current prevailing wage rates set by the State of Alaska (or U.S. Department of Labor, as applicable).
- All equal employment opportunity, certified payroll and other reports have been filed in accordance with the prime contract.
- The attached list of Subcontractors is complete (required from CONTRACTOR). The City Engineer was advised and approved of all Subcontractors before WORK was performed and has approved any substitutions of Subcontractors.
- All DBE firms listed as a precondition of the prime contract award must have performed a commercially useful function in order for the WORK to count to a DBE goal. All DBE firms performed the WORK stated and have received at least the amount claimed for credit in the Contract Documents.
- All DBE Subcontractors must attach a signed statement of the payment amount received, the nature of WORK performed, whether any balance is outstanding, and indicate that no rebates are involved.
- If the amount paid is less than the amount originally claimed for DBE credit, the CONTRACTOR has attached approval from the City Engineer for underutilization.

I understand it is unlawful to misrepresent information in order to receive a payment which would otherwise be withheld if these conditions were not met. I am an authorized agent of this firm and sign this freely and voluntarily. The foregoing statements are true and apply to the following project contractor.

_____ Capacity: CONTRACTOR
Firm Name

Signed Printed Name and Title Date

Return completed form to: Engineering Contracts Division, City and Borough of Juneau, 155 South Seward Street, Juneau, AK 99801 or by email to: contracts@juneau.org

Call (907) 586-0800 ext. 4194 if we can be of further assistance or if you have any questions.

SPECIAL PROVISIONS

SUBCONTRACTOR COMPLIANCE CERTIFICATE AND RELEASE FORM

PROJECT: Capital Transit Valley Transfer Station
CONTRACT NO: BE20-268

Each **SUBCONTRACTOR** must complete and submit this form to the Contract Administrator, through the General Contractor, with respect to the entire contract.

Completed forms shall be submitted upon completion of the Project. All requirements and submittals must be met before final payment will be made to the **CONTRACTOR**.

I certify that the following and any referenced attachments are true:

- All WORK has been performed, materials supplied, and requirements met in accordance with the applicable Drawings, Specifications, and Contract Documents.

- _____(name of firm) has been paid by the Contractor in accordance with Alaska Statute 36.90.210 (Prompt Pay Requirement). (If not, please provide written explanation on an attached sheet, for each case. Provide specific details why payment was not made and the specific mutual payment agreement reached with the Contractor if it is still unresolved.)

- CHECK ONE:
 - I / WE have been paid in full by the Contractor, with no claims for labor, materials or other services outstanding.

 - I / WE are due the following amount from the Contractor which is included in the Contractors Request for Final Payment. WE are due a total of \$ _____ for the following individual items that have yet to be paid (attach separate sheet if necessary).

	Outstanding Payment Item	Outstanding Amount Owed
1.		\$
2.		\$
3.		\$
4.		\$
5.		\$
6.		\$
7.		\$

SPECIAL PROVISIONS

- All employees have been paid not less than the current prevailing wage rates set by the State of Alaska (or U.S. Department of Labor, as applicable).
- All equal employment opportunity, certified payroll and other reports have been filed in accordance with the prime contract.

I understand it is unlawful to misrepresent information in order to receive a payment which would otherwise be withheld if these conditions were not met. I am an authorized agent of this firm and sign this freely and voluntarily. The foregoing statements are true and apply to the following project contractor.

_____ Capacity: SUBCONTRACTOR
Firm Name

_____ Printed Name and Title
Sign _____ Date

Prime Contractor shall return completed form to: Engineering Contracts Division, City and Borough of Juneau, 155 South Seward Street, Juneau, AK 99801 or email: greg.smith@juneau.org Call (907) 586-0800 ext. 4194 if we can be of further assistance or if you have any questions.

END OF SECTION

SPECIAL PROVISIONS

SECTION 02202 – EXCAVATION AND EMBANKMENT, PART 2 – PRODUCTS, Article 2.1, EXCAVATION, *replace paragraph A with the following:*

- A. Common Excavation: Silt, sand, gravel, and granular material other than rock or muck.
- B. Muck Excavation: Soils, organic matter, and other material not suitable for foundation material regardless of moisture content.

SECTION 02203 – TRENCHING, PART 2 - MATERIALS, Article 2.2, BEDDING, *add the following paragraph:*

- D. Class A bedding shall be used for all water and sanitary sewer pipe. Class B bedding may be used for all storm sewer pipe. Pea gravel, or similar product, shall not be used for bedding of any pipe.

SECTION 02204 – BASE COURSE, PART 2 – PRODUCTS, Article 2.1, MATERIAL, *add the following to paragraph B:*

BASE COURSE GRADATIONS
(Percent passing by weight)

Sieve Design	F
4	
2	
1-1/2	
1	
3/4	100
3/8	
1/2	30-50
No. 4	
No. 8	
No. 10	
No. 40	
No. 100	
No. 200	0-2

SECTION 02204 – BASE COURSE, PART 2 – PRODUCTS Article 2.1, MATERIAL, *add the following paragraphs:*

- E. Related Section – Section 02202 – EXCAVATION AND EMBANKMENT, Article 2.8, 2-INCH MINUS SHOT ROCK
- F. Rock Chips. Rock chips shall be Hidden Valley B Chip or an approved equal meeting the requirements for base course, grading F of this section.

SECTION 02204 – BASE COURSE, PART 3 – EXECUTION Article 3.1, GENERAL, *replace Paragraph I with the following:*

SPECIAL PROVISIONS

- I. The surface of the base course, when using a taut string line or straight edge of adequate length, spanning between two known grade control points (blue top hubs, lip of gutter, edge existing asphalt, etc.) shall not show any deviation in excess of 3/8 inch. This shall be checked perpendicular and longitudinally to the grade control points and be documented by the INSPECTOR. The finish surface shall not vary more than 1/2 inch from established grade. Additionally, the algebraic average of all deviations from established grade of the finish base course surface elevations taken at 50-foot intervals shall be less than 0.02 foot.

SECTION 02204 – BASE COURSE, PART 3 – EXECUTION Article 3.7, 2-INCH MINUS SHOT ROCK w/BASE COURSE, *add the following Paragraph:*

- B. The 2-Inch Minus Shot Rock will be placed and compacted into a layer that is 1 to 2 inches less than the total 2-Inch Minus Shot Rock w/Base Course thickness specified on the Drawings, and then capped with 1 to 2-inches of Base Course to achieve the overall thickness specified on the Drawings.

SECTION 02401 – SANITARY SEWER PIPE, PART 1 – GENERAL, Article 1.1, DESCRIPTION *add the following paragraph:*

- C. Work under this Section also includes the residential lift station for the break room sanitary sewer service.

SECTION 02401 – SANITARY SEWER PIPE, PART 2 – PRODUCTS, *replace Article 2.4 with the following:*

2.4 HDPE PRESSURE PIPE

- A. High Density Polyethylene (HDPE) pipe shall conform to ASTM D 3550 designation PE 3407 or PE 3408. The pipe shall have a minimum pressure rating of 200 pounds per square inch and a maximum Standard Dimension Ratio (SDR) of 11.0. All HDPE shall have a standard iron pipe size (IPS) outside diameter.

SECTION 02401 – SANITARY SEWER PIPE, PART 2 – PRODUCTS, *add the following Article:*

2.9 RESIDENTIAL LIFT STATION

- A. The residential lift station shall be an E-ONE DH071-93 submersible progressive cavity grinder pump, or an approved equal in accordance with CBJ Standard 219. Residential lift stations shall be hard wired with a 120V, 60 Hz, 1 phase motor, and capable of lifting the effluent at least 1.5 feet as shown on the Drawings.
- B. The residential lift station shall be supplied with a second 7' Level Sensing Core (grinder pump) with candy cane discharge to be used as a backup.

SECTION 02402 – SANITARY SEWER MANHOLES AND CLEANOUTS, PART 3 - EXECUTION, Article 3.1 CONSTRUCTION, Paragraph M, *delete* sub-paragraph 4 and *replace* with the following:

SPECIAL PROVISIONS

1. Rubber grade ring adjustment risers shall be bonded to adjacent surfaces by laying at least 3 beads, a minimum of 5/16” thick of Liquid Nails-Polyurethane Construction Adhesive on each side of the rubber risers or the top surface of the concrete course. Two of the adhesive beads shall be within 1” of the edges of the rubber grade ring adjustment riser, the third shall be equidistant between the two outer beads. The beads shall be continuous around the rubber grade ring adjustment riser.

SECTION 02501 – STORM SEWER PIPE, PART 2 – PRODUCTS, *add the following Article:*

2.10 PVC PRESSURE PIPE

- A. High pressure (HP) PVC storm sewer pipe culvert shall meet the requirements of sanitary sewer PVC pressure pipe.

SECTION 02502 – STORM SEWER MANHOLES, INLETS AND CATCH BASINS, PART 2 – PRODUCTS, Article 2.5, PRECAST CONCRETE UNITS *add the following paragraph:*

- E. Revise STANDARD 304A – TYPE III CATCH BASIN, as follows:
 1. Minimum wall and bottom thickness shall be 4”.
 2. Minimum outside dimensions shall be 30” by 34”.

SECTION 02714 – FILTER CLOTH, PART 2 - PRODUCTS, Article 2.1, CLOTH, *replace paragraph C. with the following:*

- C. Type A filter cloth, woven or non-woven, shall be Layfield LP3.5 geotextile, or an approved equal meeting the following requirements:

<u>Quality</u>	<u>ASTM</u>	<u>Value</u>
Grab Tensile (lbs)	D4632	90
Elongation (%)	D4632	50
Tear (lbs.)	D4533	40
CBR Punc (lbs)	D6241	250
AOS (sieve)	D4751	50
Permittivity (sec-1)	D4491	2.0
Water Flow (gpm/sf)	D4491	145
UV (500 hrs)	D4355	70%

SECTION 02718 – SIGN ASSEMBLY, PART 3 - EXECUTION, Article 3.1, GENERAL, *add the following:*

- H. Sign assemblies shall be installed as detailed in the Sign Assembly Tables on the Drawings.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 1 - GENERAL, Article 1.1, DESCRIPTION, *revise paragraph B as follows:*

- B. Asphaltic concrete mix for this Project shall be Type IIA, Class B.

SPECIAL PROVISIONS

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 1 - GENERAL, Article 1.1, DESCRIPTION, *add paragraph C as follows:*

- C. Asphalt concrete mix for sidewalks, driveways and hydrant pads may be either Type III, Class B, or Type II-A, Class B. See Table 02801-1 and Table 02801-2.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 1 – GENERAL, Article 1.1, DESCRIPTION, *revise* TABLE 02801-1, ASPHALTIC CONCRETE MIX REQUIREMENTS, *as follows:*

<u>Design Parameters</u>	<u>Class A</u>	<u>Class B</u>
Voids in total mix, percent	2.5 – 4.0	2.5 – 4.0%
Percent oil content	5.8 – 6.8	5.8 – 6.8%*

* Percent oil content for Type III Mix designs shall be 5.0 – 6.8

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 2 – PRODUCTS, Article 2.1, COMPOSITION OF ASPHALT CONCRETE MIXTURES – JOB MIX DESIGN, paragraph C., *delete* subparagraph 6 and *replace* with the following:

- 6. The mix design shall be 50 blow Marshall Method.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 2 - PRODUCTS, Article 2.3, ASPHALT MATERIALS, *revise* paragraph B as follows:

- B. Asphalt cement shall be designated PG 58-28 Plus.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 2 - PRODUCTS, *add* the following section:

2.6 RECLAIMED ASPHALT PAVEMENT

- A. Reclaimed Asphalt Pavement (RAP) may be used in the asphalt mix up to 20% of the total mix.
- B. RAP will be available at no cost from the CBJ Lemon Creek Stockpile. The contractor will notify Michael Eich, CBJ Pits and Quarries Manager, 586-0800 ext 4192, of quantity needed, to coordinate access and for Lemon Creek Gravel Pit permit compliance requirements, prior to taking any RAP. The Contractor shall weigh each load at the CBJ scales and record on a CBJ scale ticket. The CBJ makes no guarantees of the quantity or quality of the RAP.
- C. The Contractor shall provide a mix design showing the inclusion of the specified percentage of RAP according to the mix design requirements in this section.
- D. Use of RAP in the Contractor's asphalt mix does not nullify any of the other specification requirements or associated asphalt quality deductions.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 3 - EXECUTION, Article 3.2, EQUIPMENT, Paragraph C, *delete* item 2 and *replace* with the following:

SPECIAL PROVISIONS

2. Each truck shall have a watertight canvas cover of such size as to extend at least one foot over the sides and end of the truck bed and be adequately secured to protect the asphalt concrete mixture. The use of canvas covers will be required at all times.
3. The Contractor shall make the trucks to be used for hauling the asphalt concrete mixture available for inspection by the Engineer prior to paving day and shall be identified in the Paving Plan. Trucks that do not meet the requirements of this section may be rejected by the Engineer and not allowed on the project unless the deficiencies are remedied and approved by the Engineer in advance of hauling asphalt. Use of trucks not approved for delivery by the Engineer may result in the rejection of the asphalt concrete mixture within the unapproved truck.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 3 - EXECUTION, Article 3.2, EQUIPMENT, *add the following paragraph:*

- E. Heavy, full size, self-propelled laydown units that will place concentrated loading on curb and gutter sufficient to cause breakage, or other damage to the concrete, will not be permitted.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 3 - EXECUTION, Article 3.8, SPREADING AND PLACING, *delete paragraph H and replace with the following:*

- H. Manhole frame and covers and water valve boxes shall be set to final grade in accordance to CBJ Standard Details 205 – MANHOLE HEIGHTS and 407 – MAINLINE VALVE, prior to paving operations. If the cover lugs or frame, whichever is higher, does not meet the required depression range following the finish paving operations, the CONTRACTOR shall construct a transition slab with asphalt pavement overlay, per CBJ Standard 126 – CONCRETE COLLAR or as approved by the Engineer, at no additional cost to the OWNER.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 3 - EXECUTION, Article 3.8, SPREADING AND PLACING, *add the following paragraph:*

- K. The Contractor shall hold in a pre-paving conference on site to review and verify the accuracy of the Paving Plan prior to paving day. The paving foreman shall be present to explain each of the operational details included in the paving plan.

SECTION 02801 -- ASPHALT CONCRETE PAVEMENT, PART 3 – EXECUTION, Article 3.10, JOINTS, *replace* Paragraphs C and J with the following:

- C. Improperly formed joints resulting in surface irregularities or rock segregation shall be removed, full road width, replaced with new material, and thoroughly compacted.
- J. All joints with existing asphalt pavement shall be resealed with asphalt cement after the new pavement has cooled to ambient temperature.

SECTION 02801 -- ASPHALT CONCRETE PAVEMENT, PART 3 – EXECUTION, Article 3.10, JOINTS, *add the following paragraph:*

SPECIAL PROVISIONS

- K. The edge of pavement along the longitudinal joints shall not be allowed to drop below 200 degrees Fahrenheit prior to the asphalt mix from the adjacent pull being placed against this edge.

SECTION 02801 – ASPHALT CONCRETE PAVEMENT, PART 3 – EXECUTION, Article 3.13, Acceptance Sampling and Testing, *add the following paragraph:*

- K. For each lot of asphalt pavement produced, at least two (2) samples shall be taken by the CONTRACTOR for purposes of acceptance testing by the OWNER. The CONTRACTOR shall split the sample with the OWNER to retain a portion for their use. The sample shall be taken according to proper sampling methods, from the asphalt pavement on the grade.

The deduction amounts will be determined from the OWNER's acceptance testing results. The values will be calculated by averaging the amount of the absolute value of the two tests outside the job mix design tolerance (the difference between the actual test result and the job mix design tolerance range). A test value within the job mix design tolerance will be considered a zero (0) value for averaging the two values. Deduction from the asphalt pavement pay item shall be made at the following amounts:

1. #200 Sieve: the greater of either 1.0% the contract price for asphalt pavement placed within the sampled lot or \$500 per each 0.1% outside the job mix design tolerance, not exceeding 6% maximum, of the percent passing the #200 sieve. The allowable tolerance for this Contract shall be +/-1.0% of the target mix design value and shall not exceed the content limits specified in this Contract. If values fall outside of the allowable tolerance, deductions shall be calculated from the mix design target value.
2. Asphalt Content: the greater of either 1.0% of the contract price for asphalt pavement placed within the sampled lot or \$500 per each 0.1% outside the allowable job mix design asphalt content tolerance. The allowable asphalt content tolerance for this Contract shall be +/- 0.4% of the target job mix design value and not to fall below a value of 5.6%. If values fall outside of the allowable tolerance, deductions shall be calculated from the mix design target value.

The pay deductions for exceeding the job mix design tolerances does not constitute acceptance of a mix that does not meet the specifications. Variations that are excessively large in a lot may be considered for larger deductions or non-payment. Further acceptance testing will be performed to determine if the asphalt pavement specifications have been met. No payment for asphalt pavement will be made for asphalt pavement exceeding job mix design tolerances, or not meeting asphalt pavement specifications, until additional testing determines whether the asphalt pavement meets all other specifications.

For the purposes of this Contract, one lot of asphalt pavement is defined as 500 tons, or a single day's asphalt pavement production of at least 100 tons.

SPECIAL PROVISIONS

SECTION 03303 – SIDEWALK, CURB AND GUTTER, PART 2 - PRODUCTS, Article 2.1, MATERIALS, *revise paragraph B. to read:*

- B. Synthetic fibers shall be used for reinforcement with curb and gutter, concrete hydrant pads, and concrete sidewalk replacements, except a 6-foot length of No. 4 reinforcing bar shall be centered across catch basins centered in the curb. Except as described above, reinforcing steel or wire mesh shall not be used unless approved by the ENGINEER. Curbs, gutters and sidewalk shall utilize a fibrillated product, Fibermesh 300, or approved equal. Application rates shall be at least 1.5 pounds per cubic yard of concrete. Fibermesh shall be as manufactured by “SI Concrete Systems,” or approved equal.

SECTION 03303 – SIDEWALK, CURB AND GUTTER, PART 2 - PRODUCTS, Article 2.1, MATERIALS, *add the following paragraph:*

- C. Detectable tiles shall be cast iron detectable warning plates with truncated dome pattern, a slip resistant surface, and with handle or flange on bottom or approved equal. Detectable warning plates shall be coated with yellow polymer soaked finish, and manufactured according to the 2006 U.S. DOT ADA Standards for Transportation Facilities.

SECTION 03303 – SIDEWALK, CURB AND GUTTER, PART 3 – EXECUTION, Article 3.1, METHODS OF CONSTRUCTION, *add the following paragraphs:*

- K. All forms for segments between PC’s and PT’s with a radius less than 100' shall be arced to match the required curvature. No straight forms will be permitted for use within any curved segments with a radius of less than 100'. Straight forms used for any arced segment with a radius of more than 100' shall not exceed 10' in length.
- L. The CONTRACTOR shall cure and protect all newly placed concrete as required to prevent cracking or disfigurement during the curing period. Damaged concrete shall be repaired or replaced at no additional cost.

END OF SPECIAL PROVISIONS

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

- ##### B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Qualification Data: For manufacturer and Installer.

- ##### B. Research reports.

- ##### C. Field quality control reports.

1.5 QUALITY ASSURANCE

- ##### A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- ##### B. Installer Qualifications: Manufacturer of products or Manufacturer approved installer.

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by a company participating in AWI's Quality Certification Program, a licensed participant in WI's Certified Compliance Program or local cabinet shop with established successful performance record providing services to government agencies and institutions.

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Participants in AWI or WI quality certification program shall provide labels and certificates from AWI or WI indicating that woodwork complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Reveal overlay.
 - 1. Reveal Dimension: 1/2 inch.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
- F. Laminate Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Arborite
 - 2. Formica
 - 3. Nevamar
 - 4. Wilsonart
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: PVC T-mold matching laminate in color, pattern, and finish.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panel.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors, matte finish.
 - b. Wood grains, matte finish.
 - c. Patterns, matte finish.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard (Medium Density): ANSI A208.1, Grade M-2-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 - 4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal 4 inches long, 5/16 inch in diameter..
- E. Catches: Roller catches, ANSI/BHMA A156.9, B03071.
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal two-pin plastic with shelf hold-down clip.
- G. Drawer Slides: ANSI/BHMA A156.9.

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full extension.
 - b. Material: Aluminum, Epoxy-coated polymer, Galvanized steel ball bearing,]
Stainless steel or Zinc-plated ball bearing slides.
- H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 1. Satin Stainless Steel: ANSI/BHMA 630.
- I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Contact cement.
 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

END OF SECTION 064116

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, cut-back-asphalt dampproofing.
 - 2. Cold-applied, emulsified-asphalt dampproofing.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. APOC
 - 2. Brewer Co. (The)
 - 3. ChemMasters Inc.
 - 4. Henry Co.
 - 5. Karnak Corp.
 - 6. W.R. Meadows
- B. Trowel Coats: ASTM D4586/D4586M, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D4479/D4479M, Type I, fibered or nonfibered.

2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. APOC
 - 2. Brewer Co. (The)
 - 3. ChemMasters Inc.

SECTION 071113 - BITUMINOUS DAMPPROOFING

4. Henry Co.
 5. Karnak Corp.
 6. W.R. Meadows
- B. Trowel Coats: ASTM D1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.4 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D41/D41M.
- C. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- D. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- E. Protection Course: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
1. Thickness: Nominal 1/8 inch minimum.
- F. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C578, Type X, 1/2 inch minimum thickness.
- G. Protection Course: Smooth-surfaced roll roofing complying with ASTM D6380/D6380M, Class S, Type III.

PART 3 - EXECUTION

3.1 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
1. Apply dampproofing to provide continuous plane of protection.
 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

SECTION 071113 - BITUMINOUS DAMPPROOFING

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing interior face of above-grade, exterior concrete walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one trowel coat at not less than 4 gal./100 sq. ft..
- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..

3.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or one trowel coat at not less than 4 gal./100 sq. ft..
- B. Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat or primer and one trowel coat at not less than 5 gal./100 sq. ft..
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- D. Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat at not less than 1 gal./100 sq. ft..

3.4 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

END OF SECTION 071113

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Molded (expanded) polystyrene foam-plastic board insulation.
 - 2. Polyisocyanurate foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.
- B. Refer to Section 075323, "EDPM Roofing" for roof insulation systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Molded (expanded) polystyrene foam-plastic board insulation.
 - 2. Polyisocyanurate foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product test reports.
- C. Research reports.

PART 2 - PRODUCTS

2.1 POLYSTYRENE MANUFACTURERS:

- A. Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Atlas Molded Products
 - 2. Dow
 - 3. HCH Foam Technology
 - 4. Insulation Technology Inc.

2.2 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EPS)

- A. Use: Below grade wall and foundation insulation

SECTION 072100 - THERMAL INSULATION

- B. Molded (Expanded) Polystyrene Board Insulation, Type IX: ASTM C578, Type IX, 25-psi minimum compressive strength.
- C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width

2.3 POLYISOCYANURATE MANUFACTURERS

- A. Manufacturers offering products meeting requirements include but are not limited to the following”
 - 1. Atlas Molded Products
 - 2. Carlisle
 - 3. Firestone
 - 4. GAF
 - 5. RMax

2.4 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION (non-roof use).

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.
 - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION (roof use).

- A. Polyisocyanurate Board Composite: A product of closed cell polyisocyanurate roof insulation., with 5/8th CD-X Ply nailing panel on one side and glass fiber/organic mat facers on the other face. Type V, Class 1 roof per FM standard 4450.
- B. Polyisocyanurate Board Standard Type: For use in building up roof insulation layers under composite board.
 - 1. Density Nominal in concordance with ASTM D-1622: 2pcf
 - 2. Compressive Strength: Per ASTM D1621: 20psf
 - 3. Water Vapor Transmission: Per ASTM E96: Less than 1.5 perms
 - 4. Water Absorption: Per C209: Less than 1% by volume.
 - 5. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.6 GLASS-FIBER BLANKET MANUFACTURERS

- A. Manufacturers offering products meeting requirements include but are not limited to the following”
 - 1. GAF
 - 2. Guardian
 - 3. Johns Manville

SECTION 072100 - THERMAL INSULATION

4. Owens Corning

2.7 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I;; passing ASTM E136 for
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.8 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

SECTION 072100 - THERMAL INSULATION

3.2 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. Extend insulation below exterior grade line to depth indicated on Drawings. If not indicated extend to a depth required by the Building Official.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. Extend insulation a horizontally for the distance indicated on the Drawings. If not indicated extend to distance required by Building Official.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.
- C. Adhesive Installation Option: Install with adhesive or press into tacky waterproofing or damp-proofing according to manufacturer's written instructions.

3.4 INSTALLATION OF ROOF INSULATION

- A. Polyisocyanurate Boards: Install over self-adhering/self-healing vapor barrier in single or multiple layers to achieve required insulation value. Stagger joints so that there is a minimum of 6" overlap at all panel edges. Boards may be loose-laid or if desired, temporarily secured to roof sheathing with long screws and disk washers.
- B. Polyisocyanurate Composite Boards: Install over standard polyisocyanurate boards. Stagger joints so that there is a minimum of 6" overlap at all panel edges. Provide Manufacturer's recommended joint spacing between panel edges. Secure panels to roof sheathing using long screws. Follow Manufacturer's recommended fastener size and spacing.
- C. INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION
- D. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

SECTION 072100 - THERMAL INSULATION

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. Ft.
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Building wrap.
 - 2. Flexible flashing.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Water-Vapor Permeance: Not less than 75 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
 - 2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

- A. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

SECTION 072500 - WEATHER BARRIERS

1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover ridged insulation with water-resistive barrier as follows:
 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- B. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 1. Seal seams, edges, fasteners, and penetrations with tape.
 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 1. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 2. Lap flashing over water-resistive barrier at bottom and sides of openings.
 3. Lap water-resistive barrier over flashing at heads of openings.

3.3 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of modified bituminous sheet air barrier.
- B. Product test reports.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.2 SELF-ADHERING SHEET AIR BARRIER

- A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side.
 - 1. Physical and Performance Properties:
 - a. Air Permeance: Maximum [0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
 - d. Puncture Resistance: Minimum 40 lbf; ASTM E154/E154M.
 - e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D570.
 - f. Vapor Permeance: Maximum 0.1 perm; ASTM E96/E96M, Desiccant Method.
 - g. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

2.3 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- D. Bridge discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

3.2 INSTALLATION

- A. Install materials according to air-barrier manufacturer's written instructions and details and according to recommendations in ASTM D6135 to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
 - 2. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
- B. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water.
 - 2. Roll sheets firmly to enhance adhesion to substrate.
- C. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
- D. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
- F. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.
- G. Do not cover air barrier until it has been tested and inspected by testing agency.
- H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.3 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

END OF SECTION 072713

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standing-seam metal roof panels.
 - 2. Snow Guards
 - 3. Pipe Penetration Boots

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 60.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint

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sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 STANDING-SEAM METAL ROOF PANELS

A. Manufacturer/Product: Basis of Design Product is AEP Span's Design Span hp metal roofing panel system. Other Manufacturers offering products meeting requirements include but are not limited to:

1. Fabral
2. Firestone
3. Metal Sales

B. Description: Factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
2. Width: 16"
3. Gauge: 24ga
4. Factory striations between standing seams
5. Snap panel – no field seaming required
6. Testing: ASTM E1592 (wind uplift), ASTM E1680 (air infiltration) and ASTM E1646 (water infiltration). All testing performed by accredited third-party.
7. Meets UL580 Class 90 wind uplift requirements
8. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Finish: 70% fluoropolymer (PVDF) paint system in 2 or 3 coats.
 - b. Color: As selected by Architect from manufacturer's full range.
9. Clips: Manufacturer's standard to accommodate thermal movement.

2.3 UNDERLAYMENT MATERIALS

A. Manufacturer/Product: Basis of Design Product is Grace's Ice Water Shield. Other manufacturers offering similar products include but are not limited to: GAF, Owens Corning, Certainteed and DuPont.

B. Self-Adhering and self-healing High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of (1mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive,

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

with release-paper backing. Product shall have a foldless release paper, a rubberized asphalt layer and a polyethylene layer

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match metal roof panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

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- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

- A. Panels and Accessories:
 - 1. Two or three coat Fluoropolymer: AAMA 621/AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
 - 2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

2.7 SNOW GUARDS

- A. Manufacturer/Product: Basis of Design is Alpine SnowGuards' SimplGuard Standing Seam Fence Style Snow Guard. Other Manufactures offering similar products include but are not limited to the following:
 - 1. AceClamp
 - 2. Ceco
 - 3. Rocky Mountain Snowguards.

2.8 PIPE BOOTS

- A. Description: Roof jack square EDPM pipe flashing boot.
- B. Size according to pipe diameter.
- C. Acceptable Manufacturers include but are not limited to the following:
 - 1. Dektite
 - 2. Master Flash
 - 3. Oatey
- D. Sealant: As recommended by boot Manufacturer and acceptable to roofing Manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

- A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
- B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 INSTALLATION OF SNOW GUARDS

- A. Install according to Manufacturer's written instructions.
- B. Penetration of standing seam not permitted. Friction fit only.
- C. Install where indicated on Drawings.

3.5 INSTALLATION OF PIPE FLASHINGS

- A. Install according to Manufacturer's written instructions in the flat area between seams. Relocate pipe as required to avoid standing seams.
- B. Select boot based on pipe size and roof slope
- C. Seal bottom of boot and fasten to roof deck with gasketed metal roofing screws

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113.16

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concealed-fastener, lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

SECTION 074213.13 - FORMED METAL WALL PANELS

1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Manufacturer/Product: Basis of Design Product is AEPSpan's Flex Series 1.2FX10-12 concealed fastener formed metal wall panel. Other Manufacturers offering similar products may submit product information for review and possible approval.
- C. Description:
1. Size: 12" wide x 20' length x 1-1/4" panel depth.
 2. Shape: 2" square corrugations with equally sized square reveals between designed for lapping on one edge.
 3. Material/Gage: 22 gage Aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.15-0.25 mil primer, 0.70-0.80 mil top coat and 0.50 mil backer coat (polyester system applied over primer).
 - b. Exterior Finish: DuraTech 5000 Kynar per ASTM D5796.
 - c. Color: As selected by Architect from manufacturer's full range.

SECTION 074213.13 - FORMED METAL WALL PANELS

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Sub-framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end-walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

SECTION 074213.13 - FORMED METAL WALL PANELS

- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Panels and Accessories:
 - 1. Two-Coat Fluoropolymer Exterior Finish: Manufacturer's standard Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
 - 2. Siliconized Polyester Backer (concealed) Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a combined dry film thickness of not less than 0.5 mil.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations to achieve rainscreen assembly.

3.2 INSTALLATION

- A. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 - 5. Flash and seal panels with weather closures at perimeter of all openings.
- B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

SECTION 074213.13 - FORMED METAL WALL PANELS

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.13

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formed roof-drainage sheet metal fabrications.
 - 2. Formed roof sheet metal fabrications.
 - 3. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

1.3 ACTION SUBMITTALS

- A. Product Data: For each of the following
 - 1. Underlayment materials.
 - 2. Elastomeric sealant.
 - 3. Butyl sealant.
 - 4. Epoxy seam sealer.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Include details for forming, including profiles, shapes, seams, and dimensions.
 - 3. Include details for joining, supporting, and securing.
 - 4. Include details of roof-penetration flashing.
 - 5. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
 - 6. Include details of special conditions.
 - 7. Include details of connections to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Special warranty.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No.8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; material surfaces. Insert additional performance requirements here; verify system compliance with manufacturers.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); pre-painted by coil-coating process to comply with ASTM A755/A755M.
1. Surface: Smooth, flat.
 2. Exposed Coil-Coated Finish:
 - a. Two or three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Retain "Color" Subparagraph below for factory-coil-coated finish.
 3. Color: As selected by Architect from manufacturer's full range.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

2. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

F. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Accessories: Wire-ball downspout strainer.
5. Gutters: Fabricate from the following materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricate from the following materials:
 - a. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

3.2 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 - 5. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 - 7. Do not field cut sheet metal flashing and trim by torch.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
- G. Downspouts:
 - 1. Join sections with 1-1/2-inch telescoping joints.
 - 2. Provide hangers with fasteners designed to hold downspouts securely to walls.
 - 3. Locate hangers at top and bottom and at approximately 60 inches o.c.
 - 4. Connect downspouts to underground drainage system.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

3.3 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements in cited sheet metal standard.
 - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
 - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.4 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.

3.6 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nonstaining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Immersible joint sealants.
 - 4. Mildew-resistant joint sealants.
 - 5. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports.
- D. Field-adhesion-test reports.
- E. Sample warranties.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint

SECTION 079200 - JOINT SEALANTS

Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Colors of Exposed Joint Sealants: As selected by Engineer from manufacturer's full range.
- B. Where product Manufacturer has a specific recommendation for sealant to be used with their product, defer to their recommendation rather than to the schedule provided in this Section.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.4 IMMERSIBLE JOINT SEALANTS

- A. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.

SECTION 079200 - JOINT SEALANTS

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.6 BUTYL RUBBER SEALANT

- A. Formulated from butyl rubber and polyisobutylene conforming to ASTM C1311, US Fed Spec TT-S-001657, Type 1 – 10% movement maximum.

2.7 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated] and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

SECTION 079200 - JOINT SEALANTS

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates.
 - 1. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

SECTION 079200 - JOINT SEALANTS

3.4 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal building traffic surfaces - JS-#1.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
 - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion - JS-#2.
 - 1. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
 - 2. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces - JS-#3.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement - JS-#4.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - c. ther joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.
 - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces - JS-#5.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Engineer from manufacturer's full range of colors.
- F. Joint-Sealant Application: Concealed mastics - JS-#6.

SECTION 079200 - JOINT SEALANTS

1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based.

END OF SECTION 079200

SECTION 082200 – FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

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. Fiberglass reinforced plastic (FRP) doors.
 - 2. Fiberglass Resin Transfer Molded Door Frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and thicknesses.
 - 4. Preparation and accommodation for specified door hardware.
- C. Product Schedule: For doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

SECTION 082200 – FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer's offering products meeting requirements include but are not limited to the following:
1. Chem-Pruf Door Co. Ltd.
 2. Corrim Company
 3. Tiger Door
 4. Special-Lite

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.37 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 HEAVY DUTY FRP DOORS AND FRAMES

- A. Construct FRP doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames:
1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Doors shall be made of fiberglass reinforced plastic (FRP) using Class 1 premium resin with no fillers that is specifically tailored to resist chemicals and contaminants typically found in environment for which these specifications are written.
 - c. Doors shall be 1 ¾ inch thick and of flush construction, having no seams or cracks. For consistency in the resin chemistry tailored for this application and to maintain the same physical properties throughout the structure, all fiberglass components including face plates, stiles and rails and frames must be fabricated by the same manufacturer.
 2. Door Plates:
 - a. 0.125 inch thick minimum, molded in one continuous piece, starting with 25 mil gelcoat of the color specified, integrally molded with multiple layers of 1.5 ounces per square foot fiberglass mat and one layer of 18 ounce per square yard fiberglass woven roving.
 - b. Each layer shall be individually laminated with resin as mentioned above. Door plate weight shall not be less than 0.97 lbs per square foot at a ratio of 30/70 glass to resin. Plate alone to withstand Large Missile Impact per FBC TAS 201.
 3. Core: Manufacturer's standard
 - a. Fire-Rated Core: Manufacturer's standard.
 4. Stiles and Rails:
 - a. Constructed starting from the outside toward the inside, with a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall

SECTION 082200 – FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. No miter joints.

- b. Internal Reinforcement: #2 SPF sufficient to support specified hardware.
5. Finish:
 - a. 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath.
 - b. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.
 - c. Color: Selected by Architect from Manufacturer's full color range.
 6. Frames:
 - a. Materials: Frames (rated and non-rated) shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Internal Reinforcement: Provide reinforcement for attachment of hardware.
 - d. Mortises and hinge pockets: Machined by CNC.
 7. Hardware: Refer to Section 087000. Hardware shall be installed by the door/frame manufacturer at the factory to the greatest extent possible.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Manufacturer's standard for each opening type. Anchors of minimum size and type required by Door/Frame Manufacturer.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.
2. Frame insulation: Exterior frames shall be field-insulated prior to erection. Use product recommended by door/frame manufacturer.

SECTION 082200 – FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

2.5 FABRICATION

- A. Door Astragals: Provide overlapping astragal on pairs of doors where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- B. Fiberglass Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing doors and frames for hardware.

2.6 FINISHES

- A. Finish: Finish of door frame shall be identical with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture resulting in a smooth gloss surface that is dense and non-porous. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat results in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the door and frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. FRP Doors and Frames:
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. Exterior frames shall be field-insulated using material recommended by door/frame manufacturer. After wall construction is complete, remove temporary braces without damage to completed Work. Insulate voids completely in exterior door frames and seal frame on interior and exterior.
 - a. Install frames with removable stops located on secure side of opening.
 - 2. Floor Anchors: Secure with post-installed expansion anchors.

SECTION 082200 – FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

- a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
3. Installation Tolerances: Adjust frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
4. Electrified hardware: When specified, coordinate with electrical system installer.

3.2 FIELD QUALITY CONTROL

- A. Inspections: City shall provide field inspection of door and frame installations.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 REPAIR

- A. Damaged doors and finishes are unacceptable. Repair any damaged door or frame to like new condition or replace with a new factory unit.

3.4 CLEANING

- A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

END OF SECTION 082200

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. All necessary access doors and frames are not located on the Drawings. Provide access doors and frames where necessary to access plumbing equipment and concealed spaces and where required by the building official.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 ACCESS DOORS AND FRAMES

- A. Manufacturer: Manufacturers offering products meeting requirements include but are not limited to the following”
 - 1. Babcock-Davis
 - 2. J.L. Industries, Inc.
 - 3. Larsen’s Manufacturing Company
 - 4. Milcor
- B. Flush Access Doors with Exposed Flanges
 - 1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 2. Locations: Typical for most wall and ceilings.
 - 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage primed.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.

SECTION 083113 - ACCESS DOORS AND FRAMES

5. Stainless Steel Sheet for Door at wet locations only: Nominal 0.062 inch 16 gage, ASTM A480/A480M No. 4 finish.
6. Frame Material at wet locations: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch, screwdriver operated typical. Key-operated in public restroom.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Flat Bars: ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.
- F. Frame Anchors: Same material as door face.
- G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- C. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.5 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fiberglass-framed windows.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Material Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace fiberglass windows that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

SECTION 085413 - FIBERGLASS WINDOWS

1. Window Certification: WDMA certified with label attached to each window.
 - B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 1. Minimum Performance Class: CW.
 2. Minimum Performance Grade: 30.
 - C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- 2.2 FIBERGLASS WINDOWS
- A. Manufacturer/Product: Basis of Design Product is Milgard's Ultra Series Awning Window. Other Manufacturers may submit product information for approval and incorporation into the Work.
 - B. Operating Types: Awning (crank operated).
 - C. Frames and Sashes: Pultruded fiberglass complying with AAMA/WDMA/CSA 101/I.S.2/A440 and with exposed exterior fiberglass surfaces finished with manufacturer's standard enamel coating complying with AAMA 613 or AAMA 623.
 1. Exterior Color: As selected by Architect from manufacturer's full range.
 2. Interior Finish: Matching exterior color and finish.
 - D. Frame Configuration: Nail Flange Type with 1" Fin Setback
 - E. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
 - F. Insulating-Glass Units: ASTM E2190.
 1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 2. Filling: Fill space between glass lites with argon.
 3. Low-E Coating: Pyrolytic on second surface.
 - G. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
 - H. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
 - I. Projected Window Hardware:

SECTION 085413 - FIBERGLASS WINDOWS

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.
 - b. Pole Operation: Provide (1) crank type pole operator capable of engaging crank operator shaft with the handle removed. The pole operator shall be of sufficient length and configuration to easily open and close windows from the interior space.
 2. Hinges: Manufacturer's standard type for sash weight and size indicated.
 3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position on each jamb.
 4. Limit Devices: Limit clear opening to 9 inches for ventilation; with custodial key release.
- J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

2.3 ACCESSORIES

2.4 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: Full, inside for project-out sashes.
- B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.
1. Finish for Interior Screens: Baked-on organic coating.
- C. Glass-Fiber Mesh Fabric: Manufacturer's standard.
1. Mesh Color: Gray.

2.5 FABRICATION

- A. Fabricate fiberglass windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze fiberglass windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.

SECTION 085413 - FIBERGLASS WINDOWS

- D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
- E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085413

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for fiberglass doors and frames.
 - 2. Keyed cylinders as indicated.
- B. Related Sections:
 - 1. Division 8: Fiberglass Doors and Frames.
 - 2. Division 26: Electrical (for power and communications)
- C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. Builders Hardware Manufacturing Association (BHMA)
 - 2. NFPA 101 Life Safety Code
 - 3. ANSI-A156 – Various Performance Standards for Finish Hardware
 - 4. UL10C – Positive Pressure Fire Test of Door Assemblies
 - 5. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
 - 6. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
 - 7. IBC – International Building Code as adopted by AHJ
- D. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
 - 2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

1.2 SUBSTITUTIONS:

- A. Items specified in this section are products which are of acceptable design.
- B. Do not substitute products without Architect's written prior approval per Division 1. Requests for approval shall be submitted by factory authorized distributor firms representing the products proposed for substitution. Items that are noted to allow no substitution are matching existing materials and the owner's material inventory for servicing the facility.

1.3 SUBMITTALS:

- A. Comply with Division 1.
- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

SECTION 087100 - DOOR HARDWARE

- C. Product Data: Manufacturer's specifications and technical data including the following:
1. Detailed specification of construction and fabrication.
 2. Manufacturer's installation instructions.
 3. Submit 6 copies of catalog cuts with hardware schedule.
 4. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2
- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
1. List groups and suffixes in proper sequence.
 2. Completely describe door and list architectural door number.
 3. Manufacturer, product name, and catalog number.
 4. Function, type, and style.
 5. Size and finish of each item.
 6. Mounting heights.
 7. Explanation of abbreviations and symbols used within schedule.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
1. Operating and maintenance manuals: Submit 3 sets containing the following.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 2. Copy of final hardware schedule, edited to reflect, "As installed".
 3. Copy of final keying schedule
 4. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

- A. Comply with Division 1.
1. Statement of qualification for distributor and installers.
 2. Statement of compliance with regulatory requirements and single source responsibility.
 3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.

SECTION 087100 - DOOR HARDWARE

- b. Hardware Schedule shall be prepared and signed by an AHC.
- 4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
- 5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
- 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- 7. Provide hardware for all openings, whether specified or not, in compliance with NFPA Standard No. 80, proper operation and local building code requirements. Where required, provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in IBC.
- 8. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990 as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1.
 - 1. Deliver products in original unopened packaging with legible manufacturer's identification.
 - 2. Package hardware to prevent damage during transit and storage.
 - 3. Mark hardware to correspond with "reviewed hardware schedule".
 - 4. Deliver hardware to door and frame manufacturer upon request.
- B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 - 1. Closers: Lifetime

SECTION 087100 - DOOR HARDWARE

2. Exit Devices: Five Years
3. Locksets & Cylinders: Three years
4. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
 1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
 3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Bommer, McKinney
Locksets	Best 45H	None
Cylinders	Best Patented	None
Closers	Dorma 8916	Best HD7016
Protection Plates	Trimco	Burns, Rockwood
Door Stops	Trimco	Burns, Rockwood
Threshold & Gasketing	National Guard	Reese, Zero

2.2 MATERIALS:

- A. Hinges: Shall be Five Knuckle Ball bearing hinges

SECTION 087100 - DOOR HARDWARE

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non-Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish

B. Mortise Type Locks and Latches:

1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Fit ANSI A115.1 door preparation
5. Functions and design as indicated in the hardware groups
6. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
10. Provide sufficient curved strike lip to protect door trim
11. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
12. Lock shall have self-aligning, thru-bolted trim
13. Levers to operate a roller bearing spindle hub mechanism
14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
15. Spindle to be designed to prevent forced entry from attacking of lever
16. Provide locksets with 7-pin removable and interchangeable core cylinders
17. Each lever to have independent spring mechanism controlling it
18. Core face must be the same finish as the lockset.

C. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.

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2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.
4. Provide cylinder cores as required to convert any existing cores to a new Best Cormax patented key system as directed by the required keying meeting.

D. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16-inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, backcheck, and delayed action
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½"/36MM minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall incorporate the manufacturer's adjustable delayed action feature.
12. Closers shall be non-handed and multi-sized.

E. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
2. Provide fastener suitable for wall construction.
3. Coordinate reinforcement of walls where wall stop is specified.
4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

F. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best standard 7-pin.

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- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. 2 each Grand Masterkeys
 - 2. 4 each Masterkeys
 - 3. 2 each Change keys each keyed core
 - 4. 10 each Construction Keys
 - 5. 1 each Construction Control keys
 - 6. 1 each Permanent Control Keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

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- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.
- B. Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
 - 1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
 - 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
 - 3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
 - 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

3.5 SCHEDULE OF FINISH HARDWARE:

List of Manufacturers

BE	Best Access Systems	Locks, Cylinders
DM	Dorma USA	Closers
NA	National Guard	Weatherstrip, Thresholds
ST	Stanley	Hinges
TR	Trimco	Flat Goods, Door Stops

SECTION 087100 - DOOR HARDWARE

Finish Codes

<u>Code</u>	<u>Description</u>
626/652	Satin Chromium Plated
630	Satin Stainless Steel
689	Painted Aluminum

Option List

<u>Code</u>	<u>Description</u>
VIN	Occupancy Indicator (Best)
CS	Counter Sinking of Kick and Mop Plates (Trimco)
B4E	Beveled 4 Edges - Kick Plates (Trimco)
SSMS/EA	Stainless Machine Screws/Expansion Anchors (NGP)
SMS-TEKS	Self-Drilling Sheet Metal Screws (NGP)

SET #1 - Break Room

Door: 101

2	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
*1	Electric Hinge	CECB199-12C 4 1/2 X 4 1/2	630	ST
*1	Electric Lockset	45H-7DEU14H PATD C RQE	626	BE
1	Closer	8916 SPA	689	DM
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Door Sweep	200 NA SMS-TEKS		NA
1	Threshold	8427 SSMS/EA		NA
*1	Wire Harness	WH-6E		ST
*1	Wire Harness	WH-50		ST
*1	Wire Harness	WH-192		ST
*1	Power Supply	RPSMLR2		PR

Card activation momentarily releases strike and allows access. Card reader by security access. Verify threshold application

SET #2 - Restroom

Door: 102

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Privacy Set	45H-0L14H VIN	626	BE
1	Closer	8916 AF89	689	DM
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SECTION 087100 - DOOR HARDWARE

SET #3 - Storage

Door: 103

6	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
2	Flush Bolts	3917-12	626	TR
1	Lockset	45H-7D14H PATD	626	BE
2	Door Stops	1214H	626	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Astragal Gasket	5040 B		NA
2	Door Sweeps	200 NA SMS-TEKS		NA
1	Threshold	8413 SSMS/EA		NA

Inactive leaf for movement of materials only. Astragal on inactive leaf by door manufacturer. Verify threshold type and application.

SET #4 - Restroom - Exterior

Door: 104

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Lockset	45H-7TA14H PATD VIN	626	BE
*1	Electric Strike	BES-F2164	630	BE
1	Closer/Stop	8916 S-DS	689	DM
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Door Sweep	200 NA SMS-TEKS		NA
1	Threshold	8427 SSMS/EA		NA
*1	Wire Harness	WH-6E		ST
*1	Wire Harness	WH-192		ST
*1	Power Supply	RPSMLR2		PR

Card activation momentarily releases strike and allows access. Throwing deadbolt prevents access until room is vacated (strike captures deadbolt). Card reader by security access. Verify threshold application.

END OF SECTION 087100

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Gypsum wallboard.
 - 2. Mold-resistant gypsum board.
 - 3. Gypsum board, Type C.
 - 4. Interior trim.
 - 5. Joint treatment materials.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch
 - 2. Long Edges: Tapered.
- B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:

SECTION 092900 - GYPSUM BOARD

- a. Cornerbead.
- b. L-Bead: L-shaped; exposed long flange receives joint compound.
- c. U-Bead: J-shaped; exposed short flange does not receive joint compound..

2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
 1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.5 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

SECTION 092900 - GYPSUM BOARD

- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints, and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.2 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 096513 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Thermoplastic-rubber base.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Armstrong
 - 2. Burke
 - 3. Flexco
 - 4. Johnsonite
 - 5. Roppe
 - 6. Tarkett

2.2 THERMOSET-RUBBER BASE

- A. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style: Cove where indicated.
- B. Thickness: 0.125 inch.
- C. Height: 4 inches.
- D. Lengths: Coils in manufacturer's standard length.

SECTION 096513 – RESILIENT BASE AND ACCESSORIES

- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: Black/Brown unless otherwise indicated.

2.3 THERMOPLASTIC-RUBBER BASE

- A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: Solid, homogeneous
 - 2. Style and Location:
 - a. Style: Cove
- B. Thickness: 0.125 inch.
- C. Height: 4 inches.
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: Black/Brown unless otherwise indicated.

2.4 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. products.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

SECTION 096513 – RESILIENT BASE AND ACCESSORIES

- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Preformed Corners: Install preformed corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

END OF SECTION 096513

SECTION 097720 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prefinished polyester glass reinforced plastic sheets and adhered to unfinished wallboard.
2. Aluminum trim.

1.2 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.

1. Submit complete with specified applied finish.
2. For selected patterns show complete pattern repeat.
3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site.

1.3 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:

1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
2. Wall Required Rating – Class A.

PART 2 - PRODUCTS

2.1 FRP PANELS

A. Description: FRP panels field-installed and factory-installed

SECTION 097720 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

1. FRP panels: 48" x 96" – smooth semi-gloss stipple finish
 2. Color: Selected by Architect from Manufacturer's full standard color range.
 3. Trims: Aluminum joint trims – clear anodized.
 4. Adhesive: Low VOC content below 150g/L and shall contain no formaldehyde.
 5. Substrate: Moisture-resistant gypsum wall board (field-installed).
- B. Manufacturer: Manufacturer's offering products meeting requirements include but are not limited to the following:
1. Crane Composites
 2. Glasteel
 3. Nudo Fiberlite
- C. Properties:
1. Resistant to rot, corrosion, staining, denting, peeling, and splintering.
 2. Flexural Strength - 1.0×10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
 3. Flexural Modulus - 3.1×10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
 4. Tensile Strength - 7.0×10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
 5. Tensile Modulus - 1.6×10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
 6. Water Absorption - 0.72% per ASTM D 570.
 7. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
 8. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- D. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- E. Front Finish: Manufacturer's White pebble finish.
- F. Size: 48" x 96"

2.2 MOLDINGS

- A. Aluminum Trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
- a. A551 Inside Corner, 8' length
 - b. A560 Outside Corner, 8' length
 - c. A565 Division, 8' length
 - d. A570 Edge, 8' length
2. Color: Clear Satin Anodized

2.3 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
1. Match panel colors.
 2. Length to suit project conditions.
- B. Adhesive: Construction adhesives complying with ASTM C 557.

SECTION 097720 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

- C. Sealant: Use Manufacturer's recommended sealant matching panel color.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
- B. Repair defects prior to installation.
 - 1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.2 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8" clearance for every 8 foot of panel.
 - 1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
 - 2. Pre-drill fastener holes 1/8" oversize with high speed drill bit.
 - a. Space at 8" maximum on center at perimeter, approximately 1" from panel edge.
 - b. Space at in field in rows 16' on center, with fasteners spaced at 12" maximum on center.
- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.
- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8" of panel expansion at joints and edges, to insure proper installation.
 - 2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.3 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

SECTION 097720 – DECORATIVE FIBERGLASS REINFORCED WALL PANELS

END OF SECTION 097720

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel and iron.
 - 2. Wood.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and each color and gloss of topcoat.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers/Products currently approved by MPI and listed in the MPI Approved Products Lists may be incorporated into the Work. To the maximum extent possible utilize products from the same Manufacturer throughout.

SECTION 099113 - EXTERIOR PAINTING

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Fiber-Cement Board: 12 percent.
 - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

SECTION 099113 - EXTERIOR PAINTING

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Water-Based Light Industrial Coating System MPI EXT 5.1C:
 - a. Prime Coat: Door Manufacturer's standard rust-inhibitive factory Primer.
 - b. Intermediate Coat: Match Top Coat
 - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
- B. Galvanized Steel Framing Hardware and Associated Fasteners:
 - 1. Water-Based Light Industrial Coating System MPI EXT 5.3J:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial. coating, exterior, water based (MPI Gloss Level 5), MPI #161.
- C. Wood Substrates: Glued-laminated construction and Decking:
 - 1. Clear 2-Component Polyurethane MPI EXT 6.3G:
 - a. Prime Coat: Clear Polyurethane, MPI #78.
 - b. Intermediate Coat: Match Topcoat
 - c. Topcoat: Clear Polyurethane, (MPI Gloss Level 6), MPI #78.
- D. Exterior MDO Plywood for Electrical Equipment Mounting MPI ext 6.4K
 - 1. Water-Based 100% Acrylic Exterior Latex
 - a. First Coat: Latex Primer MPI#6
 - b. Intermediate Coat: Match Topcoat
 - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

SECTION 099113 - EXTERIOR PAINTING

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates:
 - 1. Steel and iron.
 - 2. Wood.
 - 3. Gypsum board.
- B. Refer to Section 099600 High Performance Coatings for steel and iron materials subject to contact and abuse.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

SECTION 099123 - INTERIOR PAINTING

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Engineer will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Engineer at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Benjamin Moore & Co.
 - 2. Kelly-Moore Paint Co.
 - 3. PPG Paints
 - 4. Sherwin Williams
- B. Products: Subject to compliance with requirements, provide MPI approved products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Engineer from manufacturer's full range.
 - 1. Approximately ten percent of surface area will be painted with deep tones.

SECTION 099123 - INTERIOR PAINTING

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- C. Paint Galvanized Steel framing hardware prior to installation and touchup after installing.

3.4 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Substrates:

SECTION 099123 - INTERIOR PAINTING

1. Latex over Latex Sealer System MPI INT 9.2A:
 - a. Prime Coat: Primer sealer, latex interior MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, eggshell (MPI Gloss Level 4), MPI #43.

- B. Wood Substrates: Glued-laminated construction and Decking:
 1. Clear 2-Component Polyurethane MPI EXT 6.3G:
 - a. Prime Coat: Clear Polyurethane, MPI #78.
 - b. Intermediate Coat: Match Topcoat
 - c. Topcoat: Clear Polyurethane, (MPI Gloss Level 6), MPI #78.

- C. Wood Substrates – Miscellaneous
 1. Latex over latex primer System MPI INT 6.4R
 - a. Prime Coat: Primer, latex for interior wood MPI #39.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

- D. Concrete Substrates, Nontraffic Surfaces:
 1. Water Repellent – Clear (Paintable)
 - a. Flood Coat: Acrylic Sealer, water based, MPI #34.

- E. Concrete Substrates, Traffic Surfaces:
 1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

- F. Steel Substrates – Office and Administrative Areas:
 1. Latex over Shop-Applied Quick-Drying Shop Primer System MPI INT 5.1X:
 - a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

- A. Galvanized Steel Framing Hardware and Associated Fasteners:
 1. Water-Based Light Industrial Coating System MPI EXT 5.3J:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light Industrial coating, exterior, water based (MPI Gloss Level 5), MPI #161.

END OF SECTION 099123

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Sign Schedule: Submit schedule identifying each sign location and content.

D. Samples: For each exposed product and for each color and texture.

1.3 INFORMATIONAL SUBMITTALS

A. Product cut sheets indicating materials, finishes, colors and the like.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

SECTION 101423 - PANEL SIGNAGE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1. Comply with ADA 28 CFR Part 36 regulations

2.2 ADA RESTROOM PANEL SIGN

- A. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. ACE Sign Systems
 - 2. APCO Graphics
 - 3. Best Sign Systems
 - 4. Inpro Corporation
 - 5. Signs and Decal Corp
 - 6. Vomar Products Inc.
- B. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated-Sheet Signs: (ADA) Plastic face sheet with raised graphics laminated to plastic backing sheet to produce composite sheet.
 - a. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - 3. Mounting: Stainless steel screws, applied through sign into sheathing
- C. Sign Content:
 - 1. Comply with signage requirements described in the 2010 ADA Standards for Accessible Design published by the US Department of Justice.
 - 2. Color: Blue background with white text and pictogram.

2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, Type UVF (UV filtering) – non-glare, polycarbonate Sheet: Coated, mar-resistant, UV-stabilized polycarbonate, with coating on both sides – non-glare or Manufacturer's standard plastic sheet material.
- B. Plastic thickness: 60mil.
- C. Braille: Letters/numbers/pictograms raised 1/32".

SECTION 101423 - PANEL SIGNAGE

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

PART 3 - EXECUTION

3.1 SIGN SCHEDULE

- A. Refer to Drawings.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
 - 1. Exterior signs shall be installed with stainless steel screws at the corners, engaging wood sheathing.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101423

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Underlavatory guards.
4. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

- ##### A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- ##### B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser: Basis of Design Product is Bobrick's B-2888 Commercial Toilet Paper Dispenser. Other Manufactures offering similar products include: Bradley, American Specialties, Ganco, and Murdock.
1. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset..
 2. Mounting: Surface mounted.
 3. Capacity: Designed for (2) 5-1/4" diameter tissue rolls.
 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 5. Theft-resistant heavy duty spindles.
- B. Automatic Paper Towel (Roll) Dispenser: Basis of Design Product is Bobrick's Automatic Roll Paper Towel Dispenser B-72974. Other Manufactures offering similar products include: Bradley, American Specialties, Ganco, and Murdock.
1. Description: Automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered.
 2. Mounting: Surface mounted.
 3. Minimum Capacity: 8-inch- wide, 800-foot-long roll.
 4. Material and Finish: ABS plastic, gray.
 5. Lockset: Tumbler type – provide minimum 3 keys.
- C. Waste Receptacle: Basis of Design Product is Bobrick's Contura Series Recessed Waste Receptacle with Linermate – B-43644. Other Manufactures offering similar products include: Bradley, American Specialties, Ganco, and Murdock.
1. Mounting: Recessed.
 2. Capacity: 12.8 gallons.
 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 4. Liner: Reusable vinyl liner.
 5. Front Panel: Removable.
- D. Automatic Soap Dispenser: Basis of Design Product is Bobrick's B-2013 Automatic Wall-mounted Foam Soap Dispenser. Other Manufactures offering similar products include: Bradley, American Specialties, Ganco, and Murdock
1. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing soap in foam lather form.
 2. Mounting: Surface wall-mounted.
 3. Capacity: 27 fluid ounces.
 4. Materials: Stainless steel type 304 Satin finish.
 5. Refill Indicator: Window in face of unit.
 6. Low-Battery Indicator: LED indicator flashes when battery low..
- E. Grab Bar: Basis of Design Product is Bobrick's B-6806 Series Straight Grab Barss. Other Manufactures offering similar products include: Bradley, American Specialties, Ganco, and Murdock
1. Mounting: Flanges with concealed fasteners.
 2. Material: Stainless steel, 0.05 inch thick.

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

- a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
 3. Outside Diameter: 1-1/2 inches.
 4. Configuration and Length: Straight, Sizes as indicated on the drawings..
- F. Seat-Cover Dispenser: Basis of Design Product is Bobrick B-221 Surface-Mounted Seat Cover Dispenser. Other Manufacturers offering similar products include: Bradley, American Specialties, Ganco, and Murdock.
1. Mounting: Surface mounted.
 2. Minimum Capacity: 250 seat covers.
 3. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
- G. Mirror Unit: Basis of Design Products include (1) Bobrick's B-290 Series Glass Mirror with Stainless Steel Angle Frame, and (1) B-1556 Stainless Steel Wall-Mount Frameless Mirror. Other Manufacturers offering similar products include: Bradley, American Specialties, Ganco, and Murdock.
1. B-290:
 - a. Frame: Stainless steel angle, 0.05 inch thick.
 - b. Corners: Manufacturer's standard.
 - c. Size: 24" x 36".
 - d. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
 - e. Glass: Manufacturer's standard tempered mirror glass.
 2. B-1556:
 - a. Frame: none
 - b. Corners: Manufacturer's standard.
 - c. Size: 24" x 36".
 - d. Hangers: Attached through face with (4) #8 oval head screws
 - e. Glass: None – 20 gage mirror polished stainless steel mounted on 1/3" tempered hardboard backing.

2.3 UNDERLAVATORY GUARDS

- A. Underlavatory Guard: Basis of Design Product is Truebro's LAV Shield. Other Manufacturers offering similar products include American Standard and Plumberex.
1. Description: One piece plastic insulated guard for supply and drain piping assemblies. Prevents direct contact with and burns from piping; allow service access.
 2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

- A. Custodial Mop and Broom Holder with Shelf: Basis of Design Product is Bobrick's B-239x34 Shelf. Manufacturers offering similar products include: Bradley, American Specialties, Ganco, and Murdock
1. Description: Unit with shelf, hooks and holders.
 2. Length: 34 inches.

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Use vandal-resistant fasteners in public restroom.
 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Provide required structural backing for all accessories.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for portable fire extinguishers.

1.2 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.
- C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of City-provided fire extinguishers are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.

SECTION 104413 - FIRE PROTECTION CABINETS

- B. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Babcock-Davis
 - 2. Guardian Fire Equipment
 - 3. JL Industries
 - 4. Larsens Manufacturing
 - 5. Nystrom
- C. Cabinet Construction: Nonrated, One-hour fire rated or Two-hour fire rated depending on fire rating of wall assembly.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Cold-rolled steel sheet.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
 - 2. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: Steel sheet.
- H. Door Material: Steel sheet.
- I. Door Style: Fully glazed panel with frame.
- J. Door Glazing: Tempered float glass (clear).
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - 3. Break-Glass Door Handle: Manufacturer's standard, integral to glass with the words "PULL TO BREAK GLASS" applied to handle.
 - 4. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

SECTION 104413 - FIRE PROTECTION CABINETS

- a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

- 1) Location: Applied to cabinet door.

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Color: As selected by Engineer from manufacturer's full range.
2. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

END OF SECTION 104413

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Field quality-control reports.
- C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

SECTION 113013 - RESIDENTIAL APPLIANCES

2.2 MICROWAVE OVENS

- A. Manufacturer/Product: Basis of Design Product is GE's 1.6 Cu. Ft. Countertop Microwave Oven Model #: JES1657DMBB. Manufacturers offering products meeting requirements include but are not limited to the following:
1. LG
 2. Panasonic
 3. Toshiba
 4. Sharp
- B. Description:
1. 1.6 cu. ft. capacity
 2. Sensor cooking controls
 3. Weight and time defrost
 4. Dimensions: 12 7/8 H x 21 3/4 W x 17 3/4 D
 5. Freestanding countertop Model – Black.

2.3 REFRIGERATOR/FREEZERS

- A. Manufacturer/Product: Basis of Design Product is GE's ENERGY STAR® 19.2 Cu. Ft. Top-Freezer Refrigerator Model #GTE19DTNRWW. Other Manufacturers offering similar products include but are not limited to the following:
1. Frigidaire
 2. Kenmore
 3. LG
 4. Maytag
 5. Whirlpool
- B. Description/Features:
1. LED lighting
 2. Adjustable wire shelves
 3. Upfront temperature controls regulate both fresh food and freezer sections
 4. ADA-compliant
 5. Large 13.59 cu. ft. fresh-food capacity
 6. 5.57 cu. ft. freezer capacity
 7. Clear crisper drawers
 8. Gallon door storage bins
 9. Dairy compartment
 10. Wire freezer shelf
 11. Icemaker-ready
 12. Approximate Dimensions (in.) - 66-3/8 in. H x 29-3/4 in. W x 34-1/2 in. D
 13. Limited 1-year entire appliance warranty

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Operational Test: After installation, start units to confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

END OF SECTION 113013

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.
 - 4. Solid surface material window sills.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
- B. Manufacturers: Manufacturers offering products meeting requirements include but are not limited to the following:
 - 1. Avonite
 - 2. Formica
 - 3. WilsonArt
- C. Delete option in "Type" Subparagraph below if 1/4-inch- (6.4-mm-) thick material is not used.
 - 1. Type: Provide Standard type
 - 2. Colors and Patterns: As selected by Engineer from manufacturer's full range unless otherwise indicated.
- D. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- E. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom
- B. Configuration: Refer to Drawings.
- C. Countertops: 1/2-inch thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch-thick, solid surface material.
- E. Joints: Fabricate countertops without joints where possible.
- F. Joints: Where necessary, fabricate countertops in sections for joining in field.
- G. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.
- C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- E. Install aprons to backing and countertops with adhesive.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to

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finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Silicone sealants.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A.

- B. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A.

- B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A.

- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

- C. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

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2.6 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
 - 1.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
 - 1.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level.
 - 3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 2. Interior Partitions:
 - a. Piping Smaller Than NPS 6: PVC pipe sleeves .

END OF SECTION 220517

SECTION 220719 - PLUMBING PIPING INSULATION

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 insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
 - 1. Preformed Pipe Insulation: Type II, Class 1, without jacket.
 - 2. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ-SSL jacket.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
- H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
 - 1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ-SSL.
 - 2. 850 deg F.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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5.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
 - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
 - 2. Wet Flash Point: Below 0 deg F.
 - 3. Service Temperature Range: 40 to 200 deg F.
 - 4. Color: Black .
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 4. Color: White .
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Color: White .
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
 - 2. Service Temperature Range: 0 to plus 180 deg F
 - 3. Color: White.

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2.5 LAGGING ADHESIVES

- A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 2. Service Temperature Range: 20 to plus 180 deg F .
 - 3. Color: White.

2.6 SEALANTS

- A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
 - 1. Permanently flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 58 to plus 176 deg F .
 - 3. Color: White or gray.
- C. FSK and Metal Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F
 - 3. Color: Aluminum.
- D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F .
 - 3. Color: White.

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

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2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Width: 3 inches
 - 2. Thickness: 11.5 mils .
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.11 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A240/A240M, Type 304; 0.015 inch thick, 1/2 inch wide with closed seal.
 - 2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

2.12 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers, :
 - 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures, :
 - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.

SECTION 220719 - PLUMBING PIPING INSULATION

2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

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- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

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3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

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2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
5. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.

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2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. **NPS 1** and Smaller: Insulation shall be the following:
 - a. Cellular Glass: **1-1/2** inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 2. **NPS 1-1/4** and Larger: Insulation shall be the following:
 - a. .
 - b. Flexible Elastomeric: **1 inch** thick.
- B. Domestic Hot Hot Water:
 1. **NPS 1-1/4** and Smaller: Insulation shall be the following:
 - a. Flexible Elastomeric: **1 inch** thick.
 2. **NPS 1-1/2** and Larger: Insulation shall be the following:
 - a. Flexible Elastomeric: **1 inch** thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1/2 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

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. Copper tube and fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Copper Unions:
 - 1. MSS SP-123.

SECTION 221116 - DOMESTIC WATER PIPING

2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.
- C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Standard: ASSE 1079.
 2. Pressure Rating: 125 psig minimum at 180 deg F.
 3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

SECTION 221116 - DOMESTIC WATER PIPING

- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.

SECTION 221116 - DOMESTIC WATER PIPING

- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- G.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.5 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

SECTION 221116 - DOMESTIC WATER PIPING

- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

SECTION 221116 - DOMESTIC WATER PIPING

- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.8 PIPING SCHEDULE

- A. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
- B. Aboveground domestic water piping, NPS 2 and smaller, shall be **one of** the following:
 - 1. Hard copper tube, ASTM B 88, Type L wrought-copper, solder-joint fittings; and soldered joints.

3.9 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. Vacuum breakers backflow preventers.
 - 2. Water-hammer arresters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.
- B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
 1. Standard: ASSE 1001.
 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 3. Body: Bronze.
 4. Inlet and Outlet Connections: Threaded.
 5. Finish: Chrome plated.

2.4 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers :
 1. Standard: ASSE 1013.
 2. Operation: Continuous-pressure applications.
 3. Pressure Loss: **12** psig maximum, through middle third of flow range.
 4. Size: **3/4"** NPS.
 5. Body: Bronze for NPS 2 and smaller; .
 6. End Connections: Threaded for NPS 2 and smaller
 7. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
 8. stainless-steel door.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers :
 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated.
 3. End Connections: Threaded for NPS 2 and smaller.
 4. Screen: Stainless steel with round perforations unless otherwise indicated.
 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: **0.033** inch.
 6. Drain: Factory-installed, hose-end drain valve.

2.6 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters :
 1. Standard: ASSE 1010 or PDI-WH 201.
 2. Type: Copper tube with piston.
 3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Water Regulators: Install with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Y-Pattern Strainers: For water, install on supply side of each control valve solenoid valve and pump
- D. Water-Hammer Arresters: Install in water piping according to PDI-WH 201.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

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. PVC pipe and fittings.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water .
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

SECTION 221316 - SANITARY WASTE AND VENT PIPING

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

2.4 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - d. Sleeve Materials:
 - 1) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 3. Do not change direction of flow more than 90 degrees.
 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 1. Building Sanitary Waste: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

2. Horizontal Sanitary Waste Piping 1 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 2. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- 3.2 JOINT CONSTRUCTION
- A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.4 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
 - a. Isolate test source and allow to stand for four hours.

SECTION 221316 - SANITARY WASTE AND VENT PIPING

- b. Leaks and loss in test pressure constitute defects that must be repaired.
- 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 4. Prepare reports for tests and required corrective action.

3.6 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.7 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Underground, soil, waste, and vent piping NPS 4 shall be the following:
 - 1. Solid wall PVC pipe in non-process areas, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

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. Cleanouts.
 - 2. Roof flashing assemblies.
 - 3. Through-penetration firestop assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
 - 1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

2.2 CLEANOUTS

A. Plastic Floor Cleanouts:

1. >
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies :

1. >
2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least **10 inches** from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings :

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

B. Sleeve Flashing Device :

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

C. Stack Flashing Fittings :

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

D. Frost-Resistant Vent Terminals :

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- F. Install through-penetration firestop assemblies in plastic **conductors and stacks** at floor penetrations.
 1. Comply with requirements in Section 078413 "Penetration Firestopping."
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

- J. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, light-duty, storage, electric, domestic-water heaters.
 - 2. Thermostat-control, electric, tankless, domestic-water heaters.
 - 3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Product Certificates: For each type of commercial **and** tankless, electric, domestic-water heater.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
 - 1) Storage Tank: Threeyears.
 - 2) Controls and Other Components: Threeyears.
 - b. Electric, Tankless, Domestic-Water Heaters: Two year(s).
 - c. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
 - 1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 2. Standard: UL 174.
 - 3. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

4. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish or high-impact composite material.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Electric, screw-in immersion type.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.3 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

- A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:
 1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 2. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
 3. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating:[150 psig
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Thermostat.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
 4. Support: Bracket for wall mounting.

2.4 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Expansion Tanks:
 1. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

- b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.
- C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
- D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.
- E. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.5 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
- B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heater on wall bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 5. Anchor domestic-water heaters to substrate.

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

- C. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain or mop sink.
- F. Fill electric, domestic-water heaters with water.
- G. Charge domestic-water expansion tanks with air to required system pressure.
- H. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

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. Water closets.
 - 2. Flushometer valves and tanks.
 - 3. Toilet seats.
 - 4. Supports.

1.3 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

- A. Water Closets Wall mounted, top spud, accessible.
 - 1. Bowl:

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
- b. Material: Vitreous china.
- c. Type: Siphon jet.
- d. Style: Flushometer valve.
- e. Height: Standard.
- f. Rim Contour: Elongated.
- g. Water Consumption: 1.6 gal. per flush.

2.2 FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves :

1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Concealed.
8. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Consumption: 1.6 gal. per flush.
11. Minimum Inlet: NPS 1

2.3 TOILET SEATS

A. Toilet Seats

1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Commercial (Standard).
4. Shape: Elongated rim, open front .
5. Hinge: Check.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White .

2.4 SUPPORTS

A. Water Closet Carrier:

1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.]

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

- 1. Install level and plumb according to roughing-in drawings.
- 2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

- 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- 2. Use carrier supports with waste-fitting assembly and seal.
- 3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

- 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
- 2. Match sealant color to water-closet color.
- 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory : Vitreous china, wall mounted, with back.
 1. Fixture:

SECTION 224216.13 - COMMERCIAL LAVATORIES

- a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Faucet-Hole Location: Top.
 - d. Color: White .
2. Lavatory Mounting Height: Handicapped/elderly according to ICC A117.1.

2.2 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets : Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.
 1. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
 2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 4. Finish: Polished chrome plate .
 5. Maximum Flow Rate:[0.5 gpm
 6. Mounting Type: Deck, concealed .
 7. Spout: Rigid type.
 8. Spout Outlet: Aerator >.

2.3 SUPPORTS

- A. Type III Lavatory Carrier:
 1. Standard: ASME A112.6.1M.

2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation:T-Handle.

SECTION 224216.13 - COMMERCIAL LAVATORIES

2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

SECTION 224216.13 - COMMERCIAL LAVATORIES

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Service basins.
 - 2. Utility sinks.
 - 3. Supports.
 - 4. Supply fittings.
 - 5. Waste fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
 - 2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

- A. Service Basins : Terrazzo, floor mounted.
 - 1. Fixture:
 - a. Standard: IAPMO PS 99.
 - b. Shape: Five sided.

SECTION 224216.16 - COMMERCIAL SINKS

- c. Nominal Size: 24 by 24 inches
 - d. Height: **12 inches** with dropped front .
 - e. Rim Guard: On all top surfaces.
 - f. Drain: Grid with NPS 3 outlet.
2. Mounting: On floor and flush to wall.

2.2 UTILITY SINKS

A. Utility Sinks : Stainless steel, counter mounted.

1. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Number of Compartments: One.
 - c. Compartment:
 - 1) Drain: **Grid with** NPS 2 tailpiece and twist drain
2. Faucet(s):
 - a. Number Required:[One.
 - b. Mounting: On ledge.
3. Supply Fittings:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
4. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 2.
5. Mounting: On counter with sealant.

2.3 SINK FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets : Manual type, single-control mixing valve.
 1. Standard: ASME A112.18.1/CSA B125.1.
 2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
- C. Water Closet Carrier:

SECTION 224216.16 - COMMERCIAL SINKS

1. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.[**Include additional extension coupling, faceplate, and feet for installation in wide pipe space.**]
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- C. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

SECTION 224216.16 - COMMERCIAL SINKS

- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 238236 - FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes electric, radiation heaters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

PART 2 - PRODUCTS

2.1 ELECTRIC FINNED-TUBE RADIATION HEATERS

- A. Description: Factory-packaged units constructed according to UL 499, UL 1030, and UL 2021.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Heating Elements: Nickel-chromium-wire heating element enclosed in metallic sheath mechanically bonded to fins, with high-temperature cutout and sensor running the full length of the element. Element supports shall eliminate thermal expansion noise.
- C.
 - 1. Enclosure Depth: 3 21/32 inches.
- D. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

SECTION 238236 - FINNED-TUBE RADIATION HEATERS

- B. Examine roughing-in for electrical connections to verify actual locations before installation of finned-tube radiation heaters.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FINNED-TUBE RADIATION HEATER INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

3.3 CONNECTIONS

- A. .Retain two paragraphs below for electric finned-tube radiation heaters.
- B. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238236

SECTION 238239.13 - CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 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 cabinet unit heaters with axial fan and electric-resistance heating coils.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. DDC: Direct digital control.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

- A.

2.2 DESCRIPTION

- A. Factory-assembled and -tested unit complying with AHRI 440.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

SECTION 238239.13 - CABINET UNIT HEATERS

- C. Comply with UL 2021.

2.3 CABINETS

- A. Material: Steel with baked-enamel finish with manufacturer's standard paint.
 - 1. Vertical Unit, Exposed Front Panels: galvanized sheet steel, removable panels.
 - 2. Recessed Flanges: Steel, finished to match cabinet.

2.4 COILS

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

2.5 CONTROLS

- A. Basic Unit Controls:
 - 1. Control voltage transformer.
 - 2. Unit-mounted thermostat with the following features:
 - a. Heat-off switch.
 - b. Fan on-auto switch.
 - c.
 - d. Exposed set point.
 - e. Deg F indication.
- B. Electrical Connection: Factory-wired motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 238239.13 - CABINET UNIT HEATERS

3.2 INSTALLATION

- A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."
- B. Install cabinet unit heaters to comply with NFPA 90A.

3.3 CONNECTIONS

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238239.13

SECTION 26 0510 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. All areas of the project shall be considered outdoors, exterior, and wet location except for inside the VTC Building. The covered bus shelters, parking lots, and area driveways are all wet location, exterior, outdoor spaces.
- B. This Section includes the following electrical materials and methods:
 - 1. Supporting devices
 - 2. Electrical identification.
 - 3. Meter Sockets.
 - 4. Fuses
 - 5. Touchup painting.
 - 6. Electrical demolition.
 - 7. Cutting and patching for electrical construction.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.
- B. Provide catalog cut sheets providing product data for each type of product specified. Note specifically what component is being submitted when more than one model or version is shown on the cut sheet. Where there is more than one of each type of component (circuit breaker), label the top of each cut sheet with the specific component that the cut sheet applies to.
- C. Provide shop drawings detailing fabrication and installation of supports and anchorage for electrical items. Show all components of a system and how they relate to each other during installation. Include details of mounting brackets, wiring interconnections, single line diagrams, component layout diagrams for enclosures, material lists for components in enclosures, wiring schematic diagrams with each wire numbered and each terminal numbered for wiring in enclosures.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

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2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Manufacturers: All materials shall be new, unused, and of the quality specified. Materials shall be standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.
- D. Installer: All equipment and materials shall be installed in a neat and workmanlike manner, shall be complete in both effectiveness and appearance, whether finally concealed or exposed and shall be executed by experienced mechanics.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other trades.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- E. Coordinate connecting electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, utility requirements, and controlling agencies.
- F. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- G. Coordinate the work shown in the plans with the work of all other trades and the General Contractor. Such coordination will include work happening concurrently as well as work that happens sequentially.

PART 2 PRODUCTS

2.01 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
 1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
 2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, or type 316L stainless steel, except as otherwise indicated.
- B. Steel channel supports have 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface.

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1. Fittings and accessories mate and match with channels and are from the same manufacturer.
- C. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, fiberglass-resin channels and angles with 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface.
 1. Fittings and accessories mate and match with channels or angles and are from the same manufacturer.
 2. Fitting and Accessory Material: Same as channels and angles, except metal items may be stainless steel.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps or "click"-type hangers.
- E. Sheet-Metal Sleeves: 0.0276-inch (0.7-mm) or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable iron casting with hot-dip galvanized finish.
- H. Expansion Anchors: Red Head, Hilti, or equal. Stainless steel.
- I. Toggle Bolts: All-steel springhead type.
- J. Powder-Driven Threaded Studs: Heat-treated steel.
- K. Extension and plaster rings shall be installed as required by the NEC.
- L. Outlet boxes shall comply with the National Electrical Code in regard to the allowable fill.
- M. Cable and Conduit Seals: Seals shall be provided around all conduits and cables which penetrate smoke walls, fire walls, and floors.

2.02 ELECTRICAL IDENTIFICATION

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels: Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
 1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over-laminated with a clear, weather- and chemical-resistant coating.
 2. Color: Black legend on orange field.
 3. Legend: Indicates voltage.

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- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide (0.08 mm thick by 25 mm wide).
- D. Underground Line Warning Tape: Permanent, bright-colored, detectable, continuous-printed, vinyl tape with the following features:
 - 1. Size: Not less than 4 mils thick by 6 inches wide.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend that indicates type of underground line.
- E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- G. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes. Engraved legend in black letters on white face.
- H. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- I. All feeder and branch circuit wiring shall be color-coded as follows:

PHASE	120/208 VOLT
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

It is acceptable to provide continuously colored conductors in lieu of black jacketed conductors with colored tape at terminals.

2.03 METER SOCKETS

- A. Meter sockets comply with serving utility company requirements. See drawings for details.

2.04 FUSES

- A. Fuses shall be furnished and installed in each fused switch, area lighting circuit, and elsewhere per the drawings. Fuses shall be rated as shown on the drawings.
- B. Provide fuses according to the following and in accordance with recommendations of manufacturers whose equipment is being protected:
 - 1. Provide UL Class CC, current limiting, rejection type, fast acting fuses rated 600-volts, 60 Hz, 1/10 to 30 amps, with 200,000A RMS symmetrical interrupting current rating for protecting critical loads, LED lighting, etc.

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- C. Provide a quantity of ten percent (10%) of spare fuses based on total quantity installed. No less than five fuses per type and size installed. Fuses shall be furnished for each size and type used. Each fused switch shall be provided with a mastic backed label clearly identifying the type and size of fuse required.

2.05 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Non-equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- B. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Mounting heights shall be considered to the top of the enclosure above finished floor. For devices, mounting heights shall be considered to the center of the box above finished floor, unless otherwise shown. All other device mounting heights shall be as shown on the drawings. All devices shall be mounted in accordance with ADA (Americans with Disabilities Act) requirements where applicable.
- E. Give right of way to raceways and piping systems installed at a required slope.
- F. Coordinate with all other trades to install electrical equipment without conflict with other work. Where devices or equipment is in conflict, work out a solution that accommodates both trades and coordinate solution with owner's representative. Do not change the design without the engineer's approval.
- G. Keep all equipment in a dry, heated, secure storage area prior to installation. After installation, all equipment shall be kept dry and above 55 degrees Fahrenheit. If the building cannot be kept that warm, do not install any equipment with microprocessors, any video equipment, or any telephone/data/television equipment.
- H. Equipment Bases. Provide concrete equipment bases for all floor mounted equipment furnished under this contract. Concrete bases shall be 4"-inches high unless noted otherwise and shall extend 6-inches beyond all sides of the unit. Trowel all edges at a 45 degree angle. This work shall be done in accordance with Division 3 of the specifications by the Division 16 Contractor. Bases shall be provided for switchboards, transformers and all other floor mounted equipment.
- I. ELECTRICAL ROOM COORDINATION:

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1. Where a number of electrical panels and/or related electrical items are shown, the Electrical Contractor shall coordinate the physical sizes with his equipment suppliers to ensure that there is adequate space for the items shown to be installed in those areas and that all Code required clearances are maintained.
2. The Contractor shall rearrange the equipment layout to achieve full use of the available space prior to installing conduit stub ups. Where a conflict or rearrangement exists, the Contractor shall submit a proposed revised layout of the area to the Architect.

3.02 ELECTRICAL SUPPORTING METHODS

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components. Consider the exterior of the building and the bus shelter spaces wet locations.
- B. Support Clamps for PVC Raceways: Click-type clamp system.
- C. Conform to manufacturer's recommendations for selecting supports.
- D. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb- (90-kg-) minimum design load.

3.03 INSTALLATION

- A. Install devices to securely and permanently fasten and support electrical components.
- B. Raceway Supports: Comply with NFPA 70 and the following requirements:
 1. Conform to manufacturer's recommendations for selecting and installing supports.
 2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
 4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
 5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
 6. Hanger Rods: 1/4-inch (6-mm) diameter or larger threaded steel, except as otherwise indicated.
 7. Spring Steel Fasteners: Specifically designed for supporting single conduits or tubing. May be used in lieu of malleable iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to channel and slotted angle supports.
 8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.
- C. Vertical Conductor Supports: Install simultaneously with conductors.

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- D. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.
- E. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls. All sleeves through floors and walls shall be black iron pipe, flush with walls or finished floors; and of sizes to accommodate the raceways shown. Sleeves through outside walls above grade shall be caulked with approved caulking compound. Sleeves shall not be required through on grade slabs. For raceways which enter buildings below grade, install manufactured floor and thruwall seals, similar to Type "FSK" or "WSK" as manufactured by O.Z. Electric Manufacturing Co.
- F. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:
1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and by machine screws, welded threaded studs, or spring-tension clamps on steel.
 2. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts, machine screws, or wood screws.
 3. Drill holes in concrete beams so holes more than 1-1/2 inches (38 mm) deep do not cut main reinforcing bars.
 4. Drill holes in concrete so holes more than 3/4 inch (19 mm) deep do not cut main reinforcing bars.
 5. Fill and seal holes drilled in concrete and not used.
 6. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- G. Install identification devices where required.
1. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
 2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
 3. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
 4. Tag or label power circuits for future connection and circuits in raceways and enclosures with other circuits. Identify source and circuit numbers in each cabinet, pull box, junction box, and outlet box. Color coding may be used for voltage and phase indication.

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5. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches (400 mm), use a single line marker. See drawings for more information.
 6. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
 7. Nameplates shall be provided for all items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, control devices and other significant equipment. Nameplates shall be 1"x 2-1/2" laminated black phenolic resin with a white core with engraved lettering, a minimum of 3/16-inch high. Manufacturers factory installed nameplates shall be acceptable provided all information is furnished. Nameplates shall identify the equipment item that the device is serving and also from where the device is being fed from. Nameplates shall also identify the system voltage of the item of equipment.
- H. Outlet Box Locations. Outlet boxes shall be located so they are not placed back-to-back in the same wall, and in metal stud walls, are separated by at least one stud space in order to limit sound transmission from room to room. Outlet boxes installed on opposite sides of fire rated walls shall be spaced at least 24" apart.
- I. Wiring - Number of Wires: the number of wires for lighting and receptacle branch circuits are not shown on the drawings. The number of wires in any circuit is determined in accordance with the National Electrical Code, and wiring is provided to perform all functions of the devices being installed. Additionally, wires shall be provided as required by the contract documents, i.e. equipment grounds, etc. Provide the number of wires required for a complete and workable system.

3.04 DEMOLITION

- A. Where electrical work to remain is damaged or disturbed in the course of the WORK, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Keep all existing electrical on the project site fully operational during the course of the Work.
- C. Remove all circuits to be demolished back to the source or to the nearest junction box not to be removed. Remove all wiring in abandoned in place conduits underground.
- D. Owner has first rights to any salvageable items removed as part of the demolition process.

3.05 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.
- C. Cutting, patching, repairing, and finishing of carpentry work, metal work, or concrete work, etc., which may be required for this work shall be done by craftsmen skilled in their respective

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trades. When cutting is required, it shall be done in such a manner as not to weaken walls, partitions, or floors. Holes required to be cut in floors must be drilled without breaking out around the holes. Cutting, patching, and painting shall conform to the requirements of the General Conditions section of this Specification.

- D. Cutting of structural framing, walls, floors, decks, or other members intended to withstand stress is not permitted.
- E. Use care in piercing water proofing. After the part piercing the waterproofing has been set in place, seal openings, and make watertight.

3.06 TOUCH-UP PAINTING

- A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

END OF SECTION

SECTION 26 0519 – LOW VOLTAGE CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.

1.02 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. All areas of the project shall be considered outdoors, exterior, and wet location except for inside the VTC Building. The covered bus shelters, parking lots, and area driveways are all wet location, exterior, outdoor spaces.

1.03 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- B. Catalog Cut Sheets: Provide product data on all equipment including installation instructions.
- C. Field Test Reports.

1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70, IBC, NESC, and all local, state, and federal regulations.
- C. Manufacturers: Firms regularly engaged in the manufacture of electric wire and cable products of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- D. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical wiring work similar to that required for this project.
- E. UL Compliance: Comply with UL standards pertaining to electrical wire cable and connectors.
- F. UL Labels: Provide electrical wires, cables and connectors which have been UL-listed and labeled.
- G. NEMA/ICEA Compliance: Comply with applicable portions of NEMA/Insulated Cable Engineers Association Standards pertaining to materials, construction and testing of electrical wire and cable.
- H. ANSI/ASTM: Comply with applicable portions of ANSI/ASTM standards pertaining to construction of electrical wire and cable.

SECTION 26 0519 – LOW VOLTAGE CONDUCTORS AND CABLES

- I. IEEE Compliance: Comply with applicable portions of IEEE standards pertaining to electrical wire and cable.
- J. NECA Compliance: Comply with NECA's "Standard of Installation."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

1.06 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by ENGINEER.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Wires and Cables:
 - a. American Insulated Wire Corp.; Leviton Manufacturing Co.
 - b. Carol Cable Co., Inc.
 - c. Southwire Company.
 - d. Leviton Manufacturing Co.
 - e. Okonite
 - f. General Cable Co.
 - 2. Connectors for Wires and Cables:
 - a. AMP Incorporated.
 - b. General Signal; O-Z/Gedney Unit.
 - c. Monogram Co.; AFC.
 - d. Square D Co.; Anderson.
 - e. 3M Company; Electrical Products Division.
 - f. Burndy Co.
 - g. Ideal Industries, Inc.
 - i. O-Z/Gedrey Co.

2.02 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Rubber Insulation Material: Comply with NEMA WC 3.
- C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

SECTION 26 0519 – LOW VOLTAGE CONDUCTORS AND CABLES

- D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
- E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
- F. Conductor Material: Copper.
 - Type MC Cable shall not be used.
- G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
- H. No wire shall be smaller than No. 12 AWG, except that wiring for signal and pilot control circuits may be No. 14 AWG, and pre-manufactured fixture whips for light fixtures may be No. 14 AWG.
 - 1. Use preinsulated connectors 3M Company "Scotchlok," or Ideal Industries, Inc. "super nut," for splices and taps in conductors No. 10 AWG and smaller. All other twist-on connectors must be reviewed by the Architect prior to installation. Use this type of connector for factory-made splices in fixtures or equipment.
 - 2. Pressure indent type connectors must be submitted to the Engineer for review.
 - 3. Tape all splices and joints with vinyl plastic tape. Use sufficient tape to secure insulation strength equal to that of the conductors joined.
 - 4. Keep splices in underground junction boxes to an absolute minimum. Where splices are necessary, use resin pressure splices and resin splicing kits to totally encapsulate the splice. Arrange the splicing kit to minimize the effects of moisture. Provide all splicing kits for review during submittals process.
- I. Connect wire No. 6 AWG and larger to panels and apparatus by means of approved lugs or connectors.
- J. Wire sizes shown are minimum based on code requirements, voltage drop and/or other considerations. Larger sizes may be installed at the Contractor's option to utilize stock size, provided conduit sizes are increased where necessary to conform to the National Electrical Code. Wires and cable sizes indicated or specified are American Wire Gage (Brown & Sharpe).

2.03 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRE AND INSULATION APPLICATIONS

SECTION 26 0519 – LOW VOLTAGE CONDUCTORS AND CABLES

- A. Service Entrance: Type XHHW, in raceway.
- B. Exterior and underground: Type XHHW, in raceway.
- C. Feeders: Type THWN, in raceway.
- D. Branch Circuits: Type THWN, in raceway.
- E. Class 1 Control Circuits: Type THWN, in raceway.
- F. Class 2 Control Circuits: Type THWN, in raceway.
- G. Additional cables shall be provided as specified on the drawings.

3.03 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation." All conductors and cables shall be continuous from source to the device they feed. There shall be no splices in the conductor or cable unless shown otherwise. Do not exceed the bending radius of any conductor or cable, replace the conductors and or cables whose bending radius has been exceeded. Do not bend large feeders past their bending radius to install them in the feeder circuit breaker. If you do, replace the entire feeder.
- B. Remove existing wires from raceway before pulling in new wires and cables.
- C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Spare/Empty Raceways: Provide pull tape within all spare conduits to be provided and all emptied raceways still useable for future work.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Support cables according to Division 26 Section 260510 - Basic Electrical Materials And Methods. Any cable that has a vertical drop exceeding six feet shall be supported by a stainless steel grip.
- G. Identify wires and cables according to Division 26 Section 260510 - Basic Electrical Materials And Methods.
- H. Run all cabling parallel and perpendicular to all walls, floors, and ceilings. When bringing cabling into equipment racks or onto mounting boards, train cables in groups, routing it parallel and perpendicular to equipment racks and mounting boards. Use cable management equipment to bundle all cables. There shall be no loose or dangling cables. Use cable ties every 12 inches to bundle cables where it is not possible to use cable management equipment.
- I. Conductors shall be continuous from outlet to outlet and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized wherever required.
- J. Prior to energization, check cable and wire for continuity of circuitry, and for short circuits. Correct malfunctions when detected.

SECTION 26 0519 – LOW VOLTAGE CONDUCTORS AND CABLES

- K. Bury a continuous, pre-printed, bright colored plastic ribbon cable marker with each underground cable, regardless of whether conductors are in conduit. Locate each directly over cables 12" below finished grade. See drawings for more on marker requirements.
- L. Conductor Installation: Install all conductors in a single raceway at one time, insuring that conductors do not cross one another while being pulled into raceway. Leave sufficient cable at all fittings or boxes and prevent conductor kinks. Keep all conductors within the allowable tension and exceeding the minimum bending radius.
- M. Many circuits are shown on the drawings to be provided with dedicated neutral and ground conductors. Carefully review circuiting and the electrical abbreviations and symbols legend and provide the number of conductors indicated.

3.04 CONNECTIONS

- A. Conductor Splices: No splices in feeders. No splices in branch circuits except at device locations. In underground circuits, the only splices shall be in the handholes within the light poles or in the electrical service equipment, panels, or wall/post mounted enclosures. Do not splice in exterior in-ground junction boxes. If this happens the conductors shall be replaced and the splices mad in a light pole or service equipment, panel, or above ground enclosures.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- F. 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.

3.05 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.

1.02 SUMMARY

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.
- C. Field Test Reports.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with UL 467.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, ground rods and plate electrodes, whose products have been of satisfactory use in similar service for not less than three years.
- E. Installer: Qualified with at least three (3) years' experience on projects with electrical grounding work similar to that required for this project.
- F. UL Compliance: Provide grounding products which are UL listed and labeled. Comply with applicable requirements of UL Standard Nos. 467 and 869 pertaining to electrical grounding and bonding.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.
- H. Utility: Grounding shall be done to comply with all applicable grounding requirements and rules of the serving utility.
- I. NECA Compliance: Comply with NECA's "Standard of Installation."

PART 2 PRODUCTS

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Ideal Industries, Inc.
 - 2. Burndy.
 - 3. O-Z/Gedney Co.
 - 4. Thomas & Betts, Electrical.
 - 5. Crouse Hinds.

2.02 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.03 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with Division 26 Section 260519 – Low Voltage Conductors and Cables. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
 - 1. Material: copper. Use only copper wire.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B 3.

2.04 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 3/0 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2.05 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.06 GROUNDING ELECTRODES

- A. Grounding Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 inch by 120 inches (19 by 3000 mm).

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 3 EXECUTION

3.01 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Single-phase motor or appliance branch circuits.
 - e. Flexible raceway runs.
 - g. All circuits in conduit including low voltage.
 - 2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet (telephone terminal board), and central equipment location. See drawings for details.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
 - 3. Other System Requirements: Furnish ground terminal block for each rack and cabinet section. Rack shall be grounded using No. 6 AWG stranded, insulated copper conductor. Furnish all required bonding material (racks and runway) and hardware. Refer to ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications, for details.
- C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

3.02 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
 - 1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.

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2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- H. Provide a separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, receptacles, controls, motors, disconnect switches, exterior lighting standards and noncurrent carrying metal enclosures. The ground wires shall be connected to the building system ground. NEC Table 250-122 (2014 Ed.) shall be used to size the ground conductor if the size is not shown on the drawings.
- I. To satisfy the "effective grounding" requirements of the NEC the path to ground from circuits, equipment, and conductor enclosures shall be permanent and continuous and shall have ample carrying capacity to conduct safely any currents liable to be imposed on it, and shall have impedance sufficiently low to limit the potential above ground and to facilitate the operation of the overcurrent devices in the circuit.
- J. At the service entrance equipment, bond the utility neutral, building neutral and building ground conductor to a common ground bus (or ground lug). Connect the ground bus to the building domestic cold-water pipe with a grounding conductor and an approved clamp and connector. Install the grounding conductor in exposed PVC conduit and make connections readily accessible for inspection. The point of connection to the water service shall be as near the building entrance as possible. Provide a copper wire shunt of the same size as the ground conductor around the water meter and clamp to the water pipe with bronze fittings. Bond the water pipe to the structural steel system of the building and reinforcing bars in footings when such building construction occurs. The telecommunications main grounding bar (TMGB) shall also be connected at the service entrance.
- K. Clean the contact surfaces of all ground connections.

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- L. Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. At the point of electrical service entrance, bond all metallic raceways together, with a ground conductor, and connect to the system ground bus. Bond all boxes as specified for equipment.
- M. Receptacles: Permanently connect the ground terminal on each receptacle to the green ground conductor.
- N. Motors: Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted, solderless lug. Maintain ground conductor size throughout connections.
- O. Provide UFER grounds to rebar in structural wall, floors, foundations, etc.

3.03 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- C. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- F. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 FIELD QUALITY CONTROL

- A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, and at service disconnect enclosure grounding terminal. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- B. Maximum grounding to resistance values are as follows:
 - 1. Equipment Rated 500 kVA and Less: 10 ohms.
- C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
- D. Report: Prepare test reports of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.05 ADJUSTING AND CLEANING

- A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.
- C. Division 26 Section 262726 – Wiring Devices.

1.02 SUMMARY

- A. All areas of the project shall be considered outdoors, exterior, and wet location except for inside the VTC Building. The covered bus shelters, parking lots, and area driveways are all wet location, exterior, outdoor spaces.
- B. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. Raceways include the following:
 - a. EMT.
 - b. FMC.
 - c. IMC.
 - d. LFNC.
 - e. RMC.
 - f. RNC.
 - 2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
 - d. Cabinets and hinged-cover enclosures.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFNC: Liquidtight flexible nonmetallic conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

- A. Product Data: For raceways and fittings, boxes, hinged-cover enclosures, and cabinets. Product data to include, but not limited to, materials, finishes, approvals, load ratings, and dimensional information.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1.05 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.
- D. Comply with ANSI/TIA/EIA 568A – Commercial Building Telecommunications Cabling Standard, and ANSI/TIA/EIA 569 – Commercial Building Standard for Telecommunications Pathways and Spaces.
- E. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways and boxes.

1.06 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Metal Conduit and Tubing:
 - a. Carol Cable Co., Inc.
 - b. Grinnell Co.; Allied Tube and Conduit Div.
 - c. Monogram Co.; AFC.
 - d. Triangle PWC, Inc.
 - 2. Nonmetallic Conduit and Tubing:
 - a. Duraline.
 - b. STI Firestopper.
 - 3. Conduit Bodies and Fittings:
 - a. American Electric; Construction Materials Group.
 - b. Crouse-Hinds; Div. of Cooper Industries.
 - c. Emerson Electric Co.; Appleton Electric Co.
 - d. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - e. Lamson & Sessions; Carlon Electrical Products.
 - f. O-Z/Gedney; Unit of General Signal.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- g. ETCO Speciality Products, Inc.
- 4. Boxes, Enclosures, and Cabinets:
 - a. Butler Manufacturing Co.; Walker Division.
 - b. Crouse-Hinds; Div. of Cooper Industries.
 - c. Hoffman Engineering Co.; Federal-Hoffman, Inc.
 - d. O-Z/Gedney; Unit of General Signal.
 - e. Robroy Industries, Inc.; Electrical Division.
 - f. Thomas & Betts Corp.

2.02 METAL CONDUIT AND TUBING

- A. EMT and Fittings: ANSI C80.3.
 - 1. Fittings: compression type.
- B. FMC: Steel flexible conduit per applicable ANSI and NEMA standards. Flexible metal conduit shall conform to UL1. It shall be formed from continuous lengths of spirally-wound, interlocked zinc-coated strip steel.
- C. IMC: ANSI C80.6.
- D. RMC: Rigid Steel Conduit: ANSI C80.1. Rigid steel conduit shall be hot-dipped galvanized.
- E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.
- F. Fittings for Rigid Steel Conduit: Hot Dipped Galvanized Steel. Provide rain-tight, non-insulated throat type steel compression fittings (connectors and couplings). All fittings shall be the steel type with steel locknuts.
- G. Expansion Joints: Provide expansion fittings, O.Z. Type AX with bonding jumper for rigid conduit and O.Z. Type TX with bonding jumper for electrical metallic tubing. Where embedded raceways cross building expansion joints, provide combination deflection/expansion fittings, O.Z. Type AXDX, or equal.

2.03 NONMETALLIC CONDUIT AND TUBING

- A. RNC: Schedule 40 or 80 PVC per NEMA TC 2.
- B. RNC Fittings: Use rigid steel elbows when using PVC conduit. Use fittings with integral cable grips for all terminations of LFNC.
- C. Fire-rated pathway fittings: UL Listed for use in rated fire walls of ratings and construction as specified in the architectural plans. See architectural plans for locations of fire rated walls. Provide material data sheet in submittal package. Pathway shall be tested and approved for cable capacities ranging from 0 to 100% visual fill. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The seal-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall the firestop materials.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- D. LFNC: Non-metallic flexible conduit. Liquid tight with stainless steel or internal galvanized spiral steel. Non-metallic flexible conduit with rigid internal PVC core and overall PVC jacket is also acceptable. Provide fittings with integral cable grips for all terminations of LFNC.

2.04 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1. Indoor uses only.
- B. Cast-Metal Boxes: NEMA FB 1, Type FSC, cast box with gasketed cover. Hot Dipped Galvanized Steel.
- C. Nonmetallic Boxes: NEMA OS 2.

2.05 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- C. All boxes installed outside of the building interior shall be hot-dipped galvanized cast steel boxes Or NEMA Type 4X 316L stainless steel. Confirm to the type callouts in the plansets.
- D. All conduit bodies shall be malleable iron.

2.06 ENCLOSURES AND CABINETS

- A. Inside buildings. NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.
- B. Exterior: NEMA 4X. All enclosures and cabinets shall be NEMA 4X type 316L stainless steel. Removable interior panel. Hinged. Lockable with pad lock.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 1. Exposed (This includes shelters): Rigid steel
 2. Concealed (This includes shelters): Rigid steel.
 3. Underground, Single Run: RNC or Rigid Steel. Rigid Steel when within 5' of buildings or other structures including canopies and equipment foundations.
 4. Underground, Grouped: RNC or Rigid Steel. Rigid Steel when within 5' of buildings or other structure including canopies and equipment foundations.
 5. Underground, spare conduit: Rigid Steel or RNC.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
 7. Boxes and Enclosures: NEMA 250, Type 4X, 316L stainless steel or hot-dipped galvanized steel.
 8. Under concrete slab: RNC or Rigid Steel.
- B. Indoors: Use the following wiring methods:
1. Exposed or concealed in buildings: EMT or IMC.
 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFNC.
 4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4X, 316 stainless steel or hot-dipped galvanized steel. Type NM boxes may also be used with Schedule 40 and Schedule 80 PVC conduit.
 5. Do not route conduit across rooms through the air below the ceiling. Route conduit below the concrete slab where possible while routing around in slab heating piping. Where conduit must be embedded in concrete, provide a minimum of 2” of concrete cover. Route conduit on walls and ceiling in generator and storage buildings and concealed in the waiting building. Surface mount conduit on canopies. Route conduit around other conflicts. Coordinate with disciplines on routing conduit , locating piping, etc. Conceal conduit at all times where possible. Partial concealment of raceway & boxes is acceptable where required. Boxes shall maintain accessibility per Code in all instances.

3.03 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 3/4-inch trade size (DN16).
- C. Conceal conduit where possible by routing it below building or inside walls. All conduit may be surface mounted if necessary. Partially conceal conduit surface mounted in exterior locations and outdoor structures. Locate pullboxes, j-boxes, and device and outlet boxes along the outdoor structures partially concealed and out of public view as much as practical.
- D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 26 Section 260510 Basic Electrical Materials and Methods.
- H. Use temporary closures to prevent foreign matter from entering raceways.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Raceways underground beneath Slabs: Do not install conduit in the slab. Conduit may be installed under the slab. This is preferable to installing it in the walls. Install all home runs from panels, lighting contactors, low voltage systems, under the slab if practical. This shall be done so that additional wiring can be easily pulled in the future. Home runs to the covered area around the waiting building is routed above the ceiling and along the structure as shown on plans.
 - 1. Locate conduit at least 4 inches below slab. Cover conduit with pit run, D-1, sand, or pea gravel.
 - 2. Locate the conduit 2 inches apart laterally and 2 inches apart vertically under the slab.
 - 3. Run conduit parallel and perpendicular to the stem walls.
 - 4. Transition from nonmetallic tubing to rigid steel conduit before rising above floor.
 - 5. Where conduit must be embedded in concrete, provide minimum of 2" of concrete cover.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- O. Tighten compression fittings with suitable tools.
- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- R. Install pull wires in all empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- S. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- T. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- U. Stub-up Connections: Extend conduits through concrete or structure with RMC. See applicable details. Coordinate with contractor installing concrete. Where there are no details, install conduit as close and concealed to the structure above the concrete slab or footing as possible. Locate to protect from physical damage as much as possible. Add a NEMA 4X enclosure as required to reduce conduit size from underground to above ground conduit.
- V. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- W. Provide additional junction boxes, pull boxes, conduit bodies, fittings, etc. as required to route conduit. Where conduit is to be routed around structural columns, beams, concrete footings, etc., providing bends as required to route conduit as close to structure as possible so it is as concealed as possible. This will require extra bends, boxes, conduit bodies, etc. Review structural, architectural, mechanical, etc. drawings to understand these systems and to be able to determine the level of work required. In some cases, flexible conduit may be required between runs of conduit to get around structure or to transition between structural elements. Plan that into the work.
- X. Provide labels on covers of all j-boxes, pullboxes, and device boxes that indicate panel circuit information and voltage of circuits contained within. For covers exposed or partially exposed, write labels on inside face of cover. Write with permanent marker or equivalent.

3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

SECTION 26 0533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

B. Repair damage to paint finishes with matching touchup coating recommended by manufacturer

3.05 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 2416 – PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.
- C. Division 26 Section 264313 – Surge Protective Devices.

1.02 SUMMARY

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.

1.03 SUBMITTALS

- A. Product Data: For each type of panelboard, accessory item, and component specified.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- C. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not limited to circuit breakers, fusible switches, fuses, ground fault circuit interrupters, and accessories.
- D. Maintenance Data: For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.
- E. Field Test Reports.
- F. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.

1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.
- C. Comply with NEMA PB 1.
- D. Manufacturers: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, size and ratings required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- E. Installer: A firm of at least three (3) years of successful installation experience on projects with electrical installation work similar to that required for this project.

SECTION 26 2416 – PANELBOARDS

- F. Special Use Markings: Provide panelboards, constructed for special use, with UL markings indicating that special type usage. Panels identified or shown on the drawings for use as main service entrance equipment shall be labeled at the factory with "SERVICE ENTRANCE" type UL label.
- G. UL Compliance: Comply with applicable UL safety standards pertaining to panelboards, accessories, and enclosures. Provide units which have been UL listed and labeled. UL standards are as follows:
 - 1. Panelboards - UL67
 - 2. Enclosures for Electrical Equipment - UL50
- H. NEMA Compliance: Comply with NEMA Stds. Pub. No. 250 "Enclosures for Electrical Equipment (1000 volt maximum)", Pub. No. 1 "Panelboards" and Pub. No. PB1.1, "Instruction for Safe Installation, Operation, and Maintenance of Panelboards Rates 600 Volts and Less".
- I. NECA Compliance: Comply with NECA's "Standard of Installation".

1.05 EXTRA MATERIALS

- A. Keys: 6 spares of each type for panelboard cabinet lock.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Div.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D Co.

2.02 PANELBOARD FABRICATION

- A. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, and which are designed and constructed in accordance with published product information. Provide solderless lugs, or connectors, in the correct number and size for conductors on mains, on the load side of each branch, circuit, and on ground and neutral bars. Provide tin plated copper busses. Provide an insulated neutral bus (equal in size to the phase bussing) and a bonded equipment ground bus mounted at the opposite end of the structure from the mains, and having numbered screw or lug terminals for connection of wires. Equip panels with the number of unit devices as required for a complete installation. Where more than one type of component meets the indicated requirements, selection is installer's option. Where types, sizes or ratings are not indicated, comply with NEC, UL and established industry standards for applications indicated.

SECTION 26 2416 – PANELBOARDS

- B. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 4X stainless steel.
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- C. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.
- D. Directory Frame: Metal, mounted inside each panelboard door.
- E. Bus: Hard drawn copper of 98 percent conductivity.
- F. Panelboards shall be constructed for top or bottom feeder service, as required by actual project conditions.
- G. Main and Neutral Lugs: Compression type.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- I. Service Equipment Approval: Listed for use as service equipment for MDP panelboard.
- J. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.03 BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.
- C. Provide Amps Interrupting Current (AIC) Rating as shown on the drawings. AIC rating shall include entire panelboard and circuit breakers.
- D. Provide fully rated main circuit breaker type panelboards, where the short circuit rating of the complete panelboard assembly is determined by the lowest rated branch device. Provide panelboard interrupting ratings as noted on the drawings.
- E. Provide fully rated main lug only type panelboards where the short circuit rating of the complete panelboard assembly is determined by the lowest rated branch device. Provide panelboard interrupting ratings as noted on the drawings.
- F. Panelboard boxes shall have 6-inch minimum gutters. Fronts are to be complete with door and cylinder lock, with all locks keyed alike. Fronts shall have adjustable trim clamps, directory frames, and shall be equipped with a typewritten directory that identifies each circuit breaker by number and the equipment that the breaker serves. One additional blank directory card for each panel shall be furnished to the Owner.
- G. Two section panels shall be equipped with boxes of equal dimensions

SECTION 26 2416 – PANELBOARDS

H. Panelboards shall be Underwriters' Laboratory listed and shall bear the UL label. The size of the panelboard main disconnect device or main lugs, the rating and number of branch circuits, and the type of mounting shall be as shown on the drawings.

I. All factory installed devices shall be re-torqued prior to energizing.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2. Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
5. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
6. Current Limiters: Where indicated, integral fuse listed for circuit breaker.
7. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
8. Shunt Trip: Where indicated.
9. GFCI Trip: Where indicated.
10. Lockable: Where indicated.

2.06 TRANSIENT VOLTAGE SURGE SUPPRESSORS (SPD)

- A. Surge protection devices (SPD) shall be provided at panelboards as noted in the planset. SPDs provided for panel boards shall adhere to requirements found within Division 26 Section 264313 Surge Protective Devices.
- B. Factory mounted with UL-recognized mounting device. Externally mounted will be considered if verification of adequate space along the wall is obtained.
- C. Feed with circuit breaker mounted in panel, sized accordingly.

2.07 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessory items according to NEMA PB 1.1.
- B. General: Install panelboards and enclosures where indicated, in accordance with the manufacturers' written instructions, applicable requirements of the NEC and NECA's "Standard

SECTION 26 2416 – PANELBOARDS

of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

- C. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- E. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
- F. Install filler plates in unused spaces.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.
- H. Neatly train wiring in switchboard. Bend conductors per their manufacturer's recommendations and listing requirements. Feeder conductors that are bent at a hard ninety degree angle shall be replaced.
- I. Coordinate the installation of panelboards and enclosures with cable and raceway work.
- J. Provide all required electrical connections within the enclosure.

3.02 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section 260510 – Basic Electrical Materials and Methods.
- B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.03 GROUNDING

- A. Make equipment grounding connections for panelboards as indicated.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
 - 2. Make continuity tests of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

SECTION 26 2416 – PANELBOARDS

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.06 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.07 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 26 2726 – WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.
- C. Division 26 Section 260533 – Raceways and Boxes for Electrical Systems.

1.02 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.03 SUBMITTALS

- A. Product Data: For each product specified.
- B. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.
- D. Manufacturers: Firms regularly engaged in manufacture of wiring devices of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- E. Installer: Qualified with at least 2 years of successful installation experience on projects with electrical installation work similar to that required for this project.
- F. UL Compliance and Labeling: Provide electrical wiring devices which have been UL listed and labeled.
- G. NEMA Compliance: Comply with NEMA standards for general and specific purpose wiring devices.
- H. NECA Compliance: Comply with NECA's "Standard of Installation."

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the WORK include, but are not limited to, the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc.
 - b. GE Company; GE Wiring Devices.

SECTION 26 2726 – WIRING DEVICES

- c. Hubbell, Inc.; Wiring Devices Div.
- d. Leviton Manufacturing Co., Inc.
- e. Pass & Seymour/Legrand; Wiring Devices Div.
- f. Cooper
- g. Crouse Hinds

2.02 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Heavy-Duty grade. 120 volt, 20 amp rated, minimum.
- B. GFI Receptacles: Provide receptacles with UL listed 5mA ground fault interrupting protection with test and reset buttons. Provide receptacle with green LED indicating light that is illuminated when power is available to receptacle. LED shall go off when receptacle has tripped due to a ground fault current.C. Receptacles on generator power shall be red in color. Coverplates for generator outlets in these areas shall be engraved with panel and circuit no. designation per NEC. Engraving shall be 1/8" high, block style letters, with red filler on front side of coverplates.

2.03 SWITCHES

- A. Snap Switches: Heavy-duty, quiet type. 120 volt, 20 amp rated, minimum.

2.04 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 - 1. Material for mechanical rooms: Galvanized steel.
 - 2. Material for all other spaces: Stainless steel.
 - 3. Provide weatherproof covers for all devices in existing and new bus storage areas, bus wash, bus wash mechanical, and exterior of building.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.
- E. Provide weatherproof covers for all devices in existing and new bus storage areas, bus wash, bus wash mechanical, and exterior of building.
- F. Install wiring devices as indicated in compliance with manufacturer's written instructions, applicable requirements of the NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

SECTION 26 2726 – WIRING DEVICES

- G. Coordinate with other work including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices and other work.
- H. All outlets shall be located as shown on the drawings, except that where practicable, outlets shall be located in center of panels or trim or otherwise symmetrically located to conform with existing structural layout. Outlets incorrectly installed shall be corrected. Damaged items or damaged finishes shall be repaired or replaced at no expense to the Owner.
- I. Receptacles, switches, etc., shown on wood trim, cases or other fixtures shall be installed symmetrically; and, where necessary, shall be set with the long dimensions of the plate horizontal, or ganged in tandem.
- J. Where devices are shown near wall openings, coordinate location if corner guards are to be installed so that cover plates do not require cutting.
- K. Where devices are shown mounted adjacent to one another on the drawings, provide multi-gang faceplates to cover all devices.

3.02 IDENTIFICATION

- A. Comply with Division 26 Section 260510 – Basic Electrical Material And Methods.
 - 1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
 - 2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.03 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Replace damaged or defective components.

3.05 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 26 4313 – SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.
- C. Division 26 Section 262416 – Panelboards.
- D. LED light fixtures shall be provided with integral surge protection and additional external surge protection as applicable. Requirements of LED light fixture surge protection are provided in Division 26 Section 265600 Exterior Lighting.

1.02 SUMMARY

- A. This Section includes transient voltage surge suppressors for low-voltage circuits and equipment.
- B. Surge protection devices (SPD) shall be provided at all service entrances and switchboards, distribution panels, and as require of the project. Devices shall be suitable for use as Type 1 or Type 2 devices per UL 1449 4th Edition, applied to the line or load side of the utility feed inside the building as specified on the project. All SPDs shall be tested and demonstrated for suitability for application within ANSI/IEEE C62.41 Category C, B, and A installation environments.
- C. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.

1.03 SYSTEM DESCRIPTION

- A. Transient voltage suppression for low-voltage distribution systems, with suppressors located at each major bus, including service entrances, feeders, and branch-circuit distribution equipment.
- B. System Exposure: IEEE C62.41, medium.

1.04 SUBMITTALS

- A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For transient voltage surge suppressors to include in the maintenance manuals specified in Division 1.
- D. Documentation of the unit's UL 1449 suppression rating shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 guidelines.
- E. Copies of documentation stating that the Surge Protective Device is listed by UL to UL1449 current edition, 20kA in Type 1 or Type 2 locations for use in UL 96A systems. Additional test information to be available upon request.

SECTION 26 4313 – SURGE PROTECTIVE DEVICES

- F. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 The unit shall be factory tested and burned in at the applicable MCOV for a minimum of one hour.
- G. The unit shall be factory-tested before shipment. Testing of each unit shall include but shall not be limited to quality assurance, MCOV and clamping voltage verification tests.
- H. Documentation stating that the SPDs used are all listed by UL to UL1449 4th Edition.
- I. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Listing and Labeling: Provide electrically operated equipment specified in this Section that is listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.

1.06 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the OWNER of other rights the OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the CONTRACTOR under requirements of the Contract Documents.
- B. Special Warranty: A written warranty, executed by manufacturer, agreeing to repair or replace components of transient voltage surge suppressors that fail in materials or workmanship within the specified warranty period.
 - 1. Warranty Period: ten (10) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Liebert, Inc.
 - 2. Transtector Systems, Inc.
 - 3. Leviton, Inc.
 - 4. Eaton
 - 5. Littlefuse
 - 6. SEC Co.

2.02 SPD GENERAL CONSTRUCTION REQUIREMENTS

SECTION 26 4313 – SURGE PROTECTIVE DEVICES

- A. Functional Description: Solid-state, transient voltage surge suppressors employing no series-connected suppression components.
1. Primary Suppression: The suppression system shall incorporate only thermally protected metal-oxide varistors (MOVs) as the core suppression component. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other such techniques. End of life mode to be open circuit, end of life short-circuit mode are not acceptable.
 2. SPDs shall feature balanced suppression platform that equally distributes surges to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
 3. All of the SPDs components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
 4. The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable/replaceable parts and shall not require periodic maintenance.
 5. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
- B. Maintenance free design shall not require any user intervention throughout its life. SPDs containing such items as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring regular maintenance of any sort, including periodic tightening of connections shall not be accepted. SPDs requiring user intervention via diagnostic test kits or similar devices are not allowed.
- C. Overall Ratings: As indicated and as required to comply with location categories according to NEMA LS 1. All SPDs shall have a 200kA Amps Interrupting Rating (AIC).
- D. Maximum Continuous Operating Voltage: At least 125% of nominal for 240-208/120volt systems.
- E. Connection Means: Permanently wired.
- F. Protection Modes: Include the following:
1. Line-to-neutral.
 2. Line-to-line.
 3. Line-to-ground.
 4. Neutral-to-ground.
- The unit's primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground for a total of 10 modes.
- G. Unit shall be operable without the need of an external overcurrent protection device; and shall be UL listed as such. This requirement is independent of the requirements for SPD overcurrent protection which may or may not exist on a given project.
- H. The operating frequency range of the unit shall be 47 to 63 Hertz.

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- I. Based on ANSI/IEEE C62.41 standard 8 x 20 microsecond current waveform, the maximum repetitive surge current capacity, in amps, of the unit shall be no less than 100 KA per mode.
- J. Nominal discharge current (In) shall be 20kA rating regardless of the SPD Type (1 or 2), or operating voltage.
- K. Units shall have no more than 10% deterioration or degradation of the UL1449 4th Edition Voltage Protection Rating (VPR) when exposed to a minimum of 5,000 repeated category C3 (20kV/10kA) surges. The SPD manufacturer must provide a test report validating the repetitive surge test was performed.
- L. The UL1449 VPR shall be permanently affixed to the SPD unit.
- M. The unit’s published performance ratings shall be the UL 1449 Listed suppression ratings. The UL 1449 suppression rating shall be, for each mode of protection and system voltage as follows:

120/208V, 120/240V Ratings

Modes:	L-N	L-G	N-G	L-L	MCOV (LN, NG, LG)	MCOV (LL)
	900	800	700	1200	150	300

The minimum surge current capacity the device is capable of withstanding shall be per ANSI/IEEE C62.41 location categories. Minimum surge current capacity as follows:

Category	Application	Per Phase Capacity	Per Mode Capacity
C	Service Entrances, (SWBs, SWGs, MDPs)	250kA	125kA

- N. Suppression/Filter System:
 - 1. The unit shall include an engineered solid-state high-performance suppression system, utilizing arrays of fused non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system’s components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the suppression system.
 - 2. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that opens below the maximum surge current level are unacceptable.
 - 3. Each Type 2 unit shall include an EMI/RFI noise suppression filter capable of up to 50 dB attenuation from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Type 2-unit filtering shall conform to UL 1283 5th Edition. Ringwave let-through voltage shall be 160 volts or less (IEEE Category B3, 208V system L-N).
 - 4. Any SPD unit mounted in a distribution panel shall have an integral disconnect or circuit breaker to be used as a means of disconnecting the suppression/filter system for

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maintenance and/or test purposes without interruption of power to the facility's distribution system.

5. All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #8 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.

O. Service Conditions: Include the following:

1. Operating Temperature: 30 to 120 deg F.
2. Humidity: 0 to 85 percent, noncondensing.
3. Altitude: Less than 20,000 feet above sea level.
4. Space: Indoor, dry environment.

P. Enclosure: NEMA 250, Type 1.

2.03 MAIN DISTRIBUTION PANEL SPD REQUIREMENTS

A. The SPD application covered under this section is for switchgear, switchboard, and main distribution panelboard locations. Service entrance located SPDs shall be tested and demonstrate suitability for application with ANSI/IEEE C62. 41 Category C environments.

1. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway.
2. The SPD shall be factory installed integral to the main distribution panel at the assembly plant by the original equipment manufacturer.
3. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
4. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short and as straight as possible.
5. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.04 SPD ACCESSORIES & ADVANCED FEATURES:

A. The unit shall include Form C dry contacts (N.O. and N.C.) to facilitate connection to a building management system in order to monitor the on-line status of the unit. The contacts shall be normally open or normally closed and shall close or open upon failure of the suppression system and/or fuse. Both the NO and NC contacts shall change state under any fault condition.

B. Provide unit with operational status indicating lights. Each SPD shall have a green/red solid-state indicator light that reports the status of the protection on each phase.

1. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also

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- contain an additional green/red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode.
2. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
 3. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a phase shall not be accepted.
- C. Provide with audible alarm and alarm indicating lights. The audible alarm shall be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
- D. Transient Voltage six-digit (nominal) digital surge event counter with battery backup. Counter shall feature an LCD display that indicates to the user how many surges have occurred at that location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 +/- 20 amps occurs. A reset button shall be standard, allowing the surge counter to be zeroed out. The reset button shall be configured to prevent an accidental resetting via a single, short-duration button press. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is interrupted, the ongoing surge count will be stored in the memory and displayed upon power restoration. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances, power characteristics, and other conditions affecting performance of transient voltage surge suppressors. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 CONNECTIONS

- A. Connect transient voltage suppression circuit in line-to-neutral configuration if a neutral conductor is available.
- B. Ground each transient voltage surge suppressor enclosure.
 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Supervision of the field assembly of components and installation of transient voltage surge suppressors, including electrical connections, by a factory-authorized service representative. Report results in writing.

END OF SECTION

SECTION 26 5100 – INTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.

1.02 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, LED drivers, LED modules, emergency lighting units, and accessories.

1.03 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of independent laboratory tests for fixtures and electrical ratings and photometric data.
 - 3. Certified results of laboratory tests of fixtures for photometric performance.
 - 4. Emergency lighting unit battery and charger.
 - 5. Submit manufacturer's product datasheet on each lighting fixture, including exit signs.
 - 6. Name of manufacturer, make and model of each particular fixture in the project
 - 7. Product listing information (UL, ETL, DLC, Dark Sky, etc...)
 - 8. Descriptive cut sheets Indicate fixture catalog number selections, highlight or make obvious which part numbers are used to build the complete fixture catalog number.
 - 9. Fixture voltage, match to project specifics.
 - 10. The wattage and illumination information for LED fixtures. Include rated life, color temperature, CRI, initial & mean lumen output of LED fixtures.
 - 11. Lens information including type, pattern, thickness, material type, special features.
 - 12. Fixture options, mounting details and ceiling compatibility information.
 - 13. Construction of fixture housing and door, door type, access hole information.
 - 14. Fixture driver manufacturer and type information.
- B. All lighting fixtures required to be used on this project shall be submitted in one single submittal so that all fixtures can be reviewed at one time. Those fixtures not receiving a shop drawing action of "Reviewed" or "Reviewed and Noted" on the first submittal shall be resubmitted for review. A light fixture receiving a shop drawing action of "Resubmit" or "Rejected" after the third review for any reason, shall be furnished as originally specified.
- C. The portfolios shall be made from standard manufacturer's specification sheets. Each fixture shall be identified by the letter or number indicated on the fixture schedule or project plan sheets as applicable. The combining of more than one fixture type of fixture on a single sheet shall not be acceptable.

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- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Field Test Reports.
- F. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.

1.04 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- D. Manufacturers: Firms regularly engaged in the manufacturer of interior and exterior light fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- E. Installer: Qualified with at least three (3) years of successful installation experience on projects with interior and exterior lighting fixture work similar to that required for this project.
- F. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.
- G. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
- H. IESNA LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.
- I. IESNA LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources
- J. NECA 1 - Good Workmanship in Electrical Construction, latest edition.
- K. NECA/IESNA 500 – Standard for Installing Indoor Commercial Lighting Systems, latest edition.
- L. Underwriter’s Laboratories (UL) Listings. Provide fixtures that have been UL Listed and labeled to any or all of the following standards, latest edition, as applicable to the project:
 - 1. UL 924 - Emergency Lighting and Power Equipment.
 - 2. UL 1598 - Luminaires.
 - 3. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.05 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.
- B. Coordinate the installation of all light fixtures with the work of other trades. This includes but is not limited to placement of fixtures in conjunction with HVAC diffusers, ductwork, equipment, fire suppression and alarm devices and infrastructure, plumbing piping, and all associated mounts, mounting hardware, and supports required for other system installations.

SECTION 26 5100 – INTERIOR LIGHTING

- C. Coordinate the installation of all light fixtures with mounting surfaces fixtures will be mounted within, onto, or through. Coordinate placement of fixture supports, anchors, and mounts in conjunction with ceiling and wall system supports, anchors and mounts. Light fixture trims shall be coordinated with ceiling and wall surfaces.
- D. Coordinate installation of recessed fixtures with ceiling system installation.

1.06 DELIVERY, STORAGE AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and all manufacturer's written instructions.
- B. Keep fixtures in original product packaging until ready for installation. Do not leave unpackaged fixtures unattended or where they are subject to dirt, debris, or damage.
- C. All fixtures shall be kept warm, dry, safe and secure. Adhere to manufacturer storage requirements.

1.07 EXTRA MATERIALS

- A. At substantial completion of the project, furnish the following extra materials that match specified and installed products to the Owner for future use after completion of project warranty periods. Extra materials shall be delivered and stored at a location or locations directed by the Owner. Products shall be packaged with protective covering for storage and shall be suitably labeled by product type.
 - 1. Provide one extra driver for every 100 units (of each type) installed on the project. Provide a minimum of at least one extra driver for each type used.
 - 2. Provide spare fixtures, complete and ready for immediate use, as indicated on the Luminaire Schedules found within the Plans.

1.08 WARRANTY

- A. General Warranty: Special warranty 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. Provide a five (5) year manufacturer warranty for all linear fluorescent ballasts, LED drivers, and LED light boards (light engines) from date of substantial completion of the project. This warranty to cover all product defects, performance criteria, and parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Lighting Fixture Schedules included within the Plans.
- B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Luminaire Schedule shown on the drawings.

SECTION 26 5100 – INTERIOR LIGHTING

2.02 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit rework with minimum tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during rework and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metalized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 - 2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.
- F. All fixtures shall be UL or other qualified third party listed for the environment where they will be installed including: damp, wet, extreme temperature, or hazardous locations.

2.03 LED LUMINAIRES

- A. Provide luminaires with features shown on the luminaire schedule. The color temp of luminaires shall be 3000k unless otherwise noted. All lumen values shown in the luminaire schedule or described by luminaire model numbers are minimums. Provide luminaires with photometric performance of the specified luminaires.
- B. Complete LED lighting fixtures for general illumination shall have been tested by IES LM-79 and LM-80 requirements.
- C. LED light fixtures shall be fabricated, assembled, and manufactured as a complete fixture unit, including housing, mounting hardware, driver, light boards (light engines), and lens.
- D. LED lighting fixtures shall allow for separate replacement of the light boards and driver. In other words, ‘throw away’ fixtures with non-replaceable components are not permitted.
- E. All fixtures to feature a minimum 80 CRI. Provide higher CRI levels as noted on the plans and luminaire schedules.

2.04 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section 260510 Basic Electrical Materials and Methods, for channel- and angle-iron supports and nonmetallic channel and angle supports.

2.05 FINISHES

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- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

2.06 EMERGENCY LIGHTING UNITS

- A. Provide emergency power units where shown on the plans. Emergency power units shall be integral with the luminaires or standalone as noted on the Plans. General Requirements for Emergency Lighting Units include:
 - 1. Self-contained units complying with UL 924.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 3. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 4. Operation: Relay automatically turns fixture on when power-supply circuit voltage drops to 80 percent of nominal voltage or less. System automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relays disconnect lights from battery and battery is automatically recharged and floated on charger.
 - 5. Test Push Button: Push-to-test type, integral to unit housing that simulates loss of normal power and demonstrates unit operability.
 - 6. LED Indicator light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.07 EXIT SIGNS

- A. Provide 'AC Only' type exit signs with integral battery backup. Exit signs to be circuited for '24/7' operation.
- B. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- C. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 50,000 hour minimum rated life.
- D. Self-Powered Exit Signs (Battery Type): Integral auto-charger in self-contained power pack.
- E. Battery: Sealed, maintenance-free, nickel-cadmium type. AC Only style signs where connected to an emergency generator circuit.
- F. Test Push Button: Push-to-test type, integral to unit housing that simulates loss of normal power and demonstrates unit operability.
- G. LED Indicator light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.08 SUBSTITUTIONS

If the Contractor proposes to substitute lighting fixtures for those shown on the drawings or specified herein, he shall submit a list of proposed fixtures together with technical data to substantiate that the substitute fixtures are equivalent in all respects to the specified equipment.

Proposed substitute fixtures must be submitted to the architect/engineer for review a minimum

SECTION 26 5100 – INTERIOR LIGHTING

of ten (10) days prior to the project bid date. After review of the proposed substitute fixtures, an addendum or bid bulletin will be issued to include acceptable equipment. The review of substitute equipment in no way relieves the contractor of the responsibility to provide equipment that is equivalent in all respects to specified fixtures. Lighting fixtures as shown on the drawings or specified herein shall be used as a basis and standard of comparison in the review and consideration of fixtures of other manufacturers. The Architect/Engineer shall have the final authority as to whether the fixture is equivalent to the specified item. The proposed substitution may be rejected for the aesthetic value if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.
- B. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of the NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- C. Coordinate with other electrical work as appropriate to properly interface installation of lighting fixtures with other work.

3.02 CONNECTIONS

- A. Ground equipment.
 - 1. 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.

3.03 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.
 - 4. Report results in writing.
- E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- F. Corrosive Fixtures: Replace during warranty period.

3.04 CLEANING AND ADJUSTING

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- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

SECTION 26 5600 – EXTERIOR LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 – Basic Electrical Materials and Methods.
- C. Division 26 Section 264313 – Surge Protective Devices.

1.02 SUMMARY

- A. This Section includes exterior lighting units with luminaires, LED modules, drivers, poles/support structures, and accessories.
- B. Coordination Requirements:
 - 1. Coordinate the installation of all light fixtures with the work of other trades. This includes but is not limited to placement of fixtures in conjunction with civil work such as sidewalks, roadways, parking lots, landscaping and building exteriors.
 - 2. Coordinate the installation of all light fixtures with mounting surfaces fixtures will be mounted within, onto, or through. Coordinate placement of fixture supports, anchors, and mounts in conjunction with ceiling and wall system supports, anchors and mounts. Light fixture trims shall be coordinated with ceiling and wall surfaces.
 - 3. Coordinate the installation of all light fixtures with required external surge protection devices and pole bases fusing. See Paragraphs below for more on these requirements.

1.03 DEFINITIONS

- A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, foundation, or other structure, and mounting and support accessories.
- B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.04 SUBMITTALS

- A. Provide catalog cut sheets providing product data for all product used. For each type of lighting unit indicated, arranged in order of lighting unit designation. Note specifically what component is being submitted when more than one model or version is shown on the cut sheet. Where there is more than one of each type of component (circuit breaker), label the top of each cut sheet with the specific component that the cut sheet applies to. Include data on features, accessories, finishes, and the following:
 - 1. Materials and dimensions of luminaires and poles.
 - 2. DELETE "INDEPENDENT" IN SUBPARA BELOW IF CERTIFIED TESTS BY MFR ARE ADEQUATE.
 - 3. SELECT ONE OF TWO SUBPARAS BELOW. WITH SECOND SUBPARA, PHOTOMETRIC TESTS BY MFR'S LABORATORY ARE ACCEPTABLE.

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4. 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
5. LED drivers and LEDs.
6. Provide information on the candela output along the vertical axis for each luminaire to show compliance with the requirements on the drawings.
7. Show glare control features on each luminaire.
8. Mill cert sheets certifying type of steel, source of steel, etc.
9. Welder Certifications for personnel who are welding the poles.
10. Pole reactions and calculations showing compliance with requirements including wind rating. These shall be stamped by Alaska Registered Engineer as the engineer of record for the pole as submitted.
11. Certificate of compliance by pole fabricator stating the pole meets contract requirements and was fabricated per the submitted shop drawings, welding plan, coating submittals, mill cert sheets, etc.
12. Coating catalog cut sheets showing compliance with contract requirements.
13. Product listing information (UL, ETL, DLC, Dark Sky, etc...)
14. Descriptive cut sheets Indicate fixture catalog number selections, highlight or make obvious which part numbers are used to build the complete fixture catalog number.
15. Fixture voltage, match to project specifics.
16. Wiring diagrams for power, control, and signal wiring.
17. The wattage and illumination information for LED fixtures. Include rated life, color temperature, CRI, initial & mean lumen output of LED fixtures.
18. Lens information including type, pattern, thickness, material type, special features
19. Fixture options, mounting details and ceiling compatibility information.
20. Construction of fixture housing and door, door type, access hole information.
21. Fixture driver manufacturer and type information.
22. Means of attaching luminaries to supports and indication that the attachment is suitable for components involved. All lighting fixtures required to be used on this project shall be submitted in one single submittal so that all fixtures can be reviewed at one time. Those fixtures not receiving a shop drawing action of "Reviewed" or "Reviewed and Noted" on the first submittal shall be resubmitted for review. A light fixture receiving a shop drawing action of "Resubmit" or "Rejected" after the third review for any reason, shall be furnished as originally specified.
23. The portfolios shall be made from standard manufacturer's specification sheets. Each fixture shall be identified by the letter or number indicated on the fixture schedule or project plan sheets as applicable. The combining of more than one fixture type of fixture on a single sheet shall not be acceptable.

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- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer. Shop Drawings of the poles for use by the pole fabricator and stamped by Alaska Registered Engineer. C. If an alternate foundation system is proposed by the CONTRACTOR, submit shop drawings and design calculations for the foundation system.
- D. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.
- E. Maintenance Data: For lighting units to include in maintenance manuals specified in Division 1.
- F. Qualification Data: For testing laboratory providing photometric data for luminaires.
- G. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency. Provide all applicable source quality-control reports.
- H. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.

1.05 QUALITY ASSURANCE

- A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by a testing agency acceptable to authorities having jurisdiction
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.
- D. FM Compliance: Units for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- E. Pole fabricator shall provide certificate of compliance.
- F. Comply with IEEE C2, "National Electrical Safety Code."
- G. Manufacturers: Firms regularly engaged in the manufacturer of interior and exterior light fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- H. Installer: Qualified with at least three (3) years of successful installation experience on projects with interior and exterior lighting fixture work similar to that required for this project.
- I. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers'.
- J. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- K. Provide luminaires from a single manufacturer for each luminaire type.
- L. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.
- M. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.

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- N. IESNA LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society.
- O. IESNA LM-80 - Approved Method: Measuring Lumen Maintenance of LED Light Sources.
- P. NECA 1 - Good Workmanship in Electrical Construction, latest edition.
- Q. NECA/IESNA 501 – Standard for Installing Exterior Lighting Systems, latest edition.
- R. Underwriter’s Laboratories (UL) Listings. Provide fixtures that have been UL Listed and labeled to any or all of the following standards as applicable to the project:
 - 1. UL 844 - Luminaires for Use in Hazardous (Classified) Locations.
 - 2. UL 924 - Emergency Lighting and Power Equipment.
 - 3. UL 1598 - Luminaires.
 - 4. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.06 DELIVERY, STORAGE, AND HANDLING OF POLES

- A. Retain factory-applied pole wrappings on metal poles until just before pole installation. For all poles, handle with web fabric straps.
- B. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 501 (exterior lighting), NECA/IESNA 502 (industrial lighting), and all manufacturer’s written instructions.
- C. All fixtures shall be kept warm, dry, safe and secure. Adhere to manufacturer storage requirements.
- D. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.07 WARRANTY

- A. General Warranty: Special warranty 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. Provide a general warranty for all materials and workmanship for a period of three years from the date of Substantial Completion.
- B. Special Warranty: Written warranty, signed by manufacturer and Installer agreeing to replace external parts of luminaires and poles exhibiting a failure of finish as specified below. This warranty is in addition to, and not a limitation of, other rights and remedies OWNER may have under requirements of the Contract Documents.
 - 1. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.
 - 2. Color Retention: Warranty against fading, staining, and chalking due to effects of weather and solar radiation.
 - 3. Warranty Period: Manufacturer's standard, but not less than five years from date of Substantial Completion.

1.08 EXTRA MATERIALS

SECTION 26 5600 – EXTERIOR LIGHTING

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Reflectors, Glare Shields, Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.
 - 5. Provide spare fixtures, complete and ready for immediate use, as indicated on the Luminaire Schedules found within the Plans.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated on the drawings.

2.02 LUMINAIRES

- A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
- F. Exposed Hardware Material: 316 Stainless steel.
- G. Plastic Parts: No plastic parts.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.

SECTION 26 5600 – EXTERIOR LIGHTING

- I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- J. All fixtures shall be UL or other qualified third party listed for the environment where they will be installed including: damp, wet, extreme temperature, or hazardous locations.
- K. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- L. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- M. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- N. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
- O. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- P. Photoelectric Relays: As follows:
 - 1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
 - 2. Relay Mounting: In electrical enclosures. See drawings for details.

2.03 LED LIGHTS AND LED DRIVERS

- A. Complete LED lighting fixtures for general illumination shall have been tested by IES LM-79 and LM-80 requirements.
- B. LED light fixtures shall be fabricated, assembled, and manufactured as a complete fixture unit, including housing, mounting hardware, driver, light boards (light engines), and lens.
- C. LED lighting fixtures shall allow for separate replacement of the light boards and driver. In other words, 'throw away' fixtures with non-replaceable components are not permitted.
- D. All LED fixture control devices shall be compatible with the type of drivers and dimming requirements of the particular project and coordinated with the lighting fixture submittals prior to ordering.
- E. Universal input voltage (120-277 VAC) drivers shall be provided for all LED applications.
- F. In-line fusing: On the primary for each luminaire.
- G. Drivers shall operate from a 60Hz input AC voltage from 120V-277V. Unit shall have an input voltage tolerance range of at least +/- 10%.
- H. The Total Harmonic Distortion (THD) of the driver input current shall be no more than 20% when operating at nominal input voltage.
- I. Drivers shall have a minimum Power Factor (PF) of 0.90.
- J. Drivers shall comply with IEEE/ANSI C62.41 Category C2 (medium) for transient voltage protection. This shall include a 10kV rating, and 5kA rating per the standard 8x20us combo wave testing parameters.

SECTION 26 5600 – EXTERIOR LIGHTING

- K. Drivers shall comply with the requirements of the FCC rules and regulations, Title 47 CFR Part 18, Non-consumer (Class A) for EMI & EMF (conducted and radiated) interference.
- L. Fixtures may require additional surge protection apart from what is integral with the LED driver. See Paragraph 2.04 below for more details.
- M. Rated minimum life of 60,000 hours minimum per IES LM-70 testing requirements.
- N. Provide a TM21 report on LED boards to be used which tests LED life and lumen maintenance per the IES LM-80 standard, and LED light output and efficacy per the IES LM-70 standard.
- O. The correlated color temperature (CCT) of the LEDs shall be 4000K unless noted otherwise. The CCT shall be uniform for all LED modules within like luminaire types and luminaires within a given project. The LED CCT measurements shall have a maximum of three standard deviations (3 SDCM, +/-90K) tolerance on the MacAdam Ellipse.
- P. Provide LED boards such that any individual LED failure on a section of LED board within the fixture will not result in significant output loss of the overall fixture.

2.04 EXTERNAL LED DRIVER SURGE PROTECTION DEVICE (SPD)

- A. All pole mounted LED light fixtures shall come equipped with an additional layer of SPD protection. This additional protection shall be in addition to requirements of the surge protection integral to the LED driver itself.
- B. The SPD shall be circuited immediately upstream of the LED driver and mounted either within the fixture or immediately adjacent to it in a concealed, protected, and accessible location. Do not void manufacturer warranty or listing requirements when mounting SPD.
- C. The external SPD shall be circuited either in series or parallel with the light fixture circuit as required of the project and Owner needs. In series circuiting shall de-energize the fixture upon SPD failure (indicating a problem) while parallel circuiting shall allow for continued fixture use after SPD failure.
- D. The additional SPD shall have a kilo-amp rating in excess of the kilo-amp rating of the fixture it is protecting. Minimum specifications shall meet IEEE/ANSI Category C2 (medium) 10kV, 5kA@ 8/20us standard combo and 6kV, 100kHz ring wave protection.
- E. The additional SPD shall have a let-through voltage rating or Voltage Performance Rating (VPR) that limits the voltage to the downstream driver to within the voltage tolerance of the driver. Anticipated maximum clamping voltage (8/20us @ 10kA) as follows: 600V (120V circuit), 1000V (208-240V circuit).

2.05 LUMINAIRE SUPPORT COMPONENTS

- A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation. Wind loads shall be in accordance with what is shown on the drawings.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade with all equipment shown to be mounted to the pole at the wind loads shown on the drawings. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.

SECTION 26 5600 – EXTERIOR LIGHTING

1. Strength Analysis: For each pole type and luminaire combination, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.
- D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Will not cause galvanic action at contact points.
 2. Mountings: Correctly position luminaire to provide indicated light distribution.
 3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
 4. Anchor-Bolt Template: Plywood or steel.
- E. Shafts and base plates for light poles shall conform to ASTM A572 Grade 50. Connecting bolts shall conform to ASTM F3125 Grade A325. Fasteners for handhole covers, bands on lighting brackets, and connector attachment brackets shall conform to ASTM F593. Steel used for light poles shall have a controlled silicon content of either 0.00 to 0.04 percent or 0.15 to 0.25 percent. Mill test certificates verifying the silicon content of the steel shall be submitted to both the galvanizer and the Engineer prior to beginning galvanizing operations.
- F. Welding of poles and associated parts shall be in accordance with AWS D1.1/D1.1M, latest edition Structural Welding Code. No welding, including tack and temporary welds shall be done in the shop or field unless the location of the welds is shown on the approved shop drawings reviewed and accepted by the Engineer. Welding procedures shall accompany the shop drawings submittal for the light pole. The procedures shall specify the type of equipment to be used, electrode selection, preheat requirements, base materials, and joint details. When the procedures are not prequalified by AWS or AASHTO, evidence of qualification tests shall be submitted. Welding shall not begin until the submittals have been approved. Nondestructive testing in addition to visual inspection shall be performed by the Contractor. Testing and inspection shall apply to welding performed in the shop and in the field. An independent firm shall perform the nondestructive testing and shall certify the poles are fabricated per the shop drawings and submittals, as well as contract requirements. All welds shall be 100% visually inspected. Visual inspection shall be performed before, during, and after the completion of welding. Grind welds and polish all surfaces to a smooth, even finish prior to galvanizing.
- G. Anchor bolts shall meet the requirements of ASTM F1554 and unless otherwise specified, shall be grade 105 and shall conform to supplemental requirements S2, S3, and S4. Anchor bolts shall be hot dipped galvanized. Nuts for anchor bolts shall either conform to ASTM A563, Grade DH or AASHTO M292, Grade 2H. The bolts shall be tested by the manufacturer and inspected prior to shipping to the project site. The manufacturer shall provide a certificate of compliance for the anchor bolts, nuts, and washers with mill sheets stating the bolts, nuts, and washers have been manufactured per the applicable contract requirements including stating the requirements they have been manufactured to.

SECTION 26 5600 – EXTERIOR LIGHTING

- H. Light poles and associated parts including anchor bolts and anchor plates shall be hot-dip galvanized in accordance with AASHTO M111 and ASSHTOM232. The hot dip galvanize shop shall provide a report of random samples of the readings of the mil thickness of the zinc. It shall be at least (3) mils. Each pole shaft end and base as well as base plate shall also be tested with readings provided in the report.
- I. See drawings for additional pole and pole base requirements.
- J. Powder coating shall be Polyester TGIC Powder coating, semi gloss smooth FS No. 27038 Black.

The coating shall conform to the following requirements:

Property	Specification	Range
Gloss @ 60 deg	ASTM D523	20% +/- 5%
Direct Impact (inch lbs)	ASTM D2794	120 in. lbs.
Indirect Impact (inch lbs)	ASTM D2794	120 in. lbs.
Pencil Hardness	ASTM D3363	2H
Cross Hatch Adhesion	ASTM D3359B	4B
Flexibility (Conical Mandrel)	D1737/D522	100%
Specific Gravity	ASTM D792	1.2 minimum

The galvanized steel shall go through a 5 to 7 stage pretreatment per the powder coating manufacturer and shall be degassed at 5 degrees above cure temperature to minimize gassing. All powder coating shall be preformed by a company with at least five years experience powder coating and shall provide a certification of completion stating the powder coating was performed per manufacturer's requirements and above ASTM specifications with the required results.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Luminaire Attachment: Fasten to indicated structural supports.

SECTION 26 5600 – EXTERIOR LIGHTING

- B. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.
- C. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.
- D. Fasten luminaire to indicated structural supports. Additional support requirements include:
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Sized and rated for luminaire weight. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
- F. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- G. Coordinate layout and installation of luminaires with other construction.
- H. Provide hot dipped galvanized poles and mast arms. All luminaires shall be light gray, unless otherwise noted.

3.03 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Ground metal poles/support structures according to Division 16 Section 16452 – Grounding.

3.04 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:
 - 1. Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s): IES LM-5, LM-50, LM-52, LM-64, LM-72.
 - 2. Check intensity and uniformity of illumination.
 - 3. Check excessively noisy drivers..

SECTION 26 5600 – EXTERIOR LIGHTING

- E. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- F. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.
- G. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.04 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.
- B. Adjust luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

END OF SECTION

SECTION 26 5700 – IP BASED VIDEO SECURITY SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 26 Section 260510 - Basic Electrical Materials and Methods
- C. Division 26 Section 260519 - Low Voltage Conductors and Cables
- D. Division 26 Section 260526 - Grounding and Bonding for Electrical Systems
- E. Division 26 Section 260533 - Raceways and Boxes for Electrical Systems
- F. Division 26 Section 271300 - Telecommunications Cabling

1.02 SUMMARY

- A. This Section includes the following electrical materials and methods:
 - 1. Complete Video Surveillance System

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of Section 01300 – CONTRACTOR Submittals.
- B. Provide catalog cut sheets providing product data for each type of product specified. Note specifically what component is being submitted when more than one model or version is shown on the cut sheet. Where there is more than one of each type of component (circuit breaker), label the top of each cut sheet with the specific component that the cut sheet applies to.
- C. Provide shop drawings detailing fabrication and installation of supports and anchorage for electrical items. Show all components of a system and how they relate to each other during installation. Include details of mounting brackets, wiring interconnections, single line diagrams, component layout diagrams for enclosures, materials lists for components in enclosures, wiring schematic diagrams with each wire numbered and each terminal numbered for wiring in enclosures.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other trades.

PART 2 PRODUCTS

SECTION 26 5700 – IP BASED VIDEO SECURITY SYSTEM

2.01 MANUFACTURERS

- A. The video cameras, recorders, support devices, and other elements listed in the drawings characterize products with features desired for this facility. Substitutions of equal or better quality with the same salient features will be considered.

2.02 VIDEO SECURITY SYSTEM, GENERAL

- A. Submittals shall include product data for all cameras, camera mounts, network video recorders (NVRs), power supplies, network switches, and other key components. Include information on dimensions, features and performance, electrical characteristics, ratings, and finishes.
- B. Project Conditions:
 - 1. Interior, Controlled Environment: System components installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 32 to 104 deg F dry bulb and 20 to 80 relative humidity, non-condensing. Use NEMA 250, Type 1 enclosures.
 - 2. Exterior Environments: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 10 to 100 relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph. Use NEMA 250, Type 4X enclosures.
- C. Outdoor Exposed Hardware Material: 316 stainless steel.
- D. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- E. Power Supplies & UPS: Low-voltage power supplies shall be matched for voltage and current requirements of cameras and accessories, and of type recommended by manufacturer of camera and lens. UPS to be provided to backup camera equipment is specified in Division 27 Section 271300.
- F. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to cameras, and control-station equipment that fail in materials or workmanship within specified warranty period.
 - a. Warranty Period: Three years from date of Substantial Completion.

2.03 FIXED CAMERA REQUIREMENTS

- A. IP addressable, fixed position cameras for continuous monitoring of project areas.
- B. Cameras to include 1080p video in full frame rate, WDR, IR, digital PTZ with presets.
- C. Pickup Device: Progressive scan RGB CMOS, 1/2.5"
- D. Sensitivity: Camera shall provide useable images in low-light, delivering an image at a scene illumination of 0.19 lux at F1.7 (color) and 0.04 lux at F1.7 (B/W).
- E. Resolution: 3840(H) x 2160(V) to 160(H) x 90 (V) pixels with a signal-to-noise ratio (SNR) of not less than 50 dB with camera AGC off.
- F. Video Compression: H.264 (MPEG-4 Part 10/AVC), Motion JPEG, frame rate 30 fps.

SECTION 26 5700 – IP BASED VIDEO SECURITY SYSTEM

- G. Image Settings: Adjustable compression, color, brightness, sharpness, contrast, white balance, AGC, backlight compensation, and wide dynamic range (WDR).
- H. Motion detection built-in digital, auto-iris lens electrically controlled to maintain a constant video in varying light conditions. Fixed lens with calibrated focus ring, provide color corrected lenses.
- I. IR Illumination: Integral Infrared (IR) with power-efficient, long-life 850nm IR LEDs. Range of 30 meters (100 feet) minimum.
- J. Camera Adjustment Angles: Pan: +/- 180 deg., Tilt: -40 to +75 deg., Rot: +/- 95 deg.
- K. Signal Transmission Cabling: Category 6 cable with RJ45 jacks.
- L. Network Connectivity: Password protected, IEEE 802.1X network access controllable, HTTPS encryption, supports protocols: IPv6, HTTP, HTTPS, SSI/TLS, QoS Layer 3, FTP, SMTP, DHCP, TCP, DNS, and UDP.
- M. Camera Power: Power over Ethernet (PoE), IEEE 802.3af, Type 1, Class 3.
- N. Complete Assembly: color dome camera assembled and tested as a manufactured unit, containing dome assembly, camera, zoom lens, receiver, embedded software.

2.04 CAMERA SUPPORT COMPONENTS

- A. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
- B. Mounting Brackets for Cameras: Type matched to item supported and mounting condition. Include manual pan-and-tilt adjustment. Color & finish matched to camera.
- C. Camera Housing: IP66, NEMA 4X rated, IK10 impact-resistant casing with hard-coated dome and dehumidifying membrane. Includes encapsulated electronics and captive screws.
- D. Finish & Rating: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment. IP66 and NEMA 4 ratings required.

2.05 NETWORK VIDEO RECORDER (NVR) & PoE SWITCH

- A. NVR shall be IP based recorder with complete server functions for the storage and management of multiple video streams. It shall have internal storage utilizing solid state drive (SSD) technology. Includes a 240GB SSD hard drive.
- B. Video and audio recording over TCP/IP network. Recordings to be H.264 compatible, as well as Motion JPEG, MPEG-2, and MPEG-4 stream complaint.
- C. NVR shall allow for simultaneous recording and playback and both continuous and alarm-based recording.
- D. Full-Featured Search Capabilities: Search based on camera, time, date, or event triggers. Automatic replacement of data upon network loss. Video to have digital certification via watermarking.
- E. Internal RAID storage with capability of adding more external RAID storage.
- F. Full integration with LAN, Intranet, or Internet via standard browser or management software. Integrated Web & FTP server functionality. Supports 48 devices, upgradable up to 64 devices.

SECTION 26 5700 – IP BASED VIDEO SECURITY SYSTEM

- G. NVR Software: Based on 64-bit, central-station with Windows 10 Enterprise operation system (complete with up-to-date service packs) and video security application software. Software includes the following capabilities:
1. Software shall provide complete manager of the camera system from the NVR utilizing a standard format windows GUI platform.
 2. Camera controls, alarm information, environmental information and adjustable settings shall be available through the GUI on the screen with the use of a mouse, no joystick required.
 3. NVR software shall allow for playback and searching of archived video. CD/DVD burning of footage, camera naming, password management, alarm configurations, software shall include these and other camera features of modern day video surveillance management software.
 4. NVR shall be accessible from any authorized PC on the TCP/IP local Ethernet system and through the Airport's fiber link for connection to other authorized PCs on the IT network.
 5. Include system license for the entire system including capability for future additions that are within the indicated system size limits specified in this Section. Both for the central-station software and the video security system application software.
 6. Open-architecture system that allows importing and exporting of data and interfacing with other systems that are compatible with Microsoft Windows.
 7. Password-protected operator login and access and open-database-connectivity compliant.

2.06 SOURCE QUALITY CONTROL

- A. All video security system cameras, NVRs, and associated peripherals shall be manufactured by the same company.
- B. Category cable jumpers shall come with pre-terminated, factory installed RJ45 jacks.

PART 3 EXECUTION

3.01 WIRING

- A. Install all video system cabling in conduit unless otherwise noted. Bundle, lace, and train conductors to terminal points with no excess and without manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- B. For LAN connections, Category cable connections, and fiber-optic and copper communication wiring provide all terminations, performance verification, labeling per TIA/EIA industry standard requirements.
- C. Provide system grounding per Plans and additional grounding as required to meet TIA/EIA industry standards.

3.02 CAMERAS

- A. Install cameras on poles per the Plans with minimum above and below clearances required. Install cameras on factory mounts aimed towards viewing objectives.

SECTION 26 5700 – IP BASED VIDEO SECURITY SYSTEM

- B. Set camera alignment stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.
- C. Adjust fixed camera final positions to obtain the field of view required. Connect all controls and make final adjustments in coordinate with Owner's staff prior to system turn over.

3.03 NVR & SWITCHES

- A. Install NVR and switch in equipment rack according to the plans.
- B. Install, program, configure, and test the NVR software and camera video stream connections to ensure a fully functional video security system. System setup shall be confirmed by Airport Management and the Engineer prior to final acceptance.
- C. Coordinate with Airport Management to connect the video security system to the network as required, and obtain the necessary IP address and other network information.

3.04 TRAINING

- A. Provide training to the owner's maintenance personnel on the operation of the video security system. Includes management, archiving, retrieval, and initiation of video streams, typical system troubleshooting and setup procedures, network connectivity, and alarm setup and response steps. Provide a minimum of 8 hours of onsite training by authorized factory trained personnel. Provide high quality video + audio recording of the training session for future training sessions.

END OF SECTION 265700

SECTION 27 1300 – TELECOMMUNICATIONS CABLING

PART 1 GENERAL

1.1 SUMMARY

- A. Provide all services labor, materials, tools, and equipment required for the complete and proper installation, splicing, and termination of new backbone cabling as called for in these specifications and related drawings.
- B. The backbone telecommunications cabling system extends from terminations in one Telecommunications Room (TR) to the next TR in adjacent building or structure.
- C. The horizontal portion of the telecommunications cabling system extends from the Communication Location (CL) to the termination in the TR.
- D. This section includes minimum requirements and installation methods for the following:
 - 1. Fiber optic backbone cabling
 - 2. Fiber splices & fiber connectors
 - 3. Copper horizontal cabling
 - 4. Copper splices & copper connectors
 - 5. Patch panels and cords
 - 6. Network switches
 - 7. IT racks, cable management, UPS units, misc.

1.2 SYSTEM DESCRIPTION

- A. Outside plant from the Utility and across the Channel will be designed and installed by the local telephone company. The outside plant copper cable will terminate in the main TR of the Generator Building (Revilla) and Terminal Building (Gravina). Confirm that the system design incorporates the pathway and termination requirements for the copper cabling.
- B. Outside plant between buildings and structures on each side of the Channel shall be by the Contractor. Fiber optic cable will be utilized to link the TR located in each building or structure.
- C. Inside plant riser fiber optic cable for connecting each building main TR to the each other TR within the building. This occurs within the Terminal Building (Gravina).
- D. All wall mounted telecommunication devices, equipment, and racks shall be mounted on telecommunication terminal boards (TTB) as noted on the plans. Coordinate locations of all devices, equipment, and racks with general layout of each room to ensure working clearances, manufacturer clearances, etc., are provided.
- E. All telecommunication devices, equipment, and racks shall be grounded as noted on the plans. Provide all grounding means necessary to meet manufacturer and industry standard practices for effective telecommunication systems grounding.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers' product information.
- B. UPS sizing calculations as noted within this specification.

SECTION 27 1300 – TELECOMMUNICATIONS CABLING

- C. Telecommunications labeling scheme for copper & fiber cables, all terminations, patch panels, faceplates, etc., as noted within this specification. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

1.4 QUALITY ASSURANCE

- A. Layout & Installer qualifications: Cabling installer must have personnel certified by BICSI on staff. Preparation of shop drawings shall be under the direction of an RCDD registered staff member. All installation work shall be under the direct supervision of a Level 2 BICSI installer who is present at all times when work of this section is performed on the project site.
- B. Acceptance of cabling installation will not be made unless all cable test results and as-built drawings are submitted and approved by the Engineer.
- C. Any printed labels must have prior approval of the Engineer as well as meet the performance requirements of UL 969 and TIA 606.
- D. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- E. Comply with NFPA 70, IBC, NESC, and all local, state, and federal regulations.
- F. All data communications cabling, materials and installation practices shall comply with the applicable sections of the following Telecommunications Industry Standards:
 - 1. ANSI/TIA/EIA-568-B.1-2001, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - 2. ANSI/TIA/EIA-568-B.2-2001, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - 3. ANSI/TIA/EIA-568-B.3-2001, Commercial Building Telecommunications Cabling Standard, Part 3: Optical Fiber Cabling Components Standard.
 - 4. ANSI/TIA/EIA-569-A-2001, (Including 5 addendums), Commercial Building Standards for Telecommunications Pathways and Spaces.
 - 5. ANSI/TIA/EIA-606-1993, The Administration Standard for the Telecommunications Infrastructure of Commercial Building.
 - 6. ANSI/TIA/EIA-607-1994, Commercial Building Grounding and Bonding Requirements for Telecommunications.
- G. Coordination: Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier (KGB and GCI).
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

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2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cables according to NEMA WC 26.
- B. Do not deliver or install equipment, devices, or racks until spaces are enclosed, weather tight, and until spaces are dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated on the drawings.

2.2 MATERIALS & FABRICATION

- A. Outside Plant Fiber Optic Cable
 1. Outside plant fiber optic cable shall be multi-mode, 24 strand, 50 micro, OM3 rated.
 2. Cable shall be indoor, outdoor, rated and tight buffered.
 3. Cable shall feature high tensile strength, crush resistance, and bend-insensitive fibers.
 4. Cable is suitable for direct termination without the need for fan-out kits.
 5. Cable color: Aqua outer jacket.
- B. Inside Fiber Optic Backbone Cabling
 1. Inside plant fiber optic cable shall meet requirements of outside plant fiber described above.
- C. Fiber Splices
 1. Provide all required hardware and kits for field fusion splicing in splice closures and for sealing and mounting the closures. Provide fiber fan out kits in racks per the drawings.
 2. Fiber fan out kits (fiber cassettes): Provide with modular style multiple cassettes, populated adapter plates & blanks as required.
- D. Fiber Connectors
 1. Use LC multi-mode connectors suitable for use with fiber cables specified. Connector types shall be consistent throughout the project.
 2. Provide all other consumables and kits as required for field termination of fiber optic cable on connectors.
- E. Horizontal Cable
 1. Data low voltage circuits: Category 6, unshielded twisted pair (UTP) with low smoke, flame retardant PVC outer jacket. Plenum rated when not in conduit in ceiling spaces. All products herein must be Category 6 compliant and shall be installed following manufacturers'

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recommendations for installation and application. Cables consist of plenum rated, 4-pair unshielded, 23 AWG, twisted copper pair cable to each CL specified on the drawings.

2. Use white cable for data.
 3. Cabling must be rated as Underwriters Laboratories (UL) level V or EIA/TIA and must be stamped with the “UL” approval mark.
- F. CL Faceplate:
1. Data cabling shall terminate at the user (CL) end in ivory 3-hole faceplates on keyed eight (8) conductor jacks.
- G. CL Data Jacks:
1. Use gray jacks for data.
 2. Use T568B jacks.
 3. Place the one gray data jack in CL position one (1).
 4. Any specialty CL location including modular furniture, floor plates, or special outlet boxes must have a wiring jack that complies with approved horizontal cabling manufacturer requirements and is consistent with jacks used elsewhere on the project.
 5. Category 6 modular jack devices, 8-position, 8-conductor modular jacks, terminated to 110 type IDC connections for the installation of UTP cable.
 6. Units shall be labeled in accordance with both wiring designations of T568A/B. See details for cable connections and labeling.
 7. Provide and install blank inserts as needed.
 8. Label communication faceplates in accordance with both wiring designations T68A/B.
 9. Ivory receptacles with stainless cover plates.
- H. Patch Panels & Cords:
1. Use 24 or 48 copper port patch panels for data as noted on the plans. Standard density with pre-populated RJ45 jacks & spaces with blank fillers per the plans.
 2. Telecommunications patch cords: All patch cords shall be factory assembled patch cords with factory made ends. Length of 36 inches. All patch cords shall meet the performance characteristics of the telephone and data low voltage circuits described herein. The quantity of patch cords shall be as required.
- I. Cable Installation Materials, Equipment and Tools:
1. Furnish all required materials, equipment, and tools necessary to properly complete the backbone cabling system installation including, but not limited to, tools for pulling, splicing, and terminating the cables, mounting hardware, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, communication devices, stands for cable reels, cable wenchers, etc.
 2. Use a pulling ‘mule’ tape for cable installation: Leave a pulling ‘mule’ tape in the conduits for future use after installing the outside plant cable.

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3. Conduit caulking compound: Compounds for sealing conduit ducts shall have putty-like consistency workable with the hands at temperatures as low as 35 degrees Fahrenheit, shall not slump at a temperature of 300 degrees Fahrenheit, and shall not harden materially when exposed to the air. Compounds shall readily caulk or adhere to clean surfaces of plastic conduit, metallic conduits, or conduit coatings; concrete, masonry; any cable sheaths, jackets, covers, or insulation material, and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect on the hands of workers or upon materials.
 4. “Caution Fiber” tags shall be installed at all locations where fiber optic cabling is visible entering a room or outside vault. Use 3M Scotchlite 5016-FO (or approved equal).
- J. Network switches:
1. Provide units as described on the plans, one switch per IT rack. Industrial grade units, with Power-Over-Ethernet ports, incoming fiber ports, and interface cards per the plan.
- K. IT Rack, Cable Management, UPS units, Misc. Components:
1. IT Rack: Provide wall mounted, IT racks where shown on the plans in electrical rooms. TIA/EIA standard racks that fully swing out to allow for rear access. See plans for specific manufacturers. Racks shall be fully enclosed and vented with minimum rack units (RUs) as noted on the plans and as required for final equipment layout.
 2. Cable Management: Provide horizontal, 1 RU cable management panels for sorting and neatly training all copper and fiber cables between elements within the IT rack.
 3. Power Supplies & UPS units: Low-voltage power supplies shall be matched for voltage and current requirements of telecommunications equipment and accessories powered. Each IT rack shall include a UPS unit to provide backup power to all equipment in the rack. Power supplies and UPS units shall have integral surge protection meeting IEEE C62.41 Category C1 requirements (6kV, 3kA). UPS units shall feature:
 - a. Line voltage (120VAC input/120VAC output) rack mountable unit with minimum 0.96 power factor.
 - b. Supports SNMP/Web connectivity via integral NIC card. Include with alarm outputs and dry contact outputs. Features front panel LCD interactive display.
 - c. Provide with five NEMA 5-15/20R receptacles.
 - d. Minimum integral battery backup of 120 minutes at 50% full load.
- Submittals shall include UPS sizing calculations and wiring diagrams for power, signal, and control wiring. Include a complete equipment list with every piece of equipment by model number and manufacturer.
4. Rack surge strips: Commercial grade, 120VAC power strips with on indicator lights, built-in surge protection. See plans for complete description. Minimum one strip per rack.

PART 3 - EXECUTION

3.1 EXAMINATION

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- A. Verify that field measurements and cable routing and termination conditions are as shown on drawings. Provide notification, in writing, of conditions deviating from drawings.

3.2 INSTALLATION

- A. Perform all backbone and horizontal cable installation in conformance with manufacturer's installation guidelines.
- B. Ensure that maximum pulling tensions of specified cables are not exceeded, and cable bends maintain the proper radius during placement.
- C. The Contractor shall be responsible for all damage to the cable during placement.
- D. Do not roll or store cable reels without an appropriate underlay.
- E. Terminate cables so as not to pull tight on terminating equipment.
- F. Ensure that all splice closures are properly sealed for protection of the cable and splices.
- G. As applicable, firestop all sleeves and conduit openings after the cable installation is complete.
- H. Plug ends of conduit entering buildings with watertight conduit caulking compound after cable installation is complete to ensure foreign matter does not enter the buildings.
- I. All cable must be installed without any splices or intermediate distribution points.
- J. Ceiling tile shall be removed as necessary for the cable installation and put back in place without damaging or soiling any of the tiles or supporting framework. Ceiling tile shall be handled with clean hands so that no fingerprints or marks are left on the tiles. The Contractor is responsible for the cost of repair or replacement of any damaged or soiled tiles or ceiling hardware.
- K. All cables in the ceiling space:
 - 1. Shall be ran along a series of J-hooks. Support all cable. Do not string through ceiling structural members.
 - 2. Shall be bundled with plenum-rated cable ties that are snug but which do not deform the cable geometry
 - 3. Shall not be routed "wild" (unsupported by conduit, J-hooks or cable tray) for lengths greater than 5 feet;
 - 4. Shall not be attached to the suspended ceiling structure or laid directly on the ceiling grids as a means of support and, whenever possible, the bottom of a cable or cable bundle shall remain a minimum of 6 inches above the ceiling grid;
 - 5. Shall not be supported by or attached by any means to fire sprinkler heads or delivery systems, any environmental sensor, or the exterior of any conduit or raceway;
 - 6. Shall be routed at right angles to the electrical power circuits where the cable is not enclosed in conduit or in cable tray.
 - 7. A minimum of 5' slack shall be left loosely wound (1'-2' diameter) above each specified work area jack to facilitate future termination changes. Coil the cable above the suspended ceiling on a j-hook, before cable enters conduit in wall. Where jack is not located below a suspend ceiling, provide slack at the patch panel.

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- L. All cables shall be tied and dressed neatly with a minimum bend radius of 10 times the cable diameter. Provide necessary hardware to maintain the proper bend radius at corners.
- M. All cables shall be firmly held in place. Fastenings and supports shall be adequate to support loads with ample safety factors.
- N. FIBER BACKBONE CABLE
 1. Install fiber optic backbone cable through conduit, manholes, and other pathways as shown on the drawings. Backbone cables and splice cases installed in manholes or pull boxes shall be strapped to the cable racks using stainless steel ties.
 2. Backbone telecommunications cabling shall be placed in dedicated pathways separate from horizontal and other cabling.
 3. Install service coils with a length of 20 feet and a diameter of 18 inches, at each end of all new backbone fiber optic cables to control excess cable lengths before terminating fiber strands. Do not leave cable slack on ladder racks.
 4. Bind fiber cable service coils in 4 places with separation of 90 degrees and anchor to the wall with cable ties within 4 feet of the cable entrance per the drawings. Do not install cable coils on cable or equipment racks.
 5. Pull new pulling ‘mule’ tape through all conduits while pulling new backbone cable.
 6. Install fiber connectors in the TRs as shown on the project drawings.
 7. Clamp all new backbone cables at the entrance facilities for strain relief.
 8. Test and document the final backbone cable installation, including cable footages, on the as-built drawings. (Test using 2 point DB loss.)
 9. Neatly and permanently label all backbone cables with the approved UNL IS standard labeling scheme at both ends and at all splice locations.
 10. Terminate fiber strands on connectors and in termination equipment (shelves and panels) as specified in the manufacturer’s color code sequence.
 11. Do not terminate, splice, or cut off “DEAD” cable strands. Neatly coil these un-terminated strands inside the shelves or panels with the proper bend radius to protect them for future termination or splicing.
 12. Perform fusion splices for multimode and single-mode fiber strands at each splice location.
 13. Perform fusion splices for single-mode fiber strands with splice loss ≤ 0.2 dB at 1310 nm.
 14. Perform termination of single-mode fiber strands on LC connectors with loss ≤ 0.2 dB at 1310 nm.
 15. Place “Caution Fiber” tags at all coils and every 50 feet along any exposed cable route.
- O. HORIZONTAL CABLE
 1. Cable installation is “home-run” between the CL and jack location on patch panels in the TR.
 2. The total length of any horizontal station cable from the jack location to the termination block shall not exceed 90 meters.
 3. Maintain the following clearances from EMI sources:

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- a. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: 12 inches.
 - b. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: 24 inches.
 - c. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: 6 inches.
 - d. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: 12 inches.
 - e. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: 3 inches.
 - f. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: 6 inches.
 - g. Motors or transformers near cable in non-metal pathway: 48 inches.
 - h. Motors or transformers near cable in grounded metal pathway: 36 inches.
4. Install faceplates and copper jacks at each CL as indicated on the project drawings. Place blank covers in the unused openings on each faceplate.
 5. Faceplates shall be secured with mechanical fasteners. Adhesive fasteners are not allowed.
 6. Data cable termination shall be EIA/TIA-568 with wiring option T568B.
 7. Terminate the data cable in the TR on the 48-port patch panels.
 8. Termination must conform to the chosen manufacturers Structured Cabling System installation rules and meet the full performance standards and certification.
 9. All outlets shall be tested and certified to meet performance standards of the chosen manufacturers Structured Cabling specifications. Testing shall be done regularly as a floor or building is completed and test results provided to the Engineer.
 10. All outlets must be labeled at both the work area location and on the patch panels in the Communications Room using the approved labeling scheme. Labels must be of the printed variety (pencil or ink hand labeling not allowed).
- P. All telecommunications installed cables, jacks, and connectors will be clearly labeled and documented to identify each cable connection. Each jack in each wall plate shall have a unique identifier that matches identifiers at the patch panel. Wall mounted jacks shall utilize a neat, long lasting computer-generated stick-on label such as those printed on the Brady SC plus printer system. Computer generated tags shall be installed on all of the cables serving the work area in order to provide ready identification of all cables in the event that the surface markings are lost or mutilated. The labeling scheme shall be per the owner's requirements. Coordinate with KGB Airport Manager and obtain labeling numbering scheme before starting project. Provide numbering scheme on a set of floor plans with all devices shown and on elevations drawings showing the patch panels with appropriate numbering at each jack in panel. Provide these shop drawings prior to ordering materials.

3.3 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

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- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- C. Telephone and data communications cable testing: All UTP cabling will be certified to meet or exceed Category 6 specifications as set forth in TIA/EIA-568-B.1 Section 11, using a level II-E field tester pre-approved by the Agency's contract administrator. Certifications shall include the following parameters for each pair of each cable installed:
1. Wire map (pin to pin connectivity)
 2. Length (in feet)
 3. Attenuation
 4. Near End Crosstalk (NEXT)
 5. Far End Crosstalk (FEXT)
 6. Equal Level Far End Crosstalk (ELFEXT)
 7. Attenuation/Crosstalk Ratio (ACR)
 8. Return Loss
 9. Propagation Delay
 10. Delay Skew
 11. Test equipment shall provide an electronic and printed record of these tests.

Owner reserves the right to hire an independent testing company to spot check the test results. If the results vary more than 10% from the results provided by the Contractor, the Contractor will be required to prove his results are correct or retest the entire system.

END OF SECTION 271300

SECTION 281300 - ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Security access central-control station.
 - 2. Security access controllers connected to high-speed electronic-data transmission network.

1.3 DEFINITIONS

- A. CPU: Central processing unit.
- B. Credential: Data assigned to an entity and used to identify that entity.
- C. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.
- D. I/O: Input/Output.
- E. LAN: Local area network.
- F. Location: A Location on the network having a PC-to-controller communications link, with additional controllers at the Location connected to the PC-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.
- G. PC: Personal computer. Applies to the central station, workstations, and file servers.
- H. PCI Bus: Peripheral Component Interconnect. A peripheral bus providing a high-speed data path between the CPU and the peripheral devices such as a monitor, disk drive, or network.
- I. RAS: Remote access services.
- J. ROM: Read-only memory. ROM data are maintained through losses of power.
- K. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- L. TWAIN: Technology without an Interesting Name. A programming interface that lets a graphics application, such as an image editing program or desktop publishing program, activate a scanner, frame grabber, or other image-capturing device.
- M. UPS: Uninterruptible power supply.
- N. USB: Universal serial bus.
- O. WAN: Wide area network.
- P. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.
- Q. Windows: Operating system by Microsoft Corporation.
- R. Workstation: A PC with software that is configured for specific, limited security-system functions.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating

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characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO- 01.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams. For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Microsoft Windows software documentation.
 - 2. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
 - 3. System installation and setup guides with data forms to plan and record options and setup decisions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Credential card blanks, ready for printing. Include enough credential cards for all personnel to be enrolled at the site plus an extra 25 percent for future use.
 - 2. Fuses of all kinds, power and electronic, equal to 10 percent of amount installed for each size used, but no fewer than three units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Cable installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
- B. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70, "National Electrical Code."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Central Station, Workstations, and Controllers:
 - 1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degree F (10 and 30 degree C), and not more than 80 percent relative humidity, noncondensing.
 - 2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
 - 3. Mark packing list with the same designations assigned to materials and equipment for recording in the system labeling schedules that are generated by software specified in "Cable and Asset Management Software" Article.
 - 4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 PROJECT CONDITIONS

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- A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient conditions of 60 to 85 degree F (16 to 30 degree C) and a relative humidity of 20 to 80 percent, noncondensing.
 2. Indoor, Controlled Environment: NEMA 250, Type 1 enclosure. System components, except the central-station control unit, installed in temperature-controlled indoor environments shall be rated for continuous operation in ambient conditions of 36 to 122 degree F (2 to 50 degree C) dry bulb and 20 to 90 percent relative humidity, noncondensing.
 3. Outdoor Environment: NEMA 250, NEMA 250, Type 4X enclosures. System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 degree F (minus 34 to plus 50 degree C) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.
 4. Corrosive Environment: For system components subjected to wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide the following:

1. Millennium Expert

2.2 DESCRIPTION

- A. Security Access System: Site controller and field-installed controllers, connected by a high-speed electronic-data transmission network.
- B. Network(s) connecting site controller and controllers shall consist of one or more of the following:
1. Local area, IEEE 802.3 Fast Ethernet, star topology network based on TCP/IP.

2.3 OPERATION

- A. Security access system shall use a single database for access-control and credential-creation functions.
- B. Distributed Processing: A fully distributed processing system.
1. Access-control information, including time, date, valid codes, access levels, and similar data, shall be downloaded to controllers so each controller can make access-control decisions.
 2. Intermediate controllers for access control are prohibited.
 3. In the event that communications with the central controller are lost, controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the central station.
- C. Number of Locations:
1. Support at least 64 separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.
 2. Each Location shall have its own database and history in the central station.
 3. Locations may be combined to share a common database.

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- D. Location Capacity:
 - 1. 64 reader-controlled doors.
 - 2. 1,000 total-access credentials.
 - 3. 16 supervised alarm inputs.
 - 4. 8 programmable outputs.
- E. System Network Requirements:
 - 1. System components shall be interconnected and shall provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
 - 2. Communication shall not require operator initiation or response and shall return to normal after partial- or total-network interruption such as power loss or transient upset.
 - 3. System shall automatically annunciate communication failures to the operator and shall identify the communications link that has experienced a partial or total failure.
 - 4. Communications controller may be used as an interface between the central-station display systems and the field device network. Communications controller shall provide functions required to attain the specified network communications performance.
- F. Field equipment shall include controllers, sensors, and controls.
 - 1. Controllers shall serve as an interface between the central station and sensors and controls.
 - 2. Data exchange between the central station and the controllers shall include down-line transmission of commands, software, and databases to controllers.
 - 3. The up-line data exchange from the controller to the central station shall include status data such as intrusion alarms, status reports, and entry-control records.
 - 4. Controllers are classified as alarm-annunciation or entry-control type.
- G. System Response to Alarms:
 - 1. Field device network shall provide a system end-to-end response time of one second or less for every device connected to the system.
 - 2. Alarms shall be annunciated at the central station within one second of the alarm occurring at a controller or at a device controlled by a local controller, and within 100 ms if the alarm occurs at the central station.
 - 3. Alarm and status changes shall be displayed within 100 ms after receipt of data by the central station.
- H. False-Alarm Reduction: The design of the central station and controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.
- I. Error Detection:
 - 1. Use a cyclic code method to detect single- and double-bit errors, burst errors of eight bits or fewer, and at least 99 percent of all other multibit and burst errors between controllers and the central station.
 - 2. Interactive or product error-detection codes alone will not be acceptable.
 - 3. A message shall be in error if one bit is received incorrectly.
 - 4. Retransmit messages with detected errors.
 - 5. Allow for an operator-assigned two-digit decimal number to each communications link representing the number of retransmission attempts.

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6. Monitor the frequency of data transmission failure for display and logging.
 - J. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.
 - K. Door Hardware Interface:
 1. Comply with requirements in Section 087100 "Door Hardware" and Section 087111 "Door Hardware (Descriptive Specification)" for door hardware required to be monitored or controlled by the security access system.
 2. Electrical characteristics of controllers shall match the signal and power requirements of door hardware.
- 2.4 APPLICATION SOFTWARE
- A. System Software: Based on 32-bit, Microsoft Windows workstation operating system and application software.
 1. Multiuser multitasking shall allow independent activities and monitoring to occur simultaneously at different workstations.
 2. Capability for future additions within the indicated system size limits.
 3. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
 4. Password-protected operator login and access.
 - B. Application Software: Interface between the alarm annunciation and entry-control controllers to monitor sensors, operate displays, report alarms, generate reports, and help train system operators.
 1. Reside at the central station, workstations, and controllers as required to perform specified functions.
 2. Operate and manage peripheral devices.
 3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
 4. Import custom icons into graphics to represent alarms and I/O devices.
 5. Globally link I/O so that any I/O can link to any other I/O within the same Location without requiring interaction with the host PC. This operation shall be at the controller.
 6. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the controller.
 7. Messages from PC to controllers and controllers to controllers shall be on a polled network that utilizes check summing and acknowledgment of each message. Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.
 8. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
 9. Automatic and encrypted backups for database and history backups shall be automatically stored at a selected workstation and encrypted with a nine-character alphanumeric password that must be used to restore or read data contained in backup.
 10. Operator audit trail for recording and reporting all changes made to database and system software.

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11. Support network protocol and topology, TCP/IP, Novel Netware, Digital Pathworks, Banyan Vines, LAN/WAN, and RAS.
- C. Controller Software:
1. Controllers shall operate as autonomous, intelligent processing units.
 - a. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door-locking schedules for their operation, independent of other system components.
 - b. Controllers shall be part of a fully distributed processing-control network.
 - c. The portion of the database associated with a controller, and consisting of parameters, constraints, and the latest value or status of points connected to that controller, shall be maintained in the controller.
 2. The following functions shall be fully implemented and operational within each controller:
 - a. Monitoring inputs.
 - b. Controlling outputs.
 - c. Automatically reporting alarms to the central station.
 - d. Reporting of sensor and output status to the central station on request.
 - e. Maintaining real time, automatically updated by the central station at least once a day.
 - f. Communicating with the central station.
 - g. Executing controller resident programs.
 - h. Diagnosing.
 - i. Downloading and uploading data to and from the central station.
 3. Controller Operations at a Location:
 - a. Globally operating I/O linking and anti-passback functions between controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the central station or workstations are off-line.
 - b. In the event of communication failure between the central station and a Location, there shall be no degradation in operations at the controllers at that Location. Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
 - c. Buffered events shall be handled in a first-in-first-out mode of operation.
 4. Individual Controller Operation:
 - a. Controllers shall transmit alarms, status changes, and other data to the central station when communications circuits are operable. If communications are not available, controllers shall function in a stand-alone mode; operational data, including the status and alarm data normally transmitted to the central station, shall be stored for later transmission to the central station. Storage capacity for the latest 1024 events shall be provided at each controller.
 - b. Card-reader ports of a controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be

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used simultaneously at different controllers or within the same controller.

- c. Controllers shall provide a response to card readers or keypad entries in less than 0.25 seconds, regardless of system size.
 - d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to their proper working state. This shall happen without any operator intervention.
 - e. Initial Startup: When controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each controller.
 - f. On failure for any reason, controllers shall perform an orderly shutdown and force controller outputs to a predetermined failure-mode state, consistent with the failure modes shown and the associated control device.
 - g. After power is restored, following a power failure, startup software shall initiate self-test diagnostic routines, after which controllers shall resume normal operation.
 - h. After controller failure, if the database and application software are no longer resident, controllers shall not restart but shall remain in the failure mode until repaired. If database and application programs are resident, controllers shall immediately resume operation. If not, software shall be restored automatically from the central station.
5. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the central station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

D. Central Station-to-Controller Communications:

1. Central workstation communications shall use the following:
 - a. TCP/IP LAN interface cards.
2. TCP/IP network interface card (NIV) shall have an option to set the poll-frequency and message-response time-out settings.
3. PC-to-controller and controller-to-controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each message. All communications in this subparagraph shall be verified and buffered, and retransmitted if not acknowledged.

E. TCP/IP Central Station-to-Controller Communications:

1. Communication software on the Central Station shall supervise the Central Station-to-controller communications link.
2. Loss of communications to any controller shall result in an alarm at all Central Stations running the communication software.
3. When communications are restored, all buffered events shall automatically upload to the Central Station, and any database changes shall be automatically sent to the controller.

F. Database Downloads:

1. All data transmissions from Central Stations to a Location shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.
2. If a controller is reset for any reason, it shall automatically request and receive a database

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download from the Central Station. The download shall restore data stored at the controller to their normal working state and shall take place with no operator intervention.

G. Operator Access Control:

1. Control operator access to system controls through three password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
2. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
3. A minimum of 32 passwords shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.
4. The password shall not be displayed or printed.
5. Each password shall be definable and assignable for the following:
 - a. Selected commands to be usable.
 - b. Access to system software.
 - c. Access to application software.
 - d. Individual zones that are to be accessed.
 - e. Access to database.

H. Operator Commands:

1. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be a word, a phrase, or an acronym.
2. Tasks that are executed by operator's commands shall include the following:
 - a. Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
 - b. Place Zone in Access: Used to remotely disable intrusion-alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
 - c. Place Zone in Secure: Used to remotely activate intrusion-alarm circuits emanating from a specific zone.
 - d. System Test: Allows the operator to initiate a system-wide operational test.
 - e. Zone Test: Allows the operator to initiate an operational test for a specific zone.
 - f. Print reports.
 - g. Change Operator: Used for changing operators.
 - h. Display Graphics: Used to show any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
 - i. Run system tests.
 - j. Generate and format reports.
 - k. Request help with the system operation.
 - 1) Include in main menus.
 - 2) Provide unique, descriptive, context-sensitive help for selections and

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functions with the press of one function key.

- 3) Provide navigation to specific topic from within the first help window.
- 4) Help shall be accessible outside the application program.
- l. Entry-Control Commands:
 - 1) Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
 - 2) Arm or disarm each monitored input up to four times a day through time-zone programming.
 - 3) Enable or disable readers or keypads up to two times a day through time-zone programming.
 - 4) Enable or disable cards or codes up to four times a day per entry point through access-level programming.
3. Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:
 - a. Command entered is incorrect or incomplete.
 - b. Operator is restricted from using that command.
 - c. Command addresses a point that is disabled or out of service.
 - d. Command addresses a point that does not exist.
 - e. Command is outside the system's capacity.
- I. Alarms:
 1. System Setup:
 - a. Assign manual and automatic responses to incoming-point status change or alarms.
 - b. Automatically respond to input with a link to other inputs, outputs, or operator-response plans; unique sound with use of WAV files; and maps or images that graphically represent the point location.
 - c. Sixty-character message field for each alarm.
 - d. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point.
 - e. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
 - f. Allow 25 secondary messages with a field of four lines of 60 characters each.
 - g. Store the most recent 1000 alarms for recall by the operator using the report generator.
 2. Software Tamper:
 - a. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
 - b. Annunciate a software tamper alarm when an operator or other individual makes

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- three consecutive unsuccessful attempts to invoke functions beyond the authorization level.
- c. Maintain a transcript file of the last 5000 commands entered at each central station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
 - d. Allow only acknowledgment of software tamper alarms.
3. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
 4. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
 5. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
 6. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
- J. Alarm Monitoring: Monitor sensors, controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.
1. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.
 2. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
 3. Maps shall automatically display the alarm condition for each input assigned to that map if that option is selected for that input location.
 4. Alarms initiate a status of "pending" and require the following two handling steps by operators:
 - a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
 - b. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.
 5. Each workstation shall display the total pending alarms and total unresolved alarms.
 6. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.
 7. Alarms shall transmit to the central station in real time except for allowing connection time for dial-up locations.
 8. Alarms shall be displayed and managed from a minimum of four different windows.
 - a. Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
 - b. History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
 - c. Alarm Log Transaction Window: Display name, time, and date in red. Selecting

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red text will acknowledge the alarm.

9. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
 10. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.
 11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
 12. Identical alarms from the same alarm point shall be acknowledged at the same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
 13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and controllers.
 14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.
- K. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.
1. Color Code:
 - a. FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
 - b. STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
 - c. YELLOW: Advises operator that a zone is in access.
 - d. GREEN: Indicates that a zone is secure and that power is on.
 2. Graphics:
 - a. Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.
 - b. Allow I/O to be placed on graphic maps by the drag-and-drop method.
 - c. Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on the graphic map.
 - d. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic maps associated with I/Os.
 - e. Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.
- L. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.
1. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.
- M. Report-Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest-priority activity. Report-generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of

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operator generating the report. Report formats may be configured by operators.

1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of the period; and the default printer.
2. Printing on Request: An operator may request a printout of any report.
3. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm, the type of sensor, the location, the time, and the action taken.
4. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.
5. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
6. Automatic History Reports: Named, saved, and scheduled for automatic generation.
7. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.
8. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
9. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.
10. Who Is "In" (Muster) Report:
 - a. Emergency Muster Report: One-click operation on toolbar launches report.
 - b. Cardholder Report. Contain a count of persons who are "In" at a selected Location and a detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.
11. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that data are available on-site at all times.
12. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events, or alarms only.
13. History Reports: Custom reports that allow the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.
 - a. Initially store history on the hard disk of the host PC.
 - b. Permit viewing of the history on workstations or print history to any system printer.
 - c. The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
 - d. Each report shall depict the date, time, event type, event description, and device; or I/O name, cardholder group assignment, and cardholder name or code number.
 - e. Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
 - f. Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms

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occurred during that period.

14. Reports shall have the following four options:
 - a. View on screen.
 - b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to the system.
 - c. "Save to File" with full path statement.
 - d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
 15. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:
 - a. Active, inactive, or future activate or deactivate.
 - b. Code number, name, or imprinted card number.
 - c. Group, Location access levels.
 - d. Start and stop code range.
 - e. Codes that have not been used since a selectable number of days.
 - f. In, out, or either status.
 - g. Codes with trace designation.
 16. The reports of system database shall allow options so that every data field may be printed.
 17. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.
- N. Anti-Passback:
1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
 2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes through a reader of opposite designation.
 3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
 4. Timed Anti-Passback: A controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
 5. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
 6. The anti-passback schemes shall be definable for each individual door.
 7. The Master Access Level shall override anti-passback.
 8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential-holder population anti-passback status to a neutral status.

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O. Visitor Assignment:

1. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only those access levels that have been designated as approved for visitors.
2. Provide an automated log of visitor name, time and doors accessed, and name of person contacted.
3. Allow a visitor designation to be assigned to a credential holder.
4. Security access system shall be able to restrict the access levels that may be assigned to credentials issued to visitors.
5. Allow operator to recall visitors' credential-holder file once a visitor is enrolled in the system.
6. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.
7. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

P. Time and Attendance:

1. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
2. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length designated in the report.
3. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.
 - a. Reports shall show in and out times for each day, total time in for each day, and a total time in for period specified by the user.
 - b. Allow the operator to view and print the reports, or save the reports to a file.
 - c. Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.

2.5 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Section 264313 "Surge Protection for Low- Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

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2.6 STANDARD CENTRAL-WORKSTATION HARDWARE

- A. Central-workstation shall consist of a standard unmodified PC with accessories and peripherals that configure the workstations for a specific duty. The station will be Owner furnished.

2.7 CONTROLLERS

- A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the central station or workstation for controlling its operation.
- B. Subject to compliance with requirements in this article, manufacturers may use multipurpose controllers.
- C. Entry-Control Controller:
 - 1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personnel identity-verification devices, door strikes, magnetic latches, gate and door operators, and exit push buttons.
 - a. Operate as a stand-alone portal controller using the downloaded database during periods of communication loss between the controller and the field-device network.
 - b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
 - 1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
 - 2) Privileges shall include, but are not limited to, time of day control, day of week control, group control, and visitor escort control.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
 - 2. Inputs:
 - a. Data from entry-control devices; use this input to change modes between access and secure.
 - b. Database downloads and updates from the central station that include enrollment and privilege information.
 - 3. Outputs:
 - a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
 - b. Grant or deny entry by sending control signals to portal-control devices.
 - c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the central station.
 - d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.
 - 4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
 - 5. Data Line Problems: For periods of loss of communication with the central station, or when

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data transmission is degraded and generating continuous checksum errors, the controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.

- a. Store up to 1000 transactions during periods of communication loss between the controller and access-control devices for subsequent upload to the central station on restoration of communication.
6. Controller Power: NFPA 70, Class II power-supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
 - a. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full one-year warranty and a pro rata 9-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
 - b. Backup Power-Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.
 - c. Power Monitoring: Provide manual, dynamic battery-load test, initiated and monitored at the control center; with automatic disconnection of the controller when battery voltage drops below controller limits. Report by using local controller-mounted digital displays and by communicating status to central station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:
 - 1) Trouble Alarm: Normal power-off load assumed by battery.
 - 2) Trouble Alarm: Low battery.
 - 3) Alarm: Power off.

2.8 CARD READERS AND CREDENTIAL CARDS

- A. Card-Reader Power: Powered from its associated controller, including its standby power source, and shall not dissipate more than 5 W.
- B. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the controller. Response time shall be 800 ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.
- C. Enclosure: Suitable for surface, semi-flush, pedestal, or weatherproof mounting. Mounting types shall additionally be suitable for installation in the following locations:
 1. Indoors, controlled environment.
 2. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.
- D. Display: Digital visual indicator shall provide visible status indications and user prompts. Indicate power on or off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.
- E. Touch-Plate and Proximity Readers:
 1. Active-detection proximity card readers shall provide power to compatible credential cards through magnetic induction, and shall receive and decode a unique identification code number transmitted from the credential card.
 2. Passive-detection proximity card readers shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential

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cards. The resonant frequencies read shall constitute a unique identification code number.

3. The card reader shall read proximity cards in a range from direct contact to at least 6 inches (150 mm) from the reader.

- F. Communication Protocol: Compatible with local processor.
- G. Touch-Plate and Contactless Card Reader: The reader shall have "flash" download capability to accommodate card format changes. The card reader shall have capability of transmitting data to security control panel and shall comply with ISO/IEC 7816.
- H. Credential Card Modification: Entry-control cards shall be able to be modified by lamination direct print process during the enrollment process without reduction of readability. The design of the credential cards shall allow for the addition of at least one slot or hole to accommodate the attachment of a clip for affixing the credential card to the badge holder used at the site.
- I. Card Size and Dimensional Stability: Credential cards shall be dimensionally stable so that an undamaged card with deformations resulting from normal use shall be readable by the card reader.
- J. Card Material: Abrasion resistant, nonflammable, nontoxic, and impervious to solar radiation and effects of ultraviolet light.

2.9 DOOR HARDWARE INTERFACE

- A. Exit Device with Alarm: Operation of the exit device shall generate an alarm. Exit device and alarm contacts are specified in Section 087100 "Door Hardware."
- B. Exit Alarm: Operation of a monitored door shall generate an alarm. Exit devices and alarm contacts are specified in Section 087100 "Door Hardware."
- C. Electric Door Strikes: Use end-of-line resistors to provide power-line supervision. Signal switches shall transmit data to controller to indicate when the bolt is not engaged and the strike mechanism is unlocked, and they shall report a forced entry. Power and signal shall be from the controller. Electric strikes are specified in Section 087100 "Door Hardware."

2.10 CABLES

- A. General Cable Requirements: Comply with requirements in Section 260519 "Low Voltage Conductors and Cables" and as recommended by system manufacturer for integration requirement.
- B. LAN Cabling:
 1. Comply with requirements in Section 260519 "Low Voltage Conductors and Cables."
 2. NFPA 262.

2.11 TRANSFORMERS

- A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

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- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. Comply with TIA/EIA 606-A, "Administration Standard for Commercial Telecommunications Infrastructure."
- C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.
 - 1. Record setup data for control station and workstations.
 - 2. For each Location, record setup of controller features and access requirements.
 - 3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
 - 4. Set up groups, facility codes, linking, and list inputs and outputs for each controller.
 - 5. Assign action message names and compose messages.
 - 6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
 - 7. Prepare and install alarm graphic maps.
 - 8. Develop user-defined fields.
 - 9. Develop screen layout formats.
 - 10. Propose setups for guard tours and key control.
 - 11. Complete system diagnostics and operation verification.
 - 12. Prepare a specific plan for system testing, startup, and demonstration.
 - 13. Develop acceptance test concept and, on approval, develop specifics of the test.
 - 14. Develop cable and asset-management system details; input data from construction documents. Include system schematics and Visio Technical Drawings in electronic format.
- D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.3 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Construction."
- B. Install cables and wiring according to requirements in Section 260519 "Low Voltage Conductors and Cables."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- D. Install LAN cables using techniques, practices, and methods that are consistent with Category 6 rating of components and fiber-optic rating of components, and that ensure Category 6 and fiber-optic performance of completed and linked signal paths, end to end.
- E. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

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F. Install end-of-line resistors at the field device location and not at the controller or panel location.

3.4 CABLE APPLICATION

A. Comply with TIA 569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. TIA 232-F Cabling: Install at a maximum distance of 50 ft. (15 m).

D. TIA 485-A Cabling: Install at a maximum distance of 4000 ft. (1220 m).

E. Card Readers and Keypads:

1. Install number of conductor pairs recommended by manufacturer for the functions specified.

2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from controller to the reader is 250 ft. (75 m), and install No. 20 AWG wire if maximum distance is 500 ft. (150 m).

3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the controller.

4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from controller to electrically powered locks. Do not exceed 250 ft. (75 m).

G. Install minimum No. 18 AWG ac power wire from transformer to controller, with a maximum distance of 25 ft. (8 m).

3.5 GROUNDING

A. Comply with 280526, "Grounding and Bonding for Electronic Safety and Security."

B. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Bond shields and drain conductors to ground at only one point in each circuit.

3.6 INSTALLATION

A. Install card readers, keypads and push buttons.

3.7 IDENTIFICATION

A. In addition to requirements in this article, comply with applicable requirements in Section 260553 "Identification for Electrical Systems" and with TIA/EIA 606-A.

B. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of wire is consistent with the associated wire connected and numbered within the panel or cabinet.

C. At completion, cable and asset management software shall reflect as-built conditions.

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3.8 SYSTEM SOFTWARE AND HARDWARE

- A. Develop, install, and test software and hardware, and perform database tests for the complete and proper operation of systems involved. Assign software license to Owner.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-B.1, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-B.1.
 - 2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
 - 3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
- C. Devices and circuits will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 STARTUP SERVICE

- A. Engage a factory-authorized service representative to supervise and assist with startup service.
 - 1. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.
 - 2. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.11 PROTECTION

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.12 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system.
- B. Develop separate training modules for the following:
 - 1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.

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2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.

END OF SECTION

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Benches
 - 2. Bicycle Lockers.
 - 3. Bus Transit Shelters.
 - 4. Ash Trays
 - 5. Trash Receptacles

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each color and texture specified.
- C. Shop Drawings. For Bus Transit Shelters, include the following:
 - 1. Include design of shelter foundations.
 - 2. Indicate wiring pathway including fixture locations and handholes (refer to electrical drawings).
 - 3. Assembly instructions.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Manufacturer/Product: Basis of Design Product is Victor Stanley's Eva Backless bench.
- B. Description:
 - 1. Size: 4' length
 - 2. Armrests at each end and intermediate at center.
 - 3. Material: Aluminum
 - 4. Finish: Powder-coated.
 - 5. Color: Black
- C. Quantity: Provide (2) for each bus shelter.

SECTION 323300 - SITE FURNISHINGS

2.2 BICYCLE LOCKERS

- A. Manufacturer/Product: Basis of Design Product is CycleSafe Inc.'s ProPark Bike Locker Bank. Other Manufacturers offering similar products may submit product information for possible approval and incorporation into the Project.
- B. Description: 2 door locker with diagonal interior partition providing parking for 2 bikes per unit, double tier type capable of supporting additional lockers above. Includes starter and add-on units.
 - 1. Material: Non-corrosive composite – hot compression molded
 - 2. In-bank Size: 38"W x 77-5/8" L x 50-1/2" H
 - 3. Color: Quartz Grey RAL 7039
 - 4. Lock: T-Handle, keyed (standard)

2.3 BUS TRANSIT SHELTERS

- A. Manufacturer/Product: Basis of Design Product is Brasco International's "Aero". Other Manufacturers offering similar products may submit product information for possible approval and incorporation into the Project.
- B. Description: Arch shaped vaulted roof structure supported by columns at the center ends of each vault segment.
 - 1. Size: 9'W x 19'L.
 - 2. Roof: Arch-shaped multiwall structured polycarbonate Batten
 - 3. Columns: 4" steel – hoop column style branching from steel base plate
 - 4. Hoop Ring: solid infill with custom transit graphic decal. Graphic original shall be provided by the City.
 - 5. Finish: Powder-coated paint – Color as selected by City from full product line.
 - 6. Lighting: AC-powered integral LED lights – (4) 24" for each 9x19 shelter. Brasco's UL listed "Eclipse"; powder-coated aluminum. Shelters shall provide electrical path from stub-up conduit at/through column/column base. Include hand holes (refer to electrical drawings). Pre-wire to maximum extent possible at factory. For any path without pre-wiring, include pull chords for on-site wiring.
- C. Foundation: Design of concrete foundation and mechanical connections between shelter structure and foundation is the responsibility of the Manufacturer. Local wind speeds are indication on the Drawings. Minimum requirements for depth of slab and reinforcing are also indicated. Drawings call for the use of chemical anchor bolts but Manufacturer may require the use of embedded anchor bolts if necessary. Selection of anchor size and type is the responsibility of the Manufacturer. Assume concrete has a minimum compressive strength of 3000psi.

2.4 ASH TRAYS

- A. Manufacturer/Product: Basis of Design Product is Sidewalk Buttler's Bolt-on Ash Tray. Other Manufacturers offering similar products may submit product information for possible approval and incorporation into the Project.

SECTION 323300 - SITE FURNISHINGS

- B. Description: A vandal-proof rectangular 1/8" aluminum cigarette butt vessel with pyramidal lid. And touch-free emptying.
- C. Finish: Powder-coated.
- D. Color: Black
- E. Installation: Bolt to trash receptacle plastic wood enclosure.

2.5 TRASH RECEPTACLES

- A. Manufacturer/Product: Basis of Design Product is Bear Savers HA Series Trash Enclosure # HA-P. Other Manufacturers offering similar products may submit product information for possible approval and incorporation into the Project.
- B. Description:
 - 1. Capacity: 40 gallons (can included)
 - 2. Enclosure: Gray plastic wood siding
 - 3. Steel materials to be powder-coated.
 - 4. Color: Black
- C. Installation: Anchor to concrete paving per Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Bus Transit Shelter: Provide complete written and illustrated assembly instructions.
- E. Bus Transit Shelter electrical power shall be fed from underground conduit stubbed up adjacent to shelter end column. Coordinate location with Manufacturer.
- F. Bus Transit Shelter Foundations: Refer to Civil and Structural plans. Column plates shall be secured to concrete foundations using chemical anchors as recommended by shelter manufacturer.

END OF SECTION 323300

SECTION 346013 - VEHICLE CHARGING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electric vehicle charging systems.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 – Cast-in-Place Concrete: Concrete pad for pedestal-mount installation.
- B. Division 26 – Electrical: Circuit breaker, electrical conduit, and electrical supply wires.

1.3 REFERENCE STANDARDS

- A. IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code).
- B. ISO/IEC 15693 – Identification cards -- Contactless integrated circuit cards -- Vicinity cards.
- C. National Electrical Code (NEC) Article 625 – Electric Vehicle Charging System.
- D. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NFPA 70 – National Electrical Code (NEC).
- F. SAE J1772 – Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler.
- G. UL 2231-1 – Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements.
- H. UL 2231-2 – Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems.
- I. UL 2594 – Electric Vehicle Supply Equipment.

1.4 PREINSTALLATION MEETINGS

- A. Convene preinstallation meeting before start of installation of electric vehicle charging systems.
- B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, installer, and manufacturer’s representative.
- C. Review materials, installation, adjusting, cleaning, demonstration, instruction and training, protection, maintenance, and coordination with other work.

1.5 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Product Data:
 - 1. Submit manufacturer’s product data, including installation instructions.
 - 2. Submit manufacturer’s project proposal describing electric vehicle charging subsystems:
 - a. Charging station.
 - b. Mounting device options.
 - c. Web-based software and network services, local paying processing software.
- C. Shop Drawings: Submit project shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, electrical wiring diagrams, options, and accessories as required by Owner.
- D. Manufacturer’s Project References: Submit manufacturer’s list of successfully completed electric vehicle charging system projects, including project name and location, name of architect, and type and quantity of electric vehicle charging systems furnished.
- E. Operation and Maintenance Data: Provide detailed information required for Owner to properly

SECTION 346013 - VEHICLE CHARGING EQUIPMENT

operate and maintain equipment.

- F. Warranty Documentation: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 3 years, in the manufacturing of electric vehicle charging systems of similar type to that specified.
- B. Installer's Qualifications:
 - 1. Installer regularly engaged, for a minimum of 5 years, in installation of low-voltage distribution equipment.
 - 2. Employ persons trained for installation of low-voltage distribution equipment.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store materials in clean, dry area indoors.
 - 4. Protect materials and finish during storage, handling, and installation to prevent damage.

1.8 WARRANTY

- A. Warranty Period: 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer:
 - 1. Basis of Design: HCS Series by ClipperCreek, 11850 Kemper Road, Auburn, CA 95630. Toll Free 877-694-4194, website: www.clippercreek.com, email: amanda@clippercreek.net
 - 2. Substitutions meeting technical requirements of this specification will be consider.
- B. Single Source: Provide electric charging stations complete each from the same, single manufacturer.

2.2 ELECTRIC VEHICLE CHARGING SYSTEMS

- A. Electric Vehicle Charging Systems:
 - 1. Electric vehicle charging stations.
 - 2. Software and network services.
 - 3. Electric vehicle driver access.
 - 4. Maintenance and service.
 - 5. Installation and training.

2.3 ELECTRIC VEHICLE CHARGING STATIONS

- A. Electric Vehicle Charging Stations: "HCS-60R" or equal with the following:.

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1. Mounting: Dual-head pedestal mount.
 2. Head Unit:
 - a. Factory-assembled, 1-piece, sealed enclosure.
 - b. No field assembly required.
 - c. Enclosure Primary Material: Polycarbonate
 3. Access Panel: For installation and maintenance.
 4. LED Lights: Indication of electric vehicle charging station status.
 - a. Steady Amber: Power applied to Station and Station available.
 - b. Steady Green: Power available to vehicle for charging.
 - c. Flashing Red: Fault.
 - d. Steady Red: Ground-fault detection.
 5. Standard Cable Management: Looped cable on rack.
 - a. When charging session is complete, electric vehicle driver returns plug to head unit and manually loops cable on stainless steel cable rack.
 6. Plug: Able to charge all new electric and plug-in hybrid electric vehicles.
 7. Electricity Metering: No metering in Electric Vehicle Charging Station. In line metering can be used
- B. Power:
1. AC Power Output, Maximum: Level 2. 10.0 kW (208 VAC at 48 FLA).
 2. AC Power Input: Level 2. 30 A; Line 1, Line 2, and Earth (no neutral).
 3. Vehicle-to-Charger Connection: SAE J1772 EV Connector, 25-foot cable.
 4. Standby Power: Under 3W typical.
 5. Service Panel Breaker: Dual-pole, 60-A, common-trip breaker, dedicated circuit.
- C. Safety:
1. Safety, Ground-Fault-Circuit Interrupt: 20 mA CCID with auto retry (1-minute delay, 3 tries).
 2. Automatic Plug-Out Detection: Power terminated, SAE J1772.
 3. General Safety Compliance: UL Certified; CCID, UL 2231-1 and UL 2231-2; Meets UL 2594; NEC Article 625 Compliant.
- D. Communications Device:
1. LED Array: 270-degree visibility, multi-color visual status indication.
- E. Site Conditions:
1. Outdoor Rated:
 - a. NEMA 4
 - b. IEC 60529: IP44.
 2. Operating Relative Humidity: Maximum 95 percent, non-condensing.
 3. Operating Temperature Range, Ambient: Minus 22 degrees F to 122 degrees F (minus 30 degrees C to 50 degrees C).
- F. Surge Protection: 5 kV at 3,000 A.

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- G. EMI Compliance: FCC Part 15 Class B.

2.4 ACCESSORIES

- A. Anchors Plates. See Plans for more information:
 1. For pedestal-mount installations.
 2. Steel.
 3. Top Plate: 3/8 inch by 8 inches by 8 inches.
 4. Tube: 18 inches by 2.5-inch diameter.
 5. Stabilizing Rods: 8 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive electric vehicle charging stations.
- B. Verify surfaces to support electric vehicle charging stations are clean, dry, flat, plumb, level, square, stable, rigid, and capable of supporting the weight.
- C. Notify Engineer of conditions that would adversely affect installation or subsequent use.
- D. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install electric vehicle charging stations in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install electric vehicle charging stations in accordance with NFPA 70.
- C. Pedestal Mount:
 1. Install concrete pad to dimensions indicated on the Drawings.
 2. Imbed anchor plate into concrete pad plumb, level, and square.
 3. Place concrete for pad as specified in Section 03 30 00.
 4. Bolt pedestal to anchor plate.
 - a. Adjust for plumb, level, and square with 4 set screws included in base.
 5. Attach head unit to pedestal.
- D. Electrical: Install circuit breaker, run electrical conduit, and connect electrical supply wires as specified in Division 26.
- E. Install electric vehicle charging stations weathertight.
- F. Cable Management: Install standard cable management in accordance with manufacturer's instructions plumb, level, and square.
- G. Manufacturer:
 1. Provide advisory assistance and guidance to installer for electrical preparation work and installation of electric vehicle charging stations.
 2. Perform testing and monitoring of electric vehicle charging stations for full operational performance.

3.3 CLEANING

- A. Clean electric vehicle charging stations promptly after installation in accordance with manufacturer's instructions.

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- B. Do not use harsh cleaning materials or methods that could damage finish.

3.4 DEMONSTRATION

- A. Demonstrate for Owner's personnel that electric vehicle charging systems function properly in every respect.

3.5 INSTRUCTION AND TRAINING

- A. Provide instruction and training of Owner's personnel in the operation and maintenance of electric vehicle charging systems.
- B. Include Instruction and Training for:
 1. Electric vehicle charging stations.
 2. Station management software.
 3. Electric vehicle driver software.
 4. Establishing access and pricing policies for Owner's electric vehicle charging station program.
- C. Provide instruction and training by factory-trained and certified representative of manufacturer.

3.6 PROTECTION

- A. Protect installed electric vehicle charging stations to ensure that, except for normal weathering, stations will be without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE

- A. Provide operational service by manufacturer to minimize system downtime and to minimize maintenance costs incurred by Owner.
 1. Service shall include full replacement of universal charging station head unit.
 2. Manufacturer shall ship replacement unit to Owner.
 3. Failed unit shall be returned to manufacturer in same box as used to ship replacement unit.
 4. Owner's electric vehicle charging system shall be immediately operational with installation of replacement unit.
- B. Include in Network Service Fee:
 1. Real-time monitoring of operational performance of electric vehicle charging stations.
 2. Automatic upgrade to latest version of system software packages, including electric vehicle charging stations, station management software, and driver account software.
 3. Access to manufacturer's 24/7 customer support.
 4. System machine-to-machine communication fees.
 5. Integration into manufacturer's network operation center.

END OF SECTION