

- 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: UL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard shall be listed and labeled with UL short circuit rating. If Series Rated Panelboard is specified-the panelboard shall be rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by UL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by UL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers
 - 1. Square D; a brand of Schneider Electric
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens Energy & Automation, Inc.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Interiors shall be completely factory assembled. These shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus interiors.
- D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- E. Mains: Circuit breaker or lugs only. Refer to panel schedules for requirements.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- H. Branch Overcurrent Protective Devices: Fused switches.
- I. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.
- J. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - 2. External Control-Power Source: 1-pole branch circuit voltage.
- K. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers
 - 1. Square D; a brand of Schneider Electric
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens Energy & Automation, Inc.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only. Refer to panel schedules for requirements.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - 2. External Control-Power Source: 1-pole branch circuit voltage.
- F. Doors: Door-in-door type. Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.04 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated. Mounting height of Over Current Protective Devices shall be 6"7" above finished floor to the center of the grip of device operating handle unless a lower height is indicated or required by code.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- K. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - i. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - ii. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - iii. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Short Circuit, Coordination, and Arc Flash Studies."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 1. Measure as directed during period of normal system loading.
 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 262713

ELECTRICITY METERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes equipment for electricity metering by Owner.

1.03 DEFINITIONS

- A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.
- B. PC: Personal computer.

1.04 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data for each type of product indicated.
- B. Shop Drawings: For electricity-metering equipment.
 - 1. Dimensioned plans and sections or elevation layouts.
 - 2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
- C. Manufacturer Seismic Qualification Certification for Electricity-Metering Equipment: Submit certification that equipment components and their mounting and anchorage provisions have been designed to remain in place without separation of any parts or loosening of factory-made connections when subjected to the seismic forces and shall include the following:
 - 1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculations.
 - 2. Detailed description of equipment mounting and anchorage devices on which the certification is based and their installation requirements.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Application and operating software documentation.
 - 2. Software licenses.
 - 3. Software service agreement.
 - 4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70 and marked for intended location and application.
- B. Owner's Meters in switchgear/switchboard/distribution board shall be installed by the manufacturer at the factory.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store, and handle modular meter center according to NECA 400.

1.09 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted in writing under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than fourteen (14) days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Owner's written permission.
 - 3. Comply with NFPA 70E.
 - 4. Provide temporary standby power through a standby diesel quiet type back-up generator complete with fuel and 7/24 monitoring if the existing service interruption exceeds 2 hours. Coordinate additional requirements with owner minimum fourteen days in advance. Indicate method of providing temporary electric service.

1.10 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
 - 1. Comply with requirements of utilities providing electrical power services.
 - 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

1.11 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years from the date of acceptance of the project by the owner.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software at no additional cost to the owner.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade his computer equipment if necessary.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D; a brand of Schneider Electric
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit

3. General Electric Company; GE Consumer & Industrial - Electrical Distribution
 4. Shark Meters.
- B. General Requirements for Owner's Meters:
1. Comply with UL 1244.
 2. Meters used for billing shall have an accuracy of 1.0 percent of reading, complying with requirements in ANSI C12.20.
 3. Meters shall be certified by [California Type Evaluation Program] <Insert agency> as complying with [Title 4, California Code of Regulations, Article 2.2] <Insert regulatory requirements>.
 4. Enclosure: NEMA 250, Type 1 minimum, with hasp for padlocking or sealing.
 5. Meters installed outdoor shall be in NEMA 4X stainless steel enclosure. Meter in enclosure shall be factory installed and assembled with strip heaters controlled by thermostat.
 6. Identification: Comply with requirements in Section 260553 "Identification for Electrical Systems."
 7. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
 8. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.
 - i. Type: Split and solid core.
 9. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
 10. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.
- C. Kilowatt-hour Meter: Electronic three-phase meters, measuring electricity used.
1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.
 3. Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.
- D. Kilowatt-hour/Demand Meter: Electronic three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.
1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.
- E. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway.

F. Accessories:

1. Fuses: Provide fuses to protect meters.
2. Shunting Devices: Provide shunting devices for maintenance of meters.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install modular meter center according to NECA 400 switchboard installation requirements.
- C. Install arc-flash labels as required by NFPA 70.
- D. Wiring Method:
 1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 271513 "Copper Horizontal Cabling."
 3. Minimum conduit size shall be 1/2 inch (13 mm).

3.02 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
 2. Equipment Identification Labels: Adhesive film labels with clear protective overlay.

3.03 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. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
 2. Turn off circuits supplied by metered feeder and secure them in off condition.
 3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
 4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results. This shall be done in the presence of Owner's Meter Shop Personnel. Coordinate through Owner's Representative.
- C. Electricity metering will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

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SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB receptacles.
3. Hazardous (classified) location receptacles.
4. Twist-locking receptacles.
5. Isolated-ground receptacles.
6. Tamper-resistant receptacles.
7. Weather-resistant receptacles.
8. Snap switches and wall-box dimmers.
9. Solid-state fan speed controls.
10. Wall-switch and exterior occupancy sensors.
11. Communications outlets.
12. Toggle switches, 120/277 V, 20 A.
13. Decorator-style devices, 20 A.
14. Pendant cord-connector devices.
15. Cord and plug sets.
16. Floor service outlets and poke-through assemblies.

1.03 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge Protective Device.
- G. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.06 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.08 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. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 - 2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

1.09 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Switches, receptacles and cover plates shall be of the same manufacturer.
- B. Comply with National Electrical Manufacturer's Association (NEMA) standards. Furnish products listed and classified by Underwriter's Laboratories Inc. as suitable for purpose specified and shown.
- C. Manufacturer shall have a minimum of ten (10) years experience in the production of wiring devices specified and shall have ISO 9001 and 9002 certifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: UL Listed and labeled and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL2459 and shall be made with stranding building wire.

2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125V, 20A: Comply with NEMA WD1, NEMA WD6 Configuration 5-20R, UL498, and FSW-C-596.
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - ii. Leviton; 5361 (single), 5362 (duplex).
 - iii. Pass & Seymour; 5361 (single), 5362 (duplex).
 2. Description: Grounded, industrial extra heavy duty specifications grade, back- and side-wired, single-piece grounding brass strap with integral ground, impact-resistant thermoplastic nylon cover and body, smooth face, with separate grounding screw and NEMA 5-20R plug configurations.
- B. Isolated-Ground, Duplex Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL498, and FSW-C-596.
1. Products: Subject to compliance with requirements, provide one of the following:
 - i. Hubbell; IG5362.
 - ii. Leviton; 5362-IG.
 - iii. Pass & Seymour; IG5362.
 - iv.
 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
- D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
- E. Controlled Duplex Receptacles, 125 V, 20A
1. Description: Two pole, three wire and self-grounding.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
 4. Marking: Shall have permanent marking per CEC 130.5 (d).
 5. USB Receptacles: Dual and quad, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
 6. Standards: Comply with UL 1310 and USB 3.0 devices.
- F. USB Charging Receptacles:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual and quad, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
3. Standards: Comply with UL 1310 and USB 3.0 devices.

G. Tamper-Resistant Duplex and USB Charging Receptacles:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
3. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.04 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
4. Include self test feature so that the outlet is automatically tested every fifteen minutes.
5. Outlets used in coastal environments shall be suitable for such applications and shall be properly protected against the ambient conditions.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; GFR5352L.
 - ii. Pass & Seymour; 2095.
 - iii. Leviton; 7590.

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; GFTR20.
 - ii. Pass & Seymour; 2095TR.

2.05 SPD RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.

1. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.

2. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex SPD Convenience Receptacles:
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; HBL5362SA.
 - ii. Leviton; 5380.
 - iii. Pass & Seymour; 5362BLSP.
 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
- C. Isolated-Ground, Duplex SPD Convenience Receptacles:
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; IG5362SA.
 - ii. Leviton; 5380-IG.
 - iii. Pass & Seymour; IG5362BLSP.
 2. Description:
 - i. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
 - ii. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.06 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - i. Cooper Crouse-Hinds.
 - ii. EGS/Appleton Electric.
 - iii. Killark; Division of Hubbell Inc.

2.07 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; HBL2310.
 - ii. Leviton; 2310.
 - iii. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; IG2310.

- ii. Leviton; 2310-IG.
- iii. Pass & Seymour; IG4700.

2. Description:

- i. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
- ii. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.08 PENDANT CORD-CONNECTOR DEVICES

A. Description:

- 1. Matching, locking-type plug and receptacle body connector.
- 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
- 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
- 4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.09 CORD AND PLUG SETS

A. Description:

- 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.10 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

- 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - 1) Single Pole:
 - 2)
 - 3) Hubbell; HBL1221.
 - 4) Leviton; 1221-2.
 - 5) Pass & Seymour; CSB20AC1.
 - 6) Two Pole:
 - 7) Hubbell; HBL1222.
 - 8) Leviton; 1222-2.

- 9) Pass & Seymour; CSB20AC2.
- 10) Three Way:
- 11) Hubbell; HBL1223.
- 12) Leviton; 1223-2.
- 13) Pass & Seymour; CSB20AC3.
- 14) Four Way:
- 15) Hubbell; HBL1224.
- 16) Leviton; 1224-2.
- 17) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

- 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; HBL1201PL for 120 and 277 V.
 - ii. Leviton; 1221-LH1.
 - iii. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.
- 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - i. Hubbell; HBL1221L.
 - ii. Leviton; 1221-2L.
 - iii. Pass & Seymour; PS20AC1-L.
- 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - i. Hubbell; HBL2057.
 - ii. Leviton; 1257.
 - iii. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - i. Hubbell; HBL2057L.
 - ii. Leviton; 1257L.
 - iii. Pass & Seymour; 1251L.

2.11 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; DR20.
 - ii. Leviton; 16252.
 - iii. Pass & Seymour; 26252.
- B. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; DR20TR.
 - ii. Pass & Seymour; TR26252.
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; DR20TR.
 - ii. LevitonTRW20.
 - iii. Pass & Seymour; TRW26252.
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.
- D. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.
 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; GF20LA.
 - ii. Leviton; 8599.
 - iii. Pass & Seymour; 2094.
- E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.
 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; GFTR20.
 - ii. Pass & Seymour; 2094TRWR.
 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- F. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Hubbell; DS120 (single pole), DS320 (three way).
 - ii. Leviton; 5621-2 (single pole), 5623-2 (three way).
 - iii. Pass & Seymour; 2621 (single pole), 2623 (three way).
- G. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - i. Cooper; 7631 (single pole), 7633 (three way).
 - ii. Hubbell; DS120IL (single pole), DS320 (three way).
 - iii. Leviton; 5631-2 (single pole), 5633-2 (three way).
 - iv. Pass & Seymour; 2625 (single pole), 2626 (three way).
 2. Description: With neon-lighted handle, illuminated when switch is "off."

2.12 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular or round, solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 271513 "Copper Horizontal Cabling."

2.14 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Pass & Seymour/Legrand.
 3. Square D/Schneider Electric.
 4. Thomas & Betts Corporation.
 5. Wiremold/Legrand.
- B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: [Pedestal type with services indicated] [Flush type with two simplex receptacles and space for two RJ-45 jacks] [Flush type with four simplex receptacles and space for four RJ-45 jacks] complying with requirements in Section 271500 "Communications Horizontal Cabling."
4. Size: Selected to fit nominal 8 inch cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 271500 "Communications Horizontal Cabling."

2.15 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. SPD Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - i. Cut back and pigtail, or replace all damaged conductors.
 - ii. Straighten conductors that remain and remove corrosion and foreign matter.
 - iii. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 20-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports. Submit reports within two (2) weeks of completion of tests.

END OF SECTION

SECTION 262813

FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches.
2. Spare-fuse cabinets.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - i. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - ii. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 3. Current-limitation curves for fuses with current-limiting characteristics.
 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 5. Coordination charts and tables and related data.
 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 4. Coordination charts and tables and related data.

1.05 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

1.07 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.08 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Bussmann, Inc.
 2. Edison Fuse, Inc.
 3. Ferraz Shawmut, Inc.
 4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.03 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 2. Finish: Gray, baked enamel.
 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Service Entrance: Class L, fast acting.
 - 2. Feeders: Class L, fast acting.
 - 3. Motor Branch Circuits: Class RK1, time delay.
 - 4. Other Branch Circuits: Class RK1, time delay.
 - 5. Control Circuits: Class CC, fast acting.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.04 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.08 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.09 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than 14 days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.11 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Bussmann, Inc.
 2. Ferraz Shawmut, Inc.

3. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 1. Oiltight key switch for key-to-test function.
 2. Oiltight red ON pilot light.
 3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 4. Form C alarm contacts that change state when switch is tripped.
 5. Three-pole, double-throw, fire-safety and alarm relay; verify coil voltage.
 6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I^2t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.05 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - i. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - ii. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - iii. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Short Circuit, Coordination and Arc Flash Studies."

END OF SECTION

SECTION 26 32 00

GENERATOR TANKS

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION AND STANDARDS

- A. Provide the rectangular ConVault® Aboveground Tank system constructed and listed in accordance with Underwriters Laboratories, Inc. (UL) Standard 2085, Aboveground Storage Tanks for Flammable and Combustible Liquids, Protected Type, Non-Metallic Secondary Containment with Vehicle Impact and Projectile Resistance. The tank system shall be listed for ballistics protection in accordance with UL Standard 752, Levels 5, 6 and 8.
- B. The tank system must comply with all provisions of: 1) UFC 79-7, Appendix A-II-F, for both Vehicle Impact Protection and Projectile Resistance; 2) NFPA 30 and 30A; 3) IFC Chapter 22; and 4) IFC Chapter 34.
- C. The tank system shall be tested, certified and approved for Vapor Recovery by the State of California Air Resource Board (CARB) under Executive Order VR-302-B Standing Loss Control Recovery System for New Installations of Aboveground Storage Tanks effective 11/30/09.
- D. The tank system shall be warranted by the manufacturer against defects in material or workmanship for 30 years following the delivery of the tank. Warranties that limit such coverage for shorter periods will not be permitted. See warranty documents.
- E. The tank system shall be manufactured and labeled in strict accordance with ConVault® standards as applied by a licensee of Convault, Inc. The tank system shall be subject to the Convault Quality Assurance Program.

PART 2 – DESIGN AND CONSTRUCTION

- A. Tank: The primary tank shall be rectangular in shape and listed per UL Standard 142. Welds shall be continuous on all sides and exterior seams, conforming to the American Welding Society Standard for continuous weld. Prior to leaving the manufacturing facility, the primary steel tank shall be pressure tested at 5 psig for a minimum of 24 hours. All openings shall be from the top only.
- B. Secondary Containment and Corrosion Protection: The tank system shall include secondary containment consisting of an impervious barrier of 30 Mil (0.76 mm) High-Density Polyethylene geomembrane enclosing the primary steel tank and insulation material to contain leaks from the primary tank and isolating the primary tank from the concrete to protect against corrosion. The secondary containment shall be impervious to corrosion, including damage or failure due to microbial infestation.
- C. Secondary containment comprised of a steel jacket not encased with concrete will not be permitted.
- D. Concrete Encasement: A vaulted concrete enclosure shall encase and protect both the primary steel tank and the secondary containment. The concrete encasement shall be 6" thick with a minimum design strength of 4000 psi. The concrete design shall include the following for long-term durability: air entrainment, water-reducing admixture, and steel reinforcement. Concrete placement shall be a visually verifiable monolithic (seamless) pour to ensure the absence of voids on all sides and beneath the steel tank.
- E. The vault enclosure shall have concrete support legs of unitized monolithic construction raising the concrete enclosure a minimum of 3" above the ground to meet visual inspection require-

ments. A mid-level seam or other cold joint construction which could compromise the liquid tightness (secondary containment) and fire protection capability of the vault is not permitted.

- F. Thermal Protection: The tank system construction shall include covering the outer surface of the primary steel tank with a minimum 1/4" inch of polystyrene foam panels and 6" thick reinforced concrete for thermal insulation to protect against temperature extremes.
- G. Corrosion Protection: All steel outside the concrete encasement shall be anti-oxidant powder coated to inhibit corrosion and meet ASTM B117.
- H. Ballistics Resistance: The tank system shall carry a listing under UL Ballistics Standard 752, Levels 5,6, and 8 (see table below), signifying bullet-resisting protection against penetration, passage of fragments of projectiles, or fragmentation of the vault enclosure to the extent that any protected material, including the secondary containment and primary tank are not damaged.

UL 752 RATINGS TABLE

PROTECTION LEVEL	# OF SHOTS	DISTANCE	GRAIN	AMMUNITION
Level 5	1	15	150	7.62mm rifle lead core full metal copper jacket, military ball
Level 6	5	15	124	9.00mm full metal copper jacket with lead core
Level 8	5	15	150	7.62mm rifle lead core full metal copper jacket, military ball

The tank system shall have been tested and passed the requirements to meet the following Ratings for Bullet Resistant Materials at a National Institute of Justice (NIJ) approved laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP):

ADDITIONAL RATINGS SYSTEMS TABLE

RATING SYSTEM AND LEVEL	# OF SHOTS	GRAIN	AMMUNITION
UL 752; Level 9	1	166	Armor piercing .30 caliber rifle steel core lead point filler full metal jacket
National Institute of Justice (NIJ); Level 4	1	166	.30-06 armor piercing
State Department SD-STD-02.01; SD-Rifle AP, .30, 30-06	3	165	(Part 1) .30-06 caliber M2AP
ASTM F-1233; .30-06 Armor Piercing Rifle	3	165	.30-06 M2 AP

- I. High Explosive (HE) Blast Resistance: The tank system design shall have been subjected to a Blast Effects Analysis (BEA) assessing resistance and performance under the following blast threat scenarios per the FEMA 426 - Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings:

BLAST RESISTANCE TABLE

BLAST SCENARIO	WEIGHT OF EXPLOSIVE DEVICE	STANDOFF DISTANCE
Man-Portable Improvised Explosive Device (MPIED)	50 pound	5 feet
Vehicle-Borne Improvised Explosive Device (VBIED)	500 pound	20 feet
Vapor Cloud Explosion (VCE)	10 psi	NA

The BEA shall conclude that the tank system will resist the explosion loads and remain intact, without failure of the primary tank or movement of the tank exceeding 2". Tank designs that do not protect the primary tank AND secondary containment by providing both Ballistics and Blast Effect resistance as specified in this Sections 2.6 and 2.7 will not be permitted.

- J. Fire Resistance: The tank system shall be designed and tested to provide 2 hour fire protection for the primary tank as per UL 2085 2-hour furnace fire test and 2 hour simulated pool fire test. The average maximum rise in temperature of the primary tank during the test shall not exceed 260° F and the maximum temperature of any single point on the primary tank shall not exceed 400° F. No steel members shall penetrate the walls or floor of the concrete encasement to assure isolation from pool fire heat.
- K. Leak Monitoring: A thru-tank leak detection monitoring tube terminating between the primary tank and the secondary containment shall be provided to monitor any leaks from the primary tank.
- L. Spill/Overfill Containment: The tank system shall include a UL listed 7-gallon spill/overfill container manufactured as an integral part of the primary tank, surrounding the fill pipe, and protected by 2-hour fire rating of the enclosure. The spill/overfill container shall include a stick port and normally closed drain valve to release spilled product into the main tank. Exterior steel shall be anti-oxidant powder coated to inhibit rust. Overfill containment systems that are designed to release spilled product into the interstitial area will not be accepted.
- M. Overfill Protection: Overfill protection shall be provided by the following methods: a) direct reading level gauge visible from fill pipe access; b) valve rated for pressurized delivery located within fill pipe to close automatically at 95% full level; and c) high level alarm.
- N. Exterior Finish: The tank system exterior shall be a low maintenance architectural exterior concrete finish. Models with fiber clad or painted steel exterior tanks will not be accepted.

PART 3 - EXECUTION

- A. Manufacturer will have a minimum of 10 years of experience in producing specified tank for commercial use and document at least 10 installations in satisfactory operation.
- B. The tank system shall be installed in strict accordance with the manufacturer's recommendations, industry standards, and applicable fire and environmental codes. All state and local permits shall be obtained prior to installation.

- C. The tank system shall be handled, lifted, stored and installed in accordance with the manufacturer's instructions on a reinforced concrete base slab designed to support the fully loaded tank. Protective bollards shall be installed where required by state and local codes. Tanks shall be marked on all sides with warning signs and product identification as required by applicable codes.
- D. Electrical work shall be in accordance with applicable codes and shall be rated for hazardous area as required. Electric feed for dispensing pumps shall include an emergency shutoff switch located per code requirements.
- E. The tank system shall be grounded in accordance with NFPA 780 and all electrical work shall be in accordance with applicable codes.
- F. Any proposed equal alternatives to this specification must be submitted for review and approval prior to bid opening. If the proposed alternative is deemed to present a better solution, review expenses will be waived. If the proposed alternative is denied or deemed to be equal, all expenses incurred for such review are to be paid for by the bidder prior to submittal of bid.
- G. Any proposed equal alternatives to this specification must be submitted for review and approval prior to bid opening. If the proposed alternative is deemed to present a better solution, review expenses will be waived. If the proposed alternative is denied or deemed to be equal, all expenses incurred for such review are to be paid for by the bidder prior to submittal of bid.

END OF SECTION

SECTION 263213

ENGINE GENERATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes packaged engine-generator sets for emergency power supply with the following features:
1. Diesel engine.
 2. Generators
 3. Unit-mounted cooling system.
 4. Unit-mounted control and monitoring.
 5. Performance requirements for sensitive loads.
 6. Load banks.
 7. Outdoor enclosure.
 8. Battery charger.
 9. Day tank.
 10. Muffler.
 11. Exhaust piping external to set.
 12. Remote annunciator.
 13. Remote radiator.
 14. Remote stop switch.
 15. Starting battery and charger.
 16. Active diesel particulate filter (DPF).
 17. Independent DPF support structure.
- B. Related Sections include the following:
1. Section 232113 "Hydronic Piping.
 2. Section 260548 "Vibrations and Seismic Controls"
 3. Section 260526 "Grounding and Bonding for Electrical Systems."
 4. Section 262416 "Panelboards"
 5. Section 262816 Enclosed Switches and Circuit Breakers.
 6. Section 263600 "Transfer Switches" for transfer switches including sensors and re-lays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.03 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. LP: Liquid petroleum.
- C. NETA: InterNational Electrical Testing Association
- D. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.
- E. OSHPD: Office of Statewide Health Planning and Development

1.04 STANDARDS

- A. National Electrical Manufacturer's Association (NEMA).
- B. National Fire Protection Association (NFPA).
- C. California Electric Code (CEC).
- D. California Air Resource Board (CARB).
- E. County of San Diego Air Pollution Control District (SDAPCD).
- F. South Coast Air Quality Management District (SCAQMD)

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
 - 3. Technical data sheets of each equipment.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
 - 2. Brake horsepower of engine.
 - 3. Fuel consumption and floor plans showing fuel line connections, pipe sizes and pump requirements.
 - 4. Cooling air requirements and its design.
 - 5. Noise db level.
 - 6. Electrical characteristics of generator, voltage regulator, and battery charger.
 - 7. Load graphs and load calculations to show the capabilities to supply the largest motor while connected to the full load. It shall also indicate the sequencing of the emergency load start-up.
 - 8. Control panel.
 - 9. Elevations of equipment including front elevation, side elevation, top view for complete assembly.

10. Engine and generator details, including governor, turbocharger, exciter, after/intercooler, [DPF],[day tank, main fuel storage tank and associated required pumping drawings. The work shall indicate the method of the installation of the electrical, mechanical and plumbing work.
11. Certified independent test lab data of generator characteristics, verification of emissions conformance to latest applicable regulations of CARB and AQMD.
12. Main line circuit breaker.
13. List showing manufacturer of each major component.
14. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
15. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
16. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.
17. Indicate name and place of manufacture of each major component.
18. Retain subparagraph below if an independently engineered DPF support structure is required to be provided by the contractor. Usually required for OSHPD projects.
19. DPF Support Structure Design Calculations and Details: Signed and sealed by a qualified professional engineer. Calculate requirements and provide design details for the structural support and anchorage of the DPF and associated equipment. The support structure shall support the DPF above, and independent from, the generator enclosure.

1.06 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that day tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - i. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - ii. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Manufacturer's dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. OSHPD Special Seismic Certification (OSP) pre-approval on OSHPD projects.
- B. Coordination Drawings: Floor plans, drawn to scale (1/4"=1'-0"), showing dimensioned layout, required working clearances, and required area above and around Engine Generator set where pipe and ducts are prohibited. Show Engine Generator layout and relationships be-

tween electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

- C. Manufacturer's certified letter stating that unit complies with all California State Codes, Uniform Building Code (UBC), California Air Resource Board (CARB), California Electrical Code (CEC), latest edition and supplements and National Electric Manufacturer's Association (NEMA) standards for an emergency power plant.
- D. Sound levels shall be measured in the octave bands, having center frequencies from 31.5 Hz to 8000 Hz according to the procedures given in American National Standards Institute (ANSI) Standards SI.13.71. Measurements shall be made in at least four locations as described in the standard and shall be made at a distance of one meter from the surface of the equipment. Sound levels generated shall be within acceptable limits.
- E. Qualification Data: For [installer] [manufacturer] [and] [testing agency].
- F. Source quality-control test reports.
 - 1. Certified summary of prototype-unit test report.
 - 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
 - 3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
 - 4. Certified Test Report of factory tests on units to be shipped for this Project, showing evidence of compliance with specified requirements. Submit within two (2) weeks of completion of tests. Report shall be signed by a factory testing engineer.
 - 5. Report of sound generation.
 - 6. Report of exhaust emissions showing compliance with applicable regulations.
 - 7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- G. Field quality-control test reports.
- H. Warranty: Special warranty specified in this Section.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply (address and phone number of sources).

1.08 MAINTENANCE MATERIAL SUBMITTALS

- 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. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.09 QUALITY ASSURANCE

- A. If alternate manufacturer of products other than what are specified in this section are submitted, all necessary documents not limited to cut sheets, technical information, test reports from recognized testing labs and factory test reports shall be submitted to the satisfaction of the owner/engineer to ensure quality and conformance to the specifications. Additional testing

shall be undertaken if it is concluded by the owner/engineer that the submitted test reports are either insufficient or do not include all tests necessary for product acceptance. The tests shall be conducted by a recognized lab acceptable to the owner/engineer and all tests shall be witnessed by owner's/engineer's personnel. All testing procedures and test results shall be satisfactory to the owner/engineer. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one owner's/engineer's representative to witness the test at the testing lab. Include all costs for the above in the bid.

- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 75 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Contractor shall ensure that the manufacturer has a minimum of 15 years experience in the production of Emergency/Standby Engine Generators similar to the type and size specified in this project. Furnish a list of three (3) contacts for the three (3) similar projects completed within the last 5 years. Include name, tele no and email of the facility engineers.
- D. Manufacturer shall have ISO 9001 or 9002 Certification.
- E. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project. Furnish a letter from the manufacturer confirming the availability.
- F. Engine Generators shall be assembled at the manufacturer's own manufacturing facility using its own major devices (e.g., circuit breakers) for the assembly. These devices shall be normally carried by the manufacturer as standard catalog items.
- G. Engine Generators shall comply with seismic zone applicable to the project. Unless otherwise indicated, verify requirements with Architect or Structural Engineer of Record (SEOR). Provide certified test reports of shake table test done by manufacturer on similar units.
- H. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests. Major components (e.g. engines, generators, governors, controls) shall be manufactured within six months of installation.
- I. Source Limitations: Obtain packaged engine generators, and accessories through one source from a single manufacturer through a local distributor. Manufacturer of overcurrent devices shall match other power distribution equipment on the project.
- J. Comply with ASME B15.1.
- K. Comply with NFPA 37.
- L. Comply with NFPA 70.
- M. Comply with NFPA 99.
- N. Comply with NFPA 110 requirements for Level 1, 2 emergency power supply system.
- O. Comply with UL 2200.
- P. Engine Exhaust Emissions: Comply with applicable state and local government requirements. Engine Exhaust Emissions: Apply and obtain a permit to construct and a permit to operate from Air Pollution Control District (authority having jurisdiction of the project) including payment of permit fees and health risk assessment fees. Contractor shall submit complete emission data along with the shop drawings for the generator set within six (6) weeks of receiving Notice to Proceed. Contractor shall not start installation without proper permits from the authority having jurisdiction.
- Q. Noise Emission: Comply with [applicable state and local government requirements] <Insert Project criteria> for maximum noise level at [adjacent property boundaries] <Insert critical locations> due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

- R. Product Options: Drawings indicate size, profiles, and dimensional requirements of engine generators and are based on the specific system indicated. Refer to Part 2 "Product Requirements."
- S. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, Article 100—and marked for intended location and application.
- T. Testing Agency Qualifications: Member of NETA;
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of ten (10) years and has permanent in-house testing engineers and technicians involved with testing of switchboards, panelboards and OCPDs similar to those specified on this project.
 - 2. Testing company shall be located with 50 miles radius of the project.
 - 3. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing to supervise on-site testing specified in Part 3.
- U. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
 - 2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.10 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than fourteen (14) days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 5 to 40 deg C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet.

1.11 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators and remote radiators mounted on grade. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Section 077200 "Roof Accessories."

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

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

1.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide [24 42] <Insert number> months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Caterpillar; Engine Div.
 2. Onan/Cummins Power Generation; Industrial Business Group
 3. Kohler Co.; Generator Division.

2.02 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
 1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 2. Output Connections: Three-phase, four wire or Single phase three wire. Refer to drawings for more information.
 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:
 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

E. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - i. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - i. Provide permanent magnet excitation for power source to voltage regulator.
10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE

- A. Fuel: ASTM D975-17, Diesel fuel oil, Grade 2-D S15.
- B. Rated Engine Speed: 1800 rpm.

- C. Lubrication System: The following items are mounted on engine or skid:
1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System:
1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
 3. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
 - i. Carburetor.
 - ii. Secondary Gas Regulators: One for each fuel type.
 - iii. Fuel-Shutoff Solenoid Valves: One for each fuel source.
 - iv. Flexible Fuel Connectors: One for each fuel source.
- E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - i. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
 - ii. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- G. Muffler/Silencer: Critical type, super quiet, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine back-pressure requirements. Provide stainless steel type muffler including pipe connection to engine where these are exposed to weather.
1. Minimum sound attenuation of 25 dB at 500 Hz.

2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.
- H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator. Provide new filters after completion for field tests and before acceptance by the owner.
- I. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified, 60 seconds.
 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least [twice] [three times] without recharging.
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
 7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - i. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - ii. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - iii. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - iv. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - v. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - vi. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.04 FUEL OIL STORAGE

- A. Comply with NFPA 30. Fuel system shall be complete and shall consist of a dual filtering system, fuel storage tank, day tank and engine fuel pump. Provide fuel for testing and full tank after testing.

- B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system
- C. Day Tank: Comply with UL 142, freestanding, factory-fabricated fuel tank assembly, with integral, float-controlled transfer pump and the following features:
 - 1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
 - i. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak. Alarm shall be remotely monitored by BMS system.
 - 2. Tank Capacity: [As recommended by engine manufacturer for an uninterrupted period of [4] or [8] or [24] hours' operation at 100 percent of rated power output of engine-generator system without being refilled] <Insert gallons>.
 - 3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.
 - 4. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of normal fuel level.
 - 5. High-Level Alarm Sensor: Liquid-level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
 - 6. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve.
 - 7. Redundant High-Level Fuel Shutoff: Actuated by high-level alarm sensor in day tank to operate a separate motor device that disconnects day-tank pump motor. Sensor shall signal solenoid valve, located in fuel suction line between fuel storage tank and day tank, to close. Both actions shall remain in shutoff state until manually reset. Shutoff action shall initiate an alarm signal to control panel but shall not shut down engine-generator set.
- D. Base-Mounted, Double-Wall Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 - 1. Tank level indicator.
 - 2. Capacity: Fuel for [eight] <Insert number> hours' continuous operation at 100 percent rated power output.
 - 3. Leak detection in interstitial space.
 - 4. Vandal-resistant fill cap.
 - 5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.05 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine

generator. Mounting method shall isolate the control panel from engine generator vibration. Panel powered from the engine generator battery. Include interconnection to energy control center, building BMS, Utility, and PV system.

- B. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
 10. Start-stop switch.
 11. Overspeed shutdown device.
 12. Coolant high-temperature shutdown device.
 13. Coolant low-level shutdown device.
 14. Oil low-pressure shutdown device.
 15. Fuel tank high-level shutdown of fuel supply alarm.
 16. Generator overload.
- C. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- D. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Section 260913 "Electrical Power Monitoring and Control."
- E. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
 2. Coolant low-temperature alarm.
 3. Control switch not in auto position.
 4. Battery-charger malfunction alarm.
 5. Battery low-voltage alarm.
- F. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
1. Engine high-temperature shutdown.
 2. Lube-oil, low-pressure shutdown.
 3. Overspeed shutdown.

4. Remote emergency-stop shutdown.
 5. Engine high-temperature prealarm.
 6. Lube-oil, low-pressure prealarm.
 7. Fuel tank, low-fuel level.
 8. Low coolant level.
- G. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
- H. Remote Emergency-Stop Switch: Red mushroom head type with an engraved label "EMERGENCY STOP SWITCH". Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation with a transparent see-thru lexan cover.

2.06 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker (400A Frame and above): Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
1. Tripping Characteristics: Field adjustable long-time and short-time delay and instantaneous. Trip unit shall be field replaceable.
 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 4. Mounting: Adjacent to or integrated with control and monitoring panel.
 5. Enclosure: Provide NEMA 4X stainless steel enclosure for breakers mounted exposed to weather.
- B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:
1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications. Alarm shall be remotely monitored by BMS.

2.07 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over-speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

2.08 LOAD BANK

- A. Description: Provide permanent hookup cabinet for connection of portable load bank. Details per plans.

2.09 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Roof shall be pitched for drainage and overlapping on all sides. Exhaust pipe opening shall be fitted watertight sealing material. Provide a drip shield around the exhaust pipe opening. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure and accessible by opening the hinged panel doors. Panel doors shall swing out 180 degrees.
- B. Description: Prefabricated or pre-engineered walk-in enclosure of sufficient size to allow code required clearances on all sides and maintenance. Provide with the following features:
 - 1. Construction: Galvanized-steel, or [NEMA 4X stainless steel] metal-clad, integral structural-steel-framed building erected on concrete foundation. .
 - 2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
 - 3. Seismic Design: Comply with ASCE 7, Chapter 13, as modified by 2022 California Building Code sections 1613A and 1616A.
 - 4. Enclosure shall have sound attenuation to reduce the noise to 70dB at 21 feet.
 - 5. Space Heater: Thermostatically controlled and sized to prevent condensation.
 - 6. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 7. Hinged Doors: With padlocking provisions.

8. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
 9. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
 10. Muffler Location: [Within] [External to] enclosure. Verify with owner if enclosure walls need to be extended up to hide the external muffler so that it is not visible from grade.
- C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- D. Interior Lights with Switch: Factory-wired, vapor proof-type fluorescent fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
1. AC lighting system and connection point for operation when remote source is available.
 2. DC lighting system for operation when remote source and generator are both unavailable.
- E. Convenience Outlets: Specification grade, factory wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene separated by steel shims.
 2. Number of Layers: One
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- C. Provide vibration isolation and flexible connector materials for steel piping.
- D. Provide vibration isolation and flexible connector materials for exhaust shroud and ductwork.

- E. Vibration isolation devices shall not be used to accommodate misalignments or to make bends

2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer. Verify with architect if a custom finish is required.
- B. Powder coated paint surfaces:
 - 1. Minimum Paint Thickness: 2.5 mil (0.06 mm) in accordance with ASTM D 1186-87.
 - 2. Material Hardness: ASTM D3363-92a.
 - 3. Resistance to Cracking: ASTM D522-B.
 - 4. Paint Adhesion: ASTM D3359-B.
 - 5. Resistance to Salt Water Corrosion: ASTM B117, ASTM D1654.
 - 6. Resistance to Humidity: ASTM D1735, ASTM D1654.
 - 7. Impact Resistance: ASTM 2784.
 - 8. UV Protection: SAE J1690.

2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Test generator, exciter, and voltage regulator as a unit.
 - 3. Full load run.
 - 4. Maximum power.
 - 5. Voltage regulation.
 - 6. Transient and steady-state governing.
 - 7. Single-step load pickup.
 - 8. Safety shutdown.
 - 9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
 - 10. Report factory test results within 10 days of completion of test.
- C. Report factory test results within 10 days of completion of test.
 - 1. Report shall be reviewed, signed by the factory testing engineer. Include name of the engineer, date and location of testing.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with [elastomeric isolator pads] [restrained spring isolators] having a minimum deflection of [1 inch] <Insert static deflection> on 4-inch-high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Install remote radiator with [elastomeric isolator pads] [restrained spring isolators] having a minimum deflection of [1 inch] <Insert static deflection> on [concrete base on grade] [roof equipment supports on roof].
- E. Install Schedule 40, black steel piping with welded joints for cooling water piping between engine-generator set and [heat exchanger] [remote radiator]. Piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
- F. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
- G. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
- H. Fuel Piping:
 - 1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
 - 2. Copper and galvanized steel shall not be used in the fuel-oil piping system.
- I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect cooling-system water piping to engine-generator set and [remote radiator] [heat exchanger] with flexible connectors.

- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Install exhaust-system piping. Extend to point of termination outside structure. Size piping according to manufacturer's written instructions.
 - 1. Install condensate drain piping for engine exhaust system. Extend drain piping from low points of exhaust system and from muffler to condensate traps and to point of disposition.
- F. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Section 231113 "Facility Fuel-Oil Piping."
 - 2. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural-Gas Piping."
 - 3. LP-gas piping, valves, and specialties for gas piping are specified in Section 231126 "Facility Liquefied-Petroleum Gas Piping."
- G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."
- B. Install a warning sign at the neutral to ground bond location indicating:
 - 1. "WARNING: SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THIS EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE IS ENERGIZED."

3.05 FIELD QUALITY CONTROL

- A. Provide simultaneous in-field coordination with service representatives for generator controls, and ATS vendor for complete controls.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection[(except those indicated to be optional)] for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

- i. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - ii. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - iii. Verify acceptance of charge for each element of the battery after discharge.
 - iv. Verify that measurements are within manufacturer's specifications.
 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Exhaust Emissions Test: Comply with applicable government test criteria.
 7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
 8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at [four] <Insert number> locations [on the property line] <Insert location for measurement>, and compare measured levels with required values.
- E. Coordinate tests with tests for transfer switches and run them concurrently.
 - F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - J. Remove and replace malfunctioning units and [retest] [reinspect] as specified above.
 - K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
 - L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
 - M. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Training shall be held on site after the generator set is complete and fully functional. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 263323

CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes fast-transfer central battery inverters with the following features:
 - 1. Output distribution section.
 - 2. Internal maintenance bypass/isolation switch.
 - 3. External maintenance bypass/isolation switch.
 - 4. Multiple output voltages.
 - 5. Emergency-only circuits.
 - 6. Remote monitoring provisions.
- B. Related Sections:
 - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems".
 - 2. Section 262813 "Fuses".

1.03 DEFINITIONS

- A. LCD: Liquid-crystal display.
- B. LED: Light-emitting diode.
- C. THD: Total harmonic distortion.
- D. UPS: Uninterruptible power supply.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Central Battery Systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Electrical ratings, including the following:
 - i. Capacity to provide power during failure of normal ac.
 - ii. Inverter voltage regulation and THD of output current.
 - iii. Rectifier data.
 - iv. Transfer time of transfer switch.
 - v. Data for specified optional features.
 - 2. Transfer switch.

3. Inverter.
 4. Battery charger.
 5. Batteries.
 6. Battery monitoring.
 7. Battery-cycle warranty monitor.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
1. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.
 2. Elevation and details of control and indication displays.
 3. Output distribution section.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Manufacturer Seismic Qualification Certification: Submit certification that central battery inverter equipment will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - i. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - ii. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 4. OSHPD Special Seismic Certification (OSP) pre-approval on OSHPD projects.
- C. Source quality-control test reports. Submit certified test reports within two (2) weeks of completion of tests.
- D. Field quality-control test reports.
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 4. Submit within two (2) weeks of completion of tests.
- E. Warranty: Special warranty specified in this Section.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For central battery inverter equipment to include in emergency, operation, and maintenance manuals.

1.08 MAINTENANCE MATERIAL SUBMITTALS

- 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. Deliver extra materials to Owner.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than three (3) of each.
 - 2. Cabinet Ventilation Filters: One complete set.
 - 3. One spare circuit board for each critical circuit.

1.09 QUALITY ASSURANCE

- A. If alternate manufacturer of products other than what are specified in this section are submitted, all necessary documents not limited to cut sheets, technical information, test reports from recognized testing labs and factory test reports shall be submitted to the satisfaction of the owner/engineer to ensure quality and conformance to the specifications. Additional testing shall be undertaken if it is concluded by the owner/engineer that the submitted test reports are either insufficient or do not include all tests necessary for product acceptance. The tests shall be conducted by a recognized lab acceptable to the owner/engineer and all tests shall be witnessed by owner's/engineer's personnel. All testing procedures and test results shall be satisfactory to the owner/engineer. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one owner's/engineer's representative to witness the test at the testing lab. Include all costs for the above in the bid.
- B. Contractor shall ensure that the manufacturer has a minimum of 10 years experience in the production of Central Battery Systems similar to the type and size specified in this project.
- C. Manufacturer shall have ISO 9001 Certification.
- D. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project. Furnish a letter from the manufacturer confirming the availability.
- E. Central Battery Inverter Systems shall be assembled at the manufacturer's own manufacturing facility using its own major components for the assembly. These devices shall be normally carried by the manufacturer as standard catalog items.
- F. Provide certified test reports of shake table test done by manufacturer on similar units.
- G. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests. Central Battery Inverter Systems shall be manufactured within six months of installation.
- H. Source Limitations: Obtain Central Battery Inverter Systems, overcurrent protective devices, components, and accessories, within same product category, through one source from a single manufacturer through a local distributor unless otherwise noted. Comply with NFPA 70.
- I. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- J. Product Options: Drawings indicate size, profiles, and dimensional requirements of Central Battery Inverter Systems are based on the specific system indicated. Refer to Part 2 "Product Requirements."
- K. Testing Agency Qualifications:
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of Central Battery Systems, OCPDs, switches and breakers similar to those specified on this project.
 - 2. Testing company shall be located with 50 miles radius of the project.

- 3. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing to supervise on-site testing specified in Part 3.
 - 4. Field Testing technician and supervisor shall have minimum ten (10) years experience in field testing of Central Battery Systems, OCPDs, switches and circuit breakers similar to the type and rating specified on this project.
 - L. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, Article 100, by a testing agency and marked for intended location and application.
 - M. Central Battery Inverter System: UL 924 and UL 1778 listed and labelled.
 - N. Comply with NFPA 70 and NFPA 101.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Deliver equipment in fully enclosed vehicles.
 - B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.
- 1.11 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace complete Central Battery Inverter Systems that fail in materials or workmanship within a warranty period of minimum three (3) years. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified. Warranties shall apply from the date of substantial completion.
 - 1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
 - i. Lead-Calcium, Wet-Cell Batteries:
 - 1) Full Warranty: One year.
 - 2) Pro Rata: Nine years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Myers.
 - 2. Cooper Industries, Inc.; Sure-Lites Division.
 - 3. Dual-Lite.
 - 4. Eaton

2.02 INVERTER PERFORMANCE REQUIREMENTS

- A. The inverter shall be fully automatic and include a linear transformer. The inverter output voltage is generated by sinusoidal pulse width modulation (PWM).
- B. Manual and Automatic Testing:
- C. 1. Automatic monthly and annual self-diagnostic test.
- D. 2. Automatically records the last twenty (20) events in the test result log.
- E. 3. Manual user initiated test at any time.
- F. Provide historical data for one year which can be downloaded.

- G. Slow-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use an electromechanical switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.
1. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
- H. Fast-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use a solid-state switch to transfer loads. Transfer in 0.004 second or less from normal supply to battery-inverter supply.
1. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.
- I. UPS-Type Central Battery Inverters: Continuously provide ac power to connected electrical system.
1. Automatic Operation:
 - i. Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, through rectifier-charger and inverter, with battery connected in parallel with rectifier-charger output.
 - ii. Abnormal Supply Conditions: If normal ac supply deviates from specified and adjustable voltage, voltage waveform, or frequency limits, battery supplies constant, regulated, inverter ac power output to the load without switching or disturbance.
 - iii. If normal power fails, battery continues supply-regulated ac power through the inverter to the load without switching or disturbance.
 - iv. When power is restored at normal supply terminals of system, controls automatically synchronize inverter with the external source before transferring the load. Rectifier-charger then supplies power to the load through the inverter and simultaneously recharges battery.
 - v. If battery becomes discharged and normal supply is available, rectifier-charger charges battery. When battery is fully charged, rectifier-charger automatically shifts to float-charge mode.
 - vi. If any element of central battery inverter system fails and power is available at normal supply terminals of system, static bypass transfer switch transfers the load to normal ac supply circuit without disturbance or interruption of supply.
 - vii. If a fault occurs in system supplied by central battery inverter and current flows in excess of the overload rating of central battery inverter system, static bypass transfer switch operates to bypass fault current to normal ac supply circuit for fault clearing.
 - viii. When fault has cleared, static bypass transfer switch returns the load to central battery inverter system.
 - ix. If battery is disconnected, central battery inverter continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.
 2. Manual Operation:

- i. Turning inverter off causes static bypass transfer switch to transfer the load directly to normal ac supply circuit without disturbance or interruption.
 - ii. Turning inverter on causes static bypass transfer switch to transfer the load to inverter.
- J. Maximum Acoustical Noise: 54db dB, "A" weighting, emanating from any UPS component under any condition of normal operation, measured 39 inches (990 mm) from nearest surface of component enclosure.

2.03 SERVICE CONDITIONS

- A. Environmental Conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
 - 1. Ambient Temperature for Electronic Components: 32 to 98 deg F (0 to 37 deg C).
 - 2. Relative Humidity: 0 to 95 percent, noncondensing.
 - 3. Altitude: Sea level to 4000 feet (1220 m).

2.04 INVERTERS

- A. Description: Solid-state type, with the following operational features:
 - 1. Automatically regulate output voltage to within plus or minus 5 percent.
 - 2. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
 - 3. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.
 - i. THD shall not exceed 5 percent when serving a resistive load of 100 percent of unit rating.
 - 4. Output Protection: Output circuit breakers with proper AIC and short-circuit protection based on maximum available fault current. Verify available fault levels from Short Circuit and Coordination Study.
 - 5. Output Protection: Ferroresonant transformer to provide inherent overload and short-circuit protection.
 - 6. Overload Capability: 125 percent for 10 minutes; 150 percent surge.
 - 7. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

2.05 BATTERY CHARGER

- A. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for "float" and "high-charge" modes.

2.06 BATTERIES

- A. Description: Lead-calcium, wet-cell batteries.
 - 1. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes at rated voltage during emergency mode.

2.07 ENCLOSURES

- A. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
- B. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

C. All components shall have modular design and quick disconnect to facilitate field service.

2.08 SEISMIC REQUIREMENTS

A. Central battery inverter assemblies, subassemblies, components, fastenings, supports, and mounting and anchorage devices shall be designed and fabricated to withstand seismic forces. The term "withstand" is defined in the "Manufacturer Seismic Qualification Certification" Paragraph in Part 1 "Informational Submittals" Article.

2.09 CONTROL AND INDICATION

A. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure. All alarms shall be automatically recoded and displayed. The front panel shall include a 2 line 20 character display and key pad for system input. To ensure only authorized persons have access, the system is multilevel password protected for all system functions and parameter changes.

B. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.

C. Indications: Labeled LED.

1. Quantitative Indications:

- i. Input voltage, each phase, line to line.
- ii. Input current, each phase, line to line.
- iii. System output voltage, each phase, line to line.
- iv. System output current, each phase.
- v. System output frequency.
- vi. DC bus voltage.
- vii. Battery current and direction (charge/discharge).
- viii. Elapsed time-discharging battery.

2. Basic Status Condition Indications:

- i. Normal operation.
- ii. Load-on bypass.
- iii. Load-on battery.
- iv. Inverter off.
- v. Alarm condition exists.

3. Alarm Indications:

- i. Battery system alarm.
- ii. Control power failure.
- iii. Fan failure.
- iv. Overload.
- v. Battery-charging control faulty.
- vi. Input overvoltage or undervoltage.
- vii. Approaching end of battery operation.
- viii. Battery undervoltage shutdown.

- ix. Inverter fuse blown.
- x. Inverter transformer overtemperature.
- xi. Inverter overtemperature.
- xii. Static bypass transfer switch overtemperature.
- xiii. Inverter power supply fault.
- xiv. Inverter output overvoltage or undervoltage.
- xv. System overload shutdown.
- xvi. Inverter output contactor open.
- xvii. Inverter current limit.

4. Controls:

- i. Inverter on-off.
- ii. Start.
- iii. Battery test.
- iv. Alarm silence/reset.
- v. Output-voltage adjustment.

D. Dry-form "C" contacts shall be available for remote indication of the following conditions:

- 1. Inverter on battery.
- 2. Inverter on-line.
- 3. Inverter load-on bypass.
- 4. Inverter in alarm condition.
- 5. Inverter off (maintenance bypass closed).

E. Include the following minimum array:

- 1. Ready, normal-power on light.
- 2. Charge light.
- 3. Inverter supply load light.
- 4. Battery voltmeter.
- 5. AC output voltmeter with minimum accuracy of 2 percent of full scale.
- 6. Load ammeter.
- 7. Test switch to simulate ac failure.

F. Enclosure: Steel, with hinged pad-lockable doors, suitable for floor mounting. Manufacturer's standard corrosion-resistant finish.

2.10 OPTIONAL FEATURES

- A. Multiple Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.
- B. Emergency-Only Circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.
- C. Maintenance Bypass/Isolation Switch: Load is supplied, bypassing central battery inverter system. Normal supply, electromechanical transfer switch, and system load terminals are completely disconnected from external circuits.

- D. Maintenance Bypass/Isolation Switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:
1. Full Isolation: Load is supplied, bypassing central battery inverter system. Normal ac input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
 2. Maintenance Bypass: Load is supplied, bypassing central battery inverter system. Central battery inverter ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
 3. Normal: Normal central battery inverter ac supply terminals are energized, and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.

2.11 OUTPUT DISTRIBUTION SECTION

- A. Panelboard: Comply with Section 262416 "Panelboards" except provide assembly integral to equipment cabinet.

2.12 SYSTEM MONITORING AND ALARMS

- A. Remote Status and Alarm Panel: Labeled LEDs on panel faceplate shall indicate five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.
1. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.
- B. Provisions for Remote Computer Monitoring: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in Part 2 "Control and Indication" Article. Remote computer and connecting signal wiring will be provided by Owner. Include the following features:
1. Connectors and network interface units or modems for data transmission via RS-232 link.
 2. Software shall be designed to control and monitor inverter system functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records. Software shall be compatible with requirements in Section 262713 "Electricity Metering" and the operating system and configuration of Owner-furnished computers.
- C. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.
1. Annunciation of Alarms: At inverter system control panel.
- D. Battery-Cycle Warranty Monitoring: Electronic device, acceptable to battery manufacturer as a basis for warranty action, for monitoring charge-discharge cycle history of batteries covered by cycle-life warranty.
1. Basic Functional Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on integral LCD.
 2. Additional monitoring functions and features shall include the following:
 - i. Measuring and recording of total voltage at battery terminals; providing alarm for excursions outside proper float voltage level.

- ii. Monitoring of ambient temperature at battery and initiating an alarm if temperature deviates from normally acceptable range.
- iii. Keypad on device front panel provides access to monitored data using front panel display.
- iv. Alarm contacts arranged to provide local and remote alarm for battery discharge events, abnormal temperature, and abnormal battery voltage or temperature.
- v. Memory device to store recorded data in nonvolatile electronic memory.
- vi. RS-232 port to permit downloading of data to a portable personal computer.
- vii. Modem to make measurements and recorded data accessible to remote personal computer via telephone line. Computer will be provided by Owner.

2.13 SOURCE QUALITY CONTROL

- A. Factory test complete inverter system, including battery, before shipment. Include the following:
 - 1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - 2. Full-load test.
 - 3. Transient-load response test.
 - 4. Overload test.
 - 5. Power failure test.
- B. Observation of Test: Give 14 days' advance notice of tests and provide access for Owner's representative to observe tests at Owner's option.
- C. Report test results. Include the following data:
 - 1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
 - 2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
 - 3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install system components on concrete base and attach by bolting.
 - 1. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems" for seismic-restraint requirements.
 - 2. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of switchgear unless otherwise indicated or unless required for seismic anchor support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
 - 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 5. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."
- B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.03 CONNECTIONS

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

- A. Identify equipment and components according to Section 260553 "Identification for Electrical Systems."
- B. Label each cabinet indicating electrical, chemical and fire hazards.
- C. Identify each cabinet indicating manufacturer, model no., serial no., voltage, current rating and date of installation.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
2. Test manual and automatic operational features and system protective and alarm functions.
3. Test communication of status and alarms to remote monitoring equipment.
4. Perform a 90 minute full load test to verify the functioning of the complete system including batteries after loss of normal power. Verify that all loads on Central Battery System are maintained during the 90 minute test. Test shall be witnessed by owner's representative. Provide 14 days advance notice.
5. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.
6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

3.06 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that central battery inverter is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
- D. Complete installation and startup checks according to manufacturer's written instructions.

3.07 ADJUSTING AND CLEANING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Install new filters in each equipment cabinet within 14 days from date of Substantial Completion.

3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery inverters. Refer to Section 017900 "Demonstration and Training." Training shall be held at site after the system is complete and functional.

END OF SECTION

SECTION 263600

TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Automatic transfer switches.
 - 2. Bypass/isolation switches.
 - 3. Nonautomatic transfer switches.
 - 4. Remote annunciation systems.
 - 5. Remote annunciation and control systems.
- B. Related Sections include the following:
 - 1. Section 213113 "Electric-Drive, Centrifugal Fire Pumps" for automatic transfer switches for fire pumps.
 - 2. Section 213213 "Electric-Drive, Vertical-Turbine Fire Pumps" for automatic transfer switches for fire pumps.

1.03 DEFINITIONS

- A. ATS: Automatic Transfer Switch
- B. BP/IS: Bypass switch and Isolation Switch
- C. EMI: Electromagnetic interference.
- D. LCD: Liquid-crystal display.
- E. LED: Light-emitting diode.
- F. NETA: InterNational Electrical Testing Association.
- G. PC: Personal computer.
- H. THD: Total harmonic distortion.
- I. UPS: Uninterruptible power supply.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Transfer switches shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[and the unit will be fully operational after the seismic event]."

1.05 ACTION SUBMITTALS

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

- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances on all sides, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified. Drawings shall be drawn to scale (1/4"=1'-0").
 - 1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [manufacturer] [and] [testing agency].
- B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - i. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - ii. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control test reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.08 QUALITY ASSURANCE

- A. American made products have been acceptable to the Owner. If non-domestic products are submitted, notice is hereby given that extensive testing shall be required to insure quality and conformance to the Specifications. Testing shall be done by a recognized lab acceptable to the Owner and all tests shall be witnessed by Owner's personnel. Testing procedures and test results shall be satisfactory to the Owner. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one Owner's representative to witness the test at the testing lab. Include all costs for the above in the bid.

- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within [75 ~~200~~-miles (120 ~~324~~ kms)] <Insert number of miles (kilometers)> of Project site, a service center capable of providing training, parts, and emergency maintenance repairs within 8 hours from the time of notification.
- C. Contractor shall ensure that the manufacturer has a minimum of 15 years experience in the production of Emergency/Standby Engine Generators similar to the type and size specified in this project. Furnish a list of three (3) contacts for the three (3) similar projects completed within the last 5 years. Include name, tele no and email of the facility engineers.
- D. Manufacturer shall have ISO 9001 or 9002 Certification.
- E. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project. Furnish a letter from the manufacturer confirming the availability.
- F. Transfer Switch shall be assembled at the manufacturer's own manufacturing facility using its own major devices (e.g., contactors) for the assembly. These devices shall be normally carried by the manufacturer as standard catalog items.
- G. Transfer Switch shall comply with seismic zone applicable to the project. Unless otherwise indicated, verify requirements with Architect or Structural Engineer of Record (SEOR). Provide certified test reports of shake table test done by manufacturer on similar units.
- H. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests. Major components (e.g. contactors, controls) shall be manufactured within six months of installation.
- I. Source Limitations: Obtain [automatic transfer switches] [bypass/isolation switches] [non-automatic transfer switches] [remote annunciators] [and] [remote annunciator and control panels] through one source from a single manufacturer switch, and accessories through one source from a single manufacturer through a local distributor.
- J. Product Options: Drawings indicate size, profiles, and dimensional requirements of engine generators and are based on the specific system indicated. Refer to Part 2 ~~Section 016000~~ "Product Requirements."
- K. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, Article 100 ~~by a qualified testing agency~~, and marked for intended location and application.
- L. Testing Agency Qualifications: Member of NETA;
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of ten (10) years and has permanent in-house testing engineers and technicians involved with testing of transfer switches, Vswitchboards, panelboards and OCPDs similar to those specified on this project.
 - 2. Testing company shall be located with 50 miles radius of the project.
 - 3. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing to supervise on-site testing specified in Part 3.
- M. Comply with NEMA ICS 1.
- N. Comply with NFPA 70.
- O. Comply with NFPA 99.
- P. Comply with NFPA 110.
- Q. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.09 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Notify [Architect] [Construction Manager] [Owner] no fewer than [fourteen (14)] <Insert number> days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without [Architect's] [Construction Manager's] [Owner's] written permission.

1.10 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
1. Contactor Transfer Switches:
 - i. Russellectric Inc
 - ii. ~~AC Data Systems, Inc.~~
 - iii. ~~Caterpillar; Engine Div.~~
 - iv. Emerson; ASCO Power Technologies, LP.
 - v. ~~Generac Power Systems, Inc.~~
 - vi. GE Zenith Controls.
 - vii. Kohler Power Systems; Generator Division.
 - viii. Onan/Cummins Power Generation; Industrial Business Group.
 - ix. ~~Spectrum Detroit Diesel.~~
 - x. <Insert manufacturer's name.>
 - xi. ~~Transfer Switches Using Molded-Case Switches or Circuit Breakers:~~
 - xii. ~~AC Data Systems, Inc.~~
 - xiii. ~~Eaton Electrical Inc.; Cutler Hammer.~~
 - xiv. ~~GE Zenith Controls.~~
 - xv. ~~Hubbell Industrial Controls, Inc.~~
 - xvi. ~~Lake Shore Electric Corporation.~~
 - xvii. <Insert manufacturer's name.>

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location. Verify maximum available fault levels from the Short Circuit and Coordination Study.
 - 2. Short-time withstand capability for [three] [30] <Insert number> cycles.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Surge Protective Device: Service rated.
 - 6. Ground-Fault Protection: Comply with UL 1008 for [normal bus] [normal and alternative buses].
 - 7. Service Disconnecting Means: Externally operated, manual [mechanically] [electrically] actuated.
- H. Neutral Switching. Where four-pole switches are indicated, provide [neutral pole switched simultaneously with phase poles] [overlapping neutral contacts].
- I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- J. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- K. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater. Thermostat shall be accessible for operator control.
- L. Battery Charger: For generator starting batteries.
 - 1. Float type rated [2] [10] A.

2. Ammeter to display charging current.
 3. Fused ac inputs and dc outputs.
- M. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- N. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "Identification for Electrical Systems."
1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- O. Enclosures: Free standing, general-purpose NEMA 250, Type [1] [3R] [12] [4X Stainless Steel], complying with NEMA ICS 6 and UL 508, unless otherwise indicated.
1. Enclosure shall be fabricated from 12 gauge steel and shall be sized to exceed minimum bending space required by UL 1008. Doors shall have hinges and locking handle latch with provision for padlocks.
 2. Contractors field wiring terminating within the enclosure shall comply with NFPA 70. Wires shall be permanently tagged near the terminal at each end with the wire number shown on approved shop drawings.
 3. The enclosure shall be constructed for convenient removal and replacement of contacts, coils, springs and control devices from the front without removal of main power conductors or removal of major components. The enclosure housing the ATS and BP/IS shall be constructed to protect personnel from energized components of the BO/IS during maintenance of the ATS.

2.03 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- G. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- H. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
 1. Fully automatic make-before-break operation.

2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - i. Initiation occurs without active control of generator.
 - ii. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 4. Failure of power source serving load initiates automatic break-before-make transfer.
- I. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.
 - J. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.
 - K. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.
 - L. Automatic Transfer-Switch Features:
 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 5. Test Switch: Simulate normal-source failure.
 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - i. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

- ii. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
 12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - i. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - ii. Push-button programming control with digital display of settings.
 - iii. Integral battery operation of time switch when normal control power is not available.

2.04 BYPASS/ISOLATION SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 1. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. While isolated, interlocks prevent transfer-switch operation, except for testing or maintenance.
 2. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations.
 3. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
 4. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 5. Operability: Constructed so load bypass and transfer-switch isolation can be performed by 1 person in no more than 2 operations in 15 seconds or less.
 6. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.

7. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.
- C. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

2.05 NONAUTOMATIC TRANSFER SWITCHES

- A. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.
- C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.
- D. Each switch shall be fully rated for the available fault current closing and withstand rating based on available fault current. Verify maximum available fault current from the Short Circuit and Coordination Study.
- E. Nonautomatic Transfer-Switch Accessories:
 1. Pilot Lights: Indicate source to which load is connected.
 2. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.
 - i. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - ii. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."
 3. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

2.06 REMOTE ANNUNCIATOR SYSTEM

- A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:
 1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 2. Switch position.
 3. Switch in test mode.
 4. Failure of communication link.
 5. Fail to transfer.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
 1. Indicating Lights: Grouped for each transfer switch monitored.
 2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
 3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.07 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

- A. Functional Description: Include the following functions for indicated transfer switches:
 1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
 2. Indication of switch position.
 3. Indication of switch in test mode.
 4. Indication of failure of digital communication link.
 5. Key-switch or user-code access to control functions of panel.
 6. Control of switch-test initiation.
 7. Control of switch operation in either direction.
 8. Control of time-delay bypass for transfer to normal source.
- B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.
- C. Remote Annunciation and Control Panel: Solid-state components. Include the following features:
 1. Controls and indicating lights grouped together for each transfer switch.
 2. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
 3. Digital Communication Capability: Matched to that of transfer switches supervised.
 4. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.

2.08 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
 1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems." Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

- C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- D. Identify components according to Section 260553 "Identification for Electrical Systems."
- E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: ~~[Owner will engage]~~ [Engage] a qualified independent testing and inspecting agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 - 2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - i. Check for electrical continuity of circuits and for short circuits.
 - ii. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - iii. Verify that manual transfer warnings are properly placed.
 - iv. Perform manual transfer operation.
 - 5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - i. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - ii. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - iii. Verify time-delay settings.
 - iv. Verify pickup and dropout voltages by data readout or inspection of control settings.

- v. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - vi. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - vii. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
- i. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in latest edition of NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - i. Check for electrical continuity of circuits and for short circuits.
 - ii. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - iii. Verify that manual transfer warnings are properly placed.
 - iv. Perform manual transfer operation.
4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - i. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - ii. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - iii. Verify time-delay settings.
 - iv. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - v. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - vi. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - vii. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

- i. Verify grounding connections and locations and ratings of sensors.
- E. Coordinate tests with tests of generator and run them concurrently.
- F. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training." Training shall be held on site after the all transfer switches are completely installed, tested and fully functional.
- B. Coordinate this training with that for generator equipment.

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SECTION 265119

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Highbay, linear.
4. Highbay, nonlinear.
5. Linear industrial.
6. Lowbay.
7. Recessed, linear.
8. Strip light.
9. Surface mount, linear.
10. Surface mount, nonlinear.
11. Suspended, linear.
12. Suspended, nonlinear.

- B. Related Requirements:

1. Section 260943 "Network Lighting Controls" systems with low-voltage control wiring or data communication circuits.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaires.

4. Include emergency lighting units, including batteries and chargers.
 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 6. Photometric data and adjustment factors based on laboratory tests[, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.
 - i. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - ii. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps, refer to light fixture schedule on plans.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
 4. Structural members to which equipment and or luminaires will be attached.
 5. Initial access modules for acoustical tile, including size and locations.
 6. Items penetrating finished ceiling, including the following:
 - i. Other luminaires.
 - ii. Air outlets and inlets.
 - iii. Speakers.
 - iv. Sprinklers.
 - v. Access panels.
 - vi. Ceiling-mounted projectors.
 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency and as follows:
1. Test reports complying with LM-79 (IES approved method for electrical and photometric measurements of Solid-State Lighting) providing total luminous flux, luminous intensity distribution, electrical power characteristics, luminous efficacy and color characteristics (CRI, CCT) shall be submitted.
 2. Test reports complying with LM-80 (IES approved standard for measuring lumen maintenance of LED light sources) providing lumen maintenance of LED light sources shall be submitted.
 3. ISTMT (IN SITU TEMPERATURE MEASUREMENT TEST) – It is the measure of the LED source case temperature within the LED system (luminaire or lamp or it is the temperature of the LED within the luminaire. This measurement should be performed according to the temperature measurement point (TMP) indicated by the particular LED package manufacturer. The temperature measured within the luminaire shall be within the temperature of the LM-80-08 LED source report.
 4. All LED lifetime projections shall be made per TM-21-11 (approved method for taking LM-80 data and making useful LED lifetime projections).
- E. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. 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 the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.

- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 REFER TO LIGHT FIXTURE SCHEDULE ON PLANS

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."
- C. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
 - 1. Relative Humidity: Zero to 95 percent.
- D. Altitude: Sea level to 1000 feet.

2.03 LUMINAIRE 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - i. "USE ONLY" and include specific lamp type.
 - ii. Lamp diameter, shape, size, wattage, and coating.
 - iii. CCT and CRI.

- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. California Title 24 compliant.

2.04 DOWNLIGHT

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
 - 1. Minimum allowable efficacy of 80 lm/W.
 - 2. CRI and CCT as indicated on plans.
 - 3. Rated lamp life of 50,000 hours to L70.
 - 4. Dimmable from 100 percent to 0 percent of maximum light output.
 - 5. Internal driver.
 - 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
 - 1. Extruded-aluminum housing and heat sink or as indicated on plans.
 - 2. Clear, anodized, powder-coat finish.
 - 3. Universal mounting bracket.
 - 4. Integral junction box with conduit fittings.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for damp location.
 - 4. Recessed luminaires shall comply with NEMA LE 4.

2.05 HIGHBAY, LINEAR

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
 - 1. Minimum allowable efficacy of 80 lm/W.
 - 2. CRI and CCT as indicated on plans.
 - 3. Rated lamp life of 50,000 hours to L70.
 - 4. Dimmable from 100 percent to 0 percent of maximum light output.
 - 5. Internal driver.
 - 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:

1. Extruded-aluminum housing and heat sink or as indicated on plans.
 2. Clear, anodized, powder-coat finish.
 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.

2.06 HIGHBAY, NONLINEAR

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
1. Minimum allowable efficacy of 80 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.
 5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
 3. Universal mounting bracket.
 4. Integral junction box with conduit fittings.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.

2.07 LINEAR INDUSTRIAL

- A. Lamp:
1. Minimum allowable efficacy of 80 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.

5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- B. Housings:
1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
- C. Housing and Heat Sink Rating:
1. Class 1, Division 2 Group(s) A.
 2. NEMA 4X.
 3. IP 54.
 4. IP 66.
 5. Marine and wet locations.
 6. CSA C22.2 No 137.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. With integral mounting provisions.
- F. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.

2.08 LOWBAY

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
1. Minimum allowable efficacy of 80 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.
 5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.

3. UL Listing: Listed for damp location.

2.09 RECESSED, LINEAR

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
 1. Minimum allowable efficacy of 85 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.
 5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
 1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
 1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.
 4. NEMA LE 4.

2.10 STRIP LIGHT

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
 1. Minimum allowable efficacy of 80 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.
 5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
 1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping of luminaire without use of tools. Com-

ponents are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.11 SURFACE MOUNT, LINEAR

A. Nominal Operating Voltage: 120 V ac thru 277 V ac.

B. Lamp:

1. Minimum allowable efficacy of 80 lm/W.
2. CRI and CCT as indicated on plans.
3. Rated lamp life of 50,000 hours to L70.
4. Dimmable from 100 percent to 0 percent of maximum light output.
5. Internal driver.
6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum and steel housing and heat sink Refer to plans.
2. Clear, anodized, powder-coat finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.12 SURFACE MOUNT, NONLINEAR

A. Nominal Operating Voltage: 120 V ac thru 277 V ac.

B. Lamp:

1. Minimum allowable efficacy of 80 lm/W.
2. CRI and CCT as indicated on plans.
3. Rated lamp life of 50,000 hours to L70.
4. Dimmable from 100 percent to 0 percent of maximum light output.
5. Internal driver.
6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.

2. Clear, anodized, powder-coat finish.
 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.

2.13 SUSPENDED, LINEAR

- A. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- B. Lamp:
1. Minimum allowable efficacy of 85 lm/W.
 2. CRI and CCT as indicated on plans.
 3. Rated lamp life of 50,000 hours to L70.
 4. Dimmable from 100 percent to 0 percent of maximum light output.
 5. Internal driver.
 6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- C. Housings:
1. Extruded-aluminum housing and heat sink.
 2. Clear, anodized, powder-coat finish.
 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.

2.14 MATERIALS

- A. Metal Parts:
1. Free of burrs and sharp corners and edges.
 2. Sheet metal components shall be steel unless otherwise indicated.
 3. Form and support to prevent warping and sagging.
- B. Steel:
1. ASTM A 36/A 36M for carbon structural steel.
 2. ASTM A 568/A 568M for sheet steel.

- C. Stainless Steel:
 - 1. 1. Manufacturer's standard grade.
 - 2. 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

2.15 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.16 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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 to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 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. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

- i. Two 5/32-inch diameter aircraft cable supports adjustable to 10 feet in length.
 - ii. Pendant mount with 5/32-inch diameter aircraft cable supports adjustable to 10 feet in length.
 - iii. Hook mount.
2. Pendants and Rods: Where longer than 24 inches, brace to limit swinging.
 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod (back of house), wire support (front of house) for suspension for each unit length of luminaire chassis, including one at each end.
 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 - B. Luminaire will be considered defective if it does not pass operation tests and inspections.
 - C. Prepare test and inspection reports.
- 3.06 STARTUP SERVICE
- A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Luminaire Lighting Controls."
 - B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."
- 3.07 ADJUSTING
- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

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SECTION 265619

LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Section 260943 "Network Lighting Controls" Programmable lighting control systems with low-voltage control wiring or data communication circuits.

1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project and testing procedures and criteria required by IES LM-79 and LM-80.
 - i. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
 - ii. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.
 7. Photoelectric relays.
 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. Sustainable Design Submittals:
1. "BUG ratings" Light Pollution Reduction for both upright and light trespass.

PART 2 - PRODUCT DATA: INDICATING LUMINAIRE IS CERTIFIED BY ENERGY STAR DESIGN LIGHTS CONSORTIUM.

- A. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- B. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports and seismic restraints.

2.02 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Structural members to which equipment and luminaires will be attached.
 3. Underground utilities and structures.
 4. Existing underground utilities and structures.
 5. Above-grade utilities and structures.
 6. Existing above-grade utilities and structures.
 7. Building features.
 8. Vertical and horizontal information.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of the following:
1. Luminaire.

2. Photoelectric relay.
- E. Test reports complying with LM-79 (IES approved method for electrical and photometric measurements of Solid-State Lighting) providing total luminous flux, luminous intensity distribution, electrical power characteristics, luminous efficacy and color characteristics (CRI, CCT) shall be submitted. Test reports complying with LM-80 (IES approved standard for measuring lumen maintenance of LED light sources) providing lumen maintenance of LED light sources shall be submitted.
- F. ISTMT (IN SITU TEMPERATATURE MEASUREMENT TEST) – It is the measure of the LED source case temperature within the LED system (luminaire or lamp or it is the temperature of the LED within the luminaire. This measurement should be performed according to the temperature measurement point (TMP) indicated by the particular LED package manufacturer. The temperature measured within the luminaire shall be within the temperature of the LM-80-08 LED source report.
- G. All LED lifetime projections shall be made per TM-21-11 (approved method for taking LM-80 data and making useful LED lifetime projections).
- H. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency as follows:
 1. Test reports complying with LM-79 (IES approved method for electrical and photometric measurements of Solid-State Lighting) providing total luminous flux, luminous intensity distribution, electrical power characteristics, luminous efficacy and color characteristics (CRI, CCT) shall be submitted.
 2. Test reports complying with LM-80 (IES approved standard for measuring lumen maintenance of LED light sources) providing lumen maintenance of LED light sources shall be submitted.
 3. ISTMT (IN SITU TEMPERATATURE MEASUREMENT TEST) – It is the measure of the LED source case temperature within the LED system (luminaire or lamp or it is the temperature of the LED within the luminaire. This measurement should be performed according to the temperature measurement point (TMP) indicated by the particular LED package manufacturer. The temperature measured within the luminaire shall be within the temperature of the LM-80-08 LED source report.
 4. All LED lifetime projections shall be made per TM-21-11 (approved method for taking LM-80 data and making useful LED lifetime projections).
- I. Source quality-control reports.
- J. Sample warranty.

2.03 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

2.04 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

2.05 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. 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.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- F. Mockups: For exterior luminaires, complete with power and control connections.
 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

2.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

2.07 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

2.08 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - i. Structural failures, including luminaire support components.
 - ii. Faulty operation of luminaires and accessories.
 - iii. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5-years from date of Substantial Completion.

PART 3 - PRODUCTS

3.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

3.02 LUMINAIRE 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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI of minimum 80. CCT as indicated on plans.
- H. L70 lamp life of 50,000 hours.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal driver.
- K. Nominal Operating Voltage: 120 V ac thru 277 V ac.
- L. In-line Fusing: On the primary for each luminaire] [Separate in-line fuse for each luminaire.
- M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- N. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

3.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 2. Adjustable window slide for adjusting on-off set points.

3.04 LUMINAIRE TYPES

A. Area and Site:

1. Luminaire Shape: Round or Square
2. Mounting: Pole or Building with stainless-steel rectangular or round arm.
3. Luminaire-Mounting Height: See plans.
4. Distribution: See plans.
5. Diffusers and Globes: See plans.
6. Housings:
 - i. Extruded-aluminum housing and heat sink.
 - ii. Clear, anodized, powder-coat finish. Verify with Architect.

B. Bollard:

1. Shape: Round or Square as indicated on plans.
2. Height Above Finished Grade: See plans.
3. Overall Height: See plans
4. Diameter: See plans.
5. Mounting: See plans.
6. Distribution: See plans.
7. Diffusers and Globes: See plans.
8. Housings:
 - i. Extruded-aluminum housing and heat sink.
 - ii. Clear, anodized, powder-coat finish. Verify with Architect.

C. Canopy:

1. Shape: Round or Square as indicated on plans.
2. Dimensions: See plans.
3. Diffusers and Globes: See plans.
4. Housings:
 - i. Extruded-aluminum housing and heat sink.
 - ii. Clear, anodized, powder-coat finish. Verify with Architect.

D. Decorative Post Top:

1. Luminaire-Mounting Height: See plans.
2. Mounting Type: See plans.
3. Distribution: See plans.
4. Diffusers and Globes: See plans.
5. Housings:
 - i. Extruded-aluminum housing and heat sink.
 - ii. Clear anodized powder-coat finish. Verify with Architect.

3.05 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.
- H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - i. "USE ONLY" and include specific lamp type.
 - ii. Lamp diameter, shape, size, wattage and coating.
 - iii. CCT and CRI for all luminaires.

3.06 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - i. Color: As selected by Architect.
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - i. Color: See plans, or as selected by Architect.

3.07 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 4 - EXECUTION

4.01 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, ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

4.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

4.03 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.

- E. Supports:
 1. Sized and rated for luminaire weight.
 2. 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.
- F. Wall-Mounted Luminaire Support:
 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

4.04 BOLLARD LUMINAIRE INSTALLATION:

- A. Align units for optimum directional alignment of light distribution.
 1. Install on concrete base. See plans for additional information. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

4.05 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

4.06 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

4.07 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Verify operation of photoelectric controls.
- C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - i. IES LM-5.
 - ii. IES LM-50.
 - iii. IES LM-52.
 - iv. IES LM-64.
 - v. IES LM-72.
 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- 4.08 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.
- 4.09 ADJUSTING
- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 270500

GENERAL REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provide a standard defining the structured communications cabling systems to be installed within the customer facility.
2. Scope of Work Compliance.
3. Contractor Qualifications.
4. Warranty.
5. Safety.
6. Working Conditions.

1.02 PROJECT INFORMATION

A. Project Site Description: New Construction for **Riverside County Fire Department FS-49**

1. Project is located: 43700 Tamarisk Dr. Desert Center, CA 92239
2. Building Owner: County of Riverside
3. Project delivery: Design Assist
4. Managed by: Fire Services
5. Project Main Point of Authorization; TBD

B. **Riverside County Fire Department:** Authorization to Work requires one or more of the following documents and shall be confirmed with the OAR or Project Manager:

1. Prequalification Package: #
2. Annual Job Order Contractor – Agreement #
 - i. Confirm with the (IOR) Authorizer that Project – SoW is included.
3. Project Purchase Order: #

1.03 GENERAL TERMS AND CONDITIONS.

- A. The goal is to accomplish this technology project utilizing **Riverside County Fire Department** -IT-approved materials in the most economical and systematic possible and compliant with the latest codes, cabling standards, and industry best practices.
- B. The General Contractor is responsible for all required Division 27 scope of work and shall ensure that all communication sub-tier contractors adhere to the qualifications outlined in project Division 27 specifications, including project experience and certifications.
- C. Prices quoted shall be all-inclusive and represent a complete, fully-engineered system installation at the Project site as contemplated and detailed in the drawing package and accompanying specifications.
- D. Omissions in the specification of any described provision shall not be construed to relieve the Contractor of any responsibility or obligation requisite to the complete and satisfactory delivery, installation, operation, and support of any and all systems, equipment, or services. Correction of any omission on the Contractor's part due to misinterpretation of this specification or any

other project conditions shall be the Contractor's responsibility and shall not result in any contract modification or additional costs to **Riverside County Fire Department**.

- E. Where conflicts and/or irregularities occur between project documents, specifications, drawings, and/or applicable codes, rules, regulations, ordinances, standards, guidelines, and practices, the more stringent requirement shall apply as reasonably determined by **Riverside County Fire Department** or government agency inspector.
- F. This specification represents the design intent for the project communicated by way of narrative descriptions of intended functionality and a single line or detail drawings indicating likely equipment connectivity to achieve that functionality. The designs in this specification do not represent fully engineered technical solutions. Contractors are required to review the designs presented in the project documents closely, submit any questions and clarifications regarding the design intent through the RFI process, and develop their own engineered solutions representing a fully functional turn-key solution in their bid responses.
- G. this project's scope includes the complete system engineering, procurement, fabrication, installation, programming, testing, training, and warranty.
- H. Proposed solutions shall be based on the designs communicated in the specifications. Still, they shall include any additional equipment, materials, software, licenses, and/or labor required for the Contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.
- I. The contractor awarded this project is responsible for ensuring that all quantities, materials, labor, licenses, permits, sales taxes, and any other costs to provide a turnkey project are included in their bid.
- J. Floor plans, drawings, elevation drawings, and other drawings received by the Contractor as part of the construction process are hereby incorporated into this document by reference. The Contractor is responsible for ensuring that amounts and lengths of cabling and pathways are correct and that all materials and labor are included to install the system per the drawings and these specifications.
- K. Permits, licenses, applicable sales taxes, insurance requirements, payment/performance bond costs, and other miscellaneous costs are the Contractor's responsibility and shall be included in the contract price and this scope of work. Such items are to be listed separately on pricing sheets if provided. Copies of all required permits, licenses, insurance requirements, and bond(s) are to be delivered to **Riverside County Fire Department** before the commencement of any work.
- L. Installation Schedule and Coordination: the Contractor shall take the fast-track nature of this project and the potential requirement for installation/work schedule adjustments and quick turnarounds into consideration in constructing this project, as the **Riverside County Fire Department** will NOT entertain or agree to added-cost change orders associated with scheduling changes.
- M. Work must be closely coordinated with the architect, **Riverside County Fire Department** Personnel (PW, IT, PD, etc.), GC, MEP contractors, structural Contractors, and all low-voltage contractors and their respective schedules.
- N. This will be a turn-key Project. Any item of the equipment or material not explicitly addressed on the drawings, specifications, or elsewhere in Division 27 specifications documents but required to provide complete and functional systems as contemplated and/or specified herein shall be provided at no additional charge to the **Riverside County Fire Department** in a quantity and quality consistent with other specified items.¹
- O. Coordination with Project Design Team: The building contractor will coordinate all communications cabling infrastructure requirements, including review of existing site conditions, review and coordination of electrical power and grounding requirements, conduits and back boxes, structural support requirements, and coordination with other trades.

- P. Assembly: The Contractor shall procure and assemble all hardware, equipment, and any additional materials required to deliver the completely functioning communications cabling system.
- Q. Installation: The Contractor shall install all equipment, inter-rack and intra-rack cable, equipment, wiring, connectors, panels, plates, and other materials at the Project site.
- R. Testing and Adjustment: The Contractor shall perform all tests and adjustments, furnish all test equipment necessary, and perform all Work required to properly configure the systems and verify their performance per the information in this document and the design-build integrator's approved engineered designs.
- S. Warranty: The Contractor shall warrant the installed system in accordance with the terms of this document and accompanying contractual documents.

1.04 RELATED DOCUMENTS

- A. All Construction Contract Documents, specification documents, and general provisions.
- B. Division 1 specification sections. (**Riverside County Fire Department** Project Manager & **Riverside County Fire Department** Acct. Representative)
- C. Division 24 & 25 for BMS and Control Systems. (Provided by EoR)
- D. Section 26 00 00 General Electrical Requirements and related documents. (Provided by EoR)
- E. Section 27 05 26 Grounding Bonding for Communications Systems
- F. Section 27 05 29 Hangers and Supports for Communications Systems.
- G. Section 27 05 33 Conduit and Boxes for Communications Systems.
- H. Section 27 05 36 Cable Tray for Communications Systems.
- I. Section 27 05 43 Underground Ducts for Communications Systems.
- J. Section 27 05 53 Identification for Communications Systems.
- K. Section 27 08 00 Commissioning for Communications Systems.
- L. Section 27 11 00 Equipment Room Fittings for Communications Systems
- M. Section 27 11 16 Cabinets, Racks, Enclosures for Communications Systems.
- N. Section 27 11 19 Termination Blocks and Patch Panels for Communications Systems.
- O. Section 27 11 23 Cable Management and Overhead Ladder (typ) Racking for Communications Systems.
- P. Section 27 11 26 Power Distribution Unit (PDU).
- Q. Section 27 15 00 Copper Horizontal Cabling.
- R. Section 27 15 43 Communications Faceplates and Connectors.
- S. Section 27 16 19 Communications Patch Cords
- T. Architectural, civil, structural, mechanical, electrical, and all technology drawings, including but not limited to Telecommunication Drawings.
- U. Product manufacture data sheets and installation requirements for the product's intended use or assembly.
- V. Project Basis of Design document for low-voltage/signal systems (a.k.a. Technology Systems including but not limited to IP Networks, Wireless IP Networks, and Category 6 Structured Cabling Solutions, Remote IDF, furniture systems interface, New conduit locations, etc).

W. Refer to structural seismic requirement design documents specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.05 REFERENCES

A. Abbreviations and Acronyms: (See associated drawing set - cover sheet(s) for a complete list).

1. A/E Architect / Engineer (designer)
2. BICSI Building Industry Consulting Service International
3. EIA Electronics Industry Alliance
4. ELFEXT Equal Level far End Cross Talk
5. FTP Foiled Twisted Pair
6. IDF Intermediate Distribution Facility (aka TR)
7. ILEC/LEC Incumbent Local Exchange Carrier
8. ISP Inside Plant
9. IT Information Technology
10. BDF Building Distribution Frame
11. LOMMF Laser Optimized Multi-Mode Fiber
12. MDF Main Distribution Facility (aka TEC)
13. MPOE Minimum Point of Entry
14. NEXT Near End Cross Talk
15. OAR Owner Approved Representative
16. OSP Outside Plant
17. PSELFEXT Power Sum Equal Level Far End Cross Talk
18. PSNEXT Power Sum Near End Cross Talk
19. PW Public Works
20. RCDD Registered Communications Distribution Designer
21. RCFS Riverside County Fire Service
22. TBD To Be Determined
23. TCIM Telecommunication Cabling Installation Manual
24. TDMM Telecommunications Distribution Methods Manual
25. TIA Telecommunications Industry Association
26. UTP Unshielded Twisted Pair
27. WAO Work Area Outlet
28. WAP Wireless Access Point

1.06 APPLICABLE REGULATORY REFERENCES

A. The Contractor is responsible for knowledge and application of current versions of all applicable Best Practices, Standards, and Codes/Regulatory requirements. In cases where listed Standards and Codes have been updated, the Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

1. ANSI/IEEE

- i. ANSI/IEEE C2, National Electrical Safety Code®
2. ANSI/NECA
- i. ANSI/NECA-1-2015 Standard for Good Workmanship in Electrical Construction
3. ANSI/TIA:
- i. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
 - ii. TIA-526-14-C (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
 - iii. ANSI/TIA/EIA-598-D (2018) Optical Fiber Cable Color Coding
 - iv. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
 - v. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
 - vi. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
 - vii. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
 - viii. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
 - ix. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
 - x. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
 - xi. ANSI/TIA-568.1 Revision E, March 2020
 - xii. ANSI/TIA-568D – Series Generic Telecommunications Cabling for Customer Premises (that includes Cat6, OM5, and other cable performance enhancements)
 - xiii. ANSI/TIA-1183-A (2017) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
 - xiv. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
 - xv. ANSI/TIA-942-B (2020) Telecommunications Infrastructure Standard for Data Centers
 - xvi. TIA-569-E (2020) Telecommunications Pathways and Spaces
 - xvii. ANSI/TIA-606-C (2017) Administration Standard for Telecommunications Infrastructure
 - xviii. TIA-607-D (2019) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
 - xix. TIA-758-B (2018) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
 - xx. TIA-1152-A (2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

- xxi. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
 - xxii. TIA-570-D (2018) Residential Telecommunications Infrastructure Standard
 - xxiii. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
 - xxiv. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
 - xxv. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 - Industrial Pathways and Spaces
 - xxvi. TIA-1179-A (July 2018) Healthcare Facility Telecommunications Infrastructure Standard
4. ISO/IEC
 - i. ISO 11801-6 (2017) - Generic Cabling for Customer Premises
 - ii. ISO/IEC TR 14763-3-2 (2016) - Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation - Identifiers within the administration system
 5. National Codes
 - i. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
 - ii. ANSI/NFPA 99-2021, Health Care Facilities Code
 - iii. ANSI/IEEE C2-2017, National Electrical Safety Code®
 - iv. ANSI/NFPA 780, Lightning Protection Code
 6. Federal Communications Commission
 - i. (FCC) Part 15
 - ii. (FCC) Part 68
 7. OSHA Standards and Regulations – all applicable
 8. American Society for Testing Materials (ASTM) Publications
 9. National Electrical Manufacturer’s Association (NEMA) Publications
 10. State of California Public Utilities Commission (Cal. P.U.C.) Publication
 - i. G.O. 92, 95, & 128 Rules for Construction of Underground Electrical and Communications Systems
 - ii. Rural Utilities Services (RUS), formally REA
 11. 2022 California Title 24
 - i. 2022 California Administrative Code, Title 24 Part 1
 - ii. 2022 California Building Code, Title 24 Part 2
 - iii. 2022 California Electrical Code, Title 24 Part 3
 - 1) Chapter 2: Article 250 “Grounding”
 - 2) Chapter 3 compliant installation with modification to accommodate category cabling manufacturer’s installation requirements.

- 3) Chapter 6: Articles 645, & 646
 - 4) Chapter 7: Articles 725 & 770
 - 5) Chapter 8: All Systems & related work by reference to other articles
 - iv. 2022 California Mechanical Code, Title 24 Part 4
 - v. 2022 California Plumbing Code, Title 24 Part 5
 - vi. 2022 California Energy Code, Title 24 Part 6
 - vii. 2022 California Fire Code, Title 24 Part 9
 - viii. 2022 Green Building Standard Code, Title 24 part 11
 - ix. 2022 California Standard Code, Title 24 Part 12
12. Underwriters Laboratories Inc. (U.L.) Publications
- i. 6-1981 (R86) Rigid Metallic Conduit
 - ii. 514B-1982 Fittings for Conduit and Outlet Boxes
 - iii. 651-1981 Schedule 40 and 80 Rigid PVC Conduit
 - iv. UL 467 “Grounding and Bonding Equipment”
 - v. UL 497, 497A, and 497B “Communications Circuit Protectors”
 - vi. UL 924 & UL1994 Emergency Lighting
13. Local Codes and Standards – all applicable
- i. **RCIT** – Installation Standards are required for all communication and technology work in Riverside County Facilities.
 - ii. **Riverside County Fire Department** – Information Technology – Requirements Rev. 1.8 – Modified per site drawing package.
14. BICSI Publications, Manuals, & ANSI Approved BICSI Standards
- i. Telecommunications Distribution Methods Manual, 14th Edition
 - ii. AV Design Reference Manual, 1st Edition
 - iii. Network Design Reference Manual, 7th Edition
 - iv. Network Systems and Commissioning (NSC) reference, 1st Edition
 - v. Outside Plant Design Reference Manual, 6th Edition
 - vi. Wireless Design Reference Manual, 3rd Edition
 - vii. Electronic Safety and Security Design Reference Manual, 4th Edition.
 - viii. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
 - ix. ANSI/BICSI 001-2017, Information Transport Systems Design Standard for K-12 Educational Institutions
 - x. ANSI/BICSI 002-2019, Data Center Design and Implementation Best Practices

- xi. ANSI/BICSI 003-2014 Building Information Modeling (BIM) Practices for Information Technology Systems
- xii. BICSI 004-2018, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
- xiii. ANSI/BICSI 005-2016 – Electronic Safety and Security (ESS) System Design and Implementation Best Practices
- xiv. ANSI/BICSI 006-2020 Distributed Antenna System (DAS) Design and Implementation Best Practices
- xv. ANSI/BICSI 007-2017 Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
- xvi. ANSI/BICSI 008-2018 Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices
- xvii. ANSI/BICSI 009-2019 Data Center Operations and Maintenance Best Practices
- xviii. ANSI/BICSI N1-19 Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure. Formally known as - ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
- xix. ANSI/BICSI N2-17 Practices for the Installation of Telecommunications and ICT Cabling Intended to Support Remote Power Applications
- xx. ANSI/BICSI N3-20 Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure – formally known as - NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- xxi. BICSI G1-17 ICT Outside Plant Construction and Installation: General Practices

- 15. Anywhere cabling Standards conflict with electrical or safety Codes, the Contractor shall defer to NEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
- 16. Knowledge and execution of applicable codes is the Contractor's sole responsibility.
- 17. Any code violations committed during installation shall be remedied at the Contractor's expense.

1.07 SCOPE OF WORK

A. General project information:

- 1. These Specifications and associated drawings are the governing documents for the telecommunications infrastructure installation and include project descriptions, specified and recommended products, installation and project management methods, the Scope of Work, and elevation drawing specifications.
- 2. This division specification document will refer to RCFS-IT as the **Riverside County Fire Department – Information Technology**.
- 3. **Riverside County Fire Department** wishes to contract with a General Contractor, who will sub-tier the supplier/contractor ("ICT-Information, Communication Technology, and Audio-Visual") to provide, install, test, and warranty a complete turn-key a Cable Infrastructure System and Audio-Visual System for the **Riverside County Fire Department's** {FS-49}, the "Project" per the scope of Work and specifications stated

herein. This inquiry implies no obligation on the part of the **Riverside County Fire Department**. The Contractor shall bear all costs and expenses incurred in preparing a response to a Request for Proposal ("RFP") and subsequent award of the project; it is understood and agreed that **Riverside County Fire Department** accepts no responsibility for any costs and/or expenses incurred by the winning Contractor in preparing and submitting such response.

4. The **Riverside County Fire Department** is developing a New Fire Station (49) located at 43700 Tamarisk Dr. Desert Center, CA 92239. The building will consist of the following:
 - i. See architect drawing package for room types and quantities.

SCOPE OF WORK

- RESTORE ARCHITECTURAL FINISHES (FLOOR, WALL, CEILING) BEING DISTURBED BY THE WORK TO ORIGINAL CONDITION.
- PROVIDE THROUGH PENETRATION FIRE-STOPPING AT ALL RATED FLOOR/WALL BARRIER.
- ALL SLEEVES (BOTH ENDS) & CONDUITS THAT END INTO A SPACE OR AT A CABLE TRAY SHALL BE FIRE-STOPPED WITH A UL LISTED ASSEMBLY INSTALLED AS PER ALL MANUFACTURERS INSTRUCTIONS AND APPROVED FOR USE BY THE CONSTRUCTION MANAGER.
- INSTALL CONDUIT AND BACK-BOXES SYSTEM FOR PROJECT DEFINED LOW-VOLTAGE/SIGNAL SYSTEM PER CHAPTER 3 OF CEC THAT MEETS CABLING MANUFACTURERS INSTALLATION REQUIREMENTS. INCLUDING MAXIMUM BEND RATIOS, CABLE PULLING TENSION, MAXIMUM DISTANCE BETWEEN PULL-POINTS.
- PROVIDE SLEEVES MANUFACTURED FOR THE PURPOSE OF RESTORING ACOUSTICAL RATINGS FOR ANY SUCH BARRIERS PENETRATED WITH PROJECT WALL STP RATING, LOCATIONS ARE REQUIRED TO BE IDENTIFIED ON CABLING SHOP DRAWINGS
- PROVIDE IDF EQUIPMENT PER PLANS
- PROVIDE A COMPLETE LV CABLING SOLUTION INCLUSIVE OF ALL PATHWAYS, CABLING, TERMINATION, TESTING, DOCUMENTATION, AND BONDING CONNECTIONS PER THESE DESIGN DOCUMENTS FOR A CABLING MANUFACTURER'S EXTENDED WARRANTY COMPLIANT SOLUTION THAT MEETS RIVERSIDE COUNTY FIRE DEPARTMENT (REQUIREMENTS REV 1.8). ADDITIONAL SITE/PROJECT REQUIREMENTS ARE IDENTIFIED IN THESE PROJECT DRAWINGS.
- PROVIDE (1) 7' CAT6 PATCH-CORD & (1) 10' CAT6 EQUIPMENT CORD FOR EACH FACEPLATE (CORDS CPOI)

B. Purpose:

1. This specification defines quality standards and practices common to all network cabling for the project. In addition, the project will have Requests for Proposals (RFP), associated drawings, and requirements about their specific environments. This document will refer to such collateral as "Project Specific Documentation" or simply "Construction Documents."
2. Voice and Data Networks encompass a broad spectrum of technologies and are distributed into internal project spaces. Installed cables will be used for Ethernet, high and low-speed data applications, and analog and digital voice, not to exclude other future Voice/Data technologies. This specification will include indoor/outdoor cable installations, backbone cabling, telecommunications closet and equipment cabling, equipment hardware, and routing and support infrastructure.
3. the installing Contractor is responsible for evaluating these general recommendations and adapting them effectively to actual projects. The Contractor is responsible for identifying and bringing to the attention any design directions that may be in conflict or otherwise improved. All such conflict resolutions shall be in writing from A/E or **Riverside County Fire Department**.

4. Note that while many portions of this global specification are addressed to "The Contractor," these requirements apply equally to anyone doing the network cabling and infrastructure work within, whether those persons are outside contractors or persons directly employed by the **Riverside County Fire Department**.
5. The Contractor shall be solely responsible for all parts, labor, testing, documentation, and all other associated processes and physical apparatus necessary to turn over the completed system fully warranted and operational for acceptance by A/E and manufacturer's representative.
6. This specification includes structured cabling design considerations, product specifications, and installation guidelines for low-voltage network systems and associated infrastructure, including but not limited to:
 - i. Cabling Sub-system 1 – Horizontal
 - 1) Category 6 cable
 - 2) Work area (equipment outlet) appliances and configuration (Furniture systems cabling).
 - 3) Horizontal Pathways
 - 4) Copper Patching (CPOI)
 - ii. Telecommunications Spaces
 - 1) Telecommunications Room Requirements
 - 2) Racks and Cabinets
 - 3) Overhead Pathways
 - iii. Communications Grounding Systems
 - iv. Communications Labeling and Administration

C. Scheduling:

1. Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the Work. All such documents shall be available through the General Contractor or Construction Manager.
2. The project schedule shall include, but is not limited to, the following task sequence:
 - i. New IDF Construction and buildout.
 - ii. Conduit infrastructure: including vaults/pull box installation and conduit duct banks.
 - iii. Individual Building Pathway Installation.
 - iv. Building Category 6 Cable installations; includes installation, termination, labeling, testing, as-built, and warranty documentation.
 - v. Wireless Access Points.
 - vi. New backbone fiber optic cabling installations include installation, termination, labeling, testing, as built, and warranty documentation.
 - vii. Service provider cabling and equipment installation.
 - viii. Service provider completion and commissioning.

D. Coordination:

1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid

interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work caused by the sub-contractor's neglect shall be made by the sub-contractor at their own expense.

E. Project Scoping from Basis of Design:

1. The Contractor shall use all **Riverside County Fire Department** current technology standards input for a complete functioning turn-key technology solution.
2. Scope of Work:
 - RESTORE ARCHITECTURAL FINISHES (FLOOR, WALL, CEILING) BEING DISTURBED BY THE WORK TO ORIGINAL CONDITION.
 - PROVIDE THROUGH PENETRATION FIRE-STOPPING AT ALL RATED FLOOR/WALL BARRIER.
 - ALL SLEEVES (BOTH ENDS) & CONDUITS THAT END INTO A SPACE OR AT A CABLE TRAY SHALL BE FIRE-STOPPED WITH A UL LISTED ASSEMBLY INSTALLED AS PER ALL MANUFACTURERS INSTRUCTIONS AND APPROVED FOR USE BY THE CONSTRUCTION MANAGER.
 - INSTALL CONDUIT AND BACK-BOXES SYSTEM FOR PROJECT DEFINED LOW-VOLTAGE/SIGNAL SYSTEM PER CHAPTER 3 OF CEC THAT MEETS CABLING MANUFACTURERS INSTALLATION REQUIREMENTS. INCLUDING MAXIMUM BEND RATIOS, CABLE PULLING TENSION, MAXIMUM DISTANCE BETWEEN PULL-POINTS.
 - PROVIDE SLEEVES MANUFACTURED FOR THE PURPOSE OF RESTORING ACOUSTICAL RATINGS FOR ANY SUCH BARRIERS PENETRATED WITH PROJECT WALL STP RATING, LOCATIONS ARE REQUIRED TO BE IDENTIFIED ON CABLING SHOP DRAWINGS
 - PROVIDE IDF EQUIPMENT PER PLANS
 - PROVIDE A COMPLETE LV CABLING SOLUTION INCLUSIVE OF ALL PATHWAYS, CABLING, TERMINATION, TESTING, DOCUMENTATION, AND BONDING CONNECTIONS PER THESE DESIGN DOCUMENTS FOR A CABLING MANUFACTURER'S EXTENDED WARRANTY COMPLIANT SOLUTION THAT MEETS RIVERSIDE COUNTY FIRE DEPARTMENT (REQUIREMENTS REV 1.8). ADDITIONAL SITE/PROJECT REQUIREMENTS ARE IDENTIFIED IN THESE PROJECT DRAWINGS.
 - PROVIDE (1) 7' CAT6 PATCH-CORD & (1) 10' CAT6 EQUIPMENT CORD FOR EACH FACEPLATE (CORDS CPOI)
3. Scope of Work (Narrative):
 - i. The telecommunications infrastructure for the **Riverside County Fire Department** (Campus/Site) shall include a standard infrastructure to support voice, data, wireless communications, and specified audio-visual services. The foundation for the design shall be according to **Riverside County Fire Department** Design Guidelines (if applicable), EIA/TIA 568C & D Series and 569B standards, along with BICSI Methodologies (TDMM and OSPDRM), Industry Best Practices, and Manufacturer's Installation Requirements.
 - ii. All Low-Voltage/Signal Systems shall be installed and furnished by a manufacturer's pre-qualified company. A certified manufacturer's representative shall install the low voltage/signal infrastructure with all material covered under an extended warranty for compliance with **Riverside County Fire Department** Standards. A minimum 25-year extended product and performance warranty must cover the new cabling. Each installer must show proof of training and proficiency for the Low-Voltage/Signal Systems being expanded and extended to for the building type. All hardware the Contractor provides shall be "new in the box" and match the existing in-service back-end and end-devices to maintain the current Campus low-voltage/signal system's integrity. All Contractor-furnished equipment and materials shall be in full compliance with district specifications and shall be

submitted to the project OAR for **Riverside County Fire Department** review and acceptance prior to contractor installation. Equipment and materials submittals shall comply with specified formatting and indexing defined in the system-specific specification. Any and all equipment that does not match the current (Campus/Site) solution/part number(s) is required to be accompanied by a letter and cross-reference table(s) from the manufacturer for verification that the product is compatible with the interface with currently deployed solutions.

- iii. Contractor shall register the "New" Fire Station #49 project 2024 with CommScope (SYSTIMAX) to add these locations to the **Riverside County Fire Department's** extended warranty agreement.

1.08 SYSTEM DESCRIPTION AND GENERAL RESPONSIBILITIES

- A. The work to be performed under this contract includes the furnishing of all labor, materials, and equipment for an industry-compliant CFCI telecommunications pathway and spaces building system, cabling solution, category six (6) manufacturer-compliant structured cabling systems with extended performance and replacement warranty, for the systems required by the project. These systems include OFOI data network connections, OFCI VoIP instruments, and CFCI headend interfaces', OFCI Campus wireless and Wi-Fi access, CFCI Paging, CFCI Time and Attendance functionality, CFCI Video surveillance system, a CFCI physical access control system, a CFCI duress/panic system, and a CFCI audio announcement system. Work shall include all provisions of new electronic controls systems, including physical access control, duress alarm, video surveillance, and audio. The portion of the work is to be bid as an optional add alternate, and the **Riverside County Fire Department** may or may not choose to execute this work under the contract.
- B. Combined Prescriptive and Performance Design Requirements
 1. Division 27 includes a combination of prescriptive and performance specifications. Compliance with the performance specifications and coordination and integration of the prescription requirements will require substantial design work on the Contractor's part.
 2. The performance requirements are intended to establish overall system performance requirements, satisfy the operational requirements, and establish the inter-coordination requirements for the Division 27 systems.
 3. The prescriptive requirements establish the minimum quality, characteristics, and types of components, equipment, and materials to be used to achieve the stated system performance requirements. The Contractor is advised, however, that prescriptive specifications have not been provided to satisfy all of the specified performance requirements.
 4. The Contractor shall carefully consider all the requirements for each of the Division 27 systems when preparing a bid. Any questions regarding the intent of these requirements, the scope of the systems, or their coordination requirements must be submitted in writing prior to bidding in accordance with the Instructions to Bidders. The Contractor shall have no claim for either extra compensation or extra time on the grounds that it did not understand the scope of the requirements of the Division 27 work and/or the coordination requirements of the Division 27 work with the work of the other Divisions.
 5. Compliance with the project requirements will be progressively monitored and adjusted through the submittal process, installation period, and performance verification testing.
- C. Drawing Interpretation
 1. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or detailed drawings. The

Drawings installation and schematic diagrams and symbols to outline the work to be provided. These drawings do not have any dimensional significance, nor do they delineate every item required for the intended work. No interpretation shall be made from the limitations of symbols and diagrams that exclude any elements necessary for complete work.

2. The work shall be provided by the intent expressed on the Drawings and Specifications and in conformance with the actual building architectural and structural conditions. When in conflict, field conditions take precedence over the Contract Documents.
 3. The meaning of abbreviations shall be the same in lowercase letters or without periods.
 4. The use of words in the singular shall not be considered as singular where other indications denote that more than one item is referred to.
 5. Details that appear on the Contract Documents, which are specific regarding the dimensioning and positioning of the Work, are intended only for establishing general feasibility. They do not replace engineering or field coordination by the Contractor for the work.
- D. Provide all parts and equipment for a complete and operational system for the Work of Division 27 as described herein and shown on the drawings.
- E. Furnish and install all trenching and backfill, duct banks, conduits, raceways, sleeves, boxes, gutters, shelves, enclosures, shelf and enclosure supports, backboards, and pull ropes (in unused or spare conduits) required to make all systems fully operational, including components not shown on the Drawings, but necessary for fully operational systems.
- F. Furnish, install, terminate, test, dress, and identify all wire and cable required to make systems fully operational, including all wire and cabling not shown on the Drawings but necessary for fully operational systems.
- G. Recognize that the Work entails integration between individual systems, as well as the design and implementation of many systems and component interfaces. Take full responsibility for the complete design, installation, and performance of the total integrated system, including integration between systems and various interfaces, in order to achieve the specified operational features and system performance requirements.
- H. Fully test the systems, demonstrate their satisfactory operation, and train maintenance and operating personnel, as specified in this Section and the Sections governed by this Section.

1.09 CONTRACTOR QUALIFICATIONS

A. General:

1. The Contractor shall have at least 5 years' experience installing and testing structured cabling systems.
2. The Contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD), and the RCDD shall sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
3. The Contractor shall be responsible for obtaining any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
4. The Contractor shall be a current manufacturer with a Certified Installer certificate. A copy of the corporate certificate shall be included with the quote.
5. The Contractor shall have service facilities within 50 miles of the project location.
6. At least 75 percent of the technicians on the job shall have a current manufacturer Certified Copper Technicians certificate to install manufacturer Copper Distribution Systems.

7. At least 75 percent of the technicians installing any Fiber Distribution Systems shall have a current manufacturer Certified Fiber Technicians certificate to install Fiber Distribution Systems.
8. The Telecommunications contractor shall provide a project manager to serve as the single point of contact to manage the installation, speak for the Contractor, and provide the following functions:
 - i. Initiate and coordinate tasks with the Construction Manager and others as specified by the project schedule.
 - ii. Provide day-to-day direction and on-site supervision of Contractor personnel.
 - iii. Ensure conformance with all contract and warranty provisions.
 - iv. Participate in weekly site project meetings.
 - v. This individual shall remain the project manager for the project duration. The Contractor may change the Project Manager only with the written approval of A/E.

B. References:

1. Communications: The Contractor shall provide with the bid a list of three reference accounts where similar Data, Voice, Fiber Optic Cable, and related migration/cutover equipment installation work was performed within the last year or twelve-month period.

C. Insurance Requirements:

1. The Contractor shall be insured and shall provide with the bid a Certificate of Indemnification and Certificate of Insurance and meet all required insurance and licensing policies as specified by A/E Risk Management Division and any Federal, State, and local organization pertaining to data, voice, and fiber optic cable installation.
2. Contractor vehicles brought onto project properties shall comply with all requirements of all Federal, State, and local agencies. Vehicles shall meet current DOT, state, and local safety inspections where required.

D. Termination of Services:

1. **Riverside County Fire Department** or A/E reserves the right to terminate the Communication Contractor's services if the A/E determines the Communication Contractor is not fulfilling their responsibilities as defined in this document.
2. The Contractor's appearance and work ethic shall be of a professional manner, and dress shall be commensurate with the work being performed.
3. Dress displaying lewd or controversial innuendos is strictly prohibited.
4. Conduct on project property shall be professional in nature.
5. Any person in the Contractor's employ working on a project considered to be incompetent or disorderly, or for any other reason unsatisfactory or undesirable, shall be removed from work on the project.
6. The Communications Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

E. Other Contractor Responsibilities:

1. The Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas shall be cleaned at the conclusion of the workday, and no tools or materials shall be left in a manner as to pose a safety hazard.

2. The Contractor shall remove all abandoned cables per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. This is mandatory; Contractors shall consider this when placing bids.
3. The Contractor shall abide by the regulations set by A/E or **Riverside County Fire Department Security Department** pertaining to access to and conduct while on project property and shall obey speed limits and parking regulations.

1.10 SYSTEM PERFORMANCE WARRANTY

A. General

1. The Contractor shall provide a manufacturer System Warranty on all copper and fiber permanent cabling links.
2. This is a system performance warranty guaranteeing for a minimum of 20 years from acceptance that the installed system shall support all data link protocols for which that copper Category (6) or fiber OS designation is engineered to support according to IEEE and TIA standards.
3. The manufacturer's System Warranty may be invoked only if the cabling channel links are comprised of manufacturer connectivity and approved by the manufacturer. Patch cords shall be same manufacturer of cable.
4. Upon acceptance of the Warranty, the manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to **Riverside County Fire Department -IT**

B. Contractor Warranty Obligations

1. The installation firm shall be a current manufacturer-certified installer in good standing and shall include a copy of the company certification with the bid.
2. The Contractor shall name a supervisor to serve on-site as a liaison responsible for inspecting and ensuring that all terminations comply with factory methods taught in manufacturer Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
3. The Contractor liaison shall have a current, up-to-date manufacturer-certified technician certificate in copper and fiber. Copies of the copper and fiber certificates of the manufacturer liaison shall be submitted with the bid.
4. The Contractor agrees that all active link components shall be of the same copper Category (6) or fiber OS/OM designation as the installed system. The Contractor shall under no circumstances mix different Categories or OS/OM classes of cable or termination devices (connectors) within the same link or system.
5. The Contractor shall install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, and approved termination methods as well as adhering to industry accepted practices of good workmanship.
6. The Contractor is responsible for understanding and submitting to the manufacturer all documents required prior to the project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
7. The Contractor is responsible for understanding and submitting to the manufacturer all documents required at the project end. These include completed warranty forms, passing test reports, and drawings of floor plans showing the locations of links tested.

8. Test results shall be delivered in the tester native format (not Excel) and represent the full test report. Summaries shall not be accepted—contact the manufacturer for a current list of approved testers, test leads, and the latest operating systems.
9. The Communications Contractor shall correct any problems and malfunctions that are warranty-related issues without additional charge for the entire warranty period. The warranty period shall commence following the acceptance of the project by A/E and written confirmation of the Warranty from the manufacturer.

1.11 SAFETY

A. General

1. All cabling work being performed on project property or under contract shall comply with Rules for safe operations of state or local safety regulations and meet the requirements of OSHA Safety and Health Standards. The contractor Project Manager shall maintain a copy of the Rules for Safe Operations for reference. It is the responsibility of the Communications Contractor to immediately correct any unsafe working practices on the part of contractor personnel. Contractor personnel's unsafe working environments or conditions shall be reported immediately to the Construction Manager.
2. Any liability for correcting conditions created by the Contractor's personnel rests with the Contractor.
3. The Communications Contractor shall be solely and entirely responsible for conditions of the job site (as pertaining to the materials and equipment specified), including the safety of persons and property during the performance of work.
4. No act, service, drawing review, or construction observance by any employee, representative, or engineer may be construed as a review or approval of the adequacy of the Contractor (s) safety measures in, on, or near the construction site.

1.12 WORKING CONDITIONS

A. Site Access

1. All cable installations shall be pre-approved by the Construction Manager to ensure that the necessary arrangements have been made for proper access to project sites.
2. A twenty-four-hour prior notice shall be submitted to the Construction Manager for any work schedule changes.
3. The Communications Contractor shall display badges or passes as mandated by project property Security Department Rules and Regulations.

B. Scheduling

1. Coordination of site surveys and the issue of project **Riverside County Fire Department** -owned materials and equipment shall be the responsibility of the Construction Manager. Once said equipment and materials are in the Contractor's possession, the contractors must safeguard the material and equipment from damage or theft.
2. Information required by the Contractor to price and complete a defined scope of Work shall be furnished to the Communications Contractor by the A/E Project Manager in a Scope of Work document and at the time of the site survey (if necessary). The Communications Contractor shall maintain it until the completion of the job.
3. The contractor is responsible for beginning Work promptly according to the Start Dates and completing Work by the Proposed Completion Date listed on the Cable Run Request Form.

4. The Contractor shall notify the Construction Manager in writing of any delays; at that time, they shall come up with a mutually agreeable project schedule.
5. The Communications Contractor shall coordinate with the Construction Manager's working hours and job site access issues.
6. The Communications Contractor shall coordinate with the Construction Manager to minimize outages to the existing systems.
7. Any service interruption required by the Communications Contractor shall be requested in writing and scheduled with the Construction Manager.
8. The Communications Contractor shall not proceed with the requested service interruption until the Construction Manager grants written approval.
9. All problems and questions relating to a particular job shall be referred to the Construction Manager, and no changes shall be made without their written approval.

C. Harmony Clause

1. The Contractor shall coordinate and work in harmony with other trades on the project as well as with A/E personnel for the best interests of the **Riverside County Fire Department** of the project.
2. Coordination shall include but not limited to:
 - i. Service Provider for the (utility) area and the building (including required services – i.e.. Riser Company)
 - ii. Division 8 contractor for access control and interfaces for indoor and outdoor.

1.13 COORDINATION

- A. Coordinate layout and installation of voice and data communication cabling with other **Riverside County Fire Department** contractors and equipment suppliers.
1. Meet jointly with other contractors, equipment suppliers, and **Riverside County Fire Department** representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distributed to other participants.
 3. Adjust arrangements and locations of distribution frames, cross-connect, and patch panels in equipment rooms and telecommunications rooms to accommodate and optimize voice and LAN equipment's arrangement and space requirements.
 4. the Contractor shall reuse existing copper and fiber optic backbone cables when indicated on drawings.
 5. Provide weekly progress reports and crew schedules to project representatives by 5:00 p.m. Thursday (or agreed upon day) of each project work week.

1.14 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
1. Submit all product data in accordance with the general requirements of the construction documents.
 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 Work for A/E review and action.
 3. The Contractor shall submit product materials in one complete Division 27 package, with sub-divisions clearly identified. Products applicable to project drawings and specifications are clearly identified under each sub-division.

4. The Contractor shall provide product data and installation instructions for all fire-stopping materials.
5. Alternate and "Or Equal" designated products shall be submitted for review and judgment to the A/E prior to installation. The contractor-proposed alternate products or components shall be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
6. Any request of an alternate or substitution shall be submitted to the A/E for action no later than fourteen (14) calendar days after the release of the original telecommunications bid documents.

1.15 Information & Communication Technology (ICT) components

- A. The Contract Documents generally outline industry-standard components to be installed as part of the project ICT installation requirements. Such identification is intended to be general in nature rather than exhaustive. All stated quantities are subject to validation by the ICT contractor. ICT The Contractor is reminded that differences between estimated quantities and those reasonably derived based from the Contract Documents (as well as through bid conferences, job walks, addendums, and other distribution of information) shall be the responsibility of the ICT contractor. There shall be no additional cost incurred by **Riverside County Fire Department** IT projects for not complying with the specifications and requirements of the Contract Documents.
- B. Any variance from those components identified on the drawings and/or below shall be submitted to **Riverside County Fire Department** IT project representatives for approval prior to ordering and installation; the risk for all costs incurred by the ICT Contractor for materials ordered prior to such written consent shall be borne entirely by the ICT Contractor. Nonetheless, the ICT Contractor must determine the availability of necessary materials and propose equivalent substitutes as necessary to meet all installation milestones. Delays in ICT installations due to lack of product availability are unacceptable. As catalog numbers change frequently, the ICT Contractor shall verify all part numbers prior to ordering materials. Clarifications shall be issued in response to written Requests for Information (RFI).
- C. Fire Stop and fire-stopping requirements for the project include the following:
 1. All conduits leaving the entrance room for other portions of the building shall be fire-stopped after cable installation.
 2. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after the installation of the cable.
 3. Strict adherence to the CEC/NEC NFPA 101 is required for any raceway penetrations of fire-rated walls. See Section 07 84 00 for UL system numbers and to construction drawings for details.
 4. All riser conduits shall be sealed using a UL-classified fire stop. The Contractor shall provide a copy of the fire seal manufacturer's installation instructions and rating information prior to inspection of the installed materials.
 5. Integrally Fire Stopped Sleeves:
 - i. Integrally Fire Stopped Sleeves shall be used for Telecommunications cabling in locations where the cabling pathway penetrates a fire barrier. The IFSS shall replace the use of conduit used in conjunction with other fire-stopping methods.

- ii. All manufacturer instructions and requirements shall be followed for the installation of the IFSS.
 - iii. Documentation shall include a picture of the completed assembly with a time/date stamp.
- D. All new fiber optic cabling shall be indoor/outdoor-Plenum rated. Unrated cable (such as filled ASP) shall not be installed within the structure except when placed within IMT, PVC, or RGS conduit.
- E. Throughout this specification, Systimax(Commscope and Chatsworth Products, Inc., and other manufacturers are cited. These citations are required to maintain the current **Riverside County Fire Department** -IT extended warranties and shall not be substituted without written permission from the **Riverside County Fire Department** -IT. These standard **Riverside County Fire Department** products are to establish quality, performance, and warranty certification criteria.

1.13 DELIVERY AND STORAGE

- C. The ICT Contractor shall provide a materials schedule prior to the start date of cable installation. The material schedule shall specify all material quantities and their delivery date for this project.
- D. The ICT Contractor shall provide protection from weather, moisture, dirt, dust, and other contaminants for telecommunications cabling and pathway equipment placed in storage.

1.14 INFORMATIONAL SUBMITTALS

A. Division 27 & 28 Submittal Schedule

- 1. Project start up submittal package shall include: (received and logged (3) business days prior to site staging)
 - i. Material data sheets not deemed part of design package.
 - ii. Scaled shop drawings.
 - iii. BoM listing with part numbers and quantities.
- 2. Closeout submittal shall include: (received and logged (3) business days prior to punch walk request).
 - i. Cable test results with RCFS-IT standard cable ID scheme.
 - ii. Digital cable record drawing showing as-built conditions for FS-49 scope of work. Cable numbers matched to test results.

B. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings at least two (2) weeks before the commencement of Division 27 work for A/E review and action.
- 3. Shop drawings shall include evidence that grounding and bonding components are coordinated with field conditions and the work of other trades. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

C. Certificates:

- 1. Submit management and installation team reference documentation verifying that:
 - i. The project manager is an RCDD in good standing with BICSI, is qualified to manage the Scope of Work described in the contract documents and has

five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.

- ii. The field supervisor is a BICSI-trained technician that is qualified to perform and oversee the work described in the contract documents.

D. Qualification Statements:

- 1. The Contractor shall submit documentation that within the past 12 months, at least 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

1.15 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 - i. The drawing notes shall define field conditions experienced not described in sheet notes.
 - ii. The drawings shall identify all fire stop locations, and a digital picture shall accompany the as-built package.
 - iii. As-built conditions shall be identified on record drawings and include:
 - 1) Outlet location w/ Cable ID (test results to use this ID).
 - a) Cable ID shall include IDF# - Patch-Panel – Port ID #
 - 2) Sleeves and poke-through conduit routing.
 - 3) Information shall be submitted for review and organizing two weeks prior to the requested punch-walk date.
- 2. Submit as-built drawings a minimum of two weeks after completion of all Division 27 work for A/E and **Riverside County Fire Department** reference.
- 3. Communication contractor to print, frame, and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.16 QUALITY ASSURANCE

A. Qualifications—Manufacturer

- 1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.
- 2. Installers shall have a manufacturer certificate of completion for the fire stop solution being proposed.

B. Qualifications—Installer:

- 1. At a minimum, seventy-five percent (75%) of the onsite Contractor field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on-site for review for each field technician at all times.

C. Workmanlike Manner

- 1. Installers shall address their job functions for this Scope of Work from the guidance provided by ANSI/NECA-1-2015.
- 2. Cable hangers, Saddles, Supports, and J-Hooks shall be routed inline and parallel to building lines.

- i. All cable routing shall maintain an "Above" approach to cabling when crossing any obstruction – Cable hangers shall be installed to support the cable bundle above and away from physical damage or electrical interference from accidental contact with the UTP cabling system.
 - ii. Cable hangers shall be installed on a minimum 3/8" threaded rod and installed at a uniform height above the finished floor wherever possible.
 - iii. Maintain a minimum 6" clearance above the finished ceiling.
 - iv. Cable hanger routing shall be identified on as-built conditions and record drawings.
3. Cable hangers, Saddles, Supports, and J-Hooks shall be attached per the manufacturer's installation requirements and reviewed and confirmed with SEOR prior to rough-in.
4. Cable hangers shall be required to maintain the maximum cable bundle size for the different ratings of PoE (power rating) listed on the cable jacket.
5. Cable hangers are field-defined routing; therefore, all non-rated, fire-rated, acoustical-rated sleeves shall be the Contractor's responsibility for configuration, furnishing, install, and documentation of required sleeves.
6. This requirement includes manufacturer training for proper fire stop installation of technicians performing these installations

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall review all drawings, data sheets, specifications, & **Riverside County Fire Department** -IT Standards and Specifications

3.02 POWER OVER ETHERNET (PoE)

- A. Check actual cable data sheets prior to the start of any work. Ensure all data and Class 2, 3, & 4 power requirements are met for the project.
- B. Methodology for PoE requirements that the Contractor shall comply with:
 1. Follow the Cable Usage Chart in the Drawings set (cover sheet)
 2. Confirm U/UTP cable bundle size (quantity of cables per dressed harness)

	Type 1	Type 2	Type 3	Type 4
Name	PoE	PoE+	PoE++ UPoE	High Power PoE
PoE Standard	IEEE 802.3af	IEEE 802.3at	IEEE 802.3bt	IEEE 802.3bt
Max. Power Per Port	15.4W	30W	60W	100W
Power to PD	12.95W	25.5W	51W	71.3W
Twisted Pair Used	2-Pair	2-Pair	4-Pair	4-Pair
Supported Cables	Cat5e	Cat5e	Cat6A	Cat6A
Typical Application	IP Phone	Video Phone	MGMT Device	LED Lighting

3.03 FIRE STOP REQUIREMENTS

- A. Check actual site conditions prior to the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with the installation or use of products specified in this section.
- B. Methodology for fire stop requirements that the Contractor shall comply with:
1. In any area where a fire-rated wall, partition, floor, or ceiling is penetrated, the Contractor shall create the pathway and seal around all cables and sleeves with a UL-classified fire seal sufficient to return the structure to its original rating. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the Contractor's responsibility. Any opening in a rated structure created by the Contractor that is larger than one inch in diameter shall be equipped with a metal sleeve secured and fire-stopped in place.
 2. Comply with requirements in **Section 07 84 13** "Penetration Firestopping."(Check Architect specifications for fire stopping)
 3. Comply with TIA-569-B, Annex A, "Firestopping."
 4. Comply with BICSI TDMM, "Firestopping Systems" Article.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - i. Seal the annular space between the sleeve and pathway or cable, using joint sealant appropriate for the size, depth, and location of the joint. Comply with requirements in **Section 07 92 00 "Joint Sealants."**
 - ii. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless the penetration arrangement requires a rectangular-sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during the erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during the erection of floors for the building.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires a rectangular sleeve opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

3.04 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** prior to beginning any re-installation work.

3.05 CLOSEOUT ACTIVITIES

- A. The Contractor shall provide testing results and as-built conditions in the documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. The Contractor is to submit all as-built drawings and any test documentation required prior to acceptance by the **Riverside County Fire Department**.

END OF SECTION

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SECTION 270526

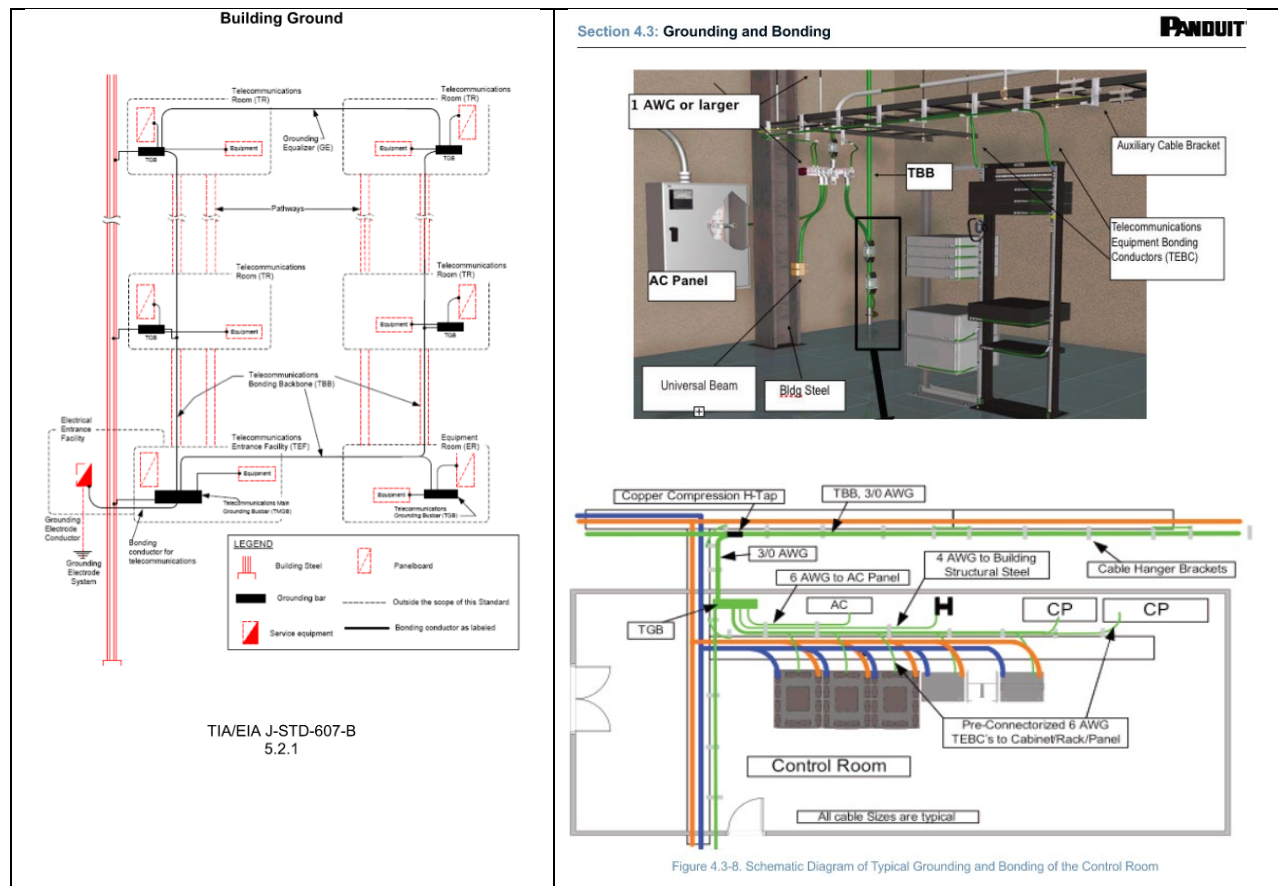
GROUNDING BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Specifications for grounding and bonding components utilized to provide proper grounding and bonding for telecommunications cabinets, racks, cable trays, ladder trays, cables, and equipment.
2. Grounding and bonding components with design criteria as a single manufacturer solution.



1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

Busbar Hardware Kit

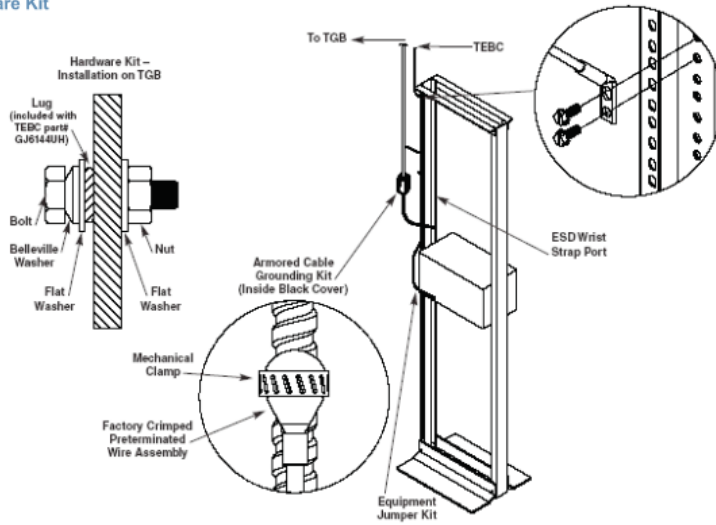


Figure 4.3-14. Busbar Hardware and Armored Fiber Grounding Kits

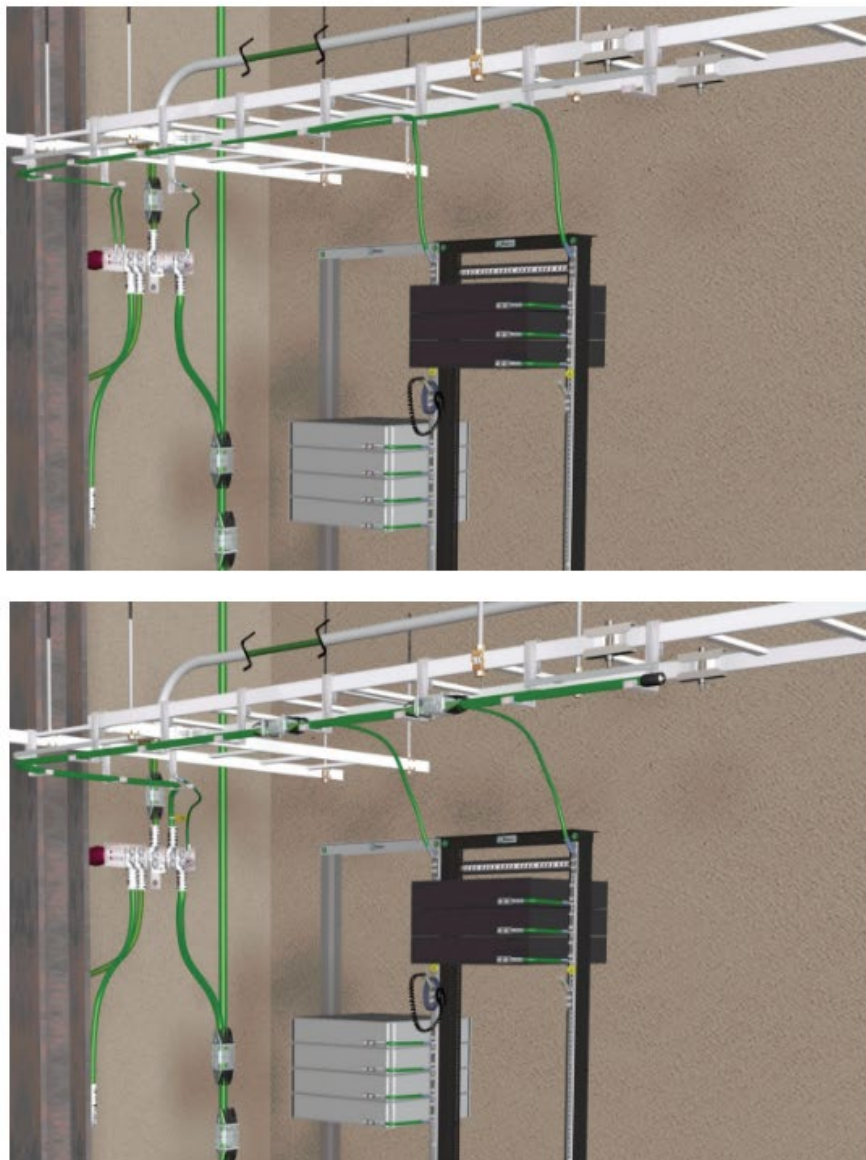


Figure 4.3-13. Telecommunications room bonding topologies (no access floor). Top – several TEBCs used to bond each rack directly to the TGB. Bottom – racks bonded to a single TEBC which then bonds to the TGB.

PART 2 - PRODUCTS

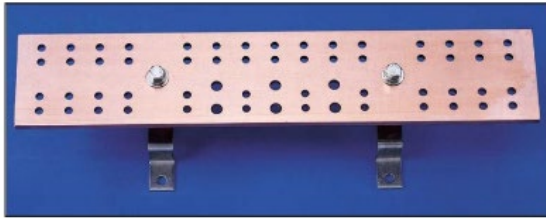


Figure 6-1
Example of a PBB

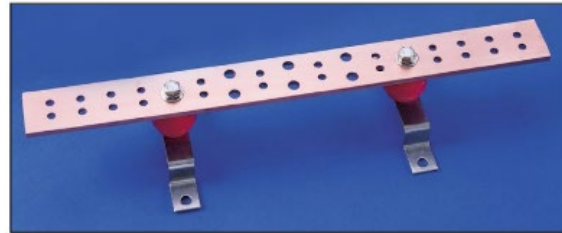
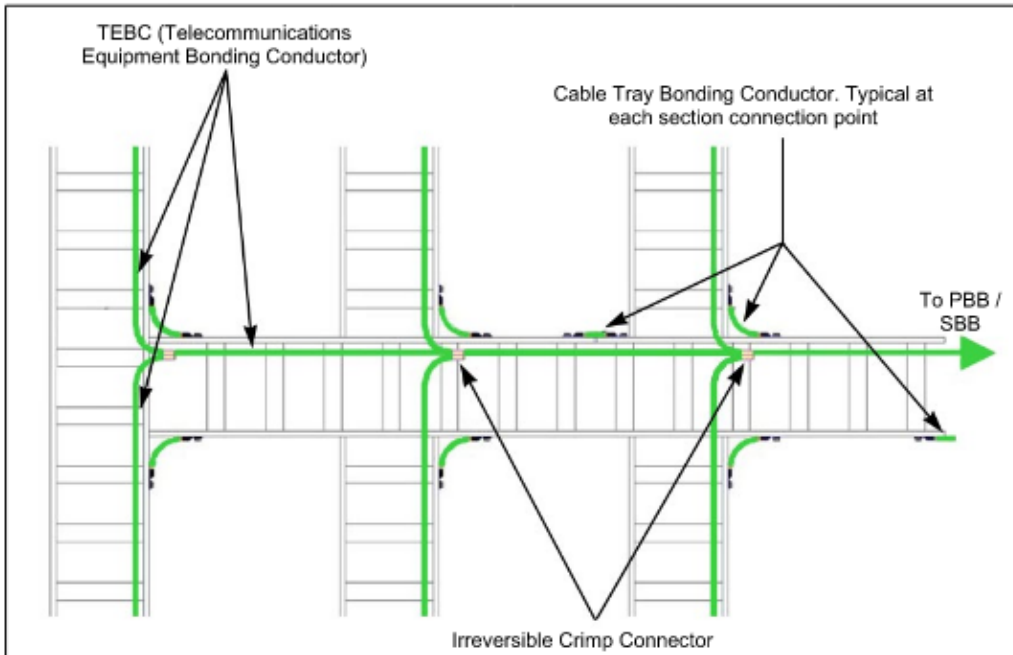
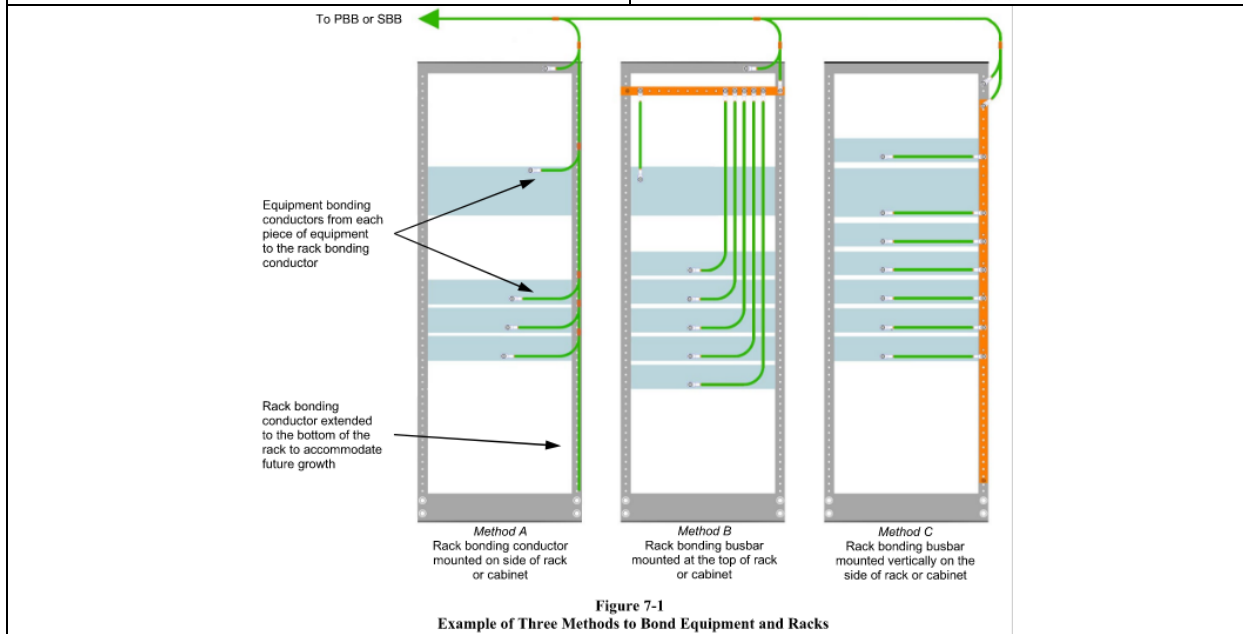
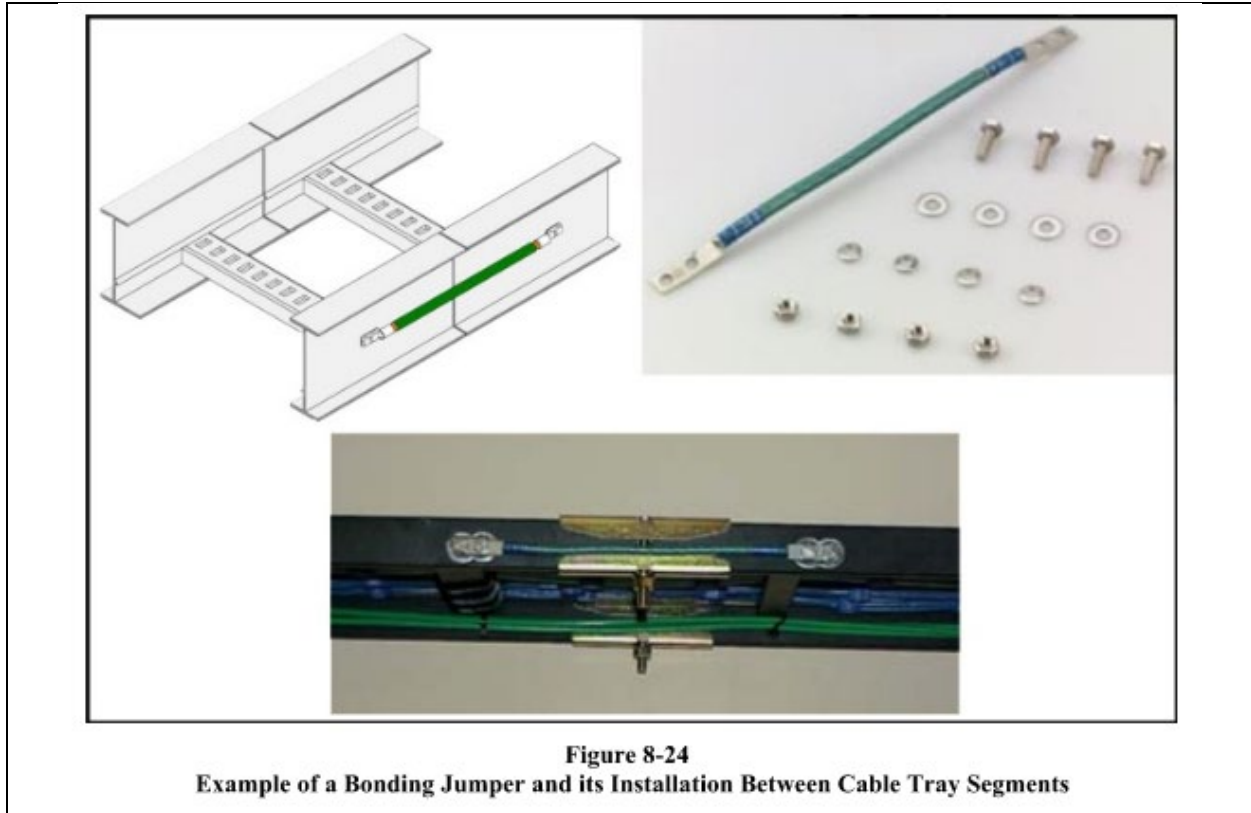


Figure 6-2
Example of an SBB





2.01 GROUNDING AND BONDING SOLUTION

- A. **Riverside County Fire Department** -IT Standards and Specifications: Subject to compliance with requirements, provide the manufacturer or comparable product by one of the following:
 - 1. Panduit
 - 2. Riverside County Fire Department -IT Approved Equal
- B. Product Options:
 - 1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the infrastructure requirement.
 - 2. All assembly components shall be from a single manufacturer's solution for the size of the telecommunications space it is being designed for.
- C. Description:
 - 1. The Subcontractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the ANSI/TIA 607, ANSI/BICSI-N3, & Panduit Bonding & Grounding Equipment Installation Requirements. All systems and assemblies shall comply with 2022-CEC Article 250 & Chapter 8.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section.

**SPECIFICATION STANDARD
GROUNDING AND BONDING 27 05 26**

1. Green insulated copper conductor, minimum as specified in the table below, size 6 AWG. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/ AWG Insulation shall meet fire ratings of its pathway.

TABLE 1			
Sizing of Telecommunication Bonding Backbone (TBB)			
TBB length FT	Grounding Conductor Size (AWG)	DC Resistance Per 100 Ft (Copper Conductor)	Short-Time Rating (A)
	8	0.0778	391
< 13 Ft	6	0.0491	621
14 - 20 Ft	4	0.0308	988
21 -26 Ft	3	0.0245	1245
27 - 33 Ft	2	0.194	1571
34 - 41 Ft	1	0.0154	1981
42 - 52 Ft	1/O	0.0122	2499
53 - 66 Ft	2/O	0.00967	3150
> 66 FT	3/O	0.00766	3972
	4/O	0.00608	5008
	Kcmil		
	250	0.00515	5917
	300	0.00429	7101
	350	0.00367	8284
	400	0.00321	9467
	500	0.00258	11834
	AWG = American Wire Gauge		
	DC = Direct Current		
	kcmil = Thousand circular mils		

3.02 INSTALLATION

A. Process:

1. All newly installed racks and cabinets shall have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
2. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar using an anodized green thread-forming grounding screw that includes serrations under the head to cut through oxidation or paint on the equipment flange.
3. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with an EBC (equipment bonding conductor) kit built for that purpose.
4. All grounding wire shall be a minimum #6 AWG stranded annealed ground wire; PVC sheathed with nylon. Meets UL83 for THHN or THWN and UL1063.
5. All OSP cabling terminated within the new campus MDF shall be terminated to a Building Entrance Terminal with gas fuses.

6. The Subcontractor shall clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces before effecting the bond.
7. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical and single-hole lugs will not be accepted and shall be removed and replaced at the Subcontractor's expense.
8. Every rack or cabinet shall have an individual bonding conductor in the grounding network. Serially connecting (daisy-chaining) racks is forbidden and will not be accepted.
9. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground or run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing five racks or less.
10. Armored cables shall be properly bonded to the earthing system with a kit built for that purpose.
11. All metallic conduit stub-ups shall be grounded. Where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded to the enclosure and the enclosure ground bus.
12. Each metallic raceway, pipe, duct, and other metal object entering the buildings shall be bonded together. The Subcontractor shall use #6 AWG green-insulated copper conductors.
13. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
 - i. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of EIA/TIA 607. The communication ground shall not ground any additional equipment or be connected to any potential high-voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG green insulated copper wire.
 - ii. The Sub-contractor shall provide, as a minimum, a continuous #3/0 AWG copper electrical conductor connected to a 1/4" x 4" x 12" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
 - iii. The ground wires from each IDF shall be routed directly to the Building Distribution Frame (BDF), terminated, and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 20" dimensions. This point of single reference for all closets in a building shall, in turn, be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.
14. Ground Bus Bar Identification.
 - i. The master ground bar shall be labeled as such.
 - ii. Each subsidiary ground bar shall be labeled as such and have a unique identifier.
 - iii. All ground bars shall have a warning label that states, "If this connector or cable is loose or shall be removed, please call the Telecommunications

Manager.” All ground bars will be connected to the building ground with continuous “3/0” AWG wire.

iv. Each ground cable shall be labeled with a unique identifier.

3.03 RE-INSTALLATION

A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.

ANSI/TIA-607-B

ANNEX E (INFORMATIVE) CROSS REFERENCE OF TERMS

Preferred terms used in this Standard	Other industry terms
Telecommunications Main Grounding Busbar (TMGB)	Building Principal Ground (BPG) CO GRD Bus COG Facility Ground Main Earthing Terminal (MET) Master Ground Bar (MGB) OPGPB PGP Bus Principal Ground Point (PGP) Reference Point 0 (RP0) Zero Potential Reference Point
Telecommunications Grounding Busbar (TGB)	Extended Reference Point 0 (Extended RP0) Floor Ground Bar (FGB) Approved Floor Ground
Telecommunications Bonding Backbone (TBB)	Equalizer Equalizing Conductor Grounding Equalizer (GE) Vertical Equalizer Vertical Ground Riser
Grounding Equalizer (GE)	Horizontal Equalizer

3.04 CLOSEOUT ACTIVITIES

A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.

B. Sub-contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department**.

END OF SECTION

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SECTION 270529

HANGER AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for non-continuous cable support components that provide pathways support to telecommunications cables traveling – Independent Cable Supports I in conduits or other continuous cable supports.
2. Non-continuous cable supports.

1.02 RELATED DOCUMENTS

A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit

model in addition to the other Div. 27 & 28 project submittal requirements.

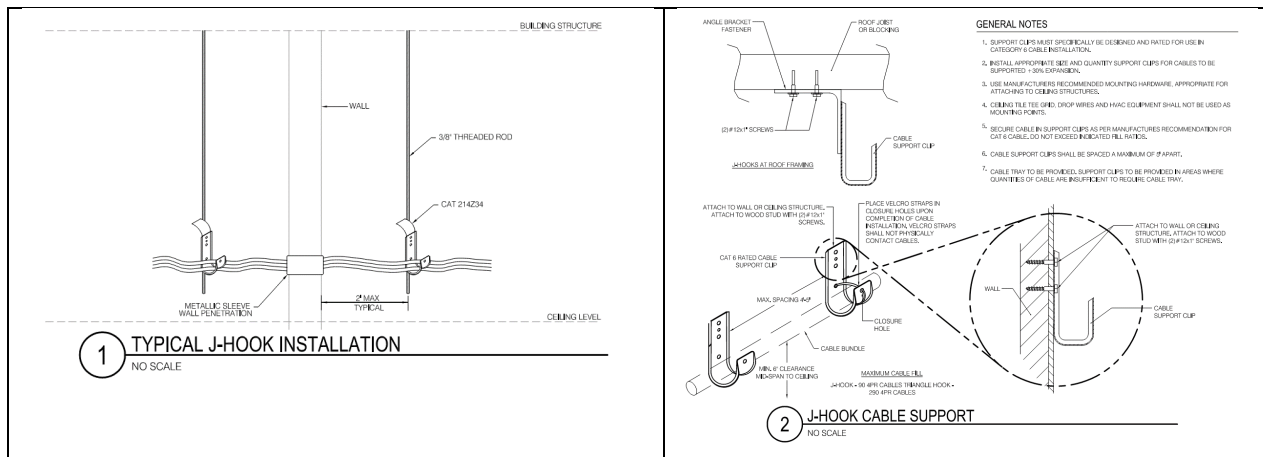
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department-IT Project Manager**.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS



2.01 NON-CONTINUOUS CABLE SUPPORTS (aka J-Hook, Cable-Saddle, Independent Cable Support, etc.)

A. Riverside County Fire Department-IT Standards and Specifications: Subject to compliance with requirements:

1. Erico – Caddy CableCat Support System – **Riverside County Fire Department-IT Standard**
2. Or Riverside County Fire Department-IT Approved Equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirement.

- i. Four-inch (0'4") Cat214z34, two-inch (0'2") J-Hook Supports Cat324z34

C. Description:

1. Non-continuous cable supports shall be available in multiple sizes, styles, and materials. Rigid supports shall be equipped with flared edges and pre-configured bend radius controls.
2. Provide drop wire supports and threaded rod assemblies in areas where structural mounting surfaces are non-functional or inaccessible.
3. Support assemblies shall provide a bearing surface of sufficient width to comply with

the required bend radii of high-performance UTP and optical fiber cables.

4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to contain cables within the hanger. The cable retainer strap shall be reusable.
5. Select approved non-continuous cable supports suitable for specific installation environments and/or air handling (plenum) spaces.

2.02 3/8" THREADED ROD FOR CEILING ATTACHMENT

A. **Riverside County Fire Department-IT Standards and Specifications:** Subject to compliance with requirements:

1. All Thread Rod – Riverside County Fire Department-IT Standard
2. Or Riverside County Fire Department-IT Approved Equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirement.
 - i. Threaded rod installation to the concrete deck above shall be made via a 3/8" Hilti-KB-TZ2 Expansion anchor.

C. Description:

2.03 1/4" CEILING HANGER (aka Pencil-rod, ceiling-wire) FOR CEILING ATTACHMENT – Impact-shot attachment,

A. **Riverside County Fire Department-IT Standards and Specifications:** Subject to compliance with requirements:

1. CPI
2. Or Riverside County Fire Department-IT Approved Equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirement.
 - i. Adherence to SEOR and manufacturer's installation requirements are the sole responsibility of the installing contractor.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before installing or using products specified in this section.

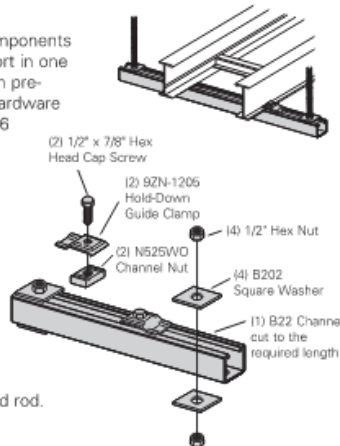
Trapeze Support Kit

B-Line trapeze kits provide the components required for a single trapeze support in one package. These kits are available in pre-galvanized steel with zinc-plated hardware or hot dip galvanized steel with 316 stainless steel hardware.

The SH channel provides the convenience of pre-punched slots, which eliminate the need for field drilling.

The illustrated hardware is sealed in a plastic bag and boxed with the channel, which is pre-cut to the appropriate length as shown in the chart.

Designed for use with 1/2" threaded rod. Order rod separately.

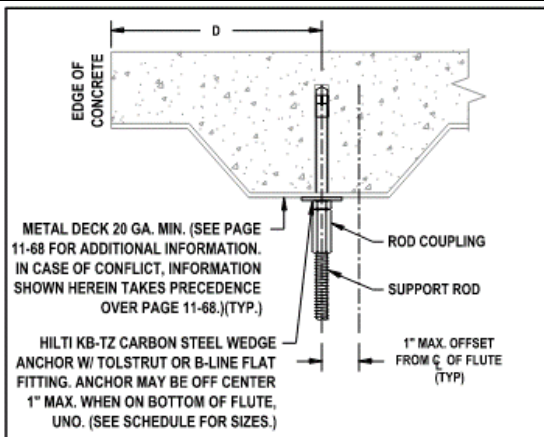


Catalog No.	Tray Width		Channel Length		Uniform Load	
	in.	(mm)	in.	(mm)	lbs	(kN)
9P-5506-22SH(†)	6	(152)	16	(406)	1600	(7.11)
9P-5509-22SH(†)	9	(229)	18	(457)	1250	(5.56)
9P-5512-22SH(†)	12	(305)	22	(559)	1125	(5.00)
9P-5518-22SH(†)	18	(457)	28	(711)	865	(3.85)
9P-5524-22SH(†)	24	(610)	34	(864)	700	(3.11)
9P-5530-22SH(†)	30	(762)	40	(1016)	590	(2.62)
9P-5536-22SH(†)	36	(914)	46	(1168)	510	(2.27)

• (†) Insert 3/8" for 1/2" threaded rod hardware.

Safety factor of 3.0 on all loads.

HILTI KB-TZ WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD)		B-LINE SOLID CHANNEL
				MAX. VERTICAL LOAD		
				SINGLE (LB)	DOUBLE (LB)	
3/8"	2"	6 3/4"	12"	210	420	B22
1/2"	2"	6 3/4"	12"	210	420	B22
1/2"	3 1/4"	9 3/4"	12"	377	750	B22A
5/8"	3 1/8"	9 3/8"	12"	288	575	B22A
5/8"	4"	12"	12"	668	1335	B22A

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

DATE: 12/0

3.02 INSTALLATION

A. Process:

1. Follow the manufacturer's instructions and recommended industry standards and guidelines.
2. The installed non-continuous support system must be an independent support structure for the voice/data communication system.
 - i. Cable bundles are to be sized as PoE+++ (90W) for all Cat6A U/UTP CMP cables.
 - ii. Sleeves are part of the independent cable support solution and shall be included in scaled shop drawings and project costing.
 - iii. No plastic or composite independent cable supports that do not have a metal strength member above areas with pedestrian foot traffic.
3. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grids, sprinkler systems, electrical supports, air ducts, or any other in-ceiling structure may not be used for cable support.
4. Sub-contractor-installed supports shall supplement the primary cable support system

when any cabling leaves the primary support system or is unsupported for more than three and one-half feet (3.1/2'-0").

5. Independent cable supports shall be located at all changes of direction (30° - 90°). Cables should not change direction over 90° at any point in a cable run.
6. Independent cable supports shall be located no more than 1' from each side of a sleeved barrier (wall). The contractor is responsible for identifying each wall rating for all locations of sleeves before cable rough-in.
7. Non-continuous supports shall be installed with rod stock or threaded rod secured to the slab above to support the telecommunications cable infrastructure parallel to the slab throughout the cable plant unless site conditions dictate a non-parallel installation.
8. Cable must be routed to follow existing corridors and parallel or 90-degree angles from all walls and the cable tray whenever possible.
9. Communication EMT conduit sleeves shall receive conduit waterfall to control the bend radius of the communication cable to a minimum of a 4" radius.
10. All pathways shall avoid electromagnetic interference (EMI). The cable that is distributed in partially enclosed metallic pathways shall be routed with the following minimum clearances:
 - i. Four (4) feet from motors or transformers.
 - ii. One (1) foot from conduit and cables used for electrical power and distribution.
 - iii. Five (5) inches from fluorescent lighting.

3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from re-installing specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department**.

END OF SECTION

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SECTION 270533

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for conduit pathways, back boxes, and pull box enclosures utilized for the distribution and housing of telecommunications cabling and components:
2. Telecom EMT conduit and boxes shall be installed per Chapter 3 of the 2022-CEC. The conduit installation requirements shall include the following:
 - i. Shorter distances between pulling points - required cable maximum pulling-tensions.
 - ii. Factory sweeps at changes of direction – required from **Riverside County Fire Department-IT** standard cable manufacturer's requirements.
 - iii. Industry best practices for low-voltage/signal cabling. Cable fill shall follow ANSI-recognized cable quantities maximum-fill of 40% for 0.285" outside diameter CMP cable.

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.
- B. Closeout Submittals - As-Built Drawings
 - 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 - 2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
 - 3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

- A. Warranty:
 - 1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
 - 2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 CONDUIT AND BACKBOXES

- A. EMT/IMT Conduit
 - 1. Wheatland Tube
 - 2. Appleton
 - 3. Crouse-Hinds
 - 4. Or Riverside County Fire Department -IT approved equal.
- B. RMC Conduit
 - 1. American Conduit
 - 2. Electro Flex
 - 3. Or Riverside County Fire Department -IT approved equal.
- C. Pull Boxes
 - 1. Hoffman Engineering Co (aka NVent)
 - 2. Or Riverside County Fire Department -IT approved equal.
- D. Back Boxes
 - 1. Hubbell Raco
 - 2. Or Riverside County Fire Department -IT approved equal.

2.02 TELECOMMUNICATIONS CONDUIT AND BACKBOXES

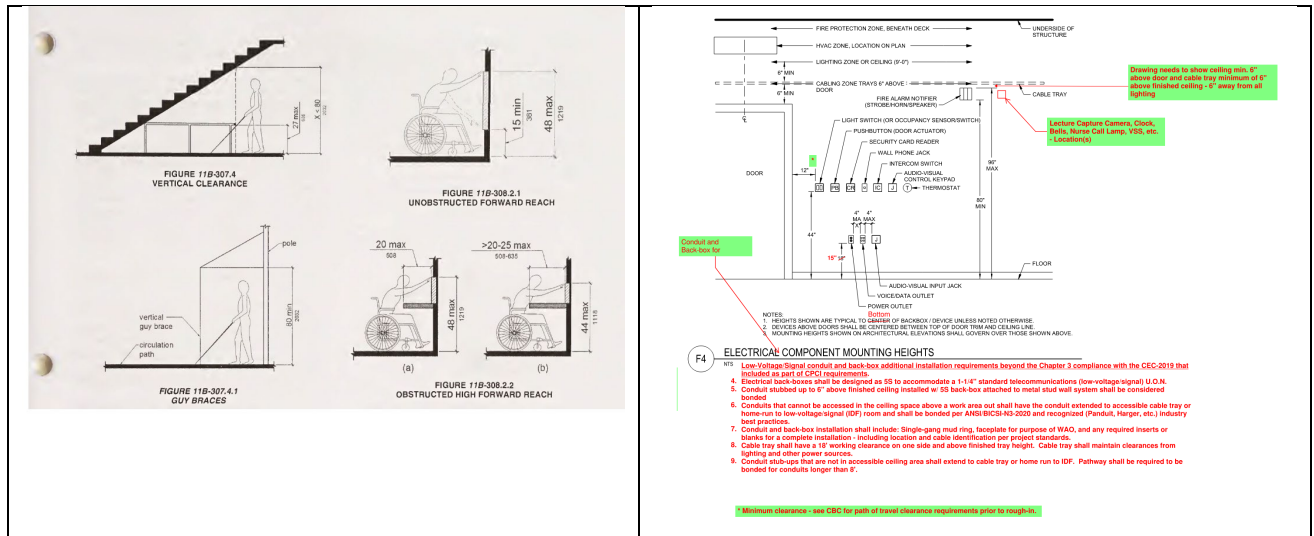
- A. Electrical Metallic Galvanized Tubing and Fittings with a natural finish for all conduits not exposed: ANSI C80.3 with compression-type fittings.
- B. Communication EMT conduit sleeves shall receive conduit waterfall to control the bend radius of the communication cable to a minimum of a 4" radius.

- C. Indoor Pull boxes: Galvanized steel, screw cover pull box. Grey polyester powder coat finishes inside and out. NEMA Type 1. Pull boxes will be sized per 2022-CBC code to accommodate the number of EMT conduits shown on Telecom drawings with adequate clearances, access, and cable management space.
- D. Supporting devices: U-channel trapeze assemblies, 3/8", 1/2", & 5/8" Threaded rods, clamps, conduit straps, C-clamps, and retainers.
- E. Fasteners: 3/8" Carbon steel expansion anchors with 2 1/2" embed into the concrete slab for pull box U-channel support attachment to a concrete slab. The anchors must be tested and approved under dual load conditions: Hilti Kwikbolt 2, Ramset/Redhead Trubolt. Or **Riverside County Fire Department -IT approved equal.**
- F. U-channel systems: 16-gauge steel channels. Provide fittings and accessories that match the U-channel of the same manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with the installation or use of products specified in this section.



3.02 INSTALLATION

- A. Pull boxes:
 1. Install Pull boxes in easily accessible locations.
 2. Install Horizontal cabling boxes immediately above suspended ceilings.
 3. A pull box should not be used in lieu of a bend.
 4. Conduits that enter the pull box from opposite ends with each other should be aligned.
 5. For direct access to a box located above inaccessible ceilings, provide a suitable, marked, hinged access panel (or equivalent) in the ceiling. This access panel can also serve as the cover for the box.
 6. Install conduit radius waterfall for all EMT conduit sleeves entering the telecommunication room or through main pathway fire-rated walls, quantity as shown on drawings.

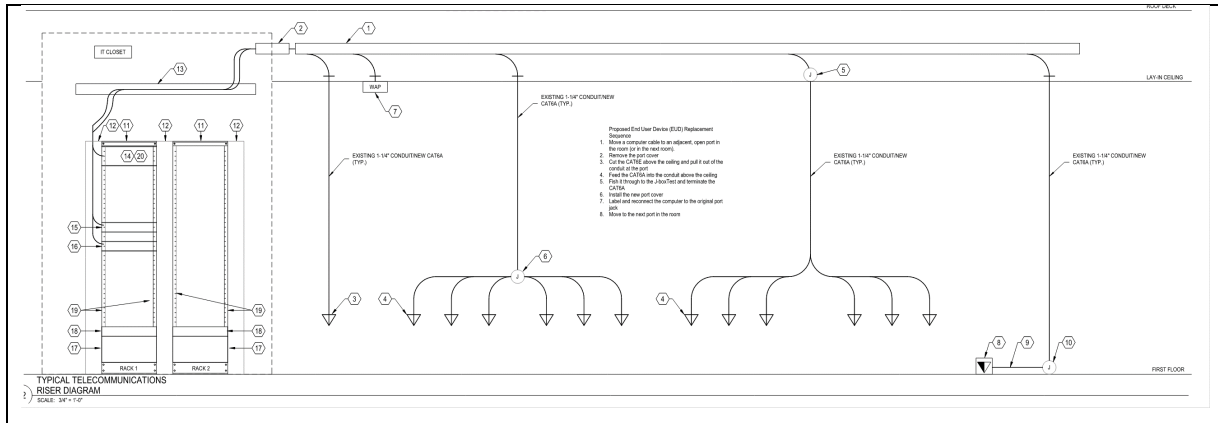
7. Pull box sizing table:

Table 5.12
Typical space requirements for pull boxes having conduit enter at opposite ends of the box

Conduit Trade Size ≈ mm (Trade Size)	Box Width ≈ mm (in)	Box Length ≈ mm (in)	Box Depth ≈ mm (in)	Box Width Increase for Each Additional Conduit ≈ mm (in)
27 (1)	100 (4)	400 (16)	75 (3)	50 (2)
35 (1-1/4)	150 (6)	508 (20)	75 (3)	75 (3)
41 (1-1/2)	200 (8)	686 (27)	100 (4)	100 (4)
53 (2)	200 (8)	900 (36)	100 (4)	125 (5)
63 (2-1/2)	250 (10)	1067 (42)	125 (5)	150 (6)
78 (3)	300 (12)	1220 (48)	125 (5)	150 (6)
91 (3-1/2)	300 (12)	1370 (54)	150 (6)	150 (6)
103 (4)	375 (15)	1525 (60)	200 (8)	200 (8)

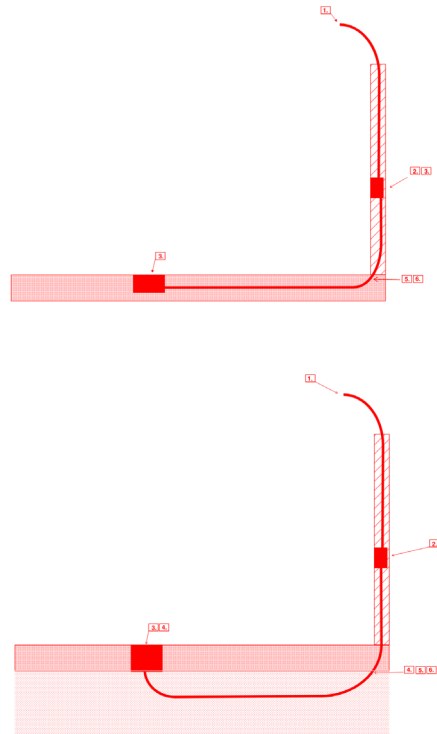
B. Back Boxes

1. Provide 4-11/16" H X 4-11/16" W X 2-1/8" D outlet back boxes at all telecom outlet locations shown on drawings. Provide (1) 1-1/4" conduit from back box to telecom room or pull box except as otherwise noted. All connectors and couplings shall be zinc-plated steel set screw type. Die-cast zinc fittings are not to be used. Provide bushing on the ends of all conduits. Provide pull string in all conduits.
2. Provide single gang plaster ring on all communications outlet back boxes unless indicated otherwise.
3. Provide bonding to cable tray pathways.

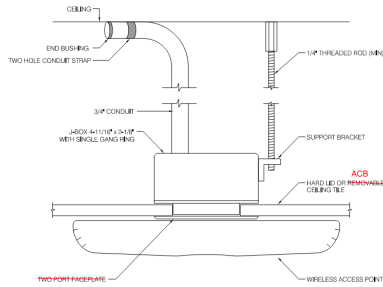


KEYNOTES

- NEW WIRE BASKET STYLE CABLE TRAY FOR HORIZONTAL TELECOMMUNICATIONS CABLING MOUNTED ABOVE LAY-IN CEILING. PROVIDE SIZE PER MANUFACTURERS RECOMMENDATION BASED ON TOTAL CABLE COUNT AND SPACE SUPPORT TO NOT EXCEED MAXIMUM LOADING.
- PROVIDE NEW HILTI SPEED SLEEVE OR EQUIVALENT SIZED PER THE TOTAL NUMBER OF CAT 6A CABLES ROUTED TO THE SPACE AND RATED FOR THE EXISTING WALL ASSEMBLY. CONTRACTOR SHALL SUBMIT SPECIFIC COMPONENTS BASED ON THE ACTUAL NUMBER OF DATA CIRCUITS BEING PROVIDED.
- NEW TELECOMMUNICATIONS OUTLET BOX WITH EXISTING 1-1/4" EMT STUB UP TO NEAREST ACCESSIBLE CEILING SPACE. REFER TO DETAILS ON SHEET T-501 AND SCHEDULE ON SHEET T-701 FOR ADDITIONAL INFORMATION.
- NEW TELECOMMUNICATIONS OUTLET. DATA CABLES TO BE ROUTED TO JUNCTION BOX TO BE STUBBED UP TO ACCESSIBLE CEILING SPACE.
- EXISTING CEILING MOUNTED JUNCTION BOX FOR DATA CABLES, PROTECT IN PLACE. ROUTE CABLES FOR TELECOMMUNICATIONS OUTLET THROUGH WALL TO FURNITURE SYSTEM. PROVIDE PROPER WIRE MANAGEMENT.
- EXISTING RECESSED JUNCTION BOX FOR FURNITURE SYSTEM DATA CABLES TO BE ROUTED TO ACCESSIBLE CEILING SPACE, PROTECT IN PLACE.
- EXISTING WIRELESS ACCESS POINT WITH TELECOMMUNICATIONS OUTLET ABOVE CEILING, PROTECT IN PLACE.
- NEW COMBINATION POWER/DATA IN-FLOOR WIREWAY DEVICE. COORDINATE FINAL FINISHES WITH COR PRIOR TO COMMENCEMENT OF ANY WORK.
- EXISTING IN-FLOOR WIREWAY SEGMENT FOR POWER WIRING AND DATA CABLES. CONNECTS POWER/DATA DEVICE TO WALL BASE TRIM.
- EXISTING WALL BASE TRIM TRANSITIONS CABLING AT THE WALL, PROTECT IN PLACE.
- NEW 4 POST EQUIPMENT RACK, FREESTANDING, STEEL, PROTECT IN PLACE. TELECOMMUNICATIONS CHANEL RACK, 19" RAILS, #12-24 TAPED EIA HOLE PATTERN, 30" DEP CHANEL MINIMUM, 7" HIGH, 45RU, WHITE.
- NEW 6" VERTICAL WIRE MANAGEMENT SYSTEM, PROTECT IN PLACE.
- NEW 12" LADDER STYLE HORIZONTAL CABLE TRAY MOUNTED ABOVE RACKS. PROTECT IN PLACE. COORDINATE WITH LIGHTING FIXTURE LOCATIONS.
- NEW 4U OPTICAL FIBER TERMINATION SHELF WITH (2) NEW 12F SM AND (2) NEW 12F MM WITH CABLE MANAGEMENT IN BREAKOUT ENCLOSURE WITH CAPACITY FOR 48 STRANDS SM OPTICAL FIBER AND 48 STRANDS MULTI-MODE FIBER.
- NEW CAT 6A 48 PORT DATA PATCH PANEL. CONTRACTOR TO SUBMIT NEW RACK ELEVATION FOR VA/AE REVIEW PRIOR TO COMMENCING WORK.
- NEW CAT 6A 48 PORT VOICE PATCH PANEL. CONTRACTOR TO SUBMIT NEW RACK ELEVATION FOR VA/AE REVIEW PRIOR TO COMMENCING WORK.
- NEW 5KW RACK-MOUNTED 208 V UNINTERRUPTIBLE POWER SUPPLY (UPS) WITH NEMA 20A L21-20P INPUT AND L21-20R OUTPUT. SEE T-502 FOR MORE DETAILS.
- NEW "ZONEIT" 30A 3-PHASE PDU BASE UNIT, REQUIRES (2) 30A 3-PHASE WYE CIRCUITS WITH L21-30R RECEPTACLES. SEE T-502 FOR MORE DETAILS.
- NEW ORTRONICS POWER DELIVERY UNIT (PDU), BASIS OF DESIGN R0-MM20PDUMB1D2W-B OR EQUAL. SEE T-502 FOR MORE DETAILS.
- PROVIDE NEW FIBER CANS IN THE TELECOM ROOMS WILL BE RACK MOUNTED, AND STACKED.



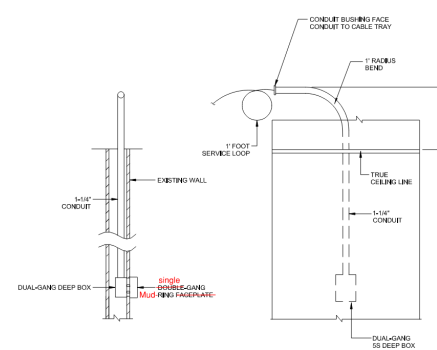
- Conduit that does not have clear access shall extend to cable tray or home-run to IDF.
- Location (4) of back-box is dependent on use:
1. DBB - 6" UOI
2. DBB - 4" UOI
3. MFOA CP - 18" UOI
Note: Conduit back-box attached to metal studs is considered bonded per this design standard
- Conduit terminations are required to be fitted with non-slag bushings and within floor boxes and pedestals require bonding rings.
- Cabling is required to transition from a rated jacket to a moisture-blocking jacket at a termination that is ANSI/TIA-568-D approved.
- Conduit 90-degree segments shall be factory sweeps at 10x OD of conduit.
- Conduits that require more than 180-degree in change of direction shall be required to be de-rated cable fill capacity by:
+10-15% - 270-degree bend
+10-25% - 175-degree bend
+10-25% - 135-degree bend
+10-25% - 90-degree bend
Note:
1. Cable manufacturers maximum pulling tensions shall be followed for all pulls.
2. Factory terminated specialty cables (JDM, USB, DP-connectors) are recommended to be installed during a single event
3. Future pulls to not recommended to non-standard conduits with active service



1 CEILING MOUNTED WIRELESS ACCESS POINT

NO SCALE

- Notes:
- Cable(s) terminated in 2-port surface jack assembly or field terminated plug requires MFG 10G Testing
 - Provide (1) Cat6A 10G S/P Equipment Cord and (1) Cat6A 10G 10' Patch-Cord per WAP Connection



3 TYPICAL OUTLET CONCEALED CONDUIT TO ACCESSIBLE CEILING

NO SCALE

- Notes:
- Back Box shall be placed to meet access requirements of this project
 - Back Box w/ (1) Stick of Conduit is considered bonded by attached to metal stud
 - Work Area Outlet that is not in accessible ceiling area shall be required for conduit to extend to cable tray or home run to IDF. Includes additional bonding requirements.

C. Conduit support and bracing:

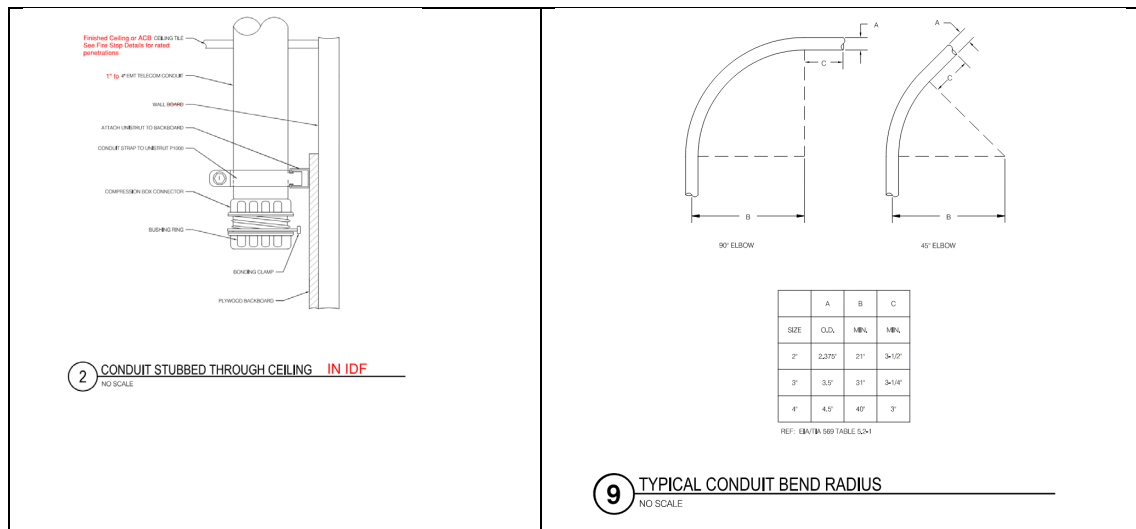
1. Coordinate layout and installation of conduits and pull boxes with other trade conditions to ensure adequate clearances, access, and cable management.
2. Install and provide support for EMT conduits and pull boxes in accordance with the latest edition of the NEC code, as well as all state and local codes and requirements. Coordinate installation and location with existing conditions. Notify and get the **Riverside County Fire Department** Representative's approval before installing conduits and pull boxes where the location needs to deviate from the contract documents.
3. Install conduits above ceilings at height to provide access to pull. Install conduits and pull boxes level and square and at proper elevations. Ensure adequate clearances, access, and cable management.
4. Use fittings and support devices compatible with conduits and pull boxes suitable for use and location. The strength of each support shall be adequate to carry present and future loads multiplied by a safety factor of at least four.
5. Install individual and multiple trapeze hangers and riser clamps as necessary to support the conduits. Provide U-bolts, clamp attachments, and other hardware needed for hanger assemblies and for securing hanger rods and conduits. Space supports for conduits on maximum 10-foot centers.
6. Provide and install expansion or deflection fittings for conduits runs at all instances at seismic or expansion joints to allow for movement in any direction.

D. Conduit routing bends and radius guidelines:

1. If the conduit has an internal diameter of 2 inches or less, the bend radius must be at least 6 times the internal conduit diameter.
2. If the conduit has an internal diameter of more than 2 inches, the bend radius must be at least 10 times the internal conduit diameter.
3. Conduit bends should be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.
4. If a conduit run requires more than two 90-degree bends, provide a pull box between sections with two bends or less.
5. If a conduit run requires a reverse bend (between 100 degrees and 180 degrees), insert a pull point or pull box at each bend with an angle from 100 degrees to 180 degrees.
6. Consider an offset as equivalent to a 90-degree bend.
7. A pull box shall not be used as a 90-degree bend.
8. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
9. Achieve the best direct route with no bend greater than 90 degrees or an aggregate of bends more than 180 degrees between pull points or pull boxes.
10. Contain no continuous sections longer than 100 ft.
11. Pull points or pull boxes should be inserted for runs that total more than 100 ft. in length so that no segment between points/boxes exceeds the 100 ft. limit.
12. Withstand the environment to which they will be exposed.
13. Conduits should not be routed through areas where flammable material may be stored or over or adjacent to boilers, incinerators, hot-water lines, and steam lines.

- Keep conduits at least 6' away from parallel runs of steam, hot water pipes, or mechanical ductwork.

E. Conduit Terminations



- Join conduits with fittings designed and approved for the purpose. Make the joints tight without protruding lips that can snag cable pulling inside the conduits.
- Where conduits are terminated with locknuts and bushings, align the conduit to enter squarely and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box.
- Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
- Conduits that enter a telecom room should terminate near the corners to allow for proper cable racking.
- Terminate conduits that protrude through the structural floor 3 inches above the surface.
- Maintain the integrity of all fire stop barriers for all floor or wall penetrations.

F. Provide grounding and bonding for conduits and pull boxes as indicated by NEC code and instructed by the manufacturer.

G. Conduits shall be clearly labeled at both ends designating the opposite location(s) served. The numbering scheme shall be a room number plus a suffix to guarantee uniqueness, e.g., 143-1. Labeling must be machine-generated.

H. Conduit Protection:

- Remove burrs, dirt, and construction debris from conduits and pull boxes.
- Conduits should be left capped for protection.
- Provide final protection and maintain conditions in a manner acceptable to the **Riverside County Fire Department** Representative to ensure that coatings, finishes, and pull boxes are without damage or deterioration at completion. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.

3.03 ACCEPTANCE

- A. All specified conduits and pull boxes indicated on the drawings and specifications shall be complete.
- B. Specified shop drawings and product submittals shall have been submitted for review, and all review comments and deficiencies shall have been resolved. Final shop drawings and product submittals shall have been submitted, reviewed, and found to meet the requirements of the specifications.
- C. Issues and deficiencies identified in field reports and punch lists shall have been resolved. Final as-built drawings shall have been submitted, reviewed, and found to meet the requirements of the specifications.
- D. The sub-contractor shall provide written notice of the final completion of the telecom infrastructure. Upon receipt, the **Riverside County Fire Department** Representative will review/observe the completed installation. Once the **Riverside County Fire Department** Representative is satisfied that all work is in accordance with the Contract Documents, the Sub-contractor will be notified in writing.

3.04 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.
- B. CLOSEOUT ACTIVITIES
- C. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- D. Sub-contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department**.

END OF SECTION

SECTION 270536

CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Ladder cable trays
 - i. Industrial Tray
 - ii. IDF (TR) & MDF (TEC)
2. Wire-basket cable trays
3. Indoor/Outdoor Tray (Non-Conductive)

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.
- B. Product Data: For each type of cable tray, See Section 270500 Appendix A for Project Required Submittal List

1. Include data indicating dimensions and finishes for each type of cable tray shown.
- C. Shop Drawings: For each type of cable tray - See Section 270500 Appendix A for Project Required Submittal List
1. Show fabrication and installation details of cable trays, including plans, elevations, and components sections and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings—drawings to match the same scale as the approved design or construction drawing set.
- D. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- E. Seismic Qualification Certificates: For cable trays, accessories, and components, from the manufacturer.
- F. Closeout Submittals - As-Built Drawings
1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
 3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

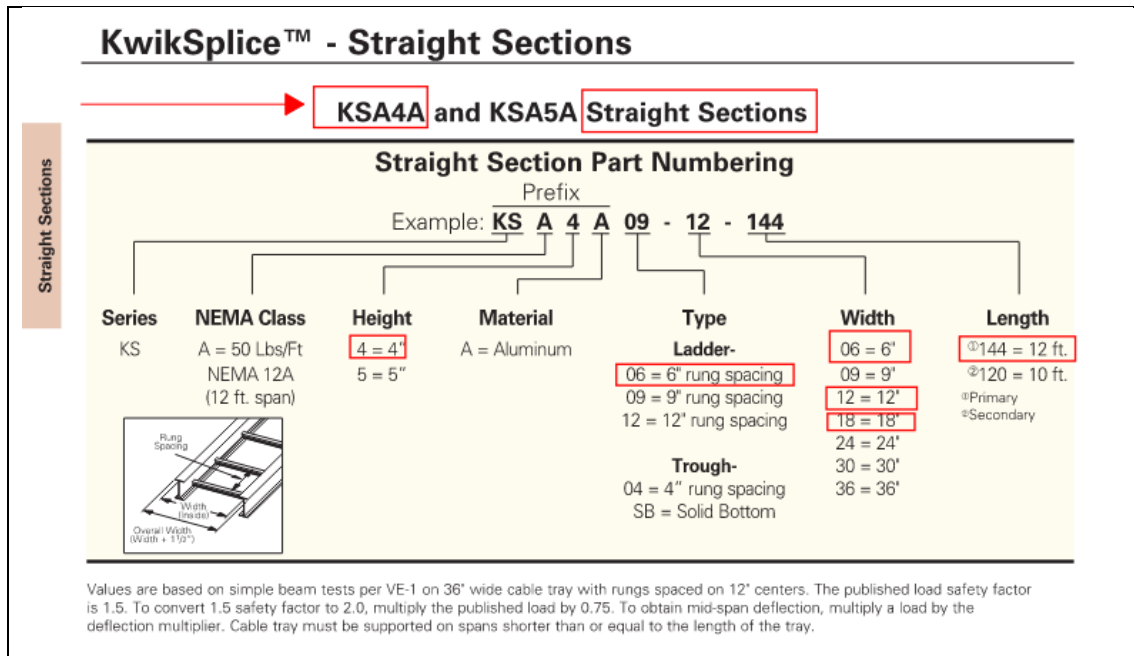
2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Component Importance Factor: 1.5.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in 2016 CEC Article 392 and marked for intended location, application, and bonding per Article 800.100/A/1-6.
1. Source Limitations: Obtain cable trays and components from a single manufacturer.
- B. Sizes and Configurations: See drawings for specific requirements for types, materials, sizes, and configurations.

- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 2. Concentrated Load: A load applied at the midpoint of the span and centerline of the tray.
 3. Load and Safety Factors: Applicable to both side rails and rung capacities.



2.03 **LADDER CABLE TRAYS (Ladder Racking)**

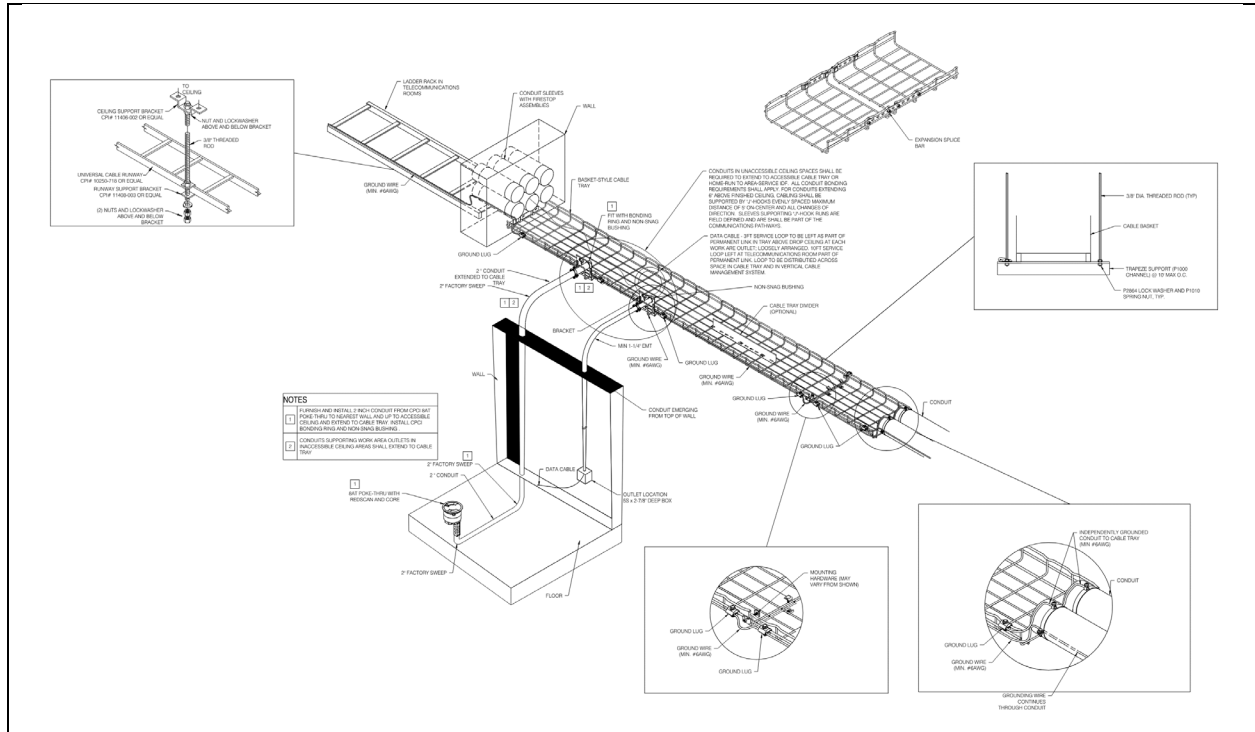
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Riverside County Fire Department -IT approved equal

B. Description:

1. Configuration: Two 1-1/2" x 3/8" 16-gauge tubular steel side rails with transverse rungs welded to side rails.
2. Rung Spacing: 9 inches O.C.
3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
4. Minimum Cable-Bearing Surface for Rungs: 1-inch width with radius edges.
5. No portion of the rungs shall protrude below the bottom plane of the side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1, Section 5.4.
7. Straight Section Lengths: 9 feet 11.5 inches, except where shorter lengths are required to facilitate tray assembly.

8. Width: 12 inches unless otherwise indicated on Drawings.
9. Fitting Minimum Radius: 12 inches.
10. Splicing Assemblies: Bolted type using serrated flange locknuts.
11. Splice Plate Capacity: Splices located within the support span shall not diminish the rated loading capacity of the cable tray.



2.04 **WIRE-BASKET CABLE TRAYS**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products Inc.
2. Riverside County Fire Department -IT approved equal

B. Description:

1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along the entire length of the section.
2. Materials: High-strength-steel longitudinal wires with no bends.
3. Safety Provisions: Wire ends along wire-basket sides (flanges) are rounded during manufacturing to maintain the integrity of cables and installer safety.
4. Sizes:
 - i. Straight sections shall be furnished in standard 10 feet lengths.
 - ii. Wire-Basket Depth: 2-inch usable loading depth by 4 inches to 24 inches wide.

- iii. Wire-Basket Depth: 4-inch usable loading depth by 4 inches to 24 inches wide.
 - iv. Wire-Basket Depth: 6-inch usable loading depth by 8 inches to 24 inches wide.
5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
 6. Connector Assembly Capacity: Splices located within the support span shall not diminish the rated loading capacity of the cable tray.
 7. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

2.05 MATERIALS AND FINISHES

A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
2. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
3. Finish: Mill galvanized before fabrication.
 - i. Standard: Comply with ASTM A 653SS/A 653M, G90.
 - ii. Hardware: Chromium-zinc plated, ASTM F 1136.
4. Finish: Electro-galvanized before fabrication.
 - i. Standard: Comply with ASTM B 633SS.
 - ii. Hardware: Galvanized, ASTM B 633SS.
5. Finish Hot-dip galvanized after fabrication.
 - i. Standard: Comply with ASTM A 123/A 123M, Class B2/ASTM A1008, Grade 33, Type 2.
 - ii. Hardware: Chromium-zinc plated, ASTM F 1136.
6. Finish Powder-coat enamel paint.
 - i. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment with factory-applied powder-coat paint.
 - ii. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
 - iii. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
 - iv. Hardware: Chromium-zinc plated, ASTM F 1136.
7. Finish Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
8. Finish Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.

B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.

2.06 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings, as indicated, of the same materials and finishes as cable trays.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as the cable tray manufacturer recommends.
- D. WARNING SIGNS - Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not to Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
 - 1. Comply with requirements for fasteners in Section 260553, "Identification for Electrical Systems."

2.07 SOURCE QUALITY CONTROL - Testing: Test and inspect cable trays according to NEMA VE 1.

2.08 INDOOR/OUTDOOR CABLE TRAYS PVC CABLE TRAY (Non-Conductive)

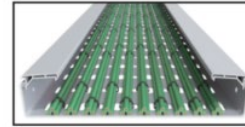
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Basorplast
 - 2. Riverside County Fire Department -IT approved equal

B. Description:



	ADVANTAGES	DISADVANTAGES
FiberGlass Cable Tray, Cable Ladder	Best price	Lowest admissible working load
	Equal or better chemical behavior	
	Self extinguising	Greater limitation of working temperatures
	Recyclable	
Weight Product for comfort installation.		
Stainless Steel Cable Tray, Cable Ladder	Major Electrical Safety of the installation, does not have electrical continuity	Lowest admissible working load
	Cost efficient	Greater limitation of working temperatures
	Facing SS304 better performance in saline environment	
Aluminium Cable Tray and Cable Ladder	Major Electrical Safety of the installation, does not have electrical continuity	Lowest admissible working load
	Cost efficient	Greater limitation of working temperatures
	Best corrosion behavior for aluminum (NO Anodized, 100% welding cable ladders)	

MODELS	B		H		Weight LBS/	PVCMI UV REF PVC
	inch	mm	inch	mm		
BPE-P 2.3/8" × 4"	4"	100	2 3/8"	60	4.83	2/10070
BPE-P 2.3/8" × 6"	6"	150	2 3/8"	60	6.02	2/10071
BPE-P 2.3/8" × 8"	8"	200	2 3/8"	60	9.59	2/10072
BPE-P 2.3/8" × 12"	12"	300	2 3/8"	60	15.48	2/10073



🔧 2 JUBPE 60 (2/10084)

USEFUL AREA [inch²]

B		H60 (2 3/8")	
in	mm	in ²	cm ²
4"	100	8.06	52
6"	150	12.4	80
8"	200	15.7	101
12"	300	23.6	152

NEMA Cable Tray Classification [U.S.] - UL 568 SWL lb/ft

VALUES		Temp. Max 104°F		Temp. Max 140°F	
		6ft span	8ft span	6ft span	8ft span
MODELS	Nema	lb/ft	lb/ft	lb/ft	lb/ft
BPE-P 2.3/8" × 4"	-	3,7	2,1	2,4	1,3
BPE-P 2.3/8" × 6"	-	5,1	2,8	3,2	1,8
BPE-P 2.3/8" × 8"	-	23,1	13,0	15,0	8,4
BPE-P 2.3/8" × 12"	5AA	25,4	14,2	16,5	9,3

NOTE: Tests acc. UL 568 Method A (Load Before Destruction). 1.5 Safety factor

*Note – The entire installation including cable tray straight sections, covers, supports, splices, nuts and bolts are all made of from high quality PVC. UV and rust resistant is required.

PART 3 - EXECUTION

3.01 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports the building structure and installs seismic restraints.
- G. Design fasteners and supports to carry the cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529, "Hangers and Supports for Electrical Systems." "Comply with seismic-restraint details in Section 260548, "Vibration and Seismic Controls for Electrical Systems."
- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturers. Arrange supports in trapeze or wall-bracket form as required by the application.
- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

- M. Support wire-basket cable trays with center support hangers, trapeze hangers, or wall brackets as noted on construction drawings.
- N. Support center support hangers and trapeze hangers for wire-basket trays with 3/8-inch-diameter rods.
- O. Connect equipment with flanged fittings fastened to cable trays and equipment. Support cable trays independent of fittings. Do not carry the weight of cable trays on the equipment enclosure.
- P. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standards.
- Q. Make changes in direction and elevation using the manufacturer's recommended fittings.
- R. Make cable tray connections using the manufacturer's recommended fittings.
- S. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413, "Penetration Firestopping."
- T. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- U. Install cable trays with enough workspace to permit access for installing cables.
- V. Install barriers to separate cables of different systems, such as power, communications, and data processing, or of different insulation levels, such as 600, 5000, and 15 000 V.
- W. Install permanent covers, if used, after installing the cable. Install cover clamps according to NEMA VE 2.
- X. Clamp covers on cable trays installed outdoors with heavy-duty clamps.
- Y. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with ANSI/NECA/BICSI-607 requirements, ITSM-2017, and Section 260526, "Grounding and Bonding for Electrical Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing the splice-to-grounding bolt attachment, repair the coated surfaces with the coating materials recommended by the cable tray manufacturer.
- E. Bond cable trays to a power source for cables contained within with bonding conductors sized according to ANSI/NECA/BICSI-607, ITSM-2017, and Section 260526 "Grounding and Bonding for Electrical Systems."

3.03 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties, according to NEMA VE 2. Tighten the clamps only enough to secure the cable without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on a vertical run to cable trays every 18 inches.

- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between a cable tray and enclosure shall be no more than 72 inches.
- E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

3.04 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to NEMA VE 2 and NEMA FG 1 requirements.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 4. Verify that there are no intruding items in the cable tray, such as pipes, hangers, or other equipment.
 - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
 - 7. Check for improperly sized or installed bonding jumpers.
 - 8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - 9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test the entire cable tray system for continuity. The maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

3.06 PROTECTION

- A. Protect installed cable trays and cables.
 - 1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable trays can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
 - 2. Repair damage to galvanized finishes with zinc-rich paint recommended by the cable tray manufacturer.

3. Repair damage to paint finishes with matching touchup coating recommended by the cable tray manufacturer.

END OF SECTION

SECTION 270543

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Related Documents
- B. Quality Assurance
- C. Submittals

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Civil and Dry Utility project drawings.
- D. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 - 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 - 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
- E. Any code violations committed during installation shall be remedied at the Subcontractor's expense.
- F. Division 26 Related Electrical Underground Section(s)
- G. Division 26 Related Bonding and Earthing Section(s)

1.03 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
 - 1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.
- B. Qualifications – Installer:
 - 1. The contractor shall coordinate the final TMGB connection with the project electrician.
 - 2. At a minimum, seventy-five percent (75%) of the onsite sub-contractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix C Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 & 28 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department -IT Project Manager**.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 COMMUNICATIONS UTILITY VAULTS

- A. All telecommunications vaults to be placed shall be specifically designed for telecommunications applications, with no exceptions.

Synertech
DUO MOLD
Junction Box 2436

Box Features
-Sheet Molding Compound (SMC)
-Duomolding monolithic construction
-High Density Polymer Concrete (HDPC) ring

Lid Features
-Sheet Molding Compound (SMC) lining
-Duomolding monolithic construction
-High Density Polymer Concrete (HDPC)

Other Features
-S/S Hardware - replaceable
-Pent or Hex Bolts
-Sidewall can be drilled with standard hole saw
-Meets ANSI/SCTE 77-2002 standards

2436-18	2436-24	2436-36	2436-48	2436-60	2436-72
18"	24"	36"	48"	60"	72"
445 mm	607 mm	914 mm	1219 mm	1524 mm	1829 mm

Box

2436	Depth	Color	SKU Number	Description 1	Description 2	Item Weight
Box	18	Gray	32164101	Box, SYN2436 T 18" Duo	SYN2436TBOX18	63
Box	24	Gray	32168101	Box, SYN2436 T 24" Duo	SYN2436TBOX24	91
Box	36	Gray	32172101	Box, SYN2436 T 36" Duo	SYN2436TBOX36	119
Box	48	Gray	32174101	Box, SYN2436 T 48" Duo (2)	SYN2436T 2 STKDBXS	181
Box	60	Gray	32176101	Box, SYN2436 T 60" Duo (2)	SYN2436T 2 STKDBXS	262
Box	72	Gray	32177101	Box, SYN2436 T 72" Duo (2)	SYN2436T 2 STKDBXS	330

Lid 2436

2436	Depth	Color	SKU Number	Description 1	Description 2	Item Weight
Lid	-	Gray	31250121	Lid, SYN2436 T - No Mark	SYN2436T000	147
Lid	-	Gray	31250221	Lid, SYN2436 T - Electric	SYN2436T011	147
Lid	-	Gray	31250321	Lid, SYN2436 T - Telephone	SYN2436T022	147
Lid	-	Gray	31250421	Lid, SYN2436 T - Fiber Optics	SYN2436T026	147
Lid	-	Gray	31250521	Lid, SYN2436 T - Water	SYN2436T031	147
Lid	-	Gray	31250621	Lid, SYN2436 T - CATV	SYN2436T162	147
Lid	-	Gray	31250721	Lid, SYN2436 T - Ground	SYN2436T017	147
Lid	-	Gray	31250821	Lid, SYN2436 T - Gas	SYN2436T034	147
Lid	-	Gray	31251021	Lid, SYN2436 T - Lighting	SYN2436T021	147
Lid	-	Gray	31251121	Lid, SYN2436 T - Street Lighting	SYN2436T022	147
Lid	-	Gray	31251221	Lid, SYN2436 T - Traffic	SYN2436T162	147
Lid	-	Gray	31251321	Lid, SYN2436 T - Traffic Signal	SYN2436T032	147
Lid	-	Gray	31251421	Lid, SYN2436 T - Non-Potable Water	SYN2436T034	147
Lid	-	Gray	31251521	Lid, SYN2436 T - Potable Water	SYN2436T031	147
Lid	-	Gray	31251721	Lid, SYN2436 T - Irrigation	SYN2436T025	147
Lid	-	Gray	31250921	Lid, SYN2436T - Marked	SYN2436T099	147

3048
OLDCASTLE POLYMER
(formerly H Series)

COVER

Style: Flush 2-Piece
Material: Polymer Concrete
Model: 30" x 48"
Weight: Tier 15 110 lbs. (per half)
Tier 22 169 lbs. (per half)

Std. Fasteners: 1/2-13 Stainless Steel Hex Head Bolt, Washer and Floating Nut
Logos and Special Markings

Options: Slip Resistant
Surface: Slip Resistant
Performance: ANSI/SCTE-77, Tier 15 or Tier 22*

BODY

Material: Polymer Concrete
Model: 30" x 48"
Weight: 18" Depth: 179 lbs.
24" Depth: 223 lbs.
36" Depth: 307 lbs.

Wall Type: Straight
Performance: ANSI/SCTE-77 Tier 22

LOAD RATING / NOTES

MEDIUM DUTY
ANSI/SCTE 118-19

HEAVY DUTY
ANSI/SCTE 118-22

For use in non-vehicular traffic situations only. Weights and dimensions may vary slightly. Actual load rating is determined by the box and cover combination.

	A	B	C	D	E
3048-18	18	29-7/16	46-15/16	44-1/2	27
3048-24	24	29-5/16	46-13/16	44-1/4	26-3/4
3048-36	36	29	46-1/2	44-1/8	26-5/8

* Based upon lid and body combination, this unit can be Tier 15 or Tier 22. T22 rating when paired with T22 polymer concrete lid.

B. Materials

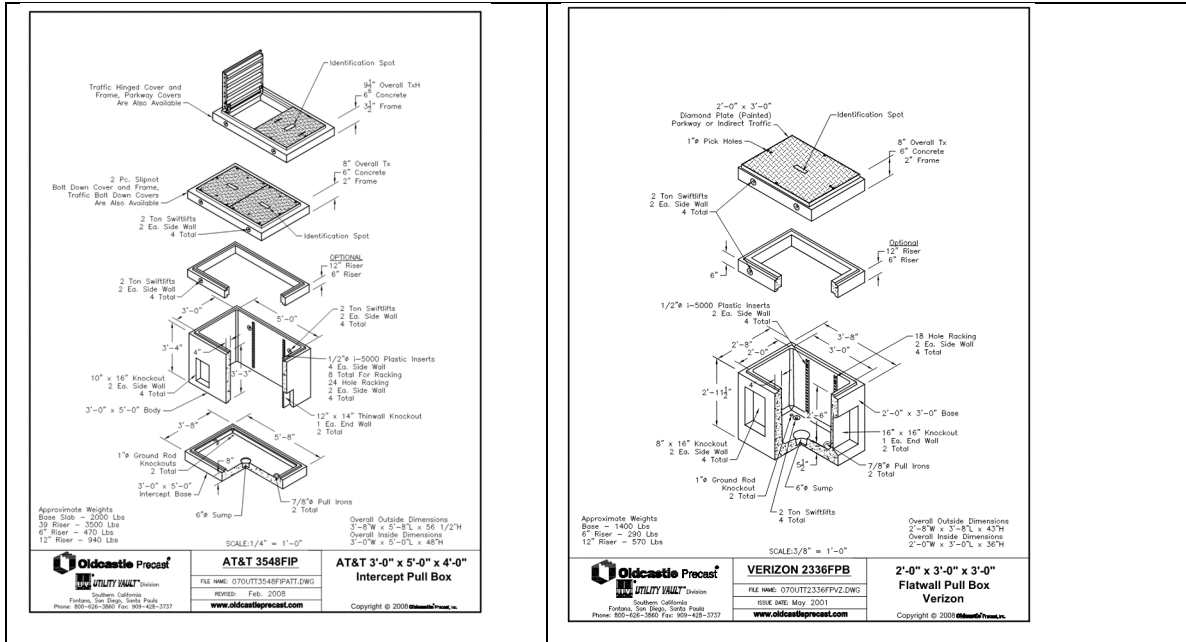
1. The Contractor shall provide pre-cast utility vaults meeting ASTM C 478 with 28-day 5500 psi minimum compressive strength concrete and designed for AASHTO H-20

loading per AASHTO HB 14. The dimensions for each utility vault are specified on the construction drawings. Any questions the Contractor has about the size should be discussed with the **Riverside County Fire Department's** representative and the telecommunications engineer.

2. Utility vaults shall have tongue-and-groove double sealed joints on mating edges of pre-cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.
3. Conduit Entrances
 - i. Knockout panels or pre-cast individual conduit openings may be used.
 - ii. On sides where no conduit is installed, 12-inch high by 12-inch wide (minimum) knockout panels for future raceway installation shall be provided. Knockouts are required on all four sides.
 - iii. For existing utility vaults, new ducts shall enter the utility vault with factory-formed bell end of the conduit, and a seal around the conduit shall be applied after installation. Existing utility vaults shall be retrofitted with the required racking and grounding and bonding per the TIA Bonding and Grounding Standards.
4. Covers
 - i. The Contractor shall provide solid covers (traffic rated), with a 76.2 cm (30 in.) diameter clear opening. For vaults longer than 12' in length, (2) openings with covers are required.
 - ii. Heavy-duty type frames and covers made of cast iron 10" high, suitable for H-20 loading, and having machined bearing surfaces shall be used.
 - iii. The covers shall be of indented type with solid top design.
 - iv. The upper side of each cover shall have the letters "Communications" cast or burned by welder, in integral letters no less than 2 inches high. Either the covers or the ring of the casting shall be field stamped with utility vault or pull box numbers.

C. Manufacturers

1. Utility Vault Company (Old Castle)
2. Jensen Precast
3. Approved equivalent product



2.02 COMMUNICATIONS PULL BOXES

- A. Pre-cast pull boxes shall meet the standards defined in Subsection 2.1.B.(1).
- B. Joints and seals shall be provided and installed as defined in Subsection 2.1.B.(2).
- C. Conduit entrances shall be provided as defined in Subsection 2.1.B.(3).
- D. Pull boxes shall be equipped with cable racking on both long walls suitable to support large copper cables as called for on the design documents.
- E. All pull boxes shall be equipped with spring-loaded, traffic-rated, skid proof lids with a locking mechanism, unless otherwise specified in the drawings. All lids shall have the identification marking of "Communications" permanently affixed to the cover. The pull box number identification shall be stamped or welded on the cover per the **Riverside County Fire Department's** specified numbering plan.

2.03 COMMUNICATIONS UTILITY VAULT/PULL BOX HARDWARE

A. Materials

- 1. Pulling irons shall be provided, as required for the size of utility vault/pull box (minimum of 4 per utility vault: 2 placed on each end wall, top and bottom). Pulling irons shall be placed opposite the terminators. All pulling irons shall be constructed of 2.2 cm (7/8 inch) hot-dip galvanized steel.
- 2. A sump of 30cm (12 in.) in diameter shall be provided in each utility vault, per the manufacturer's specifications.
- 3. Heavy-weight cable racks with adjustable arms shall be provided for all cables in each utility vault. The racks shall be attached with adjustable inserts set in the concrete walls (bolts or studs embedded in concrete will not be used). Racks and inserts shall be centered on the side walls that are utilized for the racking of splice cases in the utility vault, arranged so that all spare conduit ends are clear for future cable

installation. The racks shall have a sufficient number of arms to accommodate cables for each conduit entering or leaving the utility vault.

4. Corner stand-off brackets 15cm to 20cm (6 in. to 8 in. from wall) shall be provided if the utility vault is equipped with center exit conduits. The bracket shall extend from 15cm (6 in.) off floor to 15cm (6 in.) below roof.
5. All utility vault and pull box hardware shall be steel that is hot dip galvanized after fabrication.
6. Each utility vault shall have a detachable galvanized steel ladder that can be removed to facilitate future work in the utility vault. The ladder shall be secured to a top support arm in the utility vault opening or chimney.

B. Manufacturers

1. Hardware: Alhambra Foundry (model No. A-3382 ladder with A-3383 support bar) or Inwesco Products, or an approved equivalent product.
2. Utility vault: Utility Vault, or Associated Concrete Products, or an approved equivalent product.

C. Materials

1. Conduit

- i. Schedule 40 PVC - 4 inch inside diameter.
- ii. Type C telephone conduit - 4 inch inside diameter (if concrete encased).
- iii. If directional boring: HDPE Conduit, 4" from Carlon or equal.
- iv. Corrugated flexible orange inner duct, 1-inch ID diameter, will be placed for fiber optic cable protection. A minimum of 4 inner ducts shall be placed in a 4-inch conduit, unless otherwise directed in the drawings.

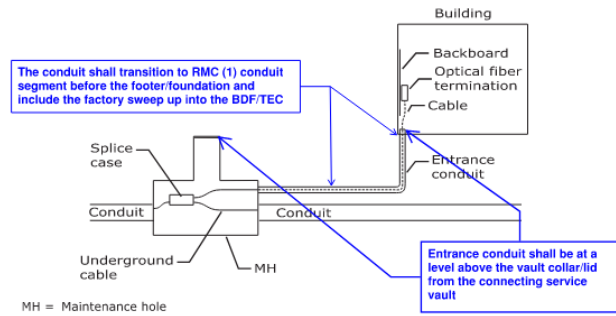
2. Conduit shall have a factory formed bell on one end for interconnecting segments.
3. Spacers: High impact spacers shall be used in all multi-duct systems, for both solely-owned or joint telecommunications/power construction. They shall conform with NEMA TC-2, TC-6, TC-8, and ASTM F 512 dimensions.
4. All fittings shall be designed specifically for use with the type of conduit placed.
5. All conduits shall be equipped with seal plugs in all utility vaults/pull boxes and expansion rubber seal plugs within all buildings.
6. Manufacturer: CARLON or approved equivalent.

2.04 COMMUNICATIONS ENTRANCE CONDUIT

- A. Building entrance conduit shall be a complete assembly to be illustrated on the required scaled project shop-drawings.



Figure 5.14
Example of optical fiber underground-to-building transition



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5-17

OSP Design Reference Manual, 6th edition

2.05 DUCT-BANK LOCATING CABLE (DETECTABLE WARNING TAPE)

A. Warning tape shall be a minimum of 3" wide, orange in color, and shall have a nondegradable imprint as follows:

1. "Caution Joint Power and Telecom Cable Buried Below"

B. The tape shall be detectable.

C. Manufacturer:

1. Carlon
2. Approved equivalent product

2.06 FABRIC INNER-DUCT SYSTEMS

A. Description:

1. Materials & Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the intended use
 - i. White Polyester and Nylon resin polymer
 2. Flexible optical fiber/communication raceway
 3. Provide wire management in a building for fiber optic and data and communications cabling.
 4. A non-metallic raceway, usually circular, is placed within a larger raceway. (Sub duct)
- B. Standard Outdoor fabric Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon fabric innerduct containing 1250lb polyester flat woven pull tape. Productivity Redefined www.maxcell.us 600 Plum Creek Drive Wadsworth, OH 44281 1-888-387-3828
- C. Detectable Outdoor fabric Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon fabric innerduct containing 1250lb polyester flat woven pull tape, and a solid copper, polyvinyl color coated conductor (19AWG minimum) for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the fabric sleeve.
- D. Indoor fabric Innerduct (Riser-listed): Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell nylon fabric innerduct containing 1250lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.

E. Plenum-Listed fabric Innerduct: Micro (33mm), 2-inch and 3-inch single or multi-cell nylon fabric innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.

F. Products:

1. MaxCell
2. Duraline

2.07 PULL ROPE

A. Pull rope shall be new 1/4” polypropylene over polyester rope with a minimum 1700 lb. tensile strength or woven cotton cord with footage markings (mule tape).

B. Manufacturers: Riverside County Fire Department -IT product.

NEPTCO DATA

Aramid MULETAPE®

Description
 Flat tape woven from aramid fiber and used for installing fiber optic, copper, and coaxial cables in underground conduit.

Features & Benefits

- ▲ Lubricated for easy pulling and reduced friction
- ▲ Durably printed with sequential footage or meter markings*
- ▲ Available in a variety of pulling strengths
- ▲ Lowest elongation available for enhanced worker safety
- ▲ Lightweight and easily blown into conduit or innerduct
- ▲ Available in splice-free lengths up to 100,000 ft. (30 km) for faster, easier installation
- ▲ Packaged on sturdy wooden or plastic reels
- ▲ Easily spliced using conventional methods or the MULEKNOT™

Please refer to NEPTCO's application bulletin for instructions on splicing using a MULEKNOT.

ARAMID MULETAPE PRODUCT ORDERING INFORMATION

PRODUCT	STRENGTH lb. DNF	APPROX. WIDTH in.
WL1250	1250 (56.7)	1/2"
WL1500	1500 (68.5)	1/2"
WL1800	1800 (81.3)	3/8"
WL2000	2000 (90.7)	3/8"
WL2500	2500 (113.4)	1/2"

*Splice lengths from 3,000 ft. (1 km) to 100,000 ft. (30 km)
 *All products are also available unprinted



WARNING MULETAPE® For cable installation only. Do not strap, bind or lift boxes with this product.

NEPTCO warrants that its products will work in a manner consistent with the capabilities described in this data sheet. This warranty shall be void if the product has been installed with or equipped with equipment for the intended use and if the user does not follow the instructions. NEPTCO disclaims all other warranties including implied warranties. NEPTCO and its authorized agents and those to whom they report the price of the product for damages to a purchaser, including consequential damages, occurring in connection with the use or performance of the product.



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 10000018 is a trademark of NEPTCO Technologies



2.08 BONDING/GROUNDING – VAULTS AND PULL BOXES

A. The reinforcing steel in the walls of the utility vault shall be bonded together and brazed to the bronze inserts of each section of the utility vault per the manufacturer’s utility vault specifications. Two ground rods at opposite corners shall be furnished and installed in each vault (one rod in vaults smaller than 3’ X 5’ X 4’). The ground inserts shall be attached to the steel rebar to provide a point of attachment for the ground wires or bonding ribbon. The inserts shall be bronze, flush mounted, and brazed (exothermic weld) to the rebar cage of all the sections of the utility vault (bottom, intermediate, and roof sections).

B. Materials

1. Bonding Ribbon: Shall be made of annealed solid copper 3/8-inch-wide x 1/16 inch thick, tin plated. Manufacturer: INWESCO Cat.12A55 or approved equivalent.
2. Bonding Ribbon Clamp: Shall be made of soft lead 1/2-inch-wide by 1/16-inch-thick and shall accept 1/4-inch diameter bolt. Manufacturer: INWESCO Cat. 12A56 or approved equivalent.

3. Fargo Clamp: Shall be cast from copper, silver plated, furnished with copper bolt. Manufacturer: INWESCO Cat.12A57 or approved equivalent.
4. Ground Rod: Shall be manufactured of high strength high carbon steel, with electrolytically bonded jacket of copper on surface, and shall meet UL spec. 467 and ANSI C-33.8-1072. Manufacturer: INWESCO Cat.12A60 or approved equivalent.
5. Ground Inserts: Shall be made of Cast Bronze W/1/4 Copper Rod. Manufacturer: INWESCO Cat.12H69 or approved equivalent.

2.09 RACEWAY TAGS

- A. Permanent markers with raceway designations engraved onto the tag shall be provided. Tags relying on adhesives or taped-on markers shall not be used.

2.10 DUCT PLUGS



- A. Provide duct plugs capping all empty conduit and at conduit with installed cabling. All ducts and duct plugs must be re-enterable.

- B. All OSP conduits entering a structure utilize re-enterable ductplugs

C. Description:

1. All Duct Plugs shall be constructed of high impact plastic components with durable elastic gaskets.
2. Shall be installed for all innerducts where water may be present.
3. Triplex and/or Quadplex Plugs shall be installed around each innerduct installed in an underground system to organize and support innerducts within conduits.
4. Fiber Optic Duct Plugs shall be installed inside each innerduct surrounding installed fiber optic cabling.
5. Shall be sized for diameter of the innerduct and fiber optic cable.
6. Expandable Plugs shall be provided within buildings for all unused underground conduits.
7. All duct plugs shall be water and airtight.

D. Acceptable Manufacturer:

1. Triplex Plugs

2. Quadplex Plugs
3. Fiber Optic Duct Plugs
4. Expandable Plugs

PART 3 - EXECUTION

3.01 COMMUNICATIONS UTILITY VAULTS AND PULL BOXES

A. General

1. The Contractor shall obtain all required permits and notifications before commencing any work operations.
 2. All state and local ordinances shall be complied with at all times.
 3. All federal, state, and local safety rules, including OSHA, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to inspect the job site to ensure compliance.
- B. Coordination with Civil and Dry Utility project drawings. This coordination shall be the contractor's responsibility to maintain communications trench routing with required depth adjustment in areas of gravity-fed services.
- C. The final location of all communications utility vaults and pull boxes shall be determined by the Contractor and **Riverside County Fire Department's** representative.
- D. All conduits entering a utility vault or pull box shall be placed at right angles to the short walls and shall be sealed to prevent seepage unless otherwise specified on the construction documents.
- E. Excavation dimensions shall be verified with the utility vault supplier in advance so as to prevent delays in setting the schedule. All utility vaults and pull boxes shall be placed on 12 inches of compacted bedding material.
- F. Shoring shall be in accordance to prevailing underground construction codes, i.e., OSHA, G. O. 128, NESC, and all applicable local, state, and federal statutes.
- G. All utility vaults shall be equipped with pulling irons and a ladder for access.
- H. Finish grade shall be established prior to placing structures.
- I. The Contractor and the **Riverside County Fire Department's** representative shall inspect all utility vaults prior to backfilling.
- J. Backfill materials shall have been sifted to provide a sand equivalent of not less than 20, and a sieve size of No.4 Backfill material shall be mechanically compacted to a minimum relative compaction of 90 percent to a level six (6) inches above final grade. The excess material shall be excavated to the final grade upon acceptance of compaction.
- K. Existing and/or new communications utility vaults/pull boxes may be placed near the existing power and signal vault system. The Contractor shall either place new or enlarge existing utility vaults/pull boxes and conduits in such a manner as to not disturb existing utilities while maintaining specified clearances from all obstructions. This may require clearing much of the

area around the vaults by hand. The final placement and depth shall be determined by the Contractor and **Riverside County Fire Department's** representative.

- L. The Contractor shall locate all existing utilities within 20 feet of the new and/or enlarged utility vault/pull box system. The Contractor and **Riverside County Fire Department's** representative shall review and approve any revised coordination schematics. Caution shall be used when working in this area.
- M. The Contractor shall excavate around existing vaults using caution to identify and preserve all utilities in the area.

How To Calculate Underground Pull Box Sizing

Determining the size of **underground pull and junction boxes** to meet NEC 314.16 code standards is required to prevent damage to conductor insulation. Calculating the correct size of pull box needed can be complicated, so please feel free to [contact us](#) or call 800-767-1576 if you need assistance.

NEC 314.28 code requirements apply to installations with conductors of 4 AWG or larger that are required to be installed, and for cables containing conductors of 4 AWG or larger. These apply to splices, straight pulls, U pulls and angle pulls.

Calculating Pull Box Enclosure Sizes:

Minimum size requirements: Minimum distance from where conductors enter to the opposite wall cannot be less than eight times the trade size of the largest raceway.

Straight Pulls

Straight pulls are when the conduit enters the box on one side, and leaves the box on the opposite side, as seen in the diagram below. Straight pulls need 8 times the diameter of the largest conduit/raceway.

In this case, simply multiply your largest raceway size by 8, and that will give you the minimum length for your box.

Largest Raceway Size x 8 = Minimum Box Length

For example, if your raceway is 3":
 $3" \times 8 = 24"$

Splices, Angle Pulls, U Pulls

<https://www.chapmanelectric.com/resources/blog/underground>

How To Calculate Underground Pull Box Sizing

Due to Covid 19, we are running behind. Please expect temporary delays in order and quote processing.

800-767-1576 [Login or Sign Up](#)

These calculations also start with the largest raceway size, but then get a little more complicated. You need to multiply your largest raceway by 6, then add the sizes of any other raceways on the same wall and row to get minimum box size.

Largest Raceway Size x 6 + Size of Raceways on the Same Row = Minimum Box Length

For example, if you have a single Splice, Angle or U pull of 3" raceway:
 $3" \times 6 = 18"$

Multiple Raceways

If you have multiple rows of raceways, calculate each one separately and choose the largest distance.

If you have multiple rows of raceways, use the largest size calculated.

For example, if you have a row with 3-3" raceways, and another row with 3-1" raceways:
Calculate Row 1: $(3" \times 6) + 3" + 3" = 24"$
Calculate Row 2: $(1" \times 6) + 1" + 1" = 8"$
Choose 24", the larger of the 2 sizes.

Distance Between Raceways

Additionally, the distance between raceways that enclose the same conductor cannot be less than six times the largest raceway, measured from the raceway's nearest edge-to-edge.

Largest Raceway Size x 6 = Minimum Distance Between Raceways

For example, if you have a 3" raceway from left to bottom:

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How To Calculate Underground Pull Box Sizing

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Multiple Types of Pulls

Multiple types of pulls can be done within the same box, for example, a straight pull with an angle pull in the same box.

If you have multiple types of pulls, you must calculate for each of the different types of pulls, using the correct formulas, then choose the larger of the sizes calculated.

For example, if you have a box with a straight pull of 3" raceway, and an angle pull with a 3" raceway:
Calculate the straight pull left to right: $3" \times 8 = 24"$
Calculate the angle pull left to right: $(3" \times 6) + 3" = 21"$
Choose 24", the larger of the 2 sizes for your left to right calculation.

Calculate the angle pull top to bottom: $3" \times 6 = 18"$
Your box must be at least 24" wide and 18" tall.

Pull Box Calculation Steps:

You will want to calculate both horizontal (left to right and right to left) and vertical (top to bottom and bottom to top) dimensions, as well as calculating the distance between raceways. Because this can be confusing, want to draw out the configuration.

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How To Calculate Underground Pull Box Sizing

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Need help choosing the right size pull boxes? Our knowledgeable staff would be happy to assist you. [Contact us](#) or call 800-767-1576.

Other Articles You May Enjoy:

- [Choosing the Right Underground Enclosures](#)
- [Determining Proper ANSI Load Ratings for Underground Pull Boxes](#)

Contact Us
Chapman Electric Supply, Inc.
1200 Westfield Road
Northville, MI 48062
Telephone (313) 773-6712 | 800-767-1576
Fax (313) 773-2926

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How To Calculate Underground Pull Box Sizing

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Determine the size of each raceway you will be using.

Determine if you need a Straight or Splice/Angle/U Pull, as you need to use different formulas.

STEP 3: Calculate the Horizontal Dimension:

- Straight Pull**
 - Left to Right: $8" \times 2 = 16"$
 - Right to Left: $8" \times 2 = 16"$
 - Your pull box must be at least 16" wide.
- Angle Pull**
 - Left to Right: $(3" \times 6) + 2" = 20"$
 - Right to Left: None

STEP 4: Calculate the Vertical Dimension:

- Angle Pull (Angle/Splice/U Pulls Only)**
 - Top to Bottom: None
 - Bottom to Top: $3" \times 6 = 18"$

STEP 5: Calculate the Distance Between Raceways (Angle/Splice/U Pulls Only)

- a. Distance Between Raceways: $3" \times 6 = 18"$

STEP 6: Compare the distance between raceways vs. Vertical and Horizontal Distances and choose the larger of the 2. (Angle/Splice/U Pulls Only)

- a. Distance Between Raceways = 18" - (Vertical Distance = 18")
- b. Distance Between Raceways = 18" - (Horizontal Distance = 120")
- c. Your pull box must be at least 20" wide by 18" tall.

STEP 7: Determine Sizes if Multiple Rows of Raceways (skip this step if you have a single raceway) and choose the largest size calculated.

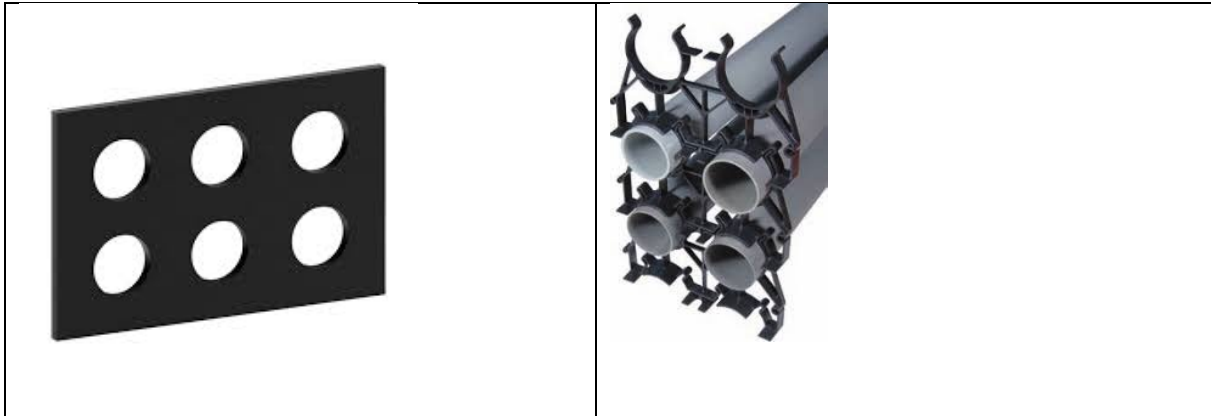
For example, if you have a row with 3-3" raceways, and another row with 3-1" raceways:

- a. Calculate Row 1: $(3" \times 6) + 3" + 3" = 24"$

<https://www.chapmanelectric.com/resources/blog/underground>

3.02 UTILITY VAULT COVERS AND HARDWARE

- A. Pull boxes shall be equipped with a non-skid, spring-loaded traffic-capable lid with a locking mechanism.
- B. **Riverside County Fire Department -PW** will provide sample identification tag prior to contractor procurement. This coordination shall take place prior to cover procurement as part of the project submittal process.




- D. Conduit spacers shall accommodate #3 rebar at four corners of encasement in congested utility area(s), Any changes of direction greater than 35°, or areas of future utility crossings. Rebar shall extend 15 feet past in each direction of the conduit route(s).
- E. Long radius bends (over 40 feet) shall be used whenever possible to make changes in direction. If it is found to be necessary to place a 90-degree bend in the conduit run, a factory-made sweep of no less than a 48" radius shall be used. No conduit run shall exceed a total of 180 degrees of bend between any two points (such as utility vaults or buildings), considering both vertical and horizontal sweeps. Cold-formed trench bends shall have a radius of not less than 40 feet and shall pass mandrel integrity. The bend radius criteria for conduit size 2" or less is 6 times the diameter of the conduit and, for any conduit larger than 2", 10 times the diameter of the conduit.
- F. All bends of less than 20-foot radius shall be encased in concrete when using Type C or Schedule 40 PVC conduits. Encasement shall start from 2 feet before curve to 2 feet past curve. Concrete shall be Type B at 2500 PSI, aggregate of no more than ¼" minus. Conduits shall be spaced at 2 inches minimum using high-impact spacers at 2 feet on center.
- G. The length and destination of all conduits shall be identified in each utility vault, pull box, and building. Embossed metal tags identifying each conduit shall be placed on end walls.
- H. After installation of the communications conduit, the Contractor shall prove all conduits by pulling a mandrel with a diameter ¼ inch smaller than the conduit and 6 inches long through each conduit end-to-end. An inspector designated by the Contractor and the **Riverside County Fire Department's** representative shall be notified 24 hours before this procedure. Each conduit shall be cleaned with a bristle brush to remove any debris.
- I. All utility vault and pull box entrances shall be shear-blocked with standard concrete extending no less than 15 inches from the entry wall. All entering ducts shall be completely encased.
- J. Utility marking tape (see 3.5.A) shall be buried 12 inches below the surface directly above the conduit.
- K. All conduit structures shall be built with the telecommunications conduits placed above the power conduits unless otherwise called out on the construction drawings and approved by the **Riverside County Fire Department** -PW project manager. If this type of construction is required, it shall receive the prior approval of the Contractor, the **Riverside County Fire Department's** representative, and the Local Exchange Carrier.

- L. All entrance conduits shall be securely fastened to the building. The end of the conduit located inside the building shall be sealed with expandable solid plugs to prevent rodents, water, or gases from entering the building.

3.04 ENTRANCE CONDUIT

- A. To prevent shear, all conduit entering a building shall transition from PVC to RMC from a minimum distance of (1) stick of conduit prior to the (footer) exterior of the foundation. These conduits shall slope downward away from the building to reduce the potential of water entering the building.
- B. The Contractor and the **Riverside County Fire Department's** representative shall determine the placement of all entrance conduit. All Applicable standards shall be adhered to, i.e., NEC, BICSI, Western Electric OSP, NESC or G.O. 128.



Jackmoon C-Series Triplex Duct Plugs
Installation Instructions

TECP-30-235 • Issue 1 • 11/2014

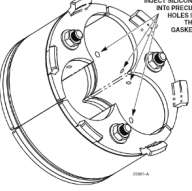
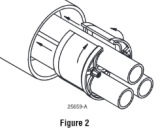
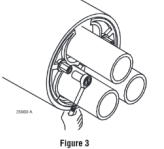
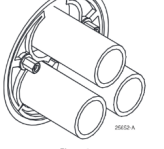
PRODUCT SELECTION

Jackmoon C-Series Triplex duct plugs are used to seal exposed concentric neutral cables in specialized conduit sealing applications. The product features hollow cavities that are filled with silicone to seal around three interwired cables with exposed concentric neutral wires.

- Determine the inside diameter of the outer duct and the outside diameter of the cable or inner duct.
- Select the correct plug from Table 1 on Page 2.

INSTALLATION INSTRUCTIONS

- Open the plug.
- Inject non-corrosive silicone sealant into the pre-cut holes in the gasket. Apply silicone sealant to all gaps and spaces between concentric wiring on cables. (Figure 1)
- Wrap the plug around the cables and position in the opening to be sealed. (Figure 2)
- Tighten each fastener one rotation at a time until a seal is achieved. Maximum torque should not exceed 5.7 foot/pounds. (Figure 3)
- Installation is done. (Figure 4)

30010017267 Rev A Fagopy-Variata CAB08 Page 1

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ORDERING GUIDE

Customer/Series Designation: JM = Jackmoon

Product Group: TRI = Triplex Duct Plugs

Product Size: See Chart Below

JM - TRI - XX - Y - XXX - Y

Suffix: A = For ducts with ID of DB 60 or larger

Range Indicator: See Chart

Product Type: C = Custom Triplex

ORDERING INFORMATION

Refer to Table 1. Dimensions are shown in inches and millimeters.

Table 1. Sizes and Specifications

PRODUCT DESCRIPTION	SIZE	OUTER DUCT ID RANGE		CABLE OR INNER DUCT OD RANGE	
		(INCHES)	(MM)	(INCHES)	(MM)
C-Series Triplex Duct Plugs					
JM-TRI-40C105A	4.0	4.16-4.34	105.7-110.2	0.94-1.05	23.9-26.7
JM-TRI-40C113A	4.0	4.16-4.34	105.7-110.2	1.02-1.13	25.9-28.7
JM-TRI-40C154A	4.0	4.16-4.34	105.7-110.2	1.36-1.54	34.5-39.1
JM-TRI-50C105A	5.0	5.11-5.35	129.8-135.9	0.94-1.05	23.9-26.7
JM-TRI-50C113A	5.0	5.11-5.35	129.8-135.9	1.02-1.13	25.9-28.7
JM-TRI-50C154A	5.0	5.11-5.35	129.8-135.9	1.36-1.54	34.5-39.1
JM-TRI-50C192A	5.0	5.11-5.35	129.8-135.9	1.79-1.92	45.5-48.8

This product chart lists common, standard sizes. Contact your local sales representative for custom sizes.

TE Connectivity
800 Purley Road, Fagopy-Variata NC 27526-3000, Tel: 919-557-8900, Fax: 919-557-8948,
www.tycoelectronics.com, www.us.telcomsp.com.
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Page 2

3.05 LOCATING DUCT BANK CABLE

- A. Underground detectable warning tape shall be placed in all trenches at one foot below the final grade after the conduit and encasement is complete. The tape shall indicate the type of cable that will utilize the substructure system, e.g., fiber optic or copper cables. The detectable warning tape shall be installed according to manufacturer's specifications to ensure access to the tape for locating purposes.

3.06 PULL ROPE

- A. Pull rope shall be new material that is free of knots, kinks, and abrasions.
- B. Pull rope shall be placed as a single continuous length in every new duct section.
- C. Pull rope shall be secured at each end.

3.07 FABRIC INNERDUCT INSTALLATION

- A. Provide fabric innerduct in conduit and wire ways, and place fabric innerduct within and under cable trays using continuous unspliced lengths of fabric innerduct between maintenance holes, pull boxes, and/or termination points as indicated on the drawings.
- B. Make a 2" incision, approximately 18" from the end of fabric innerduct. Pull out and cut off approximately 2 feet of pull-tape. Thus allowing the pull-tape ends to retract back into the cells.
- C. Using approximately 6 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of fabric innerduct. Apply black vinyl tape over all knots and the end of fabric innerduct. Using a Bow Line knot tie a swivel to the end of 3 feet pull tape. For multi-pack installations, one swivel is sufficient but stagger each fabric innerduct.
- D. Using a Bow Line knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install fabric innerduct – ensuring that no twist is introduced to the innerduct.
- E. Provide suitable fabric innerduct slack in the maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.
- F. Fabric Innerduct Mountings, Hangers, and Attachments: When exposed indoors or in maintenance holes, hold firmly in place using independent support.
 - 1. Design & install hangers and other similar fittings adequate to support loads and so as to not damage innerduct.
 - 2. Do not fasten fabric innerduct to steam, water, or other piping, ductwork, mechanical equipment, electrical equipment, electrical raceways, or wires
 - 3. When appropriate, use the following cable ties to secure fabric innerduct through previously created incisions:
 - i. Plenum areas: plenum-rated plastic or stainless steel
 - ii. Non plenum areas: Conventional flame-retardant nylon ties
 - iii. Underground locations : Conventional plastic cable ties

3.08 BONDING/GROUNDING

- A. Two ground rods shall be installed in each new manhole and one rod in a new pull box. All noncurrent-carrying metal parts in the utility vault and any metallic raceway grounding bushing shall be connected to this ground rod with a No. 4/0 bare copper ground conductor and approved ground clamp, as required per NEC.
- B. The grounding system shall not rely on plumbing systems.
- C. Bonding conductors shall be routed with a minimum number of bends. The bends placed in the conductor should be sweeping.
- D. All bonding connections shall utilize listed bolts, crimp pressure connectors, clamps, or lugs. Exothermic welding may be used.
- E. Multiple bus bars shall be directly bonded together with a No. 4/0 copper conductor.
- F. Backbone cabling shall be bonded at each sheath opening with, minimally, a 6-AWG copper conductor.

END OF SECTION

SECTION 270553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
2. Labeling and identification.

1.02 RELATED DOCUMENTS

A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.

3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department-IT** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 IDENTIFICATION LABELS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Panduit – Thermal Transfer
2. Brady Label System
3. Or Riverside County Fire Department -IT Approved Equal

B. Product Options:

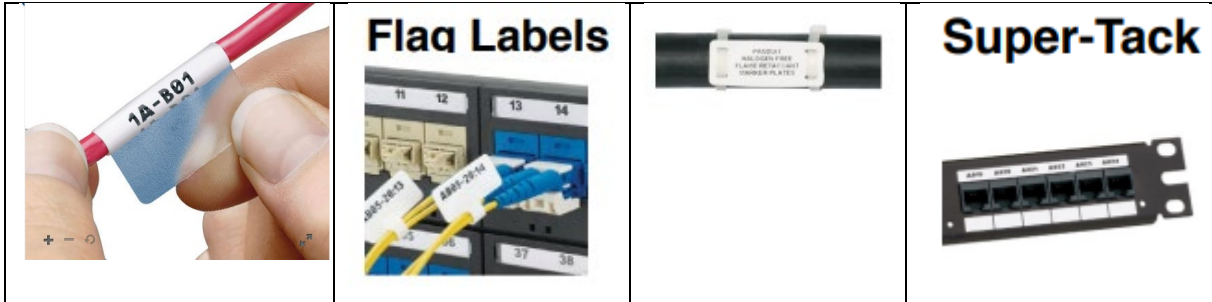
1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the infrastructure requirements.

C. Description:

1. In new installations (Greenfield), the Subcontractor shall develop and submit a labeling strategy based on the TIA 606 Circuit Designation and Labeling Standard for approval.
2. All labels shall be machine-manufactured by a labeling machine. Handwritten labels will not be accepted for final labeling.
3. The labeling scheme intends to be TIA/EIA 606-B compliant.
4. the sub-contractor is responsible for acquiring, understanding, and utilizing the **Riverside County Fire Department's** labeling scheme for all voice data communications system components.
5. the sub-contractor is responsible for providing labels sized to show the **Riverside County Fire Department's** labeling scheme in readable font size while still matching the specified hardware identification dimensions.
6. All labeling information shall be recorded on the as-built drawings, and all test documents shall reflect the appropriate labeling scheme.

D. Indoor Copper and Fiber optic cables and grounding conductors:

1. The cable sheaths shall be labeled with laser-printed polyester self-laminating wrap-around labels sized to fit the **Riverside County Fire Department's** labeling scheme in readable font size.



E. Horizontal cable outlet housings and faceplates:

1. Cable termination connectors at each position on the outlet housing shall be labeled with laser-printed polyester labels inserted into the outlet housing labeling window.

F. Copper patch panels:

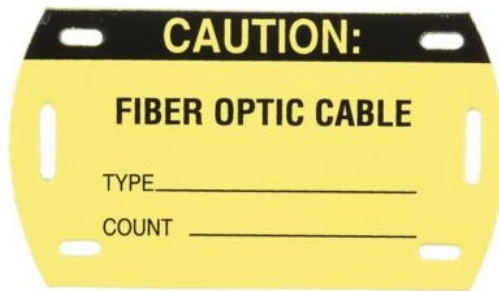
1. The patch panels shall be labeled on the front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the patch panel.

G. Copper patch termination blocks:

1. The termination blocks shall be labeled on the front rows with the termination block designation strip colored per the BICSI requirements identifying the copper cable pairs.

H. Fiber optic termination panels and housings:

1. The panels and housings shall be labeled on the outside front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the panel.
2. Cable termination identifier and fiber positions inside the termination panels shall be made using the manufacturer's provided label card behind the plastic panel.



I. Equipment racks:

1. Bakelite plastic label engraved with rack label scheme attached to the front and rear-facing top angle bracket.
2. Label shall be adhesive backed for secure placement. Optional mounting with self-tapping screws will be at the discretion of **Riverside County Fire Department -IT.**

J. Equipment cabinets:

1. Bakelite plastic label engraved with cabinet label scheme attached to the top front and rear facing the cabinet frame.
2. Label shall be adhesive backed for secure placement. Optional mounting with self-tapping screws will be at the discretion of **Riverside County Fire Department -IT.**

K. Indoor Conduits and pull-boxes:

1. Each conduit section shall be labeled on the outside facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the conduit and its origin and termination end (to and from).
2. Each pull-box shall be labeled on the outside door panel facing an unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the pull-box and building location.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with the installation or use of products specified in this section

3.02 INSTALLATION

A. Process:

1. The **Riverside County Fire Department** -provided labeling scheme is intended to comply with TIA/EIA 606-B standard for labeling and administration of a cable plant. It is the responsibility of the sub-contractor to acquire, understand, and utilize the **Riverside County Fire Department** -IT's labeling scheme for all components of the voice data communications system, including, but not limited to:
2. Indoor Horizontal copper and fiber optic cables (Identify at both ends within 6-inches of termination).
3. Indoor copper and fiber optic backbone cables (Identify at both ends within 12-inches of the point that the cable enters termination panels/blocks, within 12- of the point that the cable enters or exits pull-boxes, wall, and floor sleeves.
4. Workstation outlets, faceplates, and individual outlet connectors.
5. Termination panels.
6. Termination blocks.
7. Racks, cabinets, and equipment enclosures. (front and rear).
8. Indoor conduit pathways and pull-boxes.
9. Grounding conductors and ground bars.
10. Label each component with a specified label at an unobstructed view location and where it is accessible for administration.

3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department** -IT.

END OF SECTION

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SECTION 270800

COMMISSIONING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
2. Copper cable test device.
3. Optical fiber test device.
4. Coax test device.

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

C. NPI Testing Guidance:

1. The installer should always meet the end user's testing and testing-documentation requirements.
2. The following section outlines installer testing recommendations and requirements.
 - i. Always refer to TIA standards or the Corning Optical Communications document LANscape® Solutions Recommended Fiber Optic Test Guidelines for questions.

- ii. It is recommended that on-the-reel testing be performed to verify that received cables are not damaged.
 - iii. It is recommended that place/non-terminated cables be tested to ensure it was not damaged during installation.
 - iv. It is mandatory that Tier One testing be completed on all installed fiber optic systems.
 - v. Tier Two testing for fiber optic systems > 300 feet will be performed.
 - vi. Tier Two testing is optional for lengths shorter than 300 feet unless required by the end user.
3. Testing documentation should include both optical and non-optical data.
- i. Optical Data
 - 1) Tier One testing documentation will include:
 - a) Date of testing.
 - b) Name of personnel involved.
 - c) Description of test equipment to include the model number and serial number.
 - d) Calibration date of test equipment.
 - e) Fiber ID.
 - f) Reference method used.
 - g) Link loss results.
 - ii. Tier Two testing documentation will include:
 - a) Date of testing.
 - b) Name of personnel involved.
 - c) Description of test equipment to include the model number and serial number.
 - d) Calibration date of test equipment.
 - e) Fiber ID.
 - f) Trace file.
 - g) Tested wavelengths.
- D. Non-Optical Data
- 1. Bill of Materials of installed products.
 - 2. Route diagrams.
 - 3. Cable sheath markings.
 - 4. Splice plans (if applicable).
 - 5. Connector labeling schemes.
 - 6. Cable data sheets/reel numbers
- E. An electronic and hard copy of all testing documentation will be provided to the end user within 30 days of project completion.
- F. A copy of all documentation will be maintained by the installer for the duration.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.
- B. Closeout Submittals - As-Built Drawings
 - 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 - 2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 & 28 project submittal requirements.
 - 3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

- A. Warranty:
 - 1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
 - 2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 COPPER CABLE TESTER

- A. Basis-of-Design Product: Subject to compliance with requirements:
 - 1. Fluke - Versiv
- B. Product Options:
 - 1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirement.
 - i. Fluke DSX CableAnalyzer
- C. Description:
 - 1. Must meet or exceed TIA Level IV compliant network cable-testing device certification by an independent laboratory, such as Intertek, to verify high speed, TIA/EIA T568 compliant cables.
 - 2. Copper test equipment must be capable of certifying Category-3, Category-5e, Category-6, and Category-6A UTP links or channels independent of termination hardware configuration (RJ 45 port or 110-style) for each level of performance.
 - 3. Provide full 2-way Autotest of Category-3, 5E, 6 and 6A twisted pair links.
 - 4. All test equipment shall be capable of storing complete frequency sweep data for all tests and printing color graphical reports for all swept measurements.
- D. Accessory Products:
 - 1. Interface Adapters
 - 2. TIA Category-3, 5E,6 and 6(A): 100 ohm
 - 3. Category/Class E permanent link adapters for TIA Cat 3, 5E, 6, and 6A unshielded and shielded cables.

4. DSX CableAnalyzer - VERSIV

2.02 COAXIAL CABLE TESTER

A. Manufacturer List:

1. Fluke
2. Gepco

B. Product Options:

1. Select an analyzer to comprehensively Autotest each connection and record results verifying compliance with industry standards and manufacturer specifications.
 - i. DSX or Equal Digital Cable Analyzer.

C. Description:

1. The tester's Autotest function shall test and record cable resistance, length, impedance, insertion loss, and propagation delay. Additionally, the tester shall provide a TDR function that provides extended troubleshooting capabilities.
2. All test equipment shall be capable of storing complete frequency sweep data for all tests and printing color graphical reports for all swept measurements.

D. Materials: High-impact plastic case with a shock-absorbing over-mold.

E. Accessory Products:

1. Interface Adapters
 - i. DSX-Coax Interface Adapters

2.03 OPTICAL FIBER TESTER

A. Manufacturer List:

1. Fluke

B. Product Options:

1. Select an analyzer to comprehensively certify each optical fiber connection and record results verifying compliance with TIA/EIA performance standards and manufacturer specifications.
 - i. Versiv CertiFiber Pro Optical Loss Test Set

C. Description:

1. The optical fiber source shall permit complete end-to-end testing of Multimode, Single-mode, and LOMMF optical fiber cabling fully compliant with industry standards and manufacturer recommendations.
2. Available source types and wavelengths shall be as follows:
 - i. Multimode - 850nm LED and 1300nm LED.
 - ii. Single-mode – 1310nm FP Laser and 1550nm FP Laser.
 - iii. LOMMF – 850nm VCSEL and 1310nm FP Laser.
3. The built-in power meter shall be calibrated to read 850, 1310, and 1550nm wavelengths.
4. All test equipment shall be capable of storing complete frequency sweep data for all tests and printing color graphical reports for all swept measurements.

D. Accessory Products:

1. Interface Adapters
 - i. DSX Fiber Modules, including Multimode, Single-mode, and LOMMF adapters.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section.
- B. Verify telecommunications cabling is installed and supported, terminated, mounted in an appropriate housing, or terminated on the applicable component and labeled before certification testing and documentation.
- C. Verify certification tester universal interface adapters and manufacturer patch cords that enable permanent link verification are in new condition, not indicating any twisting or kinking resulting from incorrect storage of the tester interface adapters.
- D. Optical fiber patch cords shall be inspected to ensure connector surfaces are clean and free of defects that may affect testing results.

3.02 TESTING

- A. Process:
 1. Certification test 100% of the installed cabling plant, including all backbone and horizontal four (4) pair UTP/MTP/STP copper, multi-pair UTP, and optical fiber connections.
 2. Follow manufacturers' instructions and recommended industry standards and guidelines to complete all TIA/EIA 568 testing procedures to verify performance levels.
 3. All testing will utilize industry standard Method B parameters.
 4. All optical fiber certification testing shall include dual frequency bi-directional reports.
 5. Follow manufacturer requirements for self-calibration procedures.
 6. Update tester software to show specific project information, including but not limited to:
 7. Date and time of testing
 8. Project name
 9. Field technician's name
 10. Cable identification number
 11. Cable manufacturer, type, and part number
- B. Repair:
 1. Any connections failing to meet referenced standards or more stringent performance requirements stated above must be removed and replaced with connections that prove, in additional testing, to meet or exceed the performance standards set forth.

3.03 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.

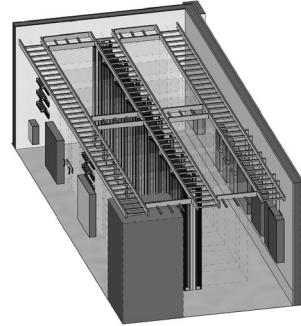
- B. Sub-contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department** -IT

END OF SECTION

SECTION 271100

EQUIPMENT ROOM FITTINGS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL



1.01 SUMMARY

A. Section Includes:

1. Provides specifications for building and fitting for **Riverside County Fire Department-IT Telecommunications Spaces** (BDF, MDF, & IDF or EF, TR, TEC).
2. Technology spaces shall be installed and constructed per all requirements of the 2022-CBC.
3. Spaces shall be stacked with a minimum 2hr rating, including door and firestop sleeves between floors and into the building's horizontal ceiling space.
4. Spaces shall be lined with 2-hr AC-grade fire-rated (Class-A stamped) starting 8" AFF and extending to 8' 8". Requires (2) coats ICG-FBL-100 or approved equal coating that meets ASTM E119
5. Factory sweeps at changes of direction – required from Riverside County Fire Department -IT standard cable manufacturer's requirements.
6. Industry best practices for low-voltage/signal cabling. Cable fill shall follow ANSI-recognized cable quantities maximum-fill of 40% for 0.265" outside diameter CMP cable.

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 & 28 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

1. Chatsworth Products INC.
2. B-Line.
3. Riverside County Fire Department -IT Approved Equal

C. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.
3. Finish the Manufacturer's standard, baked-polyester powder coat. (insert color)

D. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug. (See construction drawings for size typical horizontal managers are 6 inches wide.)
2. Baked-polyester powder coat finish.

E. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. **[Rack] [Roof]**-mounted, 550-cfm fan with filter.
8. Power strip.
9. Baked-polyester powder coat finish.
10. All cabinets keyed alike.

F. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. **[Rack] [Roof]**-mounted, 250-cfm fan.
9. Power strip.
10. All cabinets keyed alike.

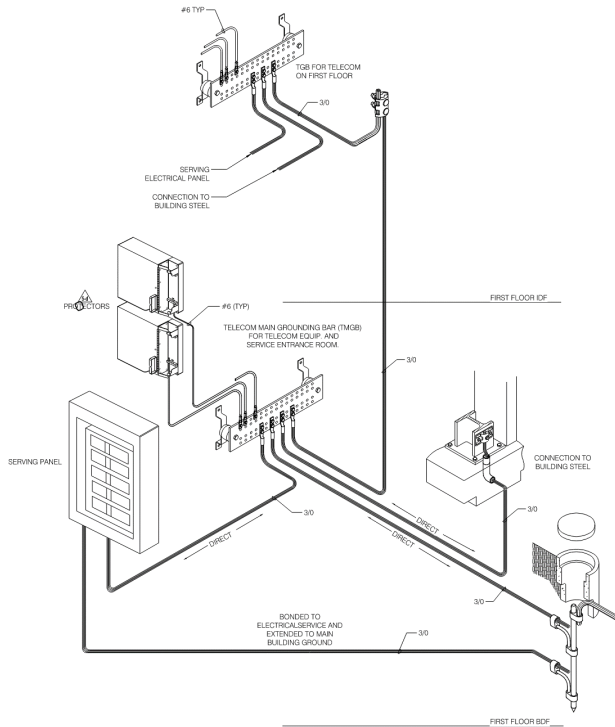
G. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.

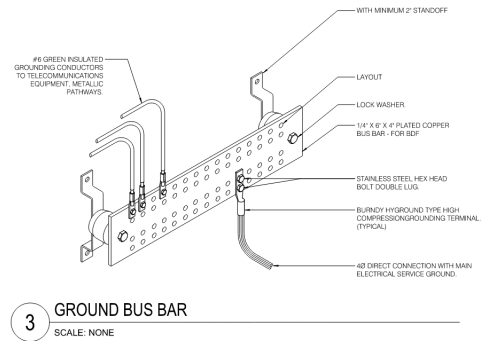
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels with covers.
4. Provide a horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.04 POWER STRIPS

- A. Equipment and materials shall comply with 27 11 26 Power Distribution for Communications Systems
- B. Power Strips: Comply with UL 1363.
 1. Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.
 2. Rack mounting.
 3. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
 4. LED indicator lights for power and protection status.
 5. LED indicator lights for reverse polarity and open outlet ground.
 6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 8. Cord connected with **15-foot** line cord.
 9. Rocker-type on-off switch, illuminated when in on position.
 10. Peak Single-Impulse Surge Current Rating: **[33] [26] [13]** kA per phase.
 11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than **[330 V]**



5 TYPICAL GROUNDING DIAGRAM
SCALE: NONE



3 GROUND BUS BAR
SCALE: NONE

2.05 GROUNDING

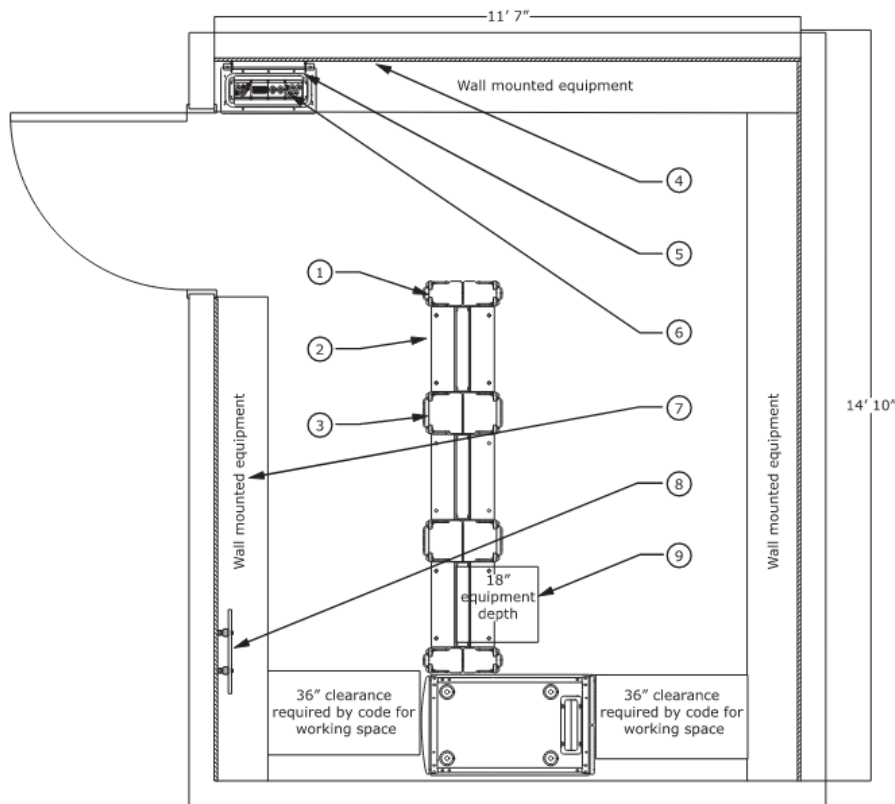
- A. Equipment and materials shall comply with 27 05 26 Grounding & Bonding for Communications Systems
- B. Comply with requirements in Section 260526, "Grounding and Bonding for Electrical Systems," for grounding conductors and connectors.
- C. Telecommunications Main Bus Bar:
 1. Connectors: Mechanical type, cast silicon bronze, solderless compression or exothermic-type wire terminals, and long-barrel, two-bolt connection to the ground bus bar.
 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 3. Stand-Off Insulators: Comply with UL 891 for use in 600 V. Lexan or PVC switchboards, impulse tested at 5000 V.
- D. Comply with J-STD-607-A.

2.06 LABELING

- A. 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.

PART 3 - EXECUTION

Figure 3.3
Space considerations when sizing a telecommunications space



3.01 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange to install a demarcation point, protected entrance terminals, and a housing when directed by the service provider.
- B. Comply with requirements in Section 270528, "Pathways for Communications Systems," for materials and installation requirements for underground pathways.

3.02 INSTALLATION

- A. Contractor shall coordinate space inside all telecommunications spaces with mechanical and electrical contractor for equipment including; fan-coils, chiller/return-lines, E-PNL, N-PNL, ground connection, etc.
- B. Comply with NECA 1.
- C. Comply with BICSI TDMM for layout and installation of communications equipment rooms. All telecommunications spaces shall conform to California Title 24 and other required energy efficiency codes.
- D. Bundle, lace, and dress conductors and cables to terminal points without exceeding the manufacturer's limitations on maximum bending radius. Install lacing bars and distribution spools.
 1. Cable bundles that drop more than 18" shall require vertical support at 18" increments from Sleeve(s), overhead conduit, or cable enclosures.
- E. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carriers.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and the Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 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 LAN equipment's arrangement and space requirements.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- F. Coordinate the location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

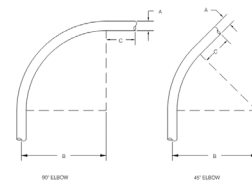
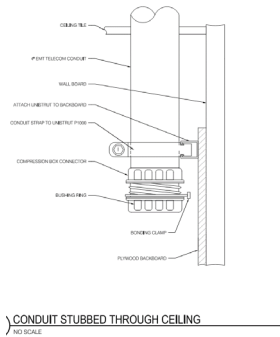
Location	Electrical	HVAC	Day One	Year Two	Year Five	Driving Factors	Recommendations	IDF
Floor - Serving IDF (1) Cabinet (2) Racks (1) UPS	(1) L6-30R, & (1) 120V-20A per rack/cabinet	Yr1 - 2RT Yr2 - 2.6RT Yr5 - 3RT	3,200w UPS-PWR & 3,200w N-PWR	4,200w UPS-PWR & 4,200w N-PWR	4,800w UPS-PWR & 4,800w N-PWR	Additional drives & storage	Yr-5 replace UPS Above 12kW per cabinet + genset Remote monitoring	Includes AC, PA, FA, and BMS for load

Floors above 10k Sq. Ft. may require a second IDF due to cable distance limitations.

IDFs that are larger than 12 x 14 shall require makeup Air.

IDF/TEC requiring more than (3) racks/cabinets require a custom loading report.

If you have any questions, Contact: **Riverside County Fire Department**



SEF	OD	MIN.	MAX.
2"	3.275	21"	3-1/2'
2"	3.27	31"	3-1/4'
4"	4.57	40"	7'

REF: IM/TS 488 TABLE 5.2.1

5 TYPICAL CONDUIT BEND RADIUS, NO SCALE

3.03 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at exterior floor and wall assemblies penetrations. Comply with requirements in Section 270500, "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

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SECTION 271116

CABINETS, RACKS, AND ENCLOSURES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for network cabinets, racks, and telecommunications enclosure components to house various telecommunications infrastructure components and systems equipment.
2. Equipment Racks
3. Equipment Cabinets
 - i. (ea.) Cabinet Over 10kW requires containment

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department IT Project Manager**.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

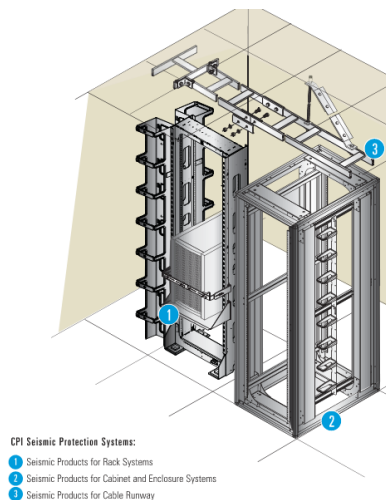
PART 2 - PRODUCTS

2.01 POWER REQUIREMENTS

- A. The contractor shall be responsible for confirming that cabinets containing active equipment have installed (2) PDUs (power strips) to provide sufficient receptacles and current capacity to support the equipment.
- B. Minimum power configuration should be no less than 20 A, 120 Vac power, with 208 Vac where needed. All circuits shall be on the same phase of power and coordinate phase requirements when circuits are fed from UPS or transformer. Consult project documentation for details on the power needs of specific racks and cabinets.

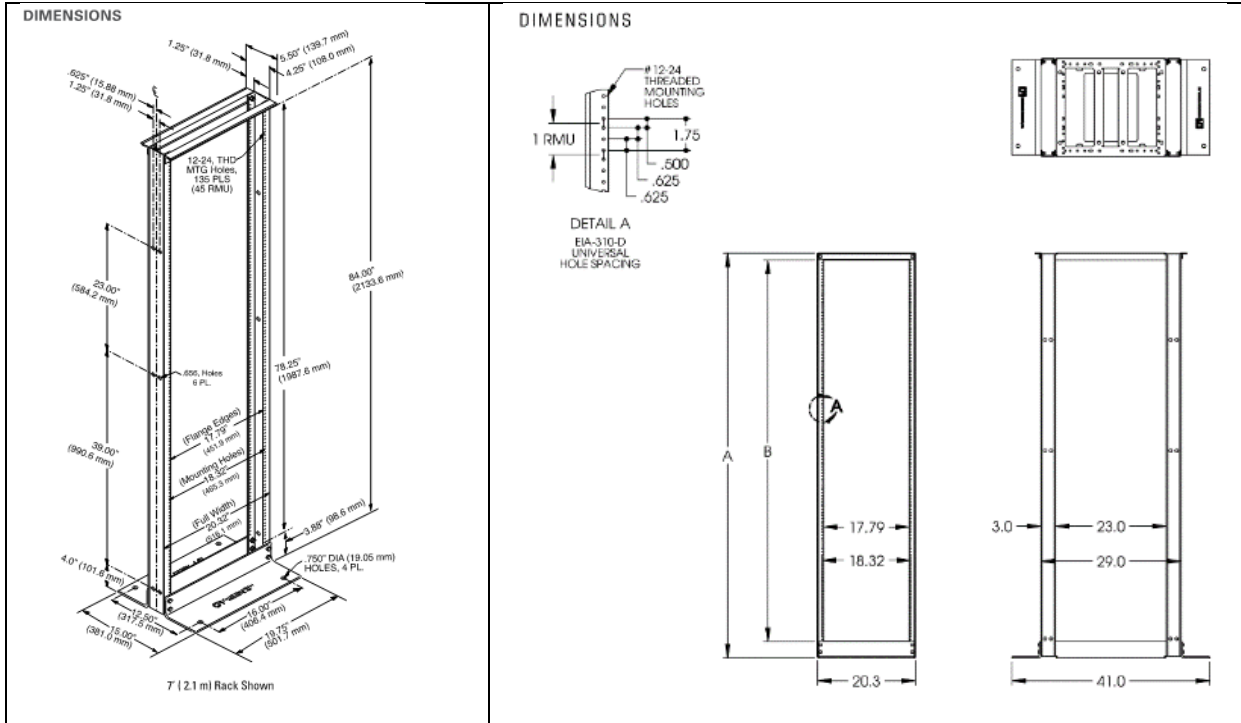
2.02 120Vac Power circuits should have dedicated neutral and ground conductors and no exposed on/off switch or breaker controls that might cause accidental shut-off.

2.03 EQUIPMENT RACKS



A. Basis-of-Design Product: Subject to compliance with requirements:

1. CPI
 - i. 2-Post Part # 55053-703
 - ii. 4-Post Part # 50120-703



B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

C. Description:

1. Equipment racks and rack components shall be black in color. The finish shall be a powder coat.
2. Universal Free Standing 2-Post Relay Racks shall be aluminum, able to support and organize electronic equipment, cross-connection, and/or termination hardware for fiber optic cabling, station cabling, riser cabling, or building entrance cabling as may be required by design.
3. Free Standing 4-Post Relay Racks shall be steel, aluminum, or a combination of both steel and aluminum, able to support and organize electronic equipment, cross-connection and/or termination hardware for fiber optic cabling, station cabling, riser cabling, or building entrance cabling as may be required by design.
4. The assembled rack will measure 84" H x 20.3" W x 29 or 36" D. The sides of the equipment- mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
5. Racks shall be manufactured from aluminum and/or steel extrusions.
6. Each rack will have two L-shaped top angles, two L-shaped base angles, and two C-shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.
7. Equipment mounting channels will be 3" deep and punched on the front and rear flange with the ANSI/EIA-310-D Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
8. The rack will be UL Listed.

9. Network equipment will mount onto a network equipment-suited cabinet 45u rack units tall.
10. Floor-mounted racks shall be permanently attached to the floor using lag bolts and lag shields for masonry-type floors or appropriate fastening hardware for other types of flooring as approved by the **Riverside County Fire Department -IT**. Racks installed adjacent to each other will be fastened using proper bolt, nut, and washer combinations.
11. Rated load for equipment cabinets shall be no less than 1000 pounds, with equipment evenly distributed along the height of the rack.
12. Ladder rack shall be fastened using the proper hanging and connecting hardware and secured in a manner consistent with recommended weight load spacing recommendations.
13. Patch panels, wire cable management hardware, and other related passive equipment will be attached to racks and mounting rails with at least two screws per mounting bracket and located in accordance with the Rack Equipment Elevation Form contained in project documentation on a per-job basis.
14. All equipment shall be free from imperfections and defects.
15. All racks shall be grounded and bonded to the specification of BICSI, Telecommunications Methods Manual, and ANSI/TIA 607-B Bonding and Grounding Standard. See the grounding section in this document for details.
16. Active equipment shall be positioned in racks to work according to that room's "hot aisle/cold aisle" configuration.
17. Equipment with intake/exhaust patterns other than front-to-back should be remediated with appropriate passive ducts to correct airflow to front-to-back patterns wherever possible.
18. Any rack/cabinet spaces not used should be filled with blank panels to minimize rogue backflow of air within the facility.
19. All racks and cabinets shall have a minimum of 3 feet clearance in the front, with 4 feet being preferable for the movement and installation of equipment. Some equipment may require more clearance. See project documentation or equipment manufacturer's guidelines for details.
20. All racks shall have a minimum of 3 feet of clearance in the rear for the movement and installation of equipment.
21. Equipment Mounting Rails shall be spaced horizontally to support 19" wide EIA-310-D compliant rack-mount equipment. Each RMU will be marked and numbered on the front mounting rails.
22. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Each rack will include (50) each combination pan head, pilot point mounting screws
23. The cabinet shall be UL Listed. UL Listing will be stated in the manufacturer's product literature.

D. Accessory Products:

1. Cabinet-mounted vertical power distribution units. Refer to the Division 27 11 26 specifications.

2.04 POWER REQUIREMENTS

- A. Communication Contractor shall be responsible for confirming that equipment racks containing active equipment have installed (2) PDUs (power strips) to provide sufficient

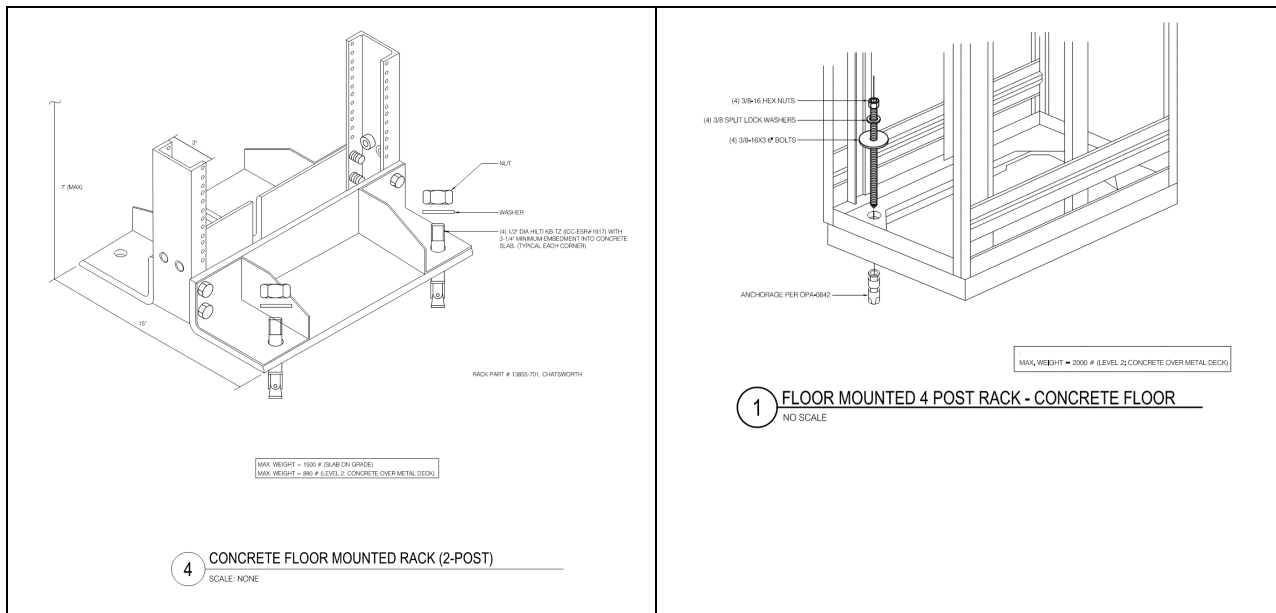
receptacles and current capacity to support the equipment. See Responsibility Matrix for additional information.

- B. Minimum power configuration should be no less than 20 A, 120 Vac power, with 208 Vac where needed. All circuits shall be on the same phase of power. Consult project documentation for details on the power needs of specific racks and cabinets.
- C. Power circuits should have dedicated neutral and ground conductors and no exposed on/off switch or breaker controls that might cause accidental shut-off.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section.



- Installation of racks and cabinets shall be coordinated with SEOR details

3.02 INSTALLATION

A. Process:

1. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:
 - i. Electrical requirements (conduit installation and capacity).
 - ii. The telecommunications rooms are the size indicated in the project drawings.
 - iii. Adequate clearances of doors, riser spaces, and ceilings for all components of the telecommunications system.

- iv. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.
2. Assemble racks and cabinets according to the manufacturer's instructions. Verify that mounting rails are correctly positioned for rack-mount equipment before attaching the rack to the floor.
3. Anchor all racks and cabinets to the concrete floor per the structural requirements and cross brace to the cable runway system above.
4. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach the ladder rack. Use appropriate hardware from the ladder rack manufacturer.

3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department**.

END OF SECTION

SECTION 271119

TERMINATION BLOCKS AND PATCH PANELS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for wall and rack/cabinet-mounted blocks, termination panels, and patch panel components utilized to terminate various telecommunications infrastructure cabling and connectivity.
2. Copper horizontal cabling Patch Panels.

1.02 RELATED DOCUMENTS

A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.

2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

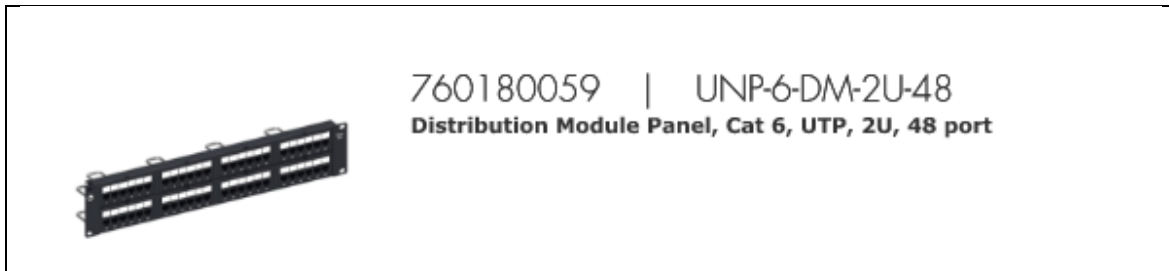
1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 COPPER HORIZONTAL CABLING PATCH PANELS

A. Manufacturer List:

1. CommScope-Systemax
 - i. Systemax - Category 6 48 Port (Flat)



B. Product Options:

1. CommScope – Systemax – U/UTP Cat6

C. Description:

1. Unless otherwise noted, All patch panels must be rack/cabinet mountable within industry standard TIA/EIA 19" mounting rails.
 - i. Patch-panel shall be provided with cable strain relief on the rear of each panel included and confirmed by cable count(s).
 - ii. (1) 2RU are required for above the top patch-panel, between each patch-panel, and below the last patch-panel – for flat patch-panels
 - iii. (1) RU are required for above the top patch-panel, between each (5) patch-panel, and below the last patch-panel – for angled patch-panels
2. All patch panels are to provide adequate space for individual port labeling on the front and cable/connector labeling on the back.
3. All installed station cable patch panels shall be Category 6A forty-eight (48) port patch panels.
4. Unless otherwise noted on drawings, All multi-pair backbone OSP cables terminated in a TR shall be terminated on a BEC protection block—Reference Division 270526 specification.

5. The performance criteria for the patch panels must meet or exceed the performance parameters for frequency, attenuation, near-end cross-talk (NEXT), attenuation to cross-talk ratio (ACR), power sum NEXT (PS-NEXT), power sum ACR (PS-ACR), equal level far end cross-talk (ELFEXT), power sum far end cross-talk (PS-FEXT), and return loss (RL) as outlined in TIA/EIA 568 standards.

D. Accessory Products:

1. Provide any accessory products related to the patch panels to provide a complete and functional infrastructure system.
2. Where required, provide Edge block out device to safely secure access to unused ports and deter vandalism to jacks.
3. Provide all required mounting hardware, fittings, and cables.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:
1. Electrical requirements (conduit installation and capacity)
 2. The telecommunications rooms are the size shown on the project drawings.
 3. Adequate clearances of doors, riser spaces, and ceilings for all components of the telecommunications system.
 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:

1. Install all optical fiber and category copper termination panels/panels under the guidelines of the manufacturer's recommended instructions and per all TIA/EIA 568 standards and manufacturer-approved industry practices as shown in the drawings.
2. The contractor shall verify the installation and performance parameters of all installed cable termination panels through ANSI/TIA 568 testing procedures.
3. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the **Riverside County Fire Department**.

B. Installation description:

1. The contractor shall use existing cabling management pathways and place cable like with like, maintaining original segregation strategies for separating fiber and copper cables and any separation necessary between different types of copper cables.
2. Cables shall be dressed neatly within patch management pathways with care taken to maintain a minimum bend radius of not less than one times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568
3. The contractor shall verify the installation and performance parameters of all installed cable termination panels through ANSI/TIA 568 testing procedures.

4. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the **Riverside County Fire Department**.

3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from the re-installation of specified components due to manufacturer defects or contractor poor performance. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department -IT** before beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department -IT**

END OF SECTION

SECTION 271123

CABLE MANAGEMENT AND OVERHEAD LADDER (TYPE) RACK FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL



Universal Runway

Traditional pathway solution for distribution over racks in equipment rooms. Note that cross-members are fixed in place.

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for cable management components utilized inside each telecommunications distribution space to support the management of horizontal workstation cabling, backbone cabling, and patch cords.
2. Vertical Cable Management
3. Horizontal Cable Management
4. Cable Runway System

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.

- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 - 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 - 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 - 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

- 1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

- 1. The contractor shall coordinate the final TMGB connection with the project electrician.
- 2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 & 28 project submittal requirements.
- 3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

- 1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
- 2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 VERTICAL CABLE MANAGEMENT

A. Basis-of-Design Product: Subject to compliance with requirements:

- 1. CPI
 - i. F-Series - Ring Cable Manager (for 24" wide cabinet)

1) Part Number 39127-703

i. Motive System 2-Post Cable Manager 6" and 10"

1) 6" Part Number 32620-703

2) 10" Part Number 32622-703

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each assembly selected shall address the particular infrastructure requirements.

C. Description:

1. All new Server Room/BDF/IDF cabinets and racks shall include vertical cable management as noted in the drawings.
2. All vertical cable management on cabinets and racks shall be the full height of available rack units unless otherwise noted in the drawings.
3. Vertical cable management shall be placed on the cabinets' left and right sides, located on the front and rear of the cabinet. A total of four (4) vertical Ring Cable managers per cabinet.
4. All components of the cable management system shall be black in color.

D. Accessory Products:

1. Provide any accessory products related to the wire management components to provide a complete and functional infrastructure system.

2.02 HORIZONTAL CABLE MANAGEMENT

A. Manufacturer List:

1. CPI

i. Motive System

1) 2 Unit -Part Number 35431-702

2) 1 Unit -Part Number 35432-701

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each assembly selected shall address the particular infrastructure requirements.

C. Description:

1. Where required, all horizontal cable management on 19" relay racks shall be provided in rack unit dimensions as noted in the drawings.
2. Horizontal managers must have sufficient depth and surfaces to allow for the category-copper cables to bend radiuses—single-sided horizontal managers to be a maximum of 8.2" deep.
3. Horizontal cable managers shall be single-sided and shall provide sufficient depth to allow for category copper and fiber bend radii internally and when entering and/or leaving the wire management frame.
4. Horizontal cable management shall have dual-hinged, removable covers.
5. Transition cable management shall be two rack unit (2 RU) deep upper jumper tray provided with a one-and-a-half inch (1.5") bend radius component compliant with TIA/EIA bend radius requirements.
6. All components of the cable management system shall be black in color.

D. Accessory Products:

1. Provide any accessory products related to the wire management components to provide a complete and functional infrastructure system.

2.03 LADDER RACK

A. Manufacturer List:

1. CPI
 - i. Ladder Rack
 - 1) 18" Part Number 10250-718
 - 2) 12" Part Number 10250-712
 - ii. Ground Cable Support
 - 1) Part Number 11268-001

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each assembly selected shall address the particular infrastructure requirements.

C. Description:

1. The ladder rack routing system shall consist of pathway sections, splice connectors, sidewalls, waterfalls, supports, end caps, mounting brackets, and accessories designed to route and manage copper, fiber optic, grounding, or power cables.
2. The pathway sections shall be provided in 12" (305 mm) widths.
3. The ladder rack shall be fastened using the proper hanging and connecting hardware and secured in a manner consistent with recommended weight load spacing recommendations.
4. All ladder racks will be connected and supported by the ladder rack manufacturer's splice, junction, wall angle, and tri-angle type braces per industry standards and authority having jurisdiction to meet local seismic codes.
5. All overhead ladder trays will be grounded and bonded per TIA standards.
6. Ladder rack sections will be supported every 4 feet; ladder racks spanning over areas that will not attach to a cabinet, rack, or wall will be supported by threaded rods ceiling mount kits provided by ladder rack manufacturers.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:
 1. Electrical requirements (conduit installation and capacity)
 2. The telecommunications rooms are the size shown on the project drawings.
 3. Adequate clearances of doors, riser spaces, and ceilings for all components of the telecommunications pathway.

4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.



- A Two- or Four-Post Racks**
Identify equipment support requirements and space limitations
- B Cable Runway and Pathway**
Provide flexible support for horizontal, vertical, and backbone pathways
- C Cable Management and Accessories**
Ensure proper bend radii and easy moves, adds and changes with space-saving, tool-less products
- D Other Considerations:**
 - For safety, be sure there is proper electric equalization with bonding busbars and bonding wires
 - To reliably deliver, remotely monitor and control power to equipment
 - To protect equipment in seismic areas, select structural bracing for racks and runway

Resources

For a list of recommended and maximum cable fill values for all of CPI's cable management and cable pathway products, visit [chatsworth.com/cable-fill](https://www.chatsworth.com/cable-fill).

3.02 INSTALLATION

A. Process:

1. The primary cable transport system shall be the overhead cable runway system inside telecom spaces, as shown in the drawings. The contractor-installed cable runway system shall include all components to complete the installation, whether indicated in the contract documents or implied by the design.

SECTION 271126

POWER DISTRIBUTION UNITS (PDU) FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for the provision and installation of power distribution units within rack or cabinet frames within telecommunications distribution spaces.
2. Rackmount Vertical Power Distribution Units
3. Rackmount Horizontal Power Distribution Units

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.
- B. Closeout Submittals - As-Built Drawings
 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
 2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
 3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside**

County Fire Department -IT Project Manager.

2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 VERTICAL POWER DISTRIBUTION UNITS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. CPI
 - i. Eaton
 - ii. Trip-Lite
2. Or Riverside County Fire Department -approved equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.
2. TVSS is required on all **Riverside County Fire Department** -IT projects.

C. Vertical Power Distribution Unit Product Description:

1. Quantity: two (2) per Data Center cabinet.
2. Output:
 - i. Nominal Output Voltage 120V or 208V
 - ii. Maximum Total Current Draw per Phase 20A or 30A
 - iii. Output Connections (Riverside County Fire Department #) C13, Riverside County Fire Department #) C19 and NEMA 5-20R or L5-30R
 - iv. Default settings are always **in the on position.**
3. Input
 - i. Nominal Input Voltage 120V, 20 AMP (**Riverside County Fire Department Std.**) or 208V Single PH 30 AMP (**Riverside County Fire Department Std.**)
 - ii. Input Frequency 50/60 Hz
 - iii. Regulatory derated Input Current (North America) 16A for 20A or 24A for 30A or 80% of rated value.
 - iv. Input Connections NEMA L5-30P (**Riverside County Fire Department Std.**), L6-30P
 - v. Minimum Cord Length 15 feet
 - vi. Number of Power Cords (1)
 - vii. Maximum Input Current per phase 30A

D. Local Current Monitoring Display

1. The aggregate current draw per power distribution unit is displayed on the unit via a digital display. The local digital display helps installers avoid overloaded circuits by providing a visible, audible, and remote warning when the current draw is close to the maximum amperage draw of the strip.
 - i. Remote Managed with the license for each device

E. Physical

1. Height 64 inches
2. Width 2.25 inches
3. Depth 1.75 inches
4. 0-RU Footprint

F. Conformance and Regulatory Approvals

1. CSA
2. FCC Part 15 Class A
3. ICES-003
4. UL 60950

G. Accessory Products:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

2.02 HORIZONTAL POWER DISTRIBUTION UNITS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. CPI
2. Eaton
3. Trip-Lite
4. Or Riverside County Fire Department -IT approved equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.
2. TVSS is required on all **Riverside County Fire Department** -IT projects.

C. Horizontal Power Distribution Unit Product Description:

1. Quantity: If Required
2. Output:
 - i. Nominal Output Voltage 120V
 - ii. Maximum Total Current Draw per Phase 20A (**Riverside County Fire Department** Std.)
 - iii. Output Connections (**Riverside County Fire Department** #) NEMA 5-20R
3. Input:
 - i. Nominal Input Voltage 100V,120V
 - ii. Input Frequency 50/60 Hz
 - iii. Regulatory Derated Input Current (North America) 16A Input
 - iv. Connections NEMA L5-20P
 - v. Cord Length 12 feet
 - vi. Number of Power Cords (1)
 - vii. Acceptable Input Voltage 100-120 VAC – Dedicated Circuit

viii. Maximum Input Current per phase 20A

ix. Load Capacity 2400 VA

D. Local Current Monitoring Display

1. The aggregate current draw per power distribution unit is displayed on the unit via a digital display. The local digital display helps installers avoid overloaded circuits by providing a visible warning when the current draw is close to the maximum amperage draw of the strip.

E. Physical

1. Height 1.75 inches
2. Width 17.50 inches
3. Depth 4.25 inches
4. 1 RU

F. Conformance and Regulatory Approvals

1. CSA
2. FCC Part 15 Class A
3. ICES-003
4. UL 60950

G. Accessory Products:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

2.03 HORIZONTAL LED LIGHT BAR

A. Basis-of-Design Product: Subject to compliance with requirements:

1. AURAY – DLED6-RM
2. Or Riverside County Fire Department -IT approved equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

C. Horizontal Power Distribution Unit Product Description:

1. Quantity: If Required
2. Input:
 - i. Nominal Input Voltage 100V,120V
 - ii. Input Frequency 50/60 Hz
 - iii. Regulatory Derated Input Current (North America) 16A Input
 - iv. Connections NEMA L5-20P
 - v. Cord Length 12 feet
 - vi. Number of Power Cords (1)
 - vii. Acceptable Input Voltage 100-120 VAC
 - viii. Maximum Input Current per phase 20A
 - ix. Load Capacity 2400 VA

2.04 RETENTION SPRING for UPS & PDU CORDS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. AURAY – DLED6-RM
2. Or Riverside County Fire Department -IT approved equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

C. Horizontal Power Distribution Unit Product Description:

1. Quantity: If Required
2. Input:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with the installation or use of products specified in this section. Examples of work that must be checked include, but are not limited to:

1. Electrical requirements (conduit installation and capacity).
2. The telecommunications rooms are the size shown on the project drawings.
3. Adequate clearances of doors, riser spaces, and ceilings for all components of the telecommunications system.
4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

B. Installation Location

1. All installations below grade shall be required to be mounted 18" AFF to the bottom of ALL-PDU devices.
 - i. The lower 18" of each rack shall not be used to house **Riverside County Fire Department** -IT equipment or cable connections.

3.02 INSTALLATION

A. Process:

1. Install all power distribution units per the manufacturer's recommended installation instructions.
2. Provide one (1) vertical power unit per PDU electrical circuit requested for each cabinet.
3. Secure power distribution units and other accessories using appropriate factory-manufactured screws. (See **Riverside County Fire Department** -IT rack elevations for placement)
4. Align devices with rack or cabinet hole patterns to allow for the installation of screws in all mounting holes. Hand-tighten screws to factory limits being careful not to over-tighten, cross thread, or strip screw heads.
5. Final location of each power distribution unit to be coordinated with the designer and

the owner.

6. All rack and cabinet-mounted vertical power strips shall be provided with rear-facing standoff or internal cabinet mounting brackets that are both offset to the side of the mounting rails so as not to interfere with the equipment mounted within the rack and provided with sufficient depth to allow access to the vertical and horizontal wire managers.

7. Contractor shall verify with OAR as to PDU facing front/rear of cabinet/rack.

3.03 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end-user interruption shall result from the re-installation of specified components. Scheduling for re-installation work shall be coordinated, in writing, with the owner prior to beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** -IT and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the **Riverside County Fire Department** -IT.

END OF SECTION

SECTION 271513

COPPER HORIZONTAL CABLE FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for four-pair U/UTP copper horizontal workstation cabling to distribute network signals from telecommunications distribution spaces to work area outlet locations.
2. Category 6 CMP-rated, Four-Pair Copper Cabling.
3. RG6 Coaxial CMP-rated Cabling.

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.
 1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
 2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
 3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.
- B. Closeout Submittals - As-Built Drawings
 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.


2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department** -IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

<p>UN874043014/10 CS37P BLU C6 4/23 U/UTP CPK 1KFT</p>  <p>CS37P ETL Verified Category 6 U/UTP Cable, plenum, blue jacket, 4 pair count, 1000 ft (305 m) length CommPak</p> <p>Product Classification</p> <p>Regional Availability: North America Portfolio: Unprise® Product Type: Twisted pair cable</p> <p>General Specifications</p> <p>Product Number: CS37P ANS/TIA Category: 6 Cable Component Type: Horizontal Cable Type: U/UTP (unshielded) Conductor Type, singles: Solid Conductors, quantity: 8 Jacket Color: Blue Note: All electrical transmission tests include swept frequency measurements Pairs, quantity: 4 Separator Type: Isolator Transmission Standards: ANS/TIA-568-2-D CENELEC EN 50288-6-1 ISO/IEC 11801 Class E</p> <p>Dimensions</p> <p>Cable Length: 304.8 m 1000 ft Diameter Over Conductor: 0.978 mm 0.038 in Diameter Over Jacket, nominal: 5.639 mm 0.222 in Jacket Thickness: 0.483 mm 0.019 in Conductor Gauge, singles: 23 AWG</p> <p>Cross Section Drawing</p> <p style="text-align: right; font-size: small;">Page 1 of 4</p> <p style="text-align: center; font-size: x-small;">©2022 CommScope, Inc. All rights reserved. All trademarks identified by ® or ™ are registered trademarks. Responsibility of CommScope: All specifications are subject to change without notice. See www.commscope.com for the most current information. Revised April 15, 2022</p> <p style="text-align: right; font-weight: bold; font-size: small;">COMMSCOPE®</p>	<p>UN874043014/10 CS37P BLU C6 4/23 U/UTP CPK 1KFT</p>  <p>Electrical Specifications</p> <p>Characteristic Impedance: 100 ohm dc Resistance Unbalance, maximum: 5 % dc Resistance, maximum: 8 ohms/100 m 2.438 ohms/100 ft Delay Skew, maximum: 45 ns Dielectric Strength, minimum: 1500 Vac 2500 Vdc Mutual Capacitance at Frequency: 5.6 nF/100 m @ 1 kHz Nominal Velocity of Propagation (NVP): 75 % Operating Frequency, maximum: 400 MHz Operating Voltage, maximum: 80 V Remote Powering: Fully complies with the recommendations set forth by IEEE 802.3ae (Type-4) for the safe delivery of power over LAN cable when installed according to ISO/IEC 14763-2, CENELEC EN 50174-1, CENELEC EN 50174-2 or TIA TSB-184-A Safety Voltage Rating: 300 V</p> <p style="text-align: right; font-size: small;">Page 2 of 4</p> <p style="text-align: center; font-size: x-small;">©2022 CommScope, Inc. All rights reserved. All trademarks identified by ® or ™ are registered trademarks. Responsibility of CommScope: All specifications are subject to change without notice. See www.commscope.com for the most current information. Revised April 15, 2022</p> <p style="text-align: right; font-weight: bold; font-size: small;">COMMSCOPE®</p>
<p style="font-size: 2em; font-weight: bold;">UN874043014/10 CS37P BLU C6 4/23 U/UTP</p>	

2.01 FOUR PAIR CATEGORY 6 CMP CABLING

A. Basis-of-Design Product: Subject to compliance with requirements:

1. CommScope Systimax (UN874043014/10)
 - i. Category 6 CMP Rated
2. **Riverside County Fire Department** IT approved CommScope equal (substitution requires approval from Greg Smith in writing prior to procurement).

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

C. Description:

1. All category-6 performance four (4) pair cables shall consist of eight (8) twenty-four (24) gauge, or greater, thermoplastic insulated solid twisted conductors that utilize the industry standard color code designations.
2. The performance criteria for four (4) pair cables shall be above and beyond specific EIA/TIA 568-C.2 standards for the particular cable's rating and shall show stable performance with documented electrical characterization out to 500 MHz.
3. Four (4) pair cables must perform over and above each current specification parameter for the latest published twisted pair, 10Gb performance cable solution.
4. Cables shall be rated per the installation environment as required by the local AHJ and local codes.
5. Select an appropriate cable construction, including external jacket properties, when installing cables in aerial, outdoor, underground, and corrosive environments.
6. Cable to be run continuously without splices.

D. Accessory Products:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

2.02 FOUR PAIR CATEGORY 6 OSP CABLING

A. Basis-of-Design Product: Subject to compliance with requirements:

1. CommScope Systemax
 - i. Category 6 CM indoor/outdoor
2. Riverside County Fire Department IT approved CommScope equal

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each component selected shall address the particular infrastructure requirements.

C. Description:

1. Category-6 performance - as listed in 2.1 above -

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check actual site conditions prior to the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:

1. Electrical requirements (conduit installation and capacity)
2. The telecommunications rooms are the size shown on the project drawings.
3. Adequate clearance of doors, riser spaces, and ceilings for all components of the telecommunications system.
4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:

1. Install all horizontal station cabling per the manufacturer's installation requirements and **Riverside County Fire Department** IT Standards and Specifications. These requirements are based on ANSI/TIA 568D-Series and BICSI methodologies. IDF schedules by symbol shall be used to identify end devices and their quantities as indicated in the project drawings.
2. Locations requiring horizontal cable shall be, but not limited to, CCTV, Elevator control panels, work area outlet, and WiFi.
3. Install all cables with proper attention to bend radii, pulling method, attachment method, and pulling forces. All cable shall be pulled using an appropriate measuring device to ensure that the specified pulling-tension (force on cable) is not exceeded, as noted in BICSI installation guidelines. Also, refer to the cable manufacturer's specifications for exact cable requirements per the particular cable type.
4. All cables shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances, shall be replaced at no additional cost to the owner.
5. The contractor shall ensure that all TIA/EIA and industry standards are met regarding the maximum stripping length of cable jackets. No four (4) pair UTP cables shall have more than three-eighth inch (3/8") of cable jacket removed beyond the termination points.
6. Install the horizontal cabling with attention to aesthetic means and methods when routing cabling within IT spaces. All horizontal cabling shall terminate in their respective floor serving technology space; specifically, cables from floor outlets must terminate in their corresponding floor telecom room.
7. All cabling distributed horizontally through metal stud framing shall have plastic protective bushings inserted to protect cables prior to installation.
8. All cables shall be clearly labeled on both ends and in an accessible location no more than six inches (0'-6") from the cable ends.
9. The owner reserves the right to specify a new location for any outlet or equipment without increasing contractor unit cost – providing that the new location is specified prior to roughing-in of technology cable and is not farther than ten (10) feet away from the original location specified.
10. Communication EMT conduit sleeves shall receive conduit waterfall to control the bend radius of the communication cable to a minimum of a 4" radius.

3.03 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network downtime, and end-user interruption shall result from re-installing specified components. Scheduling for re-installation work shall be coordinated, in writing, with the owner prior to beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

END OF SECTION

SECTION 271543

FACEPLATES AND CONNECTORS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for horizontal workstation cable termination components and outlet housing components. Includes wall-mount, floor-mount, and ceiling-mount components to support the various workstation outlets throughout the cabling plant.
2. Copper Category 6A Connectors U/UTP
3. Single-Mode Optical Fiber Pigtail Connector Assemblies/Splice-On Connectors
4. Outlet Housing Components (faceplates etc.)

1.02 RELATED DOCUMENTS

- A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

- A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the

construction documents.

2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department**-IT Project Manager.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 COPPER UTP CONNECTORS


A. Basis-of-Design Product: Subject to compliance with requirements:

1. Systimax: Category UTP Category 6A Connectors.
2. Or Riverside County Fire Department-IT approved equal.

B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the **Riverside County Fire Department** and A/E.

Category 6A UTP products



GIGASPEED® X10D MGS600 SERIES INFORMATION OUTLET		
MATERIAL ID	PRODUCT NUMBER	COLOR
760092361	MGS600-003	Black
760092379	MGS600-112	Orange
760092387	MGS600-123	Yellow
760092403	MGS600-226	Green
760092411	MGS600-246	Ivory
760092429	MGS600-262	White
760092437	MGS600-270	Gray
760092445	MGS600-317	Red
760092452	MGS600-318	Blue
760092460	MGS600-361	Violet
760092478	MGS600-148	Almond

C. Description:

1. All UTP connectors shall be rated to perform at or above the current TIA/EIA performance parameters of the UTP cabling it is terminating within the communications system.
2. All UTP connectors shall have an eight (8) position, eight (8)-conductor module that accepts RJ-45 plugs.
3. When utilized as part of a channel or permanent link, all high-performance modular outlet connectors shall not decrease the horizontal cable elevated performance

transmission requirements before and after installation as specified in ANSI/TIA/EIA 568-Series Commercial Building Telecommunications Cabling Standard (horizontal cable section) in all noted performance parameters.

D. Accessory Products:

1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
2. Port RJ-45 jack block-out-device to safely secure access to unused ports and deter vandalism to jacks.
3. Provide all required mounting hardware, fittings, and cables.

2.02 COPPER UTP CEILING CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Systimax: Category UTP Category 6A Connectors.
2. Or Riverside County Fire Department-IT approved equal.

B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the **Riverside County Fire Department** and A/E.

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Instruction Sheet
TIA568B – B Wired
Ceiling Connector Assembly Installation

General

These instructions provide the installation procedure for the Ceiling Connector (760234921) and cord assemblies incorporating the ceiling connector assembly. See the **CommScope** Product Catalog for available cord configurations.

How to Contact Us

- To find out more about **CommScope**® products, visit us on the web at www.commscope.com/
- For technical assistance, customer service, or to report any missing/damaged parts, visit us at <http://www.commscope.com/SupportCenter>



Ceiling Connector

2.03 OUTLET HOUSING COMPONENTS

A. Manufacturer List:

1. Systimax

B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the **Riverside County Fire Department** and A/E.

C. Description:

1. All outlet housings at the various technology outlet locations shall provide the designated number of modular insert ports as indicated in the drawings.
2. All flush-mounted faceplates shall be provided per the port configurations shown on the telecom drawings.
3. Faceplates for wall-mounted phones shall be one (1) port single gang faceplates that have wall-mount lugs allowing vertical phone mounting.
4. Faceplates for flush floor-mounted outlets shall be coordinated with the floor box or poke-thru device that will be selected and installed outside the scope of this section.
5. System furniture faceplates shall be capable of fitting in the furniture system selected by the **Riverside County Fire Department**. Furniture faceplates shall be provided per the port configurations shown on the telecom drawings. Furniture faceplate extenders shall be used (if required) to maintain proper bend radii within the furniture raceway/pathway.
6. Surface-mounted boxes shall be capable of the quantity of outlet jack requirements at each outlet location indicated in the drawings.
7. All outlet-housings shall provide a clear TIA/EIA 606-A labeling location for the individual outlet port and the entire outlet housing location unless otherwise indicated in the project drawings.

D. Accessory Products:

1. Provide any accessory products related to the workstation outlet housing components required to provide a complete and functional infrastructure system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions before the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:
1. Electrical requirements (conduit installation and capacity)
 2. The telecommunications rooms are the size shown on the project drawings.
 3. Adequate clearance of doors, riser spaces, and ceilings for all components of the telecommunications system.
 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

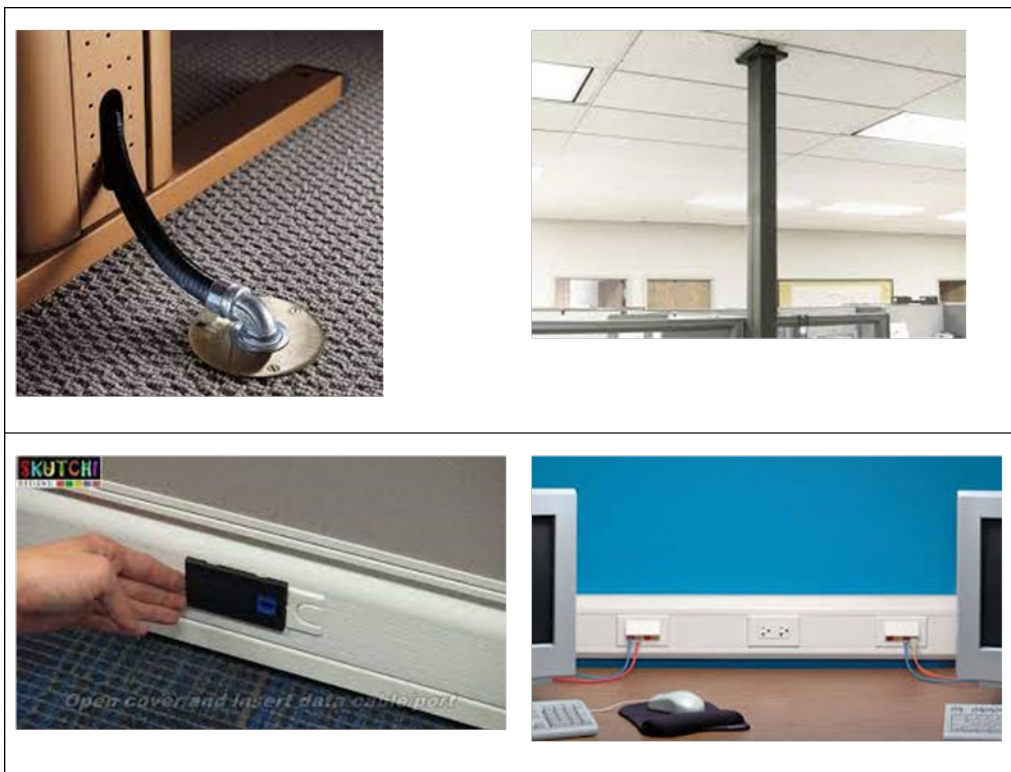
3.02 INSTALLATION

A. Process:

1. Install all connectors and couplers under the guidelines of the manufacturers' recommended instructions and per all TIA/EIA 568 series standards, BICSI guidelines, and manufacturer-approved industry practices.
2. The trade contractor shall verify the installation and performance parameters of all installed couplers and connectors through TIA/EIA 568 series testing procedures.
3. The color of all outlet housing components shall be coordinated with the **Riverside**

County Fire Department OAR before purchase and installation.

4. All technology outlets located on walls shall be flush mounted, level, and plumb.
5. All technology outlets shall be mounted at right angles and parallel to the floor unless installation requirements or design dictate otherwise.
6. Install blank inserts in outlet housing spaces that must be filled with cable termination modules. Blank inserts shall match the workstation housing color unless otherwise indicated in the drawings.
7. All outlets located in systems furniture may be served from a wall adjacent to the furniture cluster or a floor box. If the cable is exposed before entering the furniture raceway, install spiral wrap tubing to protect the cable per the manufacturer's recommendations.
8. All outlet housings and each individual utilized port must be labeled per the **Riverside County Fire Department-IT**-approved labeling scheme.



3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from re-installing specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** before beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required before acceptance by the **Riverside County Fire Department**.

END OF SECTION

SECTION 271619

PATCH CORDS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Provides specifications for Category 6 and optical fiber horizontal cable patching to distribute network signals.
2. Copper Category 6 Patch Cords UTP.
3. Optical Fiber Patch Cords.

1.02 RELATED DOCUMENTS

A. Section 270500 and all divisions of the specification and general provisions of the Construction Documents.

B. Architectural, mechanical, electrical, and all technology drawings.

C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

1. Anywhere cabling Standards conflict with electrical or safety Codes, the Subcontractor shall defer to 2022-CEC and any applicable local codes or ordinances or default to the most stringent requirements listed by either.
2. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
3. Any code violations committed during installation shall be remedied at the Subcontractor's expense.

1.03 QUALITY ASSURANCE

A. Qualifications – Manufacturer

1. Component manufacturers shall be ISO 9001:2000 and offer RoHS-compliant products.

B. Qualifications – Installer:

1. The contractor shall coordinate the final TMGB connection with the project electrician.
2. At a minimum, seventy-five percent (75%) of the onsite subcontractor-provided field technicians shall be factory-certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall always be available on-site for review for each field technician.

1.04 SUBMITTALS

A. Project Submittals – See Section 270500 Appendix A Project Submittals for contractor requirements for training validation, credentials, scaled shop drawings data sheet, and specialty product sample submittal(s) prior to site work.

B. Closeout Submittals - As-Built Drawings

1. Submit all as-built drawings in accordance with the general requirements of the construction documents.

2. Submit bonding and grounding project work from scaled Shop Drawings in the Revit model in addition to the other Div. 27 project submittal requirements.
3. Submit as-built drawings a minimum of two (2) weeks after completion of all Division-27 work for A/E and **Riverside County Fire Department** reference.

1.05 WARRANTY

A. Warranty:

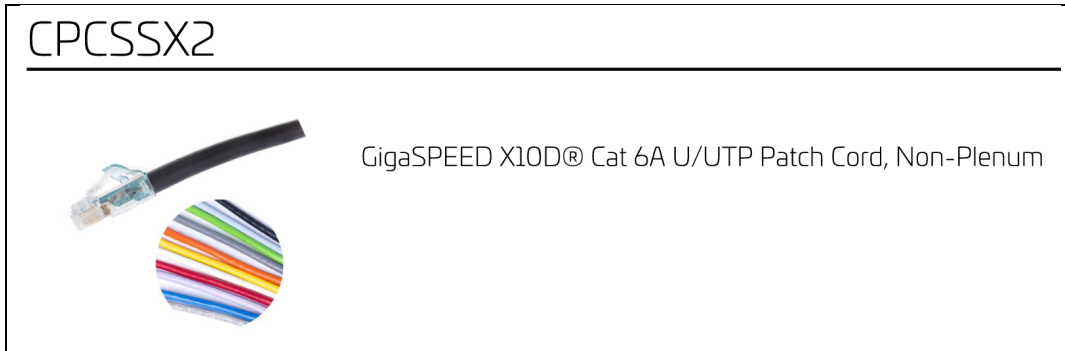
1. The contractor shall provide all extended warranty plans at no cost to the **Riverside County Fire Department-IT Project Manager**.
2. The contractor shall warranty all workmanship per the manufacturer's required installation and attachment requirements.

PART 2 - PRODUCTS

2.01 COPPER U/UTP PATCH CORDS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Systimax: Category 6A U/UTP



B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each assembly selected shall address the particular infrastructure requirements.

GIGASPEED® X10D 360GS10E MODULAR PATCH CORDS						
MATERIAL ID	PRODUCT NUMBER	DESCRIPTION	MODULAR JACK COLOR	CORD COLOR OPTIONS	UOM	CABLE/CORDAGE LENGTH OPTIONS
CPCSSX2	360GS10E	360GS10E Solid Cordage	0	1,2,3,4,6,7,8,9,8,C,Z	F, M	3-100ft / 1-30m
CPCSSY2	360GS10E-P	360GS10E Solid Plenum Cordage	0	1,4,6,7,8,9,C,Z	F, M	3-100ft / 1-30m
CPC54X2	360GS10E117	360GS10E Single-ended Solid Cordage	0	1,2,3,4,6,7,8,9,8,C,Z	F, M	3-100ft / 1-30m
CO199K2	MINo6A	MINo6A reduced Diameter Cat 6A LS-CM Patch Cord	0	1,2,3,4,7,8,9,L,Z	F, M	1-130ft / 1-40m

For information concerning Zone Extension Cords visit our eCatalog at www.commscope.com

C. Description:

1. Category UTP Copper patch cords for equipment patching (RJ-45 to RJ-45 Cords): Modular RJ45 male plug connectors equipped with (8) eight gold anodized pins shall be factory terminated at each end of the patch cords. Modular plug connectors will be snag-free in design or will utilize a molded plastic boot to cover the modular plug tab. Category 6A UTP cords shall be 26 AWG.
2. All patch cords shall conform to the requirements of the EIA/TIA 568D standard performance parameters and shall also guarantee headroom margin above the

minimum EIA/TIA 568D standard NEXT and PSNEXT requirements; and shall provide positive ACR to 5000 MHz-km as part of the connectivity system.

3. All copper UTP patch cords shall have stranded conductors that match the EIA/TIA 568D performance characteristics of the category cable specified.
4. Patch cord performance levels shall be equal to or greater than the performance level of the installed UTP cabling system.
5. All copper patch cord lengths for patching inside the telecom rooms are to be provided appropriate to patching from network equipment ports to the copper patch-panels ports within the Data Center and IDF.

D. Accessory Products:

1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
2. Port RJ-45 patch cord lock-in device to safely secure access to patched cords and deter accidental removal to the network connection.
3. Provide all required mounting hardware, fittings, and cables.

2.02 SMALL FORM-FACTOR - COPPER U/UTP PATCH CORDS

A. Basis-of-Design Product: Subject to compliance with requirements:

1. Systimax: Category 6A U/UTP.

B. Product Options:

1. The indicated manufacturers shall be the basis of the design, and each assembly selected shall address the particular infrastructure requirements.

C. Description:

1. Category UTP Copper patch cords for equipment patching (RJ-45 to RJ-45 Cords): Modular RJ45 male plug connectors equipped with (8) eight gold anodized pins shall be factory terminated at each end of the patch cords. Modular plug connectors will be snag-free in design or will utilize a molded plastic boot to cover the modular plug tab. Category 6A UTP cords shall be 28 AWG.
2. All patch cords shall conform to the requirements of the EIA/TIA 568D standard performance parameters and shall also guarantee headroom margin above the minimum EIA/TIA 568D standard NEXT and PSNEXT requirements; and shall provide positive ACR to 5000 MHz-km as part of the connectivity system.
3. All copper UTP patch cords shall have stranded conductors that match the EIA/TIA 568D performance characteristics of the category cable specified.
4. Patch cord performance levels shall be equal to or greater than the performance level of the installed UTP cabling system.
5. All copper patch cord lengths for patching inside the telecom rooms are to be provided appropriate to patching from network equipment ports to the copper patch-panels ports within the Data Center and IDF.

D. Accessory Products:

1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
2. Port RJ-45 patch cord lock-in device to safely secure access to patched cords and deter accidental removal to the network connection.
3. Provide all required mounting hardware, fittings, and cables.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Check actual site conditions prior to the start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before installing or using products specified in this section. Examples of work that must be checked include, but are not limited to:
1. Electrical requirements (conduit installation and capacity)
 2. The telecommunications rooms are the size shown on the project drawings.
 3. Adequate clearances of doors, riser spaces, and ceilings for all components of the telecommunications system.
 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.02 INSTALLATION

A. Process:

1. Install all horizontal cables per the manufacturer's recommended installation instructions under the guidelines of TIA/EIA 568 C and BICSI.
2. Category 6 equipment Patch cords: Provide (2) copper patch cords (one for each end of the cable termination) for every Category cable installed.
3. Fiber Optic Equipment Patch Cords: Provide (2) fiber optic LC duplex patch cords (one for each end of fiber termination) for every pair of fiber strands installed.
4. All patch cord lengths are to be provided appropriate to a patch from rack-mounted network equipment ports to the rack-mounted horizontal station outlet patch panel ports within the Data Center/IDF and from the workstation outlet to the computer/or other IP end device NIC card/RJ45 port.
5. Provide new, sealed patch cords in lengths, colors, and counts approved in writing by the **Riverside County Fire Department**.
6. the communication contractor will be responsible for providing installation of all Category 6A and Fiber patch cords per direction and coordination of the **Riverside County Fire Department** -IT dept.

3.03 RE-INSTALLATION

- A. No additional burden to the **Riverside County Fire Department** regarding costs, network downtime, and end-user interruption shall result from re-installing specified components. Scheduling for re-installation work shall be coordinated, in writing, with the **Riverside County Fire Department** prior to beginning any re-installation work.

3.04 CLOSEOUT ACTIVITIES

- A. Contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the **Riverside County Fire Department** and A/E team.
- B. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the **Riverside County Fire Department** -IT.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Removal of vegetation, grass, grass roots, shrubs, tree stumps, trees, upturned stumps, weed growth, tree roots, brush, masonry, concrete, rubbish, debris and other materials.
2. Removal of concrete and bituminous surfaces.
3. Removal of existing fences and gates.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 2200 - Grading.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Pavement.
5. Section 31 2319 - Excavation and Fill for Structures.
6. Section 31 2323 - Excavation and Fill for Utilities.
7. Section 31 2326 - Base Course.
8. Section 32 3113 - Chain Link Fences and Gates.
9. Section 32 9000 - Planting.

1.02 SUBMITTALS

- ###### A. Shop Drawings: Submit site plan indicating extent of site clearing.

1.03 QUALITY ASSURANCE

- ###### A. Comply with Standard Specifications for Public Works Construction, current edition, as a minimum requirement.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 TREE AND STUMP REMOVAL

- ###### A. Remove trees and stumps indicated or required to be removed. Remove trees, together with bulk of roots, to a minimum depth of 4 feet below required grade, and within a radius of approximately 7 feet beyond perimeter of trunk at grade.
- ###### B. Fill and compact excavation from tree and stump removal. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D1557.
1. Back filling shall not commence until the excavation is inspected and tested.

3.02 CONCRETE AND BITUMINOUS SURFACING REMOVAL

- ###### A. Break up and completely remove existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to indicated limits. Cutting shall be performed to a neat and even line

with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1 1/2-inch, unless otherwise indicated. Remove concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match existing.

3.03 FENCING

- A. Existing fences scheduled to remain may be removed to facilitate the Work, provided they are installed to their original condition in accordance with requirements of Section 32 3113 - Chain Link Fences and Gates.
- B. Fencing indicated to be removed and not reinstalled shall be completely removed, including footings. Fill and compact excavations.
- C. Install chain link fencing indicated to be relocated or reset in accordance with applicable requirements specified under Section 32 3113 - Chain Link Fences and Gates.

3.04 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Preparing sub-grades for walks and pavements.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Sub-base course for concrete walks and pavements.
5. Sub-base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 01 3200 - Construction Progress Documentation.
2. Section 01 3233 - Photographic Documentation.
3. Section 01 5000 - Temporary Facilities and Controls.
4. Section 03 3200 - Cast-in-Place Concrete.
5. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
6. Section 31 1000 - Site Clearing.
7. Section 31 2319 - Dewatering.
8. Section 31 5000 - Excavation Support and Protection.
9. Section 31 6329 - Drilled Concrete Piers and Shafts.
10. Section 32 9200 - Turf and Grasses
11. Section 32 9323 - Plants
12. Section 33 4600 - Sub-drainage.

1.03 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving required in Division 01 Section "Unit Prices."
- B. Quantity allowances for earth moving are included in Division 01 Section "Allowances."

- C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. 24 inches (600 mm) outside of concrete forms other than at footings.
 2. 12 inches (300 mm) outside of concrete forms at footings.
 3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.04 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench prior to laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by Construction Manager. Authorized additional excavation and replacement material will be paid for according to Contract provisions for [unit prices] [changes in the Work].
 2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
 3. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by Construction Manager. Unauthorized excavation, as well as remedial work directed by Construction Manager, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu.

yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Sub-base Course: Aggregate layer placed between the sub-grade and base course for hot-mix asphalt pavement, or aggregate layer placed between the sub-grade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- L. Sub-grade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 1. Geotextiles.
 2. Controlled low-strength material, including design mixture.
 3. Geofoam.
 4. Warning tapes.
- B. Samples for Verification: For the following products, in sizes required below:
 1. Geotextile: 12 by 12 inches (300 by 300 mm).
 2. Warning Tape: 12 inches (300 mm) long; of each color.
- C. Qualification Data: For qualified testing agency.
- D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 1. Classification according to ASTM D 2487.
 2. Laboratory compaction curve according to ASTM D 698 or ASTM D 1557.

- E. Seismic survey report from seismic survey agency.
- F. Pre-excavation Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.06 QUALITY ASSURANCE

- A. Comply with Standard Specifications for Public Works Construction, "Greenbook".
- B. Comply with the recommendations in the Geotechnical Report.
- C. Seismic Survey Agency: An independent testing agency, acceptable to the City and/or authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on the Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- D. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- E. Pre-excavation Conference: Conduct conference at the Project site.

1.07 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the City and the City and/or authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by the City or the City and/or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining the City's property will be obtained by the City prior to award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Construction Manager.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on the City's premises.
- D. Utility Locator Service: Notify Call Before You Dig for area where the Work is located prior to site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- F. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.

4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 –PRODUCTS

1

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
1. Liquid Limit: Refer to Geotechnical Report
 2. Plasticity Index: Refer to Geotechnical Report.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: Narrowly graded mixture of [washed]crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
 - 4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
 - 5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
 - 6. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
 - 4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
 - 5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C 150, Type II.
 - 2. Fly Ash: ASTM C 618, Class C or F.

3. Normal-Weight Aggregate: ASTM C 33, 3/4-inch (19-mm) nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94/C 94M.
 6. Air-Entraining Admixture: ASTM C 260.
- B. Produce low-density, controlled low-strength material with the following physical properties:
1. As-Cast Unit Weight: 30 to 36 lb/cu. ft. (480 to 576 kg/cu. m) at point of placement, when tested according to ASTM C 138/C 138M.
 2. Compressive Strength 140 psi (965 kPa), when tested according to ASTM C 495.
- C. Produce conventional-weight, controlled low-strength material with 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.

- C. Protect sub-grades and foundation soils from freezing temperatures and frost. Remove temporary protection prior to placing subsequent materials.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding the Project site and surrounding area.
- B. Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - i. 24 inches (600 mm) outside of concrete forms other than at footings.
 - ii. 12 inches (300 mm) outside of concrete forms at footings.
 - iii. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - iv. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - v. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
 - vi. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
- B. Classified Excavation: Excavate to sub-grade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Construction Manager. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - i. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and sub-grade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

- i. 24 inches (600 mm) outside of concrete forms other than at footings.
- ii. 12 inches (300 mm) outside of concrete forms at footings.
- iii. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
- iv. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- v. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
- vi. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.04 EXCAVATION FOR STRUCTURES

- A. Excavate to indicate elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and sub-grades.

3.06 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 - 1. Clearance: 12 inches (300 mm) each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape sub-grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench sub-grade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed sub-grade.
 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed sub-grade.
 4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.07 SUBGRADE INSPECTION

- A. Notify Construction Manager when excavations have reached required sub-grade.
- B. If Construction Manager determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll sub-grade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub-grades.
 1. Completely proof-roll sub-grade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Construction Manager, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Construction Manager, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Construction Manager.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Construction Manager.

3.09 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not prior to completing the following:
 - 1. Construction below finish grade including, where applicable, sub-drainage, damp proofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspection underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on sub-grades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete prior to backfilling or placing roadway sub-base course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of sub-base material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
- H. Place and compact final backfill of satisfactory soil to final sub-grade elevation.

- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final sub-grade elevation.
- J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below sub-grade under pavements and slabs.

3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
- C. Place soil fill on sub-grades free of mud, frost, snow, or ice.

3.13 GEOFOAM FILL

- A. Place a leveling course of sand, 2 inches (50 mm) thick, over sub-grade. Finish leveling course to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.
 - 1. Place leveling course on sub-grades free of mud, frost, snow, or ice.
- B. Install geofoam blocks in layers with abutting edges and ends and with the long dimension of each block at right angles to blocks in each subsequent layer. Offset joints of blocks in successive layers.
- C. Install geofoam connectors at each layer of geofoam to resist horizontal displacement according to geofoam manufacturer's written instructions.
- D. Cover geofoam with sub-drainage or separation geotextile before placing overlying soil materials.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer prior to compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing sub-grade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below sub-grade and compact each layer of backfill or fill soil material at 90 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below sub-grade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:
 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Walks: Plus or minus 1 inch (25 mm).
 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish sub-grade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Sub-drainage Pipe: Specified in Division 33 Section "Sub-drainage."
- B. Sub-surface Drain: Place subsurface drainage geotextile around perimeter of sub-drainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support sub-drainage pipe. Encase sub-drainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final sub-grade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final sub-grade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place sub-base course and base course on sub-grades free of mud, frost, snow, or ice.
- B. On prepared sub-grade, place sub-base course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared sub-grade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over sub-base course under hot-mix asphalt pavement.
 - 3. Shape sub-base course and base course to required crown elevations and cross-slope grades.
 - 4. Place sub-base course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - 5. Place sub-base course and base course] that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - 6. Compact sub-base course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of sub-base course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each sub-base and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on sub-grades free of mud, frost, snow, or ice.
- B. On prepared sub-grade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install sub-drainage geotextile on prepared sub-grade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Special Inspections: The City will engage a qualified special inspector to perform the following special inspections:
 - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 - 2. Determine that fill material and maximum lift thickness comply with requirements.

3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: The City will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
 - C. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
 - D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At sub-grade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.
 - E. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by Construction Manager; reshape and recompact.
- C. Where settling occurs prior to Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off the City's property.
- B. Transport surplus satisfactory soil to designated storage areas on the City's property. Stockpile or spread soil as directed by Construction Manager.
 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off the City's property.

END OF SECTION

SECTION 31 22 00

GRADING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 1000 - Site Clearing.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Pavement.
5. Section 31 2319 - Excavation and Fill for Structures.
6. Section 31 2323 - Excavation and Fill for Utilities.
7. Section 31 2326 - Base Course.
8. Section 32 9000 - Planting.

C. Shop Drawings: Submit site plan indicating extent of site clearing.

1.02 PROJECT REQUIREMENTS

A. General:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on public buried utilities and pipelines. Retain the services of an underground utility locator for on-site utilities.

PART 2 – PRODUCTS

2.01 MATERIALS

- ###### A. Materials shall conform to requirements specified in this and related sections.

PART 3 – EXECUTION

3.01 PREPARATION

- ###### A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
- ###### B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.02 ROUGH AND FINE GRADING

- A. Rough grade area sufficiently high to require cutting by fine grading:
 - 1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.
 - 2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
 - 3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.
 - 4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.
 - 5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.
- B. Base or Subgrade:
 - 1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:
 - i. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
 - ii. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be [90] percent minimum for the top 6 inches below subgrade.
 - iii. Install base course in accordance with Section 31 2326 - Base Course.
 - 2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.03 SHORING

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of CalOSHA.
- C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCESS MATERIAL DISPOSAL

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 31 23 13

EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.
2. Trenches for utility lines such as water, gas, irrigation, storm drain and sewer lines, concrete-encased conduits, manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes, and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2326 - Base Course.
6. Section 32 0117 - Pavement Repair.
7. Section 32 1313 - Site Concrete Work.
8. Section 32 3113 - Chain Link Fences and Gates.
9. Section 32 8413 - Potable Water Irrigation.
10. Section 32 8426 - Reclaimed Water Irrigation.
11. Section 32 9000 - Planting.
12. Section 33 1100 - Site Water Distribution Utilities.
13. Section 33 3000 - Site Sanitary Sewer Utilities.
14. Section 33 4000 - Storm Drainage Utilities.
15. Division 22 - Plumbing.
16. Division 26 - Electrical.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 SUBMITTALS

- ###### A. Shoring calculations as required in Article 3.03 of this Section.

1.04 QUALITY ASSURANCE

- A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.
- B. Sampling, testing, and certification of imported and exported soils shall be performed in accordance with Section 01 4524, Environmental Import/Export Materials Testing.

1.05 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.
- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.05 of this Section.

1.06 PROJECT CONDITIONS

- A. Information on Drawings or in soil investigation report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 – PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

- A. Materials shall conform to requirements specified in this and related sections. Fill and backfill material shall be a granular material previously removed from excavation or imported fill material, free of clods and stones larger than 3 inches, (2½ inches for utility trenches) foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and moisture content shall be blended and aerated to stabilize and upgrade the material.
- C. Bedding material from trench bottom to one foot above the pipe:
 - 1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
 - 2. Sand complying with the Specifications for cement concrete aggregates.
- D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site No such material shall be imported from outside the Project site.
- E. Permeable Backfill:
 - 1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<u>Sieve Size:</u>	<u>Percentage Passing:</u>
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100

No. 1000 to 8

No. 2000 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep-holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system Miradrain by Mirafi, Inc., American Wick Drain, JDR Enterprises, or equal, may be provided if reviewed and approved by the ARCHITECT.

F. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

PART 3 – EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Where the Work includes a building extension or addition on an occupied Project site, perform Work in such a manner, and at such times, as not to disrupt performance of existing utility services to existing Project site facilities. Where an interruption is necessary, obtain review from the OAR before proceeding.
- C. Remove concrete or bituminous pavement to straight lines by saw cutting.

3.02 PROTECTION

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.
- B. Protect existing improvements including landscaping against damage. Repair or replace damaged items.
- C. Protect existing utility services and distribution systems from damage or displacement.
- D. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of two feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.
- E. Shore, crib, or lag excavations and earthen banks as necessary to prevent cave in, erosion or gulying of sides.
- F. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed earth and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

3.03 SHORING

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing Cal-OSHA requirements.
- C. Remove shoring upon completion of the Work of this Section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCAVATION

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.
- B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other required Work.
- C. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- D. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.
- E. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000 - Construction Facilities and Temporary Controls, and in accord with Cal-OSHA standards and requirements.
- F. Trenches over five feet in depth shall comply with the Construction Safety Orders of the California Division of Industrial Safety.
- G. Where indicated or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.
- H. For Structures:
 - 1. Calculate excavation quantities based on elevations or depths indicated on Drawings.
 - 2. Provide 2,000 psi concrete for backfill of over-excavated areas to indicated or required elevations.
 - 3. Special preparation of bottom of excavated planes areas: Excavate areas shown on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.
- I. For Utilities:
 - 1. Excavate trenches to required depth for utility lines, such as pipes, conduits, and tanks, with minimum allowance of 6 inches at the bottom and 6 inches at the sides for bedding or concrete encasement as indicated on Drawings. Grade bottom of trenches to a

uniform smooth surface. Remove loose soil from the excavation before placing sand bedding or concrete encasement.

2. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.
3. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.

- i. Unless otherwise indicated on Drawings, depth of excavations outside buildings shall provide for a minimum coverage above top of piping, tank or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finish grade
Copper Water Tube	18 inches below finish grade
Cast-Iron, Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structure	36 inches below finished grade
Soil, sewer and storm drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. Install polypropylene sewer pipe with at least 24 inches of coverage.
Irrigation Pipe:	Non-pressure pipe - 12 inches, pressure pipe - 24 inches.

- ii. Trench width shall provide space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
4. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 0117 - Pavement Repair.
5. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits placed in the same trench or outside surfaces of containers and tanks.

3.05 PROTECTION

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300 - Earthwork, except as modified herein. Install and compact fill in layers not to exceed 6 inches in thickness.
- B. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Materials Testing.
- D. Imported fill materials shall be sampled by the Geotechnical Engineer, for compliance with the requirements of Part 2 of this Section.

- E. The Geotechnical Engineer, will submit the samples to an independent DSA approved testing laboratory for testing.
- F. Initial sampling and testing shall be performed before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and entity responsible for the source site. The Geotechnical Engineer, will obtain both the initial and additional samples from the identified site and submit samples for required testing.
- G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, California Building Code, and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by the CBC.
- I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

- A. Pavement: Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but not more than 1 in 20. Provide adequate drainage at all times during installation of the Work of this Section.
- B. Structures:
 - 1. After concrete has been placed, forms removed, and concrete Work inspected, backfill excavations with earth to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris and other waste materials from excavations before placing backfill.
 - 2. Before placing backfill, adequately cure concrete and provide bracing, if required to stabilize structure. Protect waterproofing or damp-proofing against damage during backfilling operations, with required protection board. Remove bracing as backfill operation progresses.
 - 3. Do not furnish or install expansive soils for retaining wall backfill.
 - 4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.

5. Install wall backfill before installing railings and fences on walls.
6. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8-inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.
7. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

C. Utilities:

1. Do not install backfill until the Work of this Section has been inspected and tested. Do not furnish or install materials excavated from the Project site containing materials not permitted for backfill.
2. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the IOR.
3. Install backfill in layers not exceeding 4 inches in thickness, except cement-sand slurry.
4. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grades plus one inch.

3.07 COMPACTING

- A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Install and compact sand bedding to provide a uniform bearing under the full length of piping and conduits.
- C. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least ninety percent.
- D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality for testing as set required in Part 2, and observe installation and compaction of fill materials.
- B. The Geotechnical Engineer will sample imported fill materials from their designated source and submit samples to the independent approved testing laboratory before delivery to the Project site.
- C. Installation of backfill shall be observed by the Geotechnical Engineer.
- D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and other materials.

- E. Compaction: Test compaction in accordance with ASTM D1557, Method C.
- F. The Project Inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

3.09 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 16

EXCAVATION AND FILL FOR PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfill, and compacting for paved areas.
2. Installation of fill materials.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2323 - Excavation and Fill for Utilities.
6. Section 32 2326 - Base Course.
7. Section 32 0117 - Pavement Repair.
8. Section 32 1216 - Asphalt Paving.
9. Section 32 1313 - Site Concrete Work.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.
- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

PART 2 – PRODUCTS

2.01 BASE MATERIALS

- A. Concrete Slabs on Grade: Provide "Crushed Aggregate Base "as specified in the Standard Specifications for Public Works Construction, Section 200: "Rock Materials," with ¾ inch maximum size aggregates. Provide 3-inch thick base, unless noted otherwise.
- B. Bituminous Surfacing: As indicated on Drawings and specified in Section 31 2326 - Base Course.

C. Imported Fill Material:

1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

D. Brick rubble and broken concrete originating from the Project site shall be legally disposed of off the Project site. No such materials shall be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80 to 100
No. 100	0 to 8
No. 200	0 to 3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep holes shall consist of two cubic feet of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system, Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the ARCHITECT.

PART 3 – EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Clear the Project site as indicated in Section 31 1000 - Site Clearing.

3.02 PROTECTION

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, Cal-OSHA regulations.
- B. Protect adjacent existing improvements including landscaping against damage.

3.03 EXISTING UTILITY LINES

- A. Protect existing utility lines from damage or displacement.
- B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.04 EXCAVATION

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

3.05 FILL

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.
- B. Provide fill materials as specified in Part 2 - Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this Section, import and/or exported materials shall comply with the requirements of Section 01 4524 - Environmental Import/Export Materials Testing.
- D. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.
- E. The Geotechnical Engineer will submit samples to a DSA approved independent approved testing laboratory for testing.
- F. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial and additional samples from the identified site and will submit samples to the approved independent testing laboratory for testing.
- G. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- H. The independent approved testing laboratory will perform the required tests and report results of tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC, and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer shall submit a verified report to the DSA as required by CBC.
- I. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- J. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.06 INSTALLATION OF MATERIALS

- A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the Geotechnical Engineer, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this Section.

3.07 COMPACTING

- A. Each layer of fill material shall be compacted by tamping, sheepfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 90 percent.
- C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.08 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.
- B. The Geotechnical Engineer will sample imported fill materials from their designated source before delivery to the Project site.
- C. Installation of backfill will be observed by the Geotechnical Engineer.
- D. The Geotechnical Engineer will inspect and test excavation Work before the installation of fill and/or other materials.
- E. Compaction: Test compaction in accordance with ASTM D1557, Method C.

3.09 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.10 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 31 23 23

EXCAVATION AND FILL FOR UTILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 - Environmental Import/Export Materials Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2316 - Excavation and Fill for Paving.
6. Section 31 2319 - Excavation and Fill for Structures.
7. Section 32 0117 - Pavement Repair.
8. Section 32 1313 - Site Concrete Work.
9. Section 32 8413 - Potable Water Irrigation.
10. Section 32 8426 - Reclaimed Water Irrigation.
11. Section 33 1100 - Site Water Distribution Utilities.
12. Section 33 3000 - Site Sanitary Sewer Utilities.
13. Section 33 4000 - Storm Drainage Utilities.
14. Division 22 - Plumbing.
15. Division 26 - Electrical.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.
- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01 4524 - Environmental Import/Export Materials Testing.

1.04 TESTING

- A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide

observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

- B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.02 of this Section.

1.05 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Bedding material from trench bottom to one foot above the pipe:
 - 1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
 - 2. Sand complying with the Specifications for cement concrete aggregates.
- B. Backfill Materials:
 - 1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2 ½-inch in any dimension.
 - 2. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.
 - 3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 – EXECUTION

3.01 GENERAL

- A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.
- B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000, Construction Facilities and Temporary Controls, and in accordance with Cal-OSHA standards and requirements.
- C. Saw-cut concrete or bituminous paving for trench installation.
- D. Trenches over 5 feet in depth shall conform to the Cal-OSHA.

- E. Where indicated and required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.
- F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.
- G. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.
- H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.
 - 1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
Irrigation Pipe:	non-pressure pipe 12 inches, pressure pipe 24 inches
 - 2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
- I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
- J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.
- K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and tanks.
- L. Do not install backfill until required inspections and testing is completed.
- M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Project Inspector.
- N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 90 percent of the maximum density.

- O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.
- P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.
- Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 0117, Pavement Repair.

3.02 IMPORT/EXPORT OF MATERIALS

- A. Provide fill materials as specified in Part 2, Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- B. In addition to the requirements of this Section, import and exported materials shall comply with the requirements of Section 01 4524, Environmental Import/Export Material Testing.
- C. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.
- D. The Geotechnical Engineer will perform the tests by utilizing an independent approved testing laboratory.
- E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.
- F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- G. The independent approved testing laboratory will perform the required tests and report results of all tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by CBC.
- H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.
- I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

- A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D1557, method "C."

3.04 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 31 23 26

BASE COURSE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Installation of base material.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4524 – Environmental Import / Export Material Testing.
3. Section 31 1000 - Site Clearing.
4. Section 31 2200 - Grading.
5. Section 31 2313 - Excavation and Fill.
6. Section 31 2316 - Excavation and Fill for Paving.
7. Section 32 0117 - Pavement Repair.
8. Section 32 1216 - Asphalt Paving.
9. Section 32 1313 - Site Concrete Work

1.02 SUBMITTALS

- A. Prior to import, submit written certification to OAR that crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082, and obtain written approval from LAUSD-OEHS prior to import at the subject site, refer to Article 2.02 for sampling frequency.
- B. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The CONTRACTOR shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OWNER'S Office of Environmental Health and Safety (OEHS) prior to importing the material. A statement on company letterhead from the CAB source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source quarry does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to OEHS. The CONTRACTOR may request variance from analytical testing required by Section 01 4524 for CAB. To be considered for a variance, the CONTRACTOR shall submit a documentation package for OEHS approval, which includes all of the aforementioned information at least 48 hours in advance of planned import.
 1. Frequently used suppliers for LAUSD projects include:
 - i. Hansen Aggregates.
 - ii. Vulcan Materials, Reliance Company.
 - iii. Vulcan Materials Durbin.
- C. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.
- D. Sample: Submit sample of proposed base course material.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Crushed Aggregate Base (CAB) materials shall conform to the requirements of the Standard Specifications for Public Works Construction: Section 200 - Rock Materials
- B. Crushed Miscellaneous Base (CMB) or materials generated on site shall not be used as a base course material

2.01 MATERIAL APPROVAL

- A. Base material shall be inspected by the Project Inspector for gradation and material content prior to installation. The OWNER may choose to have additional tests performed by a geotechnical engineer, retained by the OWNER, before installation.

PART 3 – EXECUTION

3.01 GENERAL

- A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.
- B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 2200 – Grading.

3.02 PROTECTION

- A. Protect the Work of this Section until Substantial Completion.

3.03 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 01 17

ASPHALT PAVEMENT REPAIR

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.
2. Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

B. Related Sections:

1. Division 01 - General Requirements.
2. Section 31 2200 - Grading.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2316 - Excavation and Fill for Paving.
5. Section 31 2319 - Excavation and Fill for Structures.
6. Section 31 2323 - Excavation and Fill for Utilities.
7. Section 31 2326 - Base Course.
8. Section 32 1216 - Asphalt Paving.
9. Section 32 1313 - Site Concrete Work.
10. Section 32 1236 - Seal for Bituminous Surfacing

1.02 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings indicating areas to be repaired.
- B. Product Data: Submit manufacturer's technical data for materials and products.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications for Public Works Construction, current edition.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Base course materials: Section 31 2326 - Base Course.
- B. Asphalt paving materials: Section 32 1216 - Asphalt Paving.
- C. Seal materials: Section 32 1236 - Seal for Bituminous Surfacing.
- D. Headers: Section 32 1216 - Asphalt Paving.

2.01 BITUMINOUS MATERIAL

- A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

PART 3 – EXECUTION

3.01 PAVEMENT REMOVAL

- A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.
- B. Pavement Heaved by Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12-inch clearance to pavement.
- C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.
- D. Remove raveled and depressed bituminous pavement to limits indicated or required.
- E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.
- F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

3.02 EXCAVATING, BACKFILLING AND COMPACTING

- A. Conform to requirements in Section 31 2313 - Excavation and Fill; Section 31 2316 - Excavation and Fill for Paving; Section 31 2319 - Excavation and Fill for Structures; or Section 31 2323 - Excavation and Fill for Utilities, as required.
- B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

3.03 HEADERS

- A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.
- B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.
- C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.
- D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
- E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
- F. Provide additional stakes and devices as required to fasten headers.

3.04 BASE COURSE

- A. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.
- B. Fill grade and compact as specified in Section 31 2200 - Grading.

3.05 RESURFACING

- A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.
- B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.
- C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

- A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.
- B. Repair of Existing Surfacing:
 - 1. Fill cracks ½ inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than ½ inch wide shall be filled with Type C2 Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.
 - 2. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.
- C. Testing: Flood test entire area in presence of the Project Inspector. Entire area tested shall be free of standing water or puddles.
- D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 32 1236 - Seal For Bituminous Surfacing.

3.07 CLEANING

- A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.
- B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

- A. Protect the Work of this section until Substantial Completion

END OF SECTION

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SECTION 32 12 16

ASPHALT PAVEMENT REPAIR

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Paving for playground, parking areas, areas between buildings, synthetic track surfacing adjacent to planting and turf areas as indicated.

B. Related Requirements:

1. Section 02 4116 – Demolition.
2. Section 31 1000 – Site Clearing.
3. Section 31 2200 – Grading.
4. Section 31 2316 – Excavation and Fill Pavement.
5. Section 31 2326 – Base Course.
6. Section 32 0117 – Pavement Repair

1.02 SUBMITTALS

A. Shop Drawings: Submit site plan indicating extent of paving and accessories.

B. Product Data: Manufacturer's technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction.

PART 2 – PRODUCTS

2.01 BITUMINOUS MATERIAL

A. Provide materials of the class, grade, or type indicated on the Drawings- Bituminous Materials of the Standard Specifications for Public Works Construction.

PART 3 – EXECUTION

3.01 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Where wood headers are indicated on drawing, fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on center with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

- E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
- F. Provide additional stakes and anchorage as required to fasten headers in place.

3.02 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

- A. Thickness of Surfacing: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 2 inches.
- B. Provide surfacing material over base course.
- C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.
- D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.
- E. At stairways, adjust thickness of paving such that the first tread is equal in height to all other treads.
- F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.
- G. Placing:
 - 1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.
 - 2. Where 2-inch or 3-inch thick surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2 ½ inches in thickness.
- H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent. Continuous screeds may be provided instead of stakes.
- I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.
- J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.
- K. Rolling:
 - 1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1 ½ tons and 8 tons.
 - 2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements

for specified smoothness. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.

3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.
4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D1188.

3.03 TOLERANCE

- A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10-foot straightedge is placed on surface.
- B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.

3.04 TESTING

- A. After first coat of surface seal has been installed and after a 24 hour period, the flood test shall be completed of the bituminous surfacing in presence of the Project Inspector. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

3.05 SURFACE SEALING

- A. After bituminous surfacing has passed flood test, clear and allow to dry and provide one more coat of surface seal.
- B. Where indicated, provide multiple coats of surface seal to existing bituminous surfacing.
- C. Where new bituminous surfacing joins existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

3.06 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.07 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site

END OF SECTION

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SECTION 32 12 36

SEAL FOR BITUMINOUS SURFACING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Surface sealer over bituminous surfacing.
- B. Related Requirements:
 - 1. Division 01 – General Requirements.
 - 2. Section 32 0117 – Pavement Repair.
 - 3. Section 32 1216 – Asphalt Paving.
 - 4. Section 32 1723 – Pavement Marking.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

- A. Comply with the Standard Specifications for Public Works Construction, current edition.
- B. Agitate bulk materials during transport.

1.04 MAINTENANCE

- A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Provide one of the following surface seals

Product	Name	Manufacturer
1. Guard-Top	CALMAT	Industrial Asphalt
2. Over Kote	Diversified Asphalt Product	
3. Park Top	Western Colloid Product	
4. Sure Seal	Asphalt Coating Engineering	
5. Super Drive Top.	SAF– T Seal.	Inc.
6. Equal.		

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

- A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

- B. Install seal coat in strict accordance with manufacturer's written directions and recommendations.
- C. Install two coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.
- D. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.
- E. Where existing bituminous surfacing is indicated to be patched and sealed, install two coats of surface seal after patching.

3.03 PROTECTION OF SURFACES

- A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.
- B. Protect the Work of this section until Substantial Completion.

3.04 TESTING

- A. Owner reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.

3.05 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 13 13

SITE CONCRETE WORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Portland cement concrete pavement, cement walks, curbs, gutters, trash pick-up area, ramps, mowing strips, fence post footings, sliding gate concrete tracks, catch basins, pipe bedding and encasements, thrust blocks, transition structures, flagpoles and light standard bases and footings, athletic equipment footings and equipment pads.
2. Portland cement concrete paving & concrete finishes:
 - i. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 31 2200 - Grading.
3. Section 31 2316 - Excavation and Fill for Pavement.
4. Section 32 0117 - Asphalt Pavement Repair.
5. Section 32 1100 – Base Course.
6. Section 32 1216 – Asphalt Paving

1.02 SUBMITTALS

- A. Shop Drawings: Submit plans, elevations and details of concrete site Work.
- B. Product Data: Submit mix designs and manufacturer's technical data for materials and products. Submit 3-inch by 3-inch concrete Sample of each specified color.
- C. Material Sample: Submit one concrete bumper to the Project Inspector for destructive testing.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications For Public Works Construction.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Concrete, Mortar and Related Materials: Comply with applicable provisions of Standard Specifications for Public Works Construction, Concrete, Mortar and Related Materials:
 1. Concrete: 28-day compressive strength 4,500 psi, unless specified otherwise.
 2. Reinforcing Mesh: ASTM A185, 4 by 4/W1.4 by W1.4 welded wire mesh.
 3. Expansion Joint Filler: Preformed expansion joint filler, bituminous type, complying with ASTM D994.

- B. Form Materials:
 - 1. Side forms: Douglas fir, Construction Grade or Better or metal forms.
 - 2. Stakes: Douglas fir, Construction Grade or Better or metal stakes.
- C. Concrete Parking Bumpers:
 - 1. Precast concrete, smooth and free of pits and rock pockets, providing a minimum 28-day compressive strength of 4,500 psi. Size at least 7 ½-inch wide, 5 ½-inch high and 6-foot long. Reinforce with two #5 reinforcing bars. Provide 2 ¾-inch diameter pre-drilled holes for anchor installation.
 - 2. Bumper Anchors: Provide ½ inch diameter by 18-inch long galvanized steel pipe.
 - 3. Bumper Adhesive: Provide adhesive recommended by bumper manufacturer/installer for fastening bumpers to concrete pavement.

PART 3 – EXECUTION

3.01 CONSTRUCTION OF FORMS FOR CAST-IN-PLACE STRUCTURES

- A. Concrete Pavement: Install Portland cement concrete pavement in compliance with the Standard Specifications for Public Works Construction, Roadway Surfacing.
- B. Miscellaneous Exposed Concrete: Install concrete curbs, walks, gutters, cross gutters, access ramps, driveways, catch basins, yard boxes, vaults and similar structures, in compliance with the Standard Specifications for Public Works Construction, Concrete and Masonry Construction.
- C. Exposed Concrete Bases: Install bases, such as for post, flagpole, light standards and similar bases, in compliance with the Standard Specifications for Public Works Construction, Concrete and Masonry Construction.
- D. Post, flagpole, light standard footings below grade, underground conduit bedding, encasements, thrust blocks and similar structures may be placed directly in excavations conforming to the required sizes.
- E. Reinforcement installation and concrete placement, surface finishes, curing and removal of forms shall be performed in compliance with applicable provisions of Standard Specifications for Public Works Construction, Concrete and Masonry Construction. Provide heavy broom finish at slopes exceeding six percent and medium broom finish at slopes up to six percent.

3.02 INSTALLATION OF PARKING BUMPERS

- A. Install bumpers as indicated on the Drawings. On bituminous paving, install anchors through pavement and into the ground a minimum of 12 inches. On concrete pavement, install bumpers in a continuous bed of adhesive.

3.03 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes:
 - 1. Cold-applied joint sealants.
 - 2. Cold-applied, jet-fuel-resistant joint sealants.
 - 3. Hot-applied joint sealants.
 - 4. Hot-applied, jet-fuel-resistant joint sealants.
- B. Related Requirements:
 - 1. Division 01 - General Requirements.
 - 2. Section 01 7416 - Storm Water Pollution Prevention.
 - 3. Section 07 9200 - Joint Sealants
 - 4. Section 31 2323 - Excavation and Fill for Utilities.
 - 5. Section 32 0117 - Pavement Repair.
 - 6. Section 32 1216 - Asphalt Paving
 - 7. Section 32 1313 - Site Concrete Work.

1.03 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing required below, Samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit no fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.04 SUBMITTALS

- A. Product Data: For each joint-sealant product required.
- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-)

long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- C. Pavement-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.
- D. Qualification Data: For qualified Installer and testing agency.
- E. Product Certificates: For each type of joint sealant and accessory, from manufacturer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.
- G. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for the Work.
- B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
- D. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.06 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Comply with Standard Specifications for Public Works Construction, "Greenbook".

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 COLD-APPLIED JOINT SEALANTS

- A. Multi-component, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- i. Pecora Corporation; Urexpam NR-200.

2.03 COLD-APPLIED, JET-FUEL-RESISTANT JOINT SEALANTS

- A. Jet-Fuel-Resistant, Multi component, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- i. Meadows, W. R., Inc.; Sealtight Gardox.

2.04 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

- 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

- i. Meadows, W. R., Inc.; Sealtight Hi-Spec.
- ii. Right Pointe; D-3405 Hot Applied Sealant.

2.05 HOT-APPLIED, JET-FUEL-RESISTANT JOINT SEALANTS

- A. Hot-Applied, Jet-Fuel-Resistant, Single-Component Joint Sealant for Concrete: ASTM D 7116, Type I.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- i. Crafcoc Inc., an ERGON company; Superseal 444/777.

2.06 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.07 PRIMERS

- A. Primers: Product 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.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately prior to installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet prior to sealant application and replace them with dry materials.
- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint 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 Joint Sealants: Immediately following joint-sealant application and prior to skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING

- A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.06 PAVEMENT-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Fuel-resistant joints within cement concrete pavement.
1. Joint Location:
 - i. Expansion and isolation joints in cast-in-place concrete pavement.
 - ii. Contraction joints in cast-in-place concrete slabs.
 - iii. Other joints as indicated.
 2. Jet-Fuel-Resistant, Modified-Urethane Joint Sealant for Concrete: Multi component, pourable, traffic-grade, Class 25.
 3. Hot-Applied, Jet-Fuel-Resistant, Joint Sealant for Concrete: Single component.
 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
1. Joint Location:
 - i. Joints between concrete and asphalt pavement.
 - ii. Joints between concrete curbs and asphalt pavement.
 - iii. Other joints as indicated.
 2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
 - i. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify OAR of defects found.
 - ii. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to Owner. Perform a new closed-circuit television inspection at Contractor's expense.

END OF SECTION

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SECTION 32 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Section includes Painted traffic striping and symbols on pavements and curbs.

1.03 STANDARDS AND REFERENCES

Provide pavement markings meeting the accessibility requirements of the current California Building Code (CBC).

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

Provide in accordance with Section 01 33 23 Submittals.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the requirements of Section 01 60 00 Materials and Equipment.
- B. Deliver paints and paint materials in original sealed containers that plainly show the designated name, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the project site for maintaining materials at temperatures recommended by the manufacturer.

1.08 PROJECT CONDITIONS

Do not apply paint when either air or pavement temperature is below 50 degrees F or above 95 degrees F; or when rain, fog, condensation, or temperatures below 50 degrees F are anticipated during the drying period.

1.09 WARRANTY

Provide manufacturer's standard warranty in accordance with Section 01 78 00 Warranties.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pavement Marking Paint: Vinyl acrylic type for use on asphaltic concrete and portland cement concrete, colors as indicated, specified herein, or required by CBC Title 24 Part 2.
- B. Acceptable product or Architect approved equal: Dunn-Edwards Paints Vin-L-Stripe Zone Marking Paint.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which work of this Section will be performed.

- B. Verify that specified items may be installed in accordance with the approved design.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

- A. Immediately before applying the paint, thoroughly clean the pavement surface of dust, dirt, sand, scale, water, oil, grease or other objectionable matter. Do not use solvent material that will damage pavements as cleaning agents. Immediately before painting, give pavement surfaces a final cleaning by means of a power broom and a power blower using compressed air following the brooming.
- B. Provide warning devices required to protect the painting operations and the finished work.

3.03 APPLICATION

- A. Do not apply pavement markings until after sealer has been applied. Apply the paint only when the pavement is dry and clean. Under inclement weather conditions, or when temperature is below 50 degrees F, painting will not be permitted.
- B. Equipment: Apply the traffic and parking striping with a traffic stripe painting machine with a compressor capacity of at least 105 cubic feet and capable of operating at an air pressure of 125 psi. Mechanically agitate paint while the machine is in operation. Equip the striping machine with a pointer so designed that the machine will hold exactly to the alignment. Equip the propelling vehicle with a speedometer or tachometer, and with a suitable device for determining the quantity of paint in the container. Thoroughly clean the paint container and spray nozzles on the machine before starting each day's work.
 - 1. Equipment used for applying reflectorized striping shall be equipped with a bead dispenser capable of applying the beads at the specified rate.
 - 2. Where the configuration or location of a traffic stripe is such that a striping machine is not suitable, use hand spraying equipment and stencils or templates.
 - 3. Apply paint for word markings, letters, numerals, and symbols using hand spraying equipment and stencils or templates.
- C. Application: Immediately following the preparation of the pavement surface, apply the striping at the rate of 100 to 110 square feet per gallon of paint. Apply lines 4 inches wide unless otherwise indicated. Apply the stripe of the indicated or specified width, with clean true edges and without sharp breaks. Repaint, to the applicable specifications, portions of the stripe damaged by any type of traffic within 24 hours after the stripe has been applied.
 - 1. Provide International Symbol of Accessibility for each parking stall for the disabled at location indicated. Symbol shall be 36 inches square, white on standard blue background and shall conform to CBC Title 24 Part 2, Chapter 11; and ADA Accessibility Guidelines for Buildings and Facilities.
 - 2. Tactile warning lines shall be in conformance with CBC Section 1133B.8.3 and 1133B.8.4.
- D. Tolerances: Apply striping within a tolerance of 1/2 inch in 50 feet. Apply markings and stripings to the widths indicated within a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.
- E. At completion touch up stripes and markings which are not clear and distinct or which are not uniform in color.

END OF SECTION

SECTION 32 17 26

TACTILE WARNING SURFACE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Control Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

A. Furnish materials, labor, transportation, services, and equipment necessary to furnish and install Architectural Concrete Pavers as indicated on drawings and as specified herein.

1.03 STANDARDS AND REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM C-150 Specification for Portland Cement.
2. ASTM C-33 Specification for Concrete Aggregates.
3. ASTM C-140 Specification for Concrete.
4. ASTM C-293
5. ASTM C-1028
6. ASTM C501, 50
7. ASTM C241

B. Tile Council of America (TCA)

1. TCA F102 Installation Method Cement Mortar Bonded.
2. TCA F101 Installation Method Cement Mortar Bonded.

C. American National Standards Institute (ANSI)

1. ANSI A-118.4 - Latex Portland Cement Mortar.
2. ANSI A-118.6 - Grout - Latex.

D. Performance Requirements

1. *Compressive Strength*: At the time of delivery, the average compressive strength shall not be less than 8,000psi with no individual unit less than 7,000psi (48,000kPa) per ASTM C-140.
2. *Water Absorption*: Shall not be greater than 6% per ASTM C-936.
3. *Flexural Strength*: Shall not be less than 800psi (5,500kPa) per ASTM C-293.
4. *Freeze/Thaw*: Durability of the paver shall meet the freeze/thaw tests per Section 8 of ASTM C-67 and shall have no breakage and not greater than 1 % loss in dry weight of any individual unit when subject to 50 cycles of freeze/ thaw.
5. *Static Coefficient of Friction*: ASTM C-1028 conditionally slip resistant:
 - a. Wet: 0.50 - 0.60 and Dry: 0.60 - 0.70
6. *Sizing Dimensions*: Shall not differ by more than 1/16 inch (1.6 mm) from width, height, length or thickness. Unit shall conform to a true plane and not differ by more than 1/16 inch (1.6 mm) in either concave and/or convex warpage.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All products covered under this Section shall be produced by a single manufacturer unless otherwise specified with a minimum of ten (10) years proven production experience.
- B. Installer Qualifications: Installer shall have a minimum of three (3) years proven specialized construction experience with this product and be capable of estimating & building from blueprint plans and details, in addition to proper material handling. All Work must comply with local, state/provincial licensing and bonding requirements.
- C. Special Consideration: The paver manufacturer shall demonstrate, either by proven field performance or a laboratory freeze-thaw test, that the paving units have adequate durability if they are to be subjected to a freeze-thaw environment.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

- A. Submit under provisions of Section 01 33 23 Submittals.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used, including preparation instructions, Installation methods, Storage and handling requirements and recommendations.
 - 2. Submit test results from an independent testing laboratory for compliance with performance requirements specified herein.
 - 3. Submit two copies of written instructions for recommended maintenance.
- C. Shop Drawings:
 - 1. Layout drawings of each paved area showing the pattern of pavers, indicate pavers requiring cutting, indicate setting bed methods in each area, drainage patterns and drains and indicate and relationship of paving joints. Include details of setting beds, noting all materials and their thickness, show details at curbs and vertical surfaces.
 - 2. Details of custom (nonstandard) curbs and stair tread/risers, include methods of installation.
- D. Samples: Submit two complete sets of color chips representing manufacturer's full range of available colors and texture. Color will be selected by Architect / Engineer / Landscape Architect / Owner from manufacturer's available standard and custom colors.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the requirements of Section 01 60 00 Materials and Equipment.
- B. Protect Precast Concrete Pavers during shipment, storage and construction against damage. Store a minimum of 4 inches off the ground on pallets in a dry location and cover with polyethylene to protect from contact with materials which would cause staining or discoloration.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1. Do not work during freezing weather or on wet or frozen sub-base.

1.09 WARRANTIES / GUARANTEES

A. Provide manufacturer's standard warranty in accordance with Section 01 78 00 Warranties.

B. Tile Tech Detectable Warning Pavers shall remain free from defects for a period of ten (5) years. The contractor shall warrant that his work will remain free from defects of labor and materials used in conjunction with his work in accordance with the general conditions for this project or a maximum of three (3) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: Tile Tech Pavers Inc., Toll Free (888) 380-5575 Phone: (213) 380-5560 Fax: (213) 380-5561, E-mail: sales@tiletechpavers.com, Website: www.tiletechpavers.com

B. Or Architect approved equal.

2.02 MATERIALS

A. **Concrete Pavers: Detectable Warning or ADA Truncated Dome Pavers** as manufactured by Tile Tech

1. Color: Standard and custom range as manufactured by Tile Tech Pavers Inc.
2. Size: Nominal 12"x12"
3. Thickness: 2"
4. Surface Finish: Shot-blasted & Sealed.
5. Edge Finish: 3/16" bevel on all four (4) sides.
6. Weight: 22 lbs per square foot.

2.03 PRECAST MATERIAL REQUIREMENTS

A. *Portland Cement*: ASTM C-150 specifications for Portland Cement.

B. *Aggregates*: All aggregates to meet ASTM C-33 specifications, cleaned and properly graded to size. Aggregate shall be blended to meet individual project requirements. Aggregates to meet ASTM C241 & HA 10 minimum.

C. *Coloring*: Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer's recommendations.

D. *Color Blending*: Factory-blend pre-cast paver that has a natural color range so products taken from one batch will have the same range as products from a separate batch.

E. *Cleaner*: Liquid neutral chemical cleaner with pH factor between 7 and 8, of formulation recommended by sealer manufacturer for type of precast paver used.

F. *Sealer*: Colorless, slip and stain resistant penetrating or acrylic sealer with pH factor between 7 and 10 that does not affect color or physical properties of precast paver surface.

2.04 INSTALLATION MATERIALS

A. Sand-Set Method

1. *Sand Setting Bed Material*: Sand shall be common sand generally referred to as concrete sand and shall be free of organic materials and any other contaminants that could potentially stain or otherwise damage the unit pavers.
2. *Joint Filler Materials*: Sand conforming with ASTM C-144 with 100% passing a No.16

sieve.

3. *Landscape Filter Fabric*: Woven or non-woven non-biodegradable filter between the compacted base and the sand leveling bed.
 4. *Preformed Asphalt Joint Filler*: As indicated on drawings: ASTM D-994, 1/2inch (13 mm) thick, for expansion joints which are not sealed, one of the following:
 - a. *Code 1301* by W.R. Grace and Co.
 - b. *Asphalt Expansion Joint* by W. R. Meadows, Inc.
 - c. *Elastite Asphalt Expansion Joint* by The Celotex Corporation.
- B. Mortar Setting Bed (Thin-Set) Method - PEDESTRIAN
1. *Latex Mortar Mix*: ANSI A-118.4.
 2. *Water*: Clean and free of deleterious acids, alkalies or organic materials.
 3. *Grout*: ANSI A-118.6, Grout - Latex.
 4. *Sealant, Back-up & Bond Breaker*: As specified in Section 07920 - Sealants and Caulking.
- C. Portland Cement Setting Bed (Thick-Set) Method
1. *Portland Cement Mortar Mix*: ASTM C-150 Custom Bldg Products thick Bed Mortar Mix with Admix, or approved equal.
 2. *Reinforcement*: 2inches by 2inches (51mm by 51mm) - 16/16 welded galvanized wire mesh used in thick mortar bed.
 3. *Water*: Clean and free of deleterious acids, alkalies or organic materials.
 4. *Grout*: Custom Bldg Products Grout with Admix, color as selected or approved equal.
 5. *Bond Slurry*: Custom Bldg Products bond coat or approved equal.
 6. *Sealant, Back-up & Bond Breaker*: As specified in Section 07920 - Sealants and Caulking.
- D. Bituminous Setting Bed Method
1. *Asphalt Setting Bed Materials*:
 - a. Asphalt Cement: ASTM D-3381, viscosity grade AC-10 or AC-20.
 - b. Fine Aggregate: Clean, hard sand, free of organic matter, uniformly graded from coarse to fine, all passing the No.4 sieve meeting the gradation requirements when testing in accordance with ASTM-C136.
 - c. Mixing: Provide plant mixed asphalt setting bed by combining approximately 93% dry fine aggregate and approximately 7% hot asphalt cement and heat to approximately 300 degrees F (149 degree C). Provide each ton of setting bed material apportioned by weight with the approximate ratio of 145lb (66kg) of asphalt to 1,855lb (841kg) of sand.
 2. *Setting Bed Primer*: Cut back asphalt, ASTM D-2028, grade as recommended by manufacturer.
 3. *Asphalt Adhesive*: Standard neoprene modified asphalt adhesive containing oxidized asphalt combined with 2% neoprene and 10% long fibered mineral fibers with a softening point of 155 degrees F.
 4. *Joint Filler Materials*: Sand conforming to ASTM C-144 with 100% passing a No.16 sieve.

5. *Pre-formed Asphalt Joint Filler*: ASTM D-994, 1/2inch (13mm) thick, for expansion joints which are not sealed, one of the following:
 - a. *Code 1301* by W.R. Grace and Co.
 - b. *Asphalt Expansion Joint* by W. R. Meadows, Inc.
- c. *Elastite Asphalt Expansion Joint* by The Celotex Corporation.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Prior to starting work inspect the sub-grade to ensure that it has been properly prepared. Commencement of work shall imply acceptance of sub-grade conditions.
 1. Verify that sub-grade preparation, compacted density and elevations conform to the specifications. Compaction of the soil sub-grade to at least 95% Standard Proctor Density per ASTM D-698 is recommended. Higher density or compaction to ASTM D-1557 may be necessary for areas subject to vehicular traffic.
 2. Stabilization of the sub-grade and/or base material may be necessary with weak or saturated sub-grade soils. The Architect/Engineer should inspect sub-grade preparation, elevations, and conduct density tests for conformance to specifications.
 3. Verify that Geotextiles, if applicable, have been placed according to specifications.
 4. Verify that aggregate base materials, thickness, compaction, surface tolerances, and elevations conform to the specifications.
 5. Verify that base is dry, uniform, even, and ready to support sand, pavers, and imposed or anticipated vehicular loads.
 6. Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with Tile Tech Pavers Inc. and other contributing manufacturer's instructions. Installation requirements vary for each individual project site. Precast Pavers used, pattern, grid layout, starting point, and finished elevation should be shown on plan view shop drawings, which have been prepared and approved by the designer, installing contractor and/or owner.
- B. Placement Tolerance:
 1. Maximum of 1/16 inch (1.6 mm) height variation between adjacent pavers.
 2. Individual pavers shall not vary more than 1/16 inch (1.6mm) from level across width of the paver.
 3. Paved areas shall not vary more than 1/4 inch (6 mm) from level in a distance of 10 feet (3m) measured at any location and in any direction.
 4. The surface elevation of pavers shall be 1/8 in. to 1/4 in. (3mm to 6mm) above

adjacent drainage inlets, concrete collars or channels.

5. Joints between pavers to be 3/16 inch (4.8mm) or 1/8 inch (3mm).
6. Concrete shall not exceed 1/8 inch in 10 feet (3 mm in 3 m) from required plane. Concrete to be steel troweled with fine broom finish. No curing or sealing compound used.

C. Sand-Set Method Installation:

1. Spread a sand/cement mix evenly over the base course and screed to a nominal 1 in. (25 mm.) thickness, not exceeding 1-1/2 in. (40mm) thickness. The screened sand should not be disturbed. Place sufficient sand to stay ahead of the laid pavers. Do not use the bedding sand to fill depressions in the base surface.
2. Lay the pavers in the pattern(s) as shown on the drawings. Maintain straight pattern lines.
3. Field cut pavers with wet masonry saw in accordance with manufacturer's recommendations for methods, equipment and precautions.
4. Tamp into bedding or use a low amplitude, high frequency plate vibrator to vibrate the pavers into the sand. Cover vibrator plate with carpet or card board to prevent surface damage to pavers.
5. Sweep dry joint sand into the joints & sweep off excess sand when the job is complete.

D. Mortar Setting Bed (Thin-Set) Method Installation - PEDESTRIAN

1. Installation of Mortar bed as per TCA F102. All Materials used shall follow instructions of manufacturer for use in mortar method.
2. Install precast concrete pavers.
3. Grouting of pavers in strict accordance with grout manufacturer's directions and instructions. Use latex or acrylic additives from the same manufacturer as the grout.
4. All expansion and Control joints shall be installed per TCA EJ171. Joint materials used shall follow manufacturer's directions and instructions.
5. Rework mixes from time to time to maintain proper consistency, as recommended by manufacturer but do not add ingredients. Discard mortar that has reached its initial set.
6. Field cut pavers with wet masonry saw in accordance with manufacturer's recommendations for methods, equipment and precautions.
7. Remove, scrub & wash clean mortar stains and all other types of soiling from exposed paver surfaces.

E. Portland Cement Setting Bed (Thick-Set) Method Installation

1. Installation of Mortar bed as per TCA F101. All materials used follow instructions of manufacturer for use in mortar method.
2. Install precast concrete pavers and firmly set, tamp into bedding to ensure minimum 95% surface contact with mortar bed. Coat underside of each precast pavers unit with latex cement mortar.
3. Grouting of pavers in strict accordance with grout manufacturer's directions and instructions. Use latex or acrylic additives from the same manufacturer as the grout.
4. All expansion and Control joints shall be installed per TCA EJ171. Joint materials used shall follow manufacturer's directions and instructions.

5. Field cut pavers with wet masonry saw in accordance with manufacturer's recommendations for methods, equipment and precautions.
6. Remove, scrub & wash clean mortar stains and all other types of soiling from exposed paver surfaces.

F. Bituminous Setting Bed Method Installation

1. Place solid steel 3/4 inch (19 mm) thick control bars directly on the base or slab. Install shims under bars for minor adjustment of depth and finish paver elevations. Space bars approximately 11 feet (3.4m) apart and parallel to each other to serve as guides for strike-off boards.
2. Place asphalt setting bed at not less than 200 degrees F (93 degree C) in panels between control bars on the primed concrete slab or binder course to no less than 3/4 inch (19mm) compacted thickness. Spread material and strike off by pulling the material with a 12 feet long by 2 inches by 6 inches (3.7m by 51mm by 152mm) wood board several times to produce a smooth firm and even setting bed. Add fresh material in low, porous spots after each pass of the strike-off board. After each panel is complete remove and advance the first control bar to the next panel position in readiness for placing and striking adjacent panels. Fill in depressions left by the control bar.
3. Roll setting bed with a roller (not over one ton in weight) to a nominal depth of 3/4 inch (19 mm) thick while it is still hot. Add additional material to adjust thickness required and to allow for setting of pavers to finish elevations and slopes.
 - a. If setting bed is installed greater than 1-1/2 inches (38mm) thick, place in two equal lifts. Place the second lift immediately after the first to assure bond between lifts.
 - b. If pavers are not installed immediately after setting bed, provide protection of setting bed with minimum 1/2 inch plywood sheet laid on the setting bed with butted joints. Repair all damage to the setting bed prior to installing pavers.

G. Concrete Slab Installation – VEHICULAR

1. Install precast concrete pavers, slabs and curbs in locations, patterns and at elevations and with slopes for surface drainage as shown on the Drawings and in accordance with the manufacturer's printed installation instructions and the final reviewed shop drawings.
2. Apply neoprene modified asphalt adhesive on the cured setting bed by squeegeeing or troweling. If troweled on, use a trowel with serrations not exceeding 1/16 inch (1.5 mm) depth. Place adhesive to not more than 1/16 inch (1.6mm) thickness over the total surface of the setting bed. Do not begin installation of pavers, slabs and curbs until adhesive is dry to the touch.
3. Lay out pavement in 30 feet (9m) working area modules. Set precast concrete pavers, slabs and curbs by hand on dry adhesive in patterns shown on the Drawings with hand tight joints 1/16 inch to 1/8 inch (1.6 mm to 3 mm) wide joints and uniform top surfaces.
4. Field cut pavers with wet masonry saw in accordance with manufacturer's recommendations for methods, equipment and precautions.
5. Maintain accurate alignment and check for creep and shrinkage. Make adjustments to creep and shrinkage within the 30 feet (9 m) module area.
6. Sweep fine dry sand over pavement surface to fill joints immediately after installing pavers, slabs and curbs on setting bed. Brush in sand until joints are completely filled, remove surplus sand. Do not allow traffic on installed pavers, slabs or curbing until the joints have been filled.

7. Protect newly laid pavers, slabs and curbs with plywood panels on which workers stand. Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of installed pavers, slabs and curbs.
8. Install the specified joint filler where precast concrete pavers, slabs and curbs abut curbs, other vertical surfaces and other construction.
9. After the precast concrete paving is completed, backfill the spaces along the edges of the walks, metal edging and pavements to the required elevations with material reviewed by the Testing Laboratory. The Material shall then be compacted until firm and the surface neatly graded, with allowance made for top soil.

3.04 PROTECTION

- A. Protect installed pavers until completion of project.
- B. Remove and replace pavers which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement before Substantial Completion.

3.05 CLEANING & SEALING

- A. Wash entire surface with phosphate free neutral cleaner with pH factor between 7 to 10 and rinse with clean water and allow to dry thoroughly.
- B. Apply sealer in accordance with manufacturer's directions.
 1. pH factor between 7 and 10
 2. Non-discoloring and UV resistant.
 3. Penetrating type designed especially for precast concrete pavers.

3.06 MAINTENANCE

- A. Extra Materials: Deliver supply of maintenance materials to the owner. Furnish not less than 1 percent maintenance materials from same lot as materials installed, and enclosed in protective packaging with appropriate identifying labels.

END OF SECTION

SECTION 32 31 00

TUBE STEEL FENCES AND GATES

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install all tubular steel fence system, as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References.

1.04 QUALITY ASSURANCE

A. Comply with the Standard requirements established by Manufacturer.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

A. Provide in accordance with Section 01 33 23 Submittals.

B. Provide:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
4. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures for the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Sections 01 60 00 Materials and Equipment.

1.08 PROJECT CONDITIONS

A. Comply with the requirements of Sections 01 50 00 Construction Facilities.

B. Comply with Manufacturer's Standard Requirements.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 78 39 Contract Closeout.

1.10 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 00 Warranties.

PART 2 – PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. All steel material for posts and rails shall have a minimum yield strength of 45,000 psi (310 MPa).
- B. All HSS tubing to conform to ASTM A500, cold formed steel tubing.
- C. Posts for end, corner and line types as indicated below:
 - 1. Fence: Tube steel per Plans
 - 2. Vehicular and Trash Enclosure Gates: Tube steel per Plans
 - 3. Man Gates: Tube steel per Plans
 - 4. Provide steel caps at all posts.
 - 5. Add 1'-6" to the gross height of the fence for posts going into concrete footings. If posts are designed to be flange mounted, no additional length is required.
- D. Rails for fences and frames for man gates shall be tube steel sized per Plans. Frames for vehicular and trash enclosure gates to be tube steel sized per Plans.
- E. Frame Corner Construction: Mitered and Welded.
- F. Pickets shall be 1" square tube steel with pressed point (spear shape) top ends. Pickets shall be spaced 4" on center unless otherwise shown on the Drawings.
- G. Finishes:
 - 1. Finish metal components individually prior to assembly
 - 2. Manufacturer Preparation: Hot-Dip galvanize interior and exterior of all metal components in accordance with ASTM A123 standards.
 - 3. Shop Preparation: After shop fabrication, apply hot process galvanizing repair compound to damaged / welded connections and surfaces. Clean by removing all bumps, runs, drips, and organic materials from all surfaces. Rinse and dry after cleaning. Profile the exterior galvanized surfaces using Sweep Blasting, Wash Primer, Acrylic Pre-Treatment methods, or prepare using ASTM D6386 Standards.
 - 4. Shop Priming: Electrostatic applied zincrich epoxy coating, minimum 2 mils (0.0508 mm) thick.
 - 5. Shop Finishing: Electrostatic applied polyester color coat, minimum 2 mils (0.0508 mm) thick.
 - 6. Finished Coating Performance Requirements:
 - a. Adhesion: ASTM D3359, Method B.
 - b. Corrosion Resistance: ASTM B117 and D1654.
 - c. Impact Resistance: ASTM D2794.
 - d. Weathering Resistance: ASTM D822, D2244, and D523, 60 Degree Method.
 - 7. Provide color sample of protective coating as indicated on the Drawings for Architect review and approval.

2.02 HARDWARE

- A. General: Provide standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components unless noted otherwise.
- B. Swing Gate Hardware:

1. Hinges: Provide clamp-on hardware for flat wall or post installation as shown on the Drawings.
 - a. Hinge operation shall be one-way self-closing butt hinges unless shown otherwise on the Drawings.
 - b. Hinges shown on the drawings to be dual acting will also be self-closing butt hinges.
 2. Latches: If no other latch / lock is specified, gate manufacturer shall provide padlock hasp at post and gate for securing the gate. Latch shall be a forked or plunger bar to permit operation from either side of the gate.
 3. Gate pairs shall be provided with drop rod, which shall be accessible only from the interior of the gate and protected by a welded steel box.
- C. Rolling Gate Hardware: Provide following for each gate:
1. Latches:
 - a. Provide forked type or plunger-bar type to permit operation from either side of the gate.
 - b. Provide padlock eye as integral part of latch.
 2. Universal Track Bracket: Provide 10 gage galvanized steel brackets with 3/8" diameter galvanized J-Bolts and nuts.
 3. Rear Wheels:
 - a. Provide 5" outside diameter, 4" diameter V-Groove, galvanized steel roller bearing wheel.
 - b. Anchor rear wheels to gate frame with 5/8" diameter.
 4. Double Wheel Carriage: Provide 1" x 2" x 14 ga. galvanizing steel tube axle with 3/8" diameter galvanized J-Bolts and 6" diameter rubber tire with galvanized steel roller bearing hub.
- D. Man Gate Hardware:
1. Hinges:
 - a. Material: Steel, Heavy-Duty
 - b. Weight Rating: 3,000 lb per pair
 - c. Bearings: Sealed, Roller Bearing
 2. Latches and/or locks

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this Section will be performed.
- B. Ensure property lines and legal boundaries of work are clearly established.
- C. Survey of fence location to be provided by general contractor.
- D. Verify areas to receive fencing are completed to final grade.
- E. Notify the Construction Manager and Architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- F. Correct conditions detrimental to timely and proper completion of the Work.

G. Do not proceed until unsatisfactory conditions are corrected.

H. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION

A. General:

1. Install posts at a maximum spacing of 8 feet on centers.
2. Install corner of slope posts where changes in line or grade exceed a 30° deflection.
3. The distance between end or corner posts shall be divided equally into panels not over 8'-0" long.
4. Install panels at a bias when there is more than a 4" drop for the distance that the panels in this section cover and more than 2" drop within the length of a given panel. A post shall be installed at the top and bottom of each bias.

B. Excavating:

1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
2. Post hole dimensions:
 - a. Provide 24" deep by 6" diameter foundations for line posts.
 - b. Provide 24" deep by 9" diameter foundations for all other posts. (i.e.: corner and gateposts).
3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.
4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.
5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths as specified above.

C. Setting posts:

1. Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
2. Center and align posts in hole.
3. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation.
4. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
5. Trowel tops of footings, and slope or dome to direct water away from posts.
6. Extend footings for gateposts to the underside of bottom hinge.
7. Set keeps, stops, sleeves, and other accessories into concrete as required.
8. Keep exposed concrete surfaces moist for at least seven days after placement, or cure with membrane curing material or other curing method accepted by the Architect.
9. Grout-in those posts, which are set into, sleeved holes, concrete constructions, or rock excavations, using non-shrink Portland cement grout or other grouting material accepted by the Architect.

D. Concrete strength:

1. Allow concrete to attain at least 75% of its minimum 28-day strength before rails are installed.
2. Do not, in any case, install such items in less than seven days after placement of concrete.
3. Do not hang gates until concrete has attained its full design strength.

E. Installing rails:

1. Install with panel mounting angle clips with screws into post top and bottom.
2. Ensure each panel is level and plumb.
3. Rails shall be mounted to maintain an even 4" above ground.

F. Installing gates:

1. Install gates plumb, level, and secure for full opening without interference.
2. Install ground-set items in concrete for anchorage in accordance with the fence manufacturer's recommendations as accepted by the Architect.
3. Lubricate and adjust the hardware for smooth operation.

3.03 FIELD QUALITY CONTROL

A. Field Tolerances:

1. Post to post spacing: +/- 1/2"
2. Plumbness of Posts: +/- 1/8"
3. Consistency of picket alignment: +/- 1/8"

3.04 ADJUSTING AND CLEANING

- A. Adjust gates to operate smoothly, easily and quietly, free of binding, warp, excessive deflection, distortion, non-alignment, misplacement, disruption, or malfunction, throughout entire operational range.
- B. Confirm that latches and locks engage accurately and securely without forcing or binding.
- C. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as accepted by the Architect.

END OF SECTION

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SECTION 32 31 11

GATE OPERATORS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK SUMMARY

Supply and install gate operators as shown on Drawings and as specified herein, including all materials and labor for a timely, complete, and proper installation.

1.03 STANDARDS AND REFERENCES

Comply with the industry standards and references as established by the manufacturer.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Installer Qualifications: Firm specializing in work of this Section, with minimum 3 years' experience.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

- A. Provide in accordance with Section 01 33 23 Submittal Procedures.
- B. Shop drawings: provide illustrate products, installation, and relationship to adjacent construction.
- C. Product data: provide manufacturer's descriptive data and product attributes.

1.07 DELIVERY, STORAGE, AND HANDLING

Comply with the requirements of Section 01 60 00 Materials and Equipment

1.08 PROJECT CONDITIONS

- A. Comply with the requirements of Section 01 50 00 Construction Facilities.
- B. Comply with manufacturer's standard requirements.

1.09 OPERATION AND MAINTENANCE DATA

Provide in accordance with Section 01 78 39 Contract Closeout.

1.10 WARRANTY

- A. Provide manufacturer's standard warranty in accordance with Section 01 78 39 Warranties.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Gate Operator Manufacturer: LiftMaster, www.LiftMaster.com
- B. Basis of Design Opticom System Manufacturer: Global Traffic Technologies, www.gtt.com

2.02 Gate Operator Unit

- A. Slide Gate Operators:
 - 1. Model: SL3000UL.

2. Operation: Gear driven.
3. Meet UL 325, UL 991, ASTM F2200, and CAS C22.2 No. 247.
4. Motor: 115 VAC, continuous duty type, sized to gate conditions.
5. Traveling speed: 12 inches per second.
6. Monitoring and controls:
 - a. Internet connectivity: MyQ technology with 50 channel FHSS.
 - b. Built-in Wi-Fi with internet gateway.
 - c. Radio receiver: Security+ 2.0 technology.
 - d. Monitored retro-reflective photo eyes.
 - e. Monitored small profile wired safety edge.
7. Accesories
 - a. Monitored safety devices: [Thru-beam photo eyes.] [Wireless edge with transmitter and receiver.] [Wireless edge transceiver.]
 - b. Wired monitored safety edges: [Small profile edge.] [Large profile edge.]
 - c. Plug-in loop detector.

B. Vehicle Detection

1. Detector Model: LOOPDETLM
2. Vehicle Detection Loops:
 - a. 6' X 8' Outside Obstruction Loop
 - b. 6' X 8' Inside Obstruction Loop
 - c. 6' X 8' Free Exit Loop
3. Meet UL 325, UL 991, ASTM F2200, and CAS C22.2 No. 247.
4. Motor: 115 VAC, continuous duty type, sized to gate conditions.

2.03 Opticom System Components

- A. Opticom 764 Multimode Phase Selector: plug-in, four-channel, dual-priority, multimode encoded signal device.
- B. Opticom 762 Phase Selector: plug-in, two-channel, dual priority, encoded signal device.
- C. Opticom 770 Card Rack for gate opener applications where relay is needed.
- D. Opticom 700 Series Detectors: Opticom 771 one direction, single channel; Opticom 721 single channel, dual detection; Opticom 722 two direction, two output detection, dual channel.

PART 3- EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 CLOSEOUT ACTIVITIES

- A. Test and adjust operators for proper operation.
- B. Demonstration: Demonstrate operation and programming of operators to Owner.

END OF SECTION

SECTION 32 31 19

SECURE PERIMETER FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

Division 0, Contract requirements and Division 1, General Conditions apply to this Section.

1.02 SCOPE OF WORK

The contractor shall provide all labor, materials and appurtenances necessary for installation of the steel corrugated pale security fence system defined herein.

1.03 SYSTEM DESCRIPTION

The manufacturer shall supply a total steel ornamental pale high security fence system of the Ameristar Impasse II model with Gauntlet design. The system shall include all components (i.e., pales, rails, posts, gates and hardware) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- C. ASTM D523 - Test Method for Specular Gloss.
- D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- E. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- F. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- G. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- H. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- I. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.06 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.07 SUBMITTAL

- A. The manufacturer's submittal package shall be provided prior to installation.

1.08 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.09 PRODUCT WARRANTY

- A. All structural fence components (i.e. rails, pales, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 15 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

PART 2 - MATERIALS

2.01 MANUFACTURER AND PRODUCT

- A. Basis of Design manufacturer: Ameristar Perimeter Security Inc., in Tulsa, Oklahoma.
- B. Basis of Design product: The steel ornamental pale high security fence system shall conform to Ameristar Impasse II model, Gauntlet, 3-Rail, style.

2.02 MATERIAL

- A. Steel material for fence framework (i.e., corrugated pales, rails and posts), when galvanized prior to forming, shall conform to the requirements of ASTM A924/A924M, with a minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90.
- B. Material for corrugated pales shall be a nominal 2.75" x .75" x 14 Ga. The cross-sectional shape of the rails shall conform to the manufacturer's Impasse II® rail design a nominal 2" x 2" x 11 Ga. Pre-drilled holes in the Impasse II® rail shall be spaced 6" on center, providing a pale airspace of no greater than 3.25" or Pre-drilled holes in the Impasse II Anti-Scale rail shall be spaced 4.1875" on center, providing a pale airspace of no greater than 1.5" (38mm). Tamperproof fasteners shall be used to fasten each pale to rail at every intersection. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
- C. If applicable - Material for steel Impasse II privacy screening shall be 18ga. preformed slats, providing complete screening coverage between pales and at pale to post connections. Impasse II privacy screening shall provide screening from top rail to bottom rail, and be capable of traversing terrain without impeding the raking capabilities of the fencing panel. Privacy screening not available for Impasse II Anti-Scale model.

2.03 FABRICATION

- A. Pales, rails and posts shall be pre-cut to specified lengths. Impasse II rails shall be pre-punched to accept tamperproof security fasteners. Post flange shall be pre-punched to accept rail to post attachment. Post web shall be punched providing a clear opening for interior of rails to align throughout the entire system for affixing conduit, video cabling, IDS wiring, and other components for a complete systems integration. Impasse II rails shall be attached to post flange providing a bracket-less design at each intermediate post.
- B. The manufactured galvanized framework shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash, an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be (specify Black, Bronze, White, or Desert Sand). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
- C. Completed panels shall be capable of supporting a 400 lb. load (applied at midspan) without permanent deformation. Panels shall be biasable to a 30° change in grade.
- D. Impasse II fence system shall be designed to minimize the system impedance to comply with IEEE grounding requirements. No additional grounding material, beyond the structure

grounding lug installation, will be required to create a safe low resistance fence system. By way of fence construction, the entire fence system is inherently grounded without the need for any additional work. Grounding location at the post is for taking the fence system to site ground.

- E. Swing gates shall be fabricated using 2" sq. x 12ga rail, 2" sq. x 12ga. gate ends, and 2.75" x .75" x 0.075 pales. Gates that exceed 6' in width will have a 2" sq. x 11ga. intermediate upright. All rail and upright intersections shall be joined by welding. All pale and rail intersections shall also be joined by welding.
- F. Pedestrian swing gates shall be self-closing, having a gate leaf no larger than 48" width. Integrated hinge-closer set (2 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5" x 6" footprint). Hinge-closer set (2 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs. Hinge-closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability, horizontal (.5" - 1.375") and vertical (0 - .5"). Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement. Infill metal panel to be 16-gauge, perforated panel, round hole, 1/8" round on 3/16" staggered centers.
- G. Sliding gates: Refer to Section 32 31 00 Vehicular Gate.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus 1/4". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to the line and end posts with fasteners supplied by the manufacturer. Attachment to corner post shall be made using brackets and fasteners supplied by the manufacturer (See Figure 1). Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

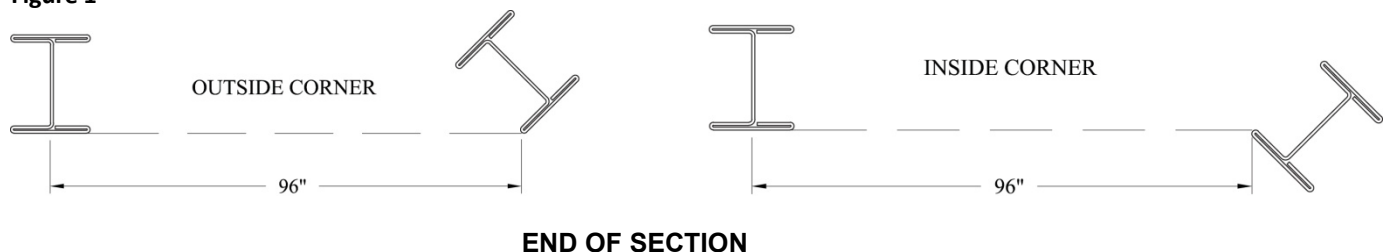
Table 1 – Minimum Sizes for Impasse II® Posts				
<u>Fence Posts (Nominal)</u>	<u>Panel Height</u>			
3" x 2.75" x 12 Ga. I-Beam	Up to & Including 8' Height			
4" x 2.75" x 11 Ga. I-Beam	Over 8' Height up to & including 10' Height			
<u>Gate Leaf</u>	<u>Gate Height</u>			
	<u>Up to & Including 6'</u>	<u>Over 6' Up to & Including 8'</u>	<u>Over 8' Up to & Including 10'</u>	<u>Over 12'</u>
Up to 4'	3" x 12Ga.	3" x 12 Ga.	4" x 11 Ga.	4" x 11 Ga.
4'1" to 6'	3" x 12Ga.	3" x 12 Ga.	4" x 11 Ga.	4" x 11 Ga.
6'1" to 8'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	6" x 3/16"
8'1" to 10'	4" x 11 Ga.	6" x 3/16"	6" x 3/16"	6" x 3/16"
10'1" to 12'	6" x 3/16"	6" x 3/16"	6" x 3/16"	8" x 1/4"
12'1" to 16'	6" x 3/16"	6" x 3/16"	8" x 1/4"	8" x 1/4"

Table 2 – Coating Performance Requirements		
<u>Quality Characteristics</u>	<u>ASTM Test Method</u>	<u>Performance Requirements</u>
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Impasse II® Post Spacing		
<u>Span</u>	<u>8' Nominal (95" Rail)</u>	
	<u>Line & End Posts</u>	
Post Size	3" x 2.75" x 12 Ga. I-Beam	4" x 2.75" x 11 Ga. I-Beam
Post Settings ± 1/4" O.C.	96"	96"

*For Corner Posts see Figure 1

Figure 1



SECTION 32 33 00

SITE FURNISHINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

Division 0, Contract Requirements and Division 1, General Requirements apply to this Section.

1.02 SCOPE OF WORK

Work included: Provide items listed in this Section where shown on the Drawings. All of the requirements of the Contract Documents apply to this Section.

1.03 STANDARDS AND REFERENCES

Comply with the Industry Standards and References as established by Manufacturer.

1.04 QUALITY ASSURANCE

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.05 SUBSTITUTIONS

Substitutions will be considered per Section 01 25 00 Substitution Procedures.

1.06 SUBMITTALS

- A. Provide in accordance with Section 01 33 23 Submittals.
- B. Provide cut sheets and product data of items proposed to be provided under this Section.
- C. Erection procedures, sequence of erection and required handling equipment.

1.07 DELIVERY, STORAGE AND HANDLING

Comply with the requirements of Section 01 60 00 Materials and Equipment.

1.08 PROJECT CONDITIONS

- A. Comply with the requirements of Section 01 50 00 Construction Facilities.
- B. Comply with Manufacturer's Standard Requirements.
- C. Comply with Manufacturer's recommendations regarding project conditions.

1.9 WARRANTY

Provide Manufacturer's Standard Warranty in accordance with Section 01 78 00 Warranties.

PART 2 – PRODUCTS

2.01 MANUFACTURER/DISTRIBUTOR

- A. Basis of Design Manufacturer: Belson Outdoors, 627 Amersale Drive, Naperville, IL 60563.
Web: www.belson.com. Email: sales@belson.com. Phone: (800) 323-5664.

2.02 PRODUCTS

- A. Bike Rack
 - 1. Steel tube, minimum 11 gauge
 - 2. "U" type rack

3. Capacity: 5 bikes
4. Finish: Powder-coat
5. Mounting: In-ground
6. Basis of Design: Model CBBR-5URI-BK

B. Picnic Table

1. Rolled expanded steel table top and seats
2. Capacity: Four seats. ADA model, 3 seats and space for accessibility.
3. Finish: Thermoplastic polyethylene coating
4. Mounting: Portable
5. Basis of Design: 4-seat Model RR468-P, ADA 3-seat Model RR4683H-P.

C. Receptacles: Trash and Recycle

1. Steel Slat Receptacle with liner, all welded construction with door
2. Capacity: 36 Gallon
3. Finish: Powder-coat
4. Mounting: Surface Mount, Accessory Model: TRL-PSM
5. Trash Receptacle Lid: Flat Top Lid Model #TRL-FT
6. Recycle Receptacle Lid: Flat Recycle Top Model #TRL-FRT
7. Basis of Design: Model CBTRD-36

D. Quantities: As indicated in the Drawings.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Confirm locations with Owner and Architect in field.

3.02 INSTALLATION

- A. Install items per manufacturer's recommendations.
- B. All items to be secured in place to limit vandalism.

3.03 CLEAN-UP

- A. Wipe clean all surfaces and protect from work of other trades.

END OF SECTION

SECTION 33 11 00

SITE WATER DISTRIBUTION UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. 1. Site water distribution systems located outside the building perimeter, extending to an existing water line or meter.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 22 – Plumbing.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2323 - Excavation and Fill for Utilities.
5. Section 32 0117 - Pavement Repair.
6. Section 32 1313 - Site Concrete Work.
7. Section 33 3000 - Site Sanitary Sewer Utilities.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan indicating locations of lines, valves, and related appurtenances.
- B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publications have been performed, and the performance requirements have been satisfied.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ANSI:
 - i. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
 - ii. ANSI B18.5.2.1M Metric Round Head Short Square Neck Bolts.
2. ASME:
 - i. ASME B16.3 Malleable Iron Threaded Fittings.
 - ii. ASME B16.4 Grey Iron Threaded Fittings.
 - iii. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - iv. ASME B16.26 Cast Copper Alloy Fitting for Flared Copper Tubes.
 - v. ASME B18.2.2 Nuts for General Applications (Inches Series).
 - vi. ASME B18.5.2M Metric Round Head Square Neck Bolts.
3. ASTM:
 - i. ASTM A47 Standard Specification for Ferritic Malleable Iron Castings.

- ii. ASTM A48 Standard Specification for Gray Iron Castings.
 - iii. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - iv. ASTM A307 Standard Specification for Carbon Steel bolts and Studs, 60,000 psi Tensile Strength.
 - v. ASTM A536 Standard Specification for Ductile Iron Castings.
 - vi. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts.
 - vii. ASTM B61 Standard Specification for Steam or Valve Bronze Castings.
 - viii. ASTM B62 Standard Specification for Composition Bronze or Ounce Metal Castings.
 - ix. ASTM B88 Standard Specification for Seamless Copper Water Tube.
 - x. ASTM C94 Standard Specification for Ready-Mixed Concrete.
 - xi. ASTM D1527 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.
 - xii. ASTM D1785 Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
 - xiii. ASTM D2235 Standard Specification for Solvent Cement for ABS Plastic Pipe, and Fittings.
 - xiv. ASTM D2241 Standard Specification for PVC Plastic Pipe Fittings, Schedule 40.
 - xv. ASTM D2282 Standard Specification for ABS Plastic Pipe.
 - xvi. ASTM D2466 Standard Specification for PVC Plastic Pipe Fittings, Schedule 80.
 - xvii. ASTM D2468 Standard Specification for ABS Plastic Pipe Fittings, Schedule 40.
 - xviii. ASTM D2564 Standard Specification for PVC Plastic Piping Systems.
 - xix. ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
 - xx. ASTM D2855 Standard Test Method for Making Solvent-Cemented Joints with PVC Pipe and Fittings.
 - xxi. ASTM D3139 Standard Specification for Joints Pressure Pipes Using Flexible Elastomeric Seals.
 - xxii. ASTM F402 Standard Practice for Safe Handling Of Solvent Cements, Primer and Cleaners Used for Joining Thermoplastic Pipes and Fittings.
 - xxiii. ASTM F477 Standard Specification for Elastomeric Seals for Joining Plastic Pipes.
4. American Water Works Association (AWWA) Standards:
- i. AWWA C104/A21.4 Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water.
 - ii. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.
 - iii. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron pressure Pipe and Fittings.

- iv. AWWA C153/A21.53 Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.
 - v. AWWA C500 Metal Seated Gate Valves for Water and Sewage Systems.
 - vi. AWWA C503 Wet- Barrel Fire Hydrants.
 - vii. AWWA C508 Swing-Check Valves for Waterworks Service, 2 inches through 24 inches NPS.
 - viii. AWWA C509 Resilient Seated Gate Valves for Water and Sewerage Systems.
 - ix. AWWA C511 Reduced-Pressure Principal Backflow-Prevention Assembly.
 - x. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - xi. AWWA C651 Disinfecting Water Mains.
 - xii. AWWA C800 Underground Service Line valves and Fittings.
 - xiii. AWWA C900 PVC Pressure Pipe, 4 inches through 12 inches, for Water Distribution.
 - xiv. AWWA M23 PVC Pipe - Design and Installation.
- 5. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
 - i. MSS SP-80 Bronze Gate, Globe, Angle and Check Valves.
 - 6. Uni-Bell PVC Pipe Association (UBPPA):
 - i. UBPPA UNI-B-3 Installation of PVC Pressure Pipe.
 - ii. UBPPA UNI-B-8 Direct Tapping of PVC Pressure Water Pipe.
 - iii. UBPPA UNI-B-13 Standard Performance Specification on joined restrained devices for use with Poly Vinyl Chloride (PVC) Pipe.
 - 7. Underwriters Laboratories Inc. (UL):
 - i. UL 246 Hydrants for Fire-Protection Service.
 - ii. UL 262 Gate Valves for Fire-Protection Service.
 - iii. UL 312 Check Valves for Fire-Protection Service.
 - iv. UL 789 Indicator Posts for Fire-Protection Service.
 - 8. National Pollutant Discharge Eliminations System (NPDES):
 - i. Comply with storm water requirements of general permit for storm water discharges when flushing pipe systems including storm drains and maintaining logs.
- B. Provide valves from the same manufacturer.
 - C. No pipe, pipe fitting, or any other fitting or fixture intended to convey or dispose water for human consumption for drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of Health and Safety Code 116875. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.

1.04 PRODUCT HANDLING

- A. Store items above ground on platforms, skids, or other required supports.
- B. Protect materials from direct sunlight.
- C. Protect coating and linings on piping, fittings, and accessories from damage. Repair and/or replace damaged coatings or linings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe:
 - 2. Pipe sizes up to 2.5 inches shall be copper water tubing, Type L hard, ANSI H23.1, ASTM B88, IAPMO IS. Muller Brass, Cambridge-Lee Halstead, or equal.
 - 2.
 - 3. If soil report indicates corrosive condition, an approved protective wrap shall be used to completely isolate and protect underground copper tubing and extend past the surface a minimum 12 inches. The excess wrapping shall be trimmed down and taped to copper tubing with 10 mill PVC pipe tape at grade level of concrete or asphalt.
 - 4. Underground pipe sizes 3-inch and larger shall be PVC water main pipe material complying with ASTM D1784 Cell Class 12454B and AWWA C900. Piping shall be plain end or gasket bell end, pressure class 200 (DR14) with cast iron pipe equivalent outside diameter.
 - 4.
 - 5. Stainless steel pipe, sizes 2-inch and larger may be used above or below ground in lieu of copper, ductile iron, or plastic. Stainless steel pipe shall be schedule 10 or 304 above ground and schedule 316 below ground conforming to ASTM A312. Flanges shall be HR carbon steel plated conforming to ASTM A36. Flange exterior coating shall be Zinc plated conforming to ASTM B633. Welding wire/rod shall be 308L SS wire rod conforming to ASME SF A5.9.
 - i. Underground connections shall be welded stainless steel pipe or made with a welded flange connection.
 - ii. Above ground connections may be with either flange or grooved Victaulic type coupler. Victaulic couplers shall be classified according to ANSI/NSF 61.
- B. Poly Vinyl Chloride (PVC) Water Main Fittings shall be gray-iron or ductile iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement mortar lining conforming to AWWA C104/A21.4, standard thickness unless otherwise indicated on Drawings. Fittings shall be mechanical joints.
- C. PVC Joints and Jointing Materials:
 - 6. Pipe joints shall be push on as specified in ASTM D3139.
 - 7. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints as specified in AWWA C111/A21.11.
 - 8. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling installation.
 - 9. Gaskets for push on joints for pipe shall conform to ASTM F477.
 - 10. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.
 - 11. Sleeve-type mechanically coupled joints may be provided instead of push-on joints on plain-end PVC plastic joints. Comply with requirements of ASTM D3139.

- D. Gates Valves for PVC:
12. Non-rising stem type with resilient wedge gates or iron body bronze wedge gates and mechanical joint ends conform to AWWA C500.
 13. Non-rising stem type with mechanical joints ends shall conform to AWWA C509.
 14. Valves designed for a working pressure of 175 psi shall be inside-screw type with operating nut, and resilient wedge type gate. Valve shall be provided with mechanical joints as required for the pipe to which it is intended to connect.
 15. Valves with UL listing of 262 shall conform to AWWA C500. Valves shall open by counter-clockwise rotation of valve stem.
 16. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.
 17. Sleeve type mechanical couplings may be provided instead of mechanical and push on joint ends.
 18. Valve ends and gaskets for connection to sleeve type mechanical couplings shall conform to specified requirements for the joint or coupling.
- E. Gate Valves in Valve Pits:
1. Outside screw and yoke rising stem type valves with resilient wedge gates and flanged ends shall conform to AWWA C500.
 2. Outside screw and yoke rising stem type valves with flanged ends shall conform to AWWA C509.
 3. Outside screw and yoke type Valves with double disc gates or split-wedge type gate and flanged ended ends shall be designed for 175 psi and conform to UL 262.
 4. Provide valves with hand wheels that open by counterclockwise rotation of the valve stem.
 5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.
- F. Check Valves for PVC:
- Valves shall be swing-check type conforming to AWWA C508 or UL 312.
6. Valves shall be provided with cast iron or steel body and cover, flanged ends and clear port opening.
 7. Valves shall be designed for a working pressure of 175 psi.
- G. Fire Hydrants:
8. Before procurement, verify approval issued by City of Moreno Valley and EMWD (Eastern Municipal Water District) having jurisdiction.
 9. Hydrants shall be wet barrel types conforming to AWWA C503 or UL 246.
 10. Only 1¾-inch pentagonal nuts are to be provided on stems and protective caps.
 11. Specified hydrants:
 - a. Clow/Rich # 850 or 860
 - b. James Jones #J3700 Fluted Barrel
 - c. LB Ironworks #702 Lido or 425
 - d. Equal.

- H. Valve Boxes: 14 ¾-inch by 20-inch by 12-inch cast concrete with cast iron, traffic grade cover marked "WATER" (for use over water valves).
1. Brooks 36-H MB with No. 36-T cast iron cover EISEL 363.5, or equal.
- I. Mechanical Thrust Restraint:
- Restraint shall be incorporated into the follower gland.
1. Restraint shall consist of individually actuated wedges that increase resistance to pull out as internal pressure or external forces increase.
 2. Gland shall be ductile iron conforming to ASTM A536.
 3. Provide twist off nuts and tee-head bolts of the same size to ensure proper actuating of restraint devices.
 4. Restraining device shall be provided with pressure rating equal to that of the pipe on which it is installed.
 5. Restraining gland shall be UL listed.
 6. Mechanical thrust restraint devices shall be EBAA Iron "Megalug" or equal.
- J. Restraint Device Adapters:
1. Restrained flange adapters shall be provided instead of threaded or welded flange spool pieces on plain end of ductile iron or PVC pipe.
 2. Flange adapters shall be manufactured of ductile iron conforming to ASTM A536 and be provided with flange bolt circles compatible with ANSI/AWWA C115/A21.15.
 3. Restraint of flange adapter shall consist of a multiple number of individually actuated gripping wedges to maximize restraint capability.
 4. Torque limiting actuating screws shall be provided to insure proper initial set of gripping wedges.
 5. Flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow at least 0.6 inch of gap between end of pipe and mating flange without affecting integrity of seal.
 6. Flange adapter shall be provided with a safety factor of at least 2:1 for rated pressure.
 7. Restraint device adapters shall be EBAA Iron "Megaflange", or equal.
- K. Tracer Wire for Nonmetallic Pipes: Tracer wires shall be electrically continuous #14 copper tracer wire, Type TW, blue plastic covered for domestic water and red for fire sprinkler. (Aluminum wire is prohibited). Provide in sufficient length to be continuous over each installed section of nonmetallic pipe.
- L. Pipe markers shall be a concrete plaque inscribed with the word "WATER."
- M. Water Service Line Materials:
8. Copper Tubing: Copper tubing shall conform to ASTM B88, Type L.
 9. Fittings for Copper Tubing: Fittings for solder-type joints shall conform to ANSI B16.18 or ASME/ANSI B16.22. Fittings for compression-type joints shall conform to ASME/ANSI B16.26, flared tube type.
 10. Water Service Line Appurtenances:
 - a. Corporation stops shall be ground key type; manufactured of bronze conforming to ASTM B61 or ASTM B62; and suitable for the working

pressure of the system. Ends shall be suitable for solder-joint or flared tube compression type joint connection. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing and shall conform to ASME/ANSI B16.26.

- b. Goosenecks shall be type K copper tubing. Joint ends for goosenecks shall be as required for connecting to corporation stop and service line. Where multiple gooseneck connections are required for individual service, connect goosenecks to service line through brass or bronze branch connection; the total clear area of branches shall be at least equal to clear area of service line. Length of goosenecks shall be as indicated or required.
- c. Curb or service stops shall be ground key, round way, inverted key type; bronze, conforming to ASTM B61 or ASTM B62; and rated at 150 psi. Ends shall be as required for connection to service piping. Arrow shall be cast into body of curb or service stop indicating direction of flow.
- d. Gate valves 2.5-inch and larger shall be MSS SP-80, Class 150, solid wedge, or resilient wedge gate, and non-rising stem. Valves shall be provided with flanged end connections. Provide hand wheel operators if easily accessible. Provide operating nut if inside a vault, pit or valve box.
- e. Gate valves in valve pits 2-inch, and smaller shall be MSS SP-80, Class 150, bronze, solid wedge, inside screw, rising stem. Valves shall be provided with flanged end connections or threaded end connections with union on one side of valve and hand wheel operator.
- f. Valve boxes shall be provided at each gate valve installed underground. Valve boxes shall be a size suitable for valve on which it is installed.

N. Water meter will be installed by water purveyor for the area, unless noted otherwise.

O. Strainers:

- STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blow out piping, same size as blow out plug:
- 2-inch and smaller: C.M. Bailey #100-A, bronze, 250 pound, or ductile iron with fusion bonded epoxy coating.
- 2 ½-inch and larger: Watts 77F-DI-FDA-125 pound, or other ductile iron fusion bonded epoxy coated flanged strainer, conforming to ASTM A312 for the strainer body, and ASTM A240 for the stainless steel strainer element. (No iron body strainer shall be used on potable water that is not fusion bonded epoxy coated inside and out.)
- C.M.Bailey, Armstrong, Wilkins, Watts, or equal.
- STR-2 "Y" pattern, cast iron bodies, 125 psi, monel screen 16 square. mesh. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2-inch, flanged ends for 2 ½-inch and larger perforations, in accordance with the following:
- Bailey #100, Armstrong, Rp & C, Keckley, or equal.*
- STR-3 Bucket type, flange, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations (mounted above grade for water service). All sizes, for mains serving fire sprinkler risers:

Bailey #1, Zurn 150 Series, Rp 7 C, Watts 97fb-Fsfe, or equal.

STR-42" and larger: Watts 077-F-SS Stainless steel flange type strainer, or equal conforming to ASTM A312 for strainer body, ASTM A240 for the SS strainer element and ASTM A36 for base flange material.

P. Backflow Preventer Assemblies:

1. Assembly shall be provided with flanged connections, ductile iron with fusion bonded epoxy coated construction, bronze, or stainless steel.
2. Backflow preventer shall be suitable for cold water working pressure of 175 psi.
3. Internal parts shall be designed for replacement without removing valves from line.
4. Double check backflow preventer assembly shall consist of two independently acting spring cam or poppet style check valves, 2 shut-off valves and 4 test cocks. Check valve shall be designed to provide drip tight closure against reverse flow, low pressure drop at maximum flow capacity. Spring-loaded checks shall cause valve to seal against a higher inlet pressure than outlet pressure when there is no flow.
5. Double check backflow preventer assembly shall meet AWWA Standard C510-89. Assembly shall be Ames 2000ss, Febco 850, Watts 709, Wilkins 350, or equal.
6. Reduced pressure backflow preventer assembly shall consist of two check valves located between two shut-off valves with an area of reduced pressure between two check valves and a relief device arranged to discharge to atmosphere.
 - a. Comply with AWWA Standard C511.
 - b. Fluctuation in piping pressure shall not cause cycling. Backflow preventer shall automatically maintain low pressure zone to positively prevent backflow of water into system. Assembly shall automatically indicate failure of any part vital to backflow prevention by the continuous discharge relief device.
 - c. Reduced pressure backflow preventer assembly shall be Cla-Val Model RP-4, or equal.
7. Backflow prevention assemblies (devices), shall be tested and certified by a certified backflow tester, and a test report shall be provided to the water agency having jurisdiction. Testing shall be performed in the presence of the Project Inspector.

PART 3 - EXECUTION

3.01 EXCAVATION, BACKFILLING AND COMPACTING

- A. Conform to requirements in Section 31 2323 - Excavation and Fill for Utilities or Section 31 2313 - Excavation and Fill.

3.02 PIPE INSTALLATION

- A. Project site water lines shall terminate approximately 5 feet from buildings, unless otherwise indicated on Drawings. Temporarily cap or plug terminals for future connection to building.

3.03 CLEARANCES OF WATER LINE

- A. Building or Structures: Two feet.
- B. Parallel to Sewer Line:
 - 1. Water line 4-inch or less in diameter shall not be installed in a common trench with the building sanitary drain unless the bottom of the water line is at least 12 inches above the top of the building sanitary drain or where the water line is installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the building sanitary drain.
 - 2. Water mains 6-inch and larger in diameter shall be separated from the Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, in accordance with the requirement of the State of California, Human and Welfare Agency, Department of Health Services.
- C. Crossing Sewer Line:
 - 1. A water main shall be separated from sanitary sewer in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).
 - 2. Install water main a minimum of 12 inches clear, above or below a sanitary sewer.
 - 3. A water main 6-inch or greater in diameter, crossing under a Project site sanitary sewer line, shall be installed with joints located at least 10 feet away from each side of the sanitary sewer line.
 - 4. A water main 6-inch or greater in diameter, crossing over a Project site sanitary sewer line, shall be installed with joints located at least 4 feet away from each side of a purple pipe or sanitary sewer line.
- D. Install water mains no closer than 10 feet horizontally clear from the edge of sewage leach fields, seepage pits, and septic tanks.

3.04 PIPE INSTALLATION AND JOINING

- A. Remove fins and burrs from pipe and fittings.
- B. Clean piping, fitting, valves, and accessories before installing. Maintain items in a clean condition.
- C. Provide proper facilities for lowering sections of pipe into trenches. Do not drop into piping, fittings, or other materials into trenches. Accurately cut pipe and install without springing or forcing. Replace any piping or fitting that does not provide sufficient space for proper installation of joining material.
- D. Blocking or wedging between bells and spigots is not permitted. Install bell and spigot pipe with bell end pointing in the direction of flow.
- E. Install piping to the lines and grades indicated or required. Low points and dips are not permitted. Support piping at proper elevation and grade with secure and uniform supports. Wood support blocking is not permitted. Where sand cement slurry will not be furnished for backfill, install piping so that full length of each section of pipe and each fitting will solidly rest on pipe bedding. Excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated or required for installation. Provide proper allowances and devices for expansion and contraction of piping and systems.
- F. Maintain trenches free of standing water until pipe joints have been installed.

- G. At the end of each day close open ends of pipe with temporary caps of the same material as the pipe.
- H. Do not install piping when trench or weather conditions prevent proper installation.

3.05 INSTALLATION OF TRACER WIRE AND PIPE MARKERS

- A. Tracer Wire: Install continuous length of tracer wire for full length of each run of nonmetallic pipe. Fasten wire to top of pipe in such a manner that it will not be displaced during construction operations. Wire shall be fastened to pipe at not greater than 20-foot intervals. Wire shall terminate above finished grade with a 12-inch lead taped around each riser. Provide a tracer wire to grade under a permanent marker where straight-line transitions of metallic to non-metallic pipe are installed.
- B. Underground Pipe Markers: Provide markers at grade where non-metallic pipe is installed and for each horizontal change in direction.

3.06 CONNECTIONS TO EXISTING WATER LINES

- A. After Project Inspector has inspected installation, perform connections to servicing water lines. Schedule service shutdown for connecting new system at a time causing minimum disruption.
- B. Use a tap or drilling machine with valve and mechanical joint type sleeves for connections to waterlines under pressure, only if other means of scheduling a shutdown time have been unsuccessful, and with the approval of the responsible engineer, and Project Inspector.
- C. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to branch. Open valve, attach drilling machine, perform tap, close valve, and remove drilling machine, without interruption of service. Notify the Project Inspector in writing at least five days prior to the date of scheduled connections.

3.07 INSTALLATION OF PVC PLASTIC WATER MAINS

- A. Unless otherwise indicated, install pipe and fittings as specified and in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, "Installation".
- B. Jointing:
 - 1. Provide push on joints with elastomeric gaskets specified for this type of joint, furnishing either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push on joint connections, provide pipe with push on joint ends furnished with factory installed bevel; for push on joint connections to metal fittings, valves and other accessories, square cut spigot end off pipe end.
 - 2. Provide push on joint lubricant recommended by manufacturer.
 - 3. Install push on joints for pipe-to-pipe connections in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, "Installation."
 - 4. Install push on joints for connection to fittings, valves, and other accessories in accordance with requirements of UBPPA Uni-B-3 and with applicable requirements of AWWA C600.
 - 5. Compression-type joints/mechanical-joints with gaskets, glands, bolts, nuts and internal stiffeners shall be installed in accordance with the requirements of UBPPA UNI-B-3 and AWWA C600 and Appendix A to AWWA C 111/A21.11.
 - a. Square cut spigot off end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

6. Sleeve-type mechanical couplings shall be provided in strict accordance with coupling manufacturer's recommendations using internal stiffeners as specified for compression-type joints.
- C. Provide mechanical thrust restraint devices for anchorage and piping unless thrust blocks are indicated on the Drawings. Thrust blocks shall be installed in accordance with the requirements of UBPPA UNI-B-3 except that size and location of blocks shall be as indicated. Thrust blocks shall be provided as specified in Section 32 1313 - Site Concrete Work.

3.08 INSTALLATION OF VALVES

- A. Provide gate valves conforming to AWWA C500 and UL 262 in accordance with AWWA C600 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- B. Provide gate valves conforming to AWWA C600 in accordance with AWWA C509 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- C. Provide gate valves on PVC water mains in accordance with AWWA M23 Chapter 7, "Installation."
- D. Provide check valves and fittings in accordance with applicable requirements of AWWA C600 unless noted otherwise on the Drawings.
- E. Provide gate and check valve joints as specified for the type of joints between pipe and fittings.

3.09 INSTALLATION OF HYDRANTS

- A. Install hydrants according to requirements of AWWA C600 for hydrant installation and as indicated. Provide joints as specified for the type of joints between pipe and fittings.
- B. Install hydrant with a 6-inch key gate valve between 4 and 10 feet from the hydrant.

3.10 INSTALLATION OF BACKFLOW PREVENTERS

- A. Install reduced pressure backflow preventers to comply with City of Moreno Valley standards.

3.11 WATER SERVICE LINE CONNECTION TO WATER MAINS

- A. Connect service line to main by corporation stop and gooseneck. Install service stop as indicated on the Drawings. Connect service lines to PVC plastic water mains in accordance with UBPPA UNI-B8 and AWWA M23, Chapter 9, "Service Connections".
- B. Special Requirements for Plastic Piping: Unless otherwise indicated, install pipe and fittings in accordance with ASTM D2774 and ASTM D2855. Handle solvent cements for plastic pipe jointing in accordance with ASTM F402. Install joints according to ASTM D2855. Install other joints to materials other than pipe materials in accordance with plastic pipe manufacturer's recommendations.
- C. Connect plastic pipe service lines to corporation stops and gate valves according to plastic pipe manufacture's recommendations.

3.12 INSTALLATION OF STRAINERS:

- A. Strainers shall be installed on each water main downstream of the meter, above grade at the pressure regulating station. When a pressure regulating station (assembly) is not provided, "wye" type flange strainer shall be provided, with a shut off valve on the inlet and the outlet side.

- B. If the water main is serving fire sprinkler risers or hydrants, then an approved fire service strainer shall be used: Watts 97DB-FSFE, or equal.

3.13 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. When water piping has been installed and tested, sterilize system before use and/or Substantial Completion.
- B. Inject solution of liquid chlorine or sodium hypochlorite and water containing at least 50 PPM of free chlorine into a system in a manner to ensure that entire system is completely filled with solution. During this procedure operate valves and test outlets for residual chlorine. Continue injection until outlets indicate at least 59 PPM of free chlorine.
- C. After injection, isolate system and hold solution in retention for a period of at least 8 hours. Perform tests for residual chlorine after retention. If such tests indicate less than 50 PPM of residual chlorine, repeat entire procedure. After satisfactory sterilization has been verified, flush entire system until traces of chlorine have been removed or until chlorine content is no greater than in existing water supply.

3.14 ELECTROLYSIS PREVENTION

- A. A minimum 6-inch long brass nipple shall be installed at locations specified or as required. Flanges shall be provided with a complete insulating component consisting of; gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at locations indicated or as required. Dielectric fittings are prohibited.
- B. Where steel or cast iron below grade connects to copper or brass piping above grade, the transition from steel or cast iron pipe to copper or brass pipe shall be installed in an above grade accessible location.
- C. Underground connections between dissimilar metals shall be in accessible yard boxes.
- D. Above ground dielectric connections shall be exposed.

3.15 ABANDONING WATER LINES AND STRUCTURES

- A. Water lines and appurtenances to be abandoned in place shall be cut and removed from areas where new Work is being installed.
- B. Cap or plug abandoned existing drain lines below grade in a yard box and according to CBC.

3.16 TESTS AND INSPECTIONS

- A. Provide labor, equipment, materials, test equipment and incidentals required for performing required field tests.
- B. Tests shall not be performed for five days after concrete thrust blocks have been installed.
- C. Testing Procedure: Water mains and service lines shall be tested in accordance with applicable specified standard.
 - 1. Test PVC plastic water system in accordance with UBPPA UNI-B-3 for pressure and leakage. The amount of leakage from PVC piping shall not exceed the amounts given in UBPPA UNI-B-3, except that no leakage is permitted for joints installed with sleeve type mechanical couplings.
 - 2. Test water service lines in accordance with applicable requirements of AWWA C600. No leakage is permitted.
 - 3. Pressure testing: Before pressure test, fill portion of piping being tested with water for a minimum of 24 hours. Provide hydrostatic pressure of at least 50 psi

greater than the maximum working pressure of tested system, but no less than 200 psi hydrostatic test pressure for system piping of 2-inch in diameter and larger. Provide and maintain hydrostatic test pressure for at least two hours to ensure no leakage of any portion of piping or appurtenances under pressure test.

3.17 CLEANING

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.18 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.19 NFPA CERTIFICATE

- A. Contractor/Fire Protection Engineer to provide NFPA Certificate to the owner, local official fire department, and DSA.

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SECTION 33 30 00

SITE SANITARY SEWER UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Site sanitary sewer systems from the building, to the existing site sanitary sewer.
2. Closed-circuit television inspection of sewer laterals.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Division 23 - Mechanical.
3. Section 31 2313 - Excavation and Fill.
4. Section 31 2323 - Excavation and Fill for Utilities.
5. Section 32 0117 - Pavement Repair.
6. Section 32 1313 - Site Concrete Work.

1.02 SUBMITTALS

- A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.
- B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.
- D. Closeout Submittal: Submit three DVD's of Closed-circuit television inspections performed. Include the following information:
 1. Electronic Media Recordings: Visual and audio record of the entire length of pipe. For existing laterals identify problem areas, such as roots, cracks, fractures, broken pipe, and other unusual conditions found.
 2. Digital Photographs of the pipe condition, connections, points of interest and defects found. Indicate distance of defects to a point of reference such as face of building or mainline.
 3. Inspection Log: Provide written report including:
 - i. Date and time of inspection.
 - ii. Name of School, Project, CONTRACTOR, and operator name.

- iii. Location, material and size of pipe.
- iv. Description of defects found.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

- 1. Standard Specifications for Public Works construction, current edition.
- 2. California Plumbing Code, CPC, current edition.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Pipeline:

- 1. Acid pipeline from neutralizing tank to building sanitary drain or Project site sanitary sewer: See Division 15 for corrosive waste piping.
- 2. Building or Project site sanitary sewer:
 - i. Vitrified clay extra strength piping with plain ends. Comply with ASTM C700. Install with mechanical compression couplings. Joints shall comply with ASTM C425. Installation shall be in accordance with ASTM C12. Manufacturer: Mission Clay Products, or equal.

B. Cleanout Assemblies: Cleanout plug shall be line size.

- 1. In covered concrete-paved floors: Iron body with UPC recognized plug, top, and adjustable sleeve, cut-off ferrule, polished brass/nickel/bronze, and secured Scoriated cover:

Square:	SMITH	JOSAM	ZURN	Equal	
4053	56030-2	Z-1400			
Round:	SMITH	JOSAM	WADE	ZURN	Equal
4033	56010-2	W-6000Z-1400			

- 2. Outside covered concrete-paved floors: Secured cover, extra heavy-duty, adjustable sleeve, cut-off ferrule, UPC recognized brass type plug, scoriated tractor type cover:

SMITH	JOSAM-	ZURN	WADE	Equal
4233	56050-2	Z-1402-HD	W-7030-Y	

- 3. In yard boxes: Raised threaded head brass plug.

WADE 8590A, SMITH, ZURN, JOSAM, or equal.

C. Yard Boxes: Brooks No. 3-TL, NDS, EJIW, or equal, with cast-iron locking cover with the word "SEWER," embossed on the cover in one inch high upper case lettering.

- D. Concrete, Mortar and Related Materials: Conform to Section 32 1313 - Site Concrete Work, unless noted otherwise.
- E. Metal Covers, Frames and Accessories:
 - 1. Conform to Section 206 – Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
 - 2. Metal Covers and Frames: Vandal-resistant design and construction.
 - 3. Hot-dip galvanize steel parts after fabrication and prior to assembly in accordance with Section 210 – Paint and Protective Coating of the Standard Specifications for Public Works Construction.
- F. Bedding Materials: Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.

PART 3 – EXECUTION

3.01 SANITARY SEWER INSTALLATION

- A. Install sanitary sewers in a uniform alignment and slope to the point of connection as indicated. Before trench excavation, verify size, material, depth, and location of the point of connection.
- B. Pipe slope shall not be less than ¼ inch per foot or 2 percent unless pipe inverts are indicated. Where invert elevations are indicated, install pipe at a uniform slope between inverts.
- C. Join pipes and fittings as recommended by the manufacturer.

3.02 Clearance of Sanitary SEWERS

- A. Buildings or Structures: Two feet.
- B. Parallel to Water Line:
 - 1. Building sanitary drain, is not permitted to be installed in a common trench with a potable water line unless the bottom of the water line is at least 12 inches above the top of the sanitary sewer.
 - 2. In addition, the potable water line shall be installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the sanitary sewer or building sanitary drain.
 - 3. Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, shall be separated from a potable water line in accordance with the requirements of the California Health, and Human Services Agency: Department of Public Health.
- C. Crossing Water Line:
 - 1. Building sanitary drain shall be installed a minimum of 12 inches below the potable water line.

2. Project site sanitary sewer shall be separated from the potable water main in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2).

3.03 MANHOLES

- A. Provide manholes in accordance with the Standard Plans for Public Works Construction, unless otherwise indicated.
- B. Adjust manholes in accordance with the sub-section 302-5.8 Manholes (and other structures) of the Standard Specifications for Public Works Construction.

3.04 CLEANOUTS

- A. Provide cleanout at the upper terminal for each sanitary pipeline, at intervals not exceeding 100 feet in straight run and any fraction thereof and for each aggregate horizontal change in direction exceeding 135 degrees.
- B. Install required cleanouts before back filling of horizontal pipelines.
- C. In unpaved and asphalt-paved areas, install cleanouts in yard boxes 2 inches below the yard box cover.
- D. In concrete-paved areas, extend cleanouts flush with finish grade.
- E. In traffic areas, install countersunk cleanout plugs where raised heads protrude.

3.05 ABANDONED SEWERS AND STRUCTURES

- A. Plug or cap every abandoned sanitary sewer within 5 feet of the property line in a code required manner.
- B. Demolish abandoned sanitary structures such as cesspool, septic tank, sewage pit, and manholes to a minimum depth of 5 feet below the finish grade, including removal of sewage. Disconnect any piping. After inspection, completely fill with earth, sand, gravel, cement-sand slurry, or other required material.

3.06 TESTING

- A. After installation, test each sanitary drain and/or sewer and each section between successive manholes for either infiltration or exfiltration. Test shall be conducted in accordance with Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.
- B. Where excessive ground water is encountered test the pipeline for infiltration.
- C. When infiltration or exfiltration exceeds allowable amounts as set forth in the Section 306 formula, perform repairs or replacements as necessary to comply with the required limits.

3.07 CLOSED-CIRCUIT TELEVISION INSPECTION

- A. Coordinate with OAR time and date of inspection. Project Inspector shall be present during the CCTV inspection.
- B. Clean laterals by hydraulic jet.

C. Perform internal closed-circuit television inspection of lateral from the building to the public mainline. Record sewer in its entirety with no breaks or interruptions. Move camera at a speed no greater than 30 feet per minute, stopping for a minimum of ten seconds to record pipe connections, defects, and points of interest.

D. Maintain technical quality, sharp focus and distortion free picture. Pan, tilt, and rotate as necessary to best view and evaluate connections, defects and points of interest.

E. Closed-circuit Television Equipment: As a minimum equipment shall include:

1. Television camera specially designed for pipe inspections, and operative in 100 percent humidity conditions.
2. Camera and television monitor capable of producing minimum 470H-line resolution color video picture.
3. Camera capable to inspect laterals as small as three inches up to 70 feet from sewer mainline.
4. Camera lighting shall be suitable to allow clear picture of inner wall at least ten feet in front.

F. Defective Work:

1. New Laterals: Defective Work found shall be repaired at CONTRACTOR's expense. Perform a new closed-circuit television inspection at no cost to OWNER.
2. Existing Laterals:
 - i. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify OAR of defects found.
 - ii. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to OWNER. Perform a new closed-circuit television inspection at CONTRACTOR's expense.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.09 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

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SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes storm drainage piping; sub-surface drains; metal covers, grates and frames; catch basins; box culverts; manholes.

1. Best Management Practices (BMPs):

- i. Proprietary Detention BMPs - Precast Concrete
- ii. Cartridge Media Filters
- iii. Hydrodynamic Separation Devices
- iv. Catch Basin Inserts
- v. Downspout Filters
- vi. Stormwater Interceptors
- vii. Proprietary Retention/Infiltration BMPs – Polypropylene or Polyethylene
- viii. Proprietary Retention/Infiltration BMPs – Precast Concrete
- ix. Proprietary Biotreatment Devices

2. Closed-circuit television inspection of storm drain lines.

1.02 RELATED REQUIREMENTS

- A. Division 01 - General Requirements.
- B. Section 01 3593 - Off-site Improvement Procedures.
- C. Section 01 3596 - Off-site Improvement Procedures (B-Permit).
- D. Section 01 7417 – BMP Implementation Plan.
- E. Section 01 7418 – Water Pollution Control.
- F. Section 22 1000 - Plumbing.
- G. Section 31 2313 - Excavation and Fill.
- H. Section 31 2323 - Excavation and Fill for Utilities.
- I. Section 32 0117 - Pavement Repair.
- J. Section 32 1313 - Site Concrete Work.
- K. Section 32 1343 – Pervious Concrete Pavement.
- L. Section 32 1415 – Permeable Interlocking Concrete Pavers.

1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASME: American Society of Mechanical Engineers.
- C. ASTM: American Society for Testing and Materials.

- D. BMP: Stormwater Best Management Practice.
- E. CBC: California Building Code.
- F. CCTV: Closed-Circuit Television.
- G. DET: Detention BMP.
- H. DWV: Drain, Waste, and Vent.
- I. FILT: Filter BMP.
- J. GS: Gravity Separator.
- K. HDPE: High Density Polyethylene.
- L. IAPMO: International Association of Plumbing and Mechanical Officials.
- M. IOR: Inspector of Record.
- N. NPS: Nominal Pipe Size.
- O. OAR: Owner's Authorized Representative.
- P. PE: Polyethylene.
- Q. Post Construction BMP: Devices installed by the Contractor for storm water management to be left on site after construction completion.
- R. PP: Polypropylene.
- S. PVC: Poly Vinyl Chloride.
- T. RET: Retention.
- U. SDR: Standard Dimensions Ratio.
- V. VEG: Vegetative.
- W. Owner: Los Angeles Unified School District.
- X. SWPPP: Storm Water Pollution Prevention Plan.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 1. ASHTO M 252: Geotextile Specification for Highway Applications.
 2. AASHTO M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
 3. AASHTO M 330: Standard Specification for Polypropylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
- B. American Society for Testing and Materials International (ASTM):
 1. ASTM A888: Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 2. ASTM C14: Standard Specification for Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
 3. ASTM C443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 4. ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 5. ASTM C76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

6. ASTM C857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 7. ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures.
 8. ASTM C891: Standard Practice for Installation of Underground Precast Concrete Utility Structures.
 9. ASTM D2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 10. ASTM D2665: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 11. ASTM D2855: Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
 12. ASTM D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 13. ASTM D3212: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 14. ASTM D448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 15. ASTM F1866: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings.
 16. ASTM F2306: Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
 17. ASTM F2418: Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers.
 18. ASTM F2764: Standard Specification for 6 to 60 in. [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications.
 19. ASTM F2787: Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers.
 20. ASTM F2881: Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications.
 21. ASTM F2922: Standard Specification for Polyethylene Corrugated Wall Stormwater Collection Chambers.
 22. ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 23. ASTM F656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 24. ASTM F794: Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- C. Cast Iron Soil Pipe Institute (CISPI):
1. CISPI 301: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 2. CISPI 310: Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

- D. The International Association of Plumbing and Mechanical Officials (IAPMO):
 - 1. IAPMO IS 6: Hubless Cast Iron Sanitary and Rainwater Systems - Installation Standards.
- E. Standard Specifications for Public Works Constructions (Greenbook):
 - 1. Section 202: Masonry Materials.
 - 2. Section 206: Miscellaneous Metal Items.
 - 3. Section 207: Pipe.
 - 4. Section 208: Pipe Joint Types and Materials.
 - 5. Section 210: Paint and Protective Coatings.
 - 6. Section 306: Underground Conduit Construction.

1.05 SUBMITTALS

- A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.
- B. Product Data: Manufacturer's catalog data for all required materials. Include technical data for accessories, information concerning gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.
- D. Closeout Documents: At Substantial Completion submit to the OAR two CD's and one hard copy of the documents indicated in paragraphs 1 through 5 below:
 - 1. Maintenance Log: Provide Microsoft Excel Spreadsheet including the following information:
 - i. Maintenance log and upkeep records of the installed Post Construction BMPs. Include the following headers as a minimum: "Date of Service", "Location of BMP", "Type of Maintenance or Service", "Notes", "Next Scheduled Preventive Maintenance Due", and "Inspector Signature".
 - ii. Maintenance Requirements: Include the following headers as a minimum: "BMP Description", "Location of BMP and Map Grid Location" and "Type of Maintenance or Service Needed", i.e.; weekly, monthly, quarterly, etcetera. "Stock No.", "Manufacturer Contact Information", along with "Frequency" namely: weekly, monthly, quarterly, etcetera and "Special Instructions".
 - 2. Maintenance Manuals: Provide Maintenance Manual for storm drainage BMP components installed along with requirements, replacement or maintenance schedule and plans with the location of each BMP component. This manual shall include product information cut sheet, shop drawings, vendor information for each component and warranty.
 - 3. Record drawings: 'As-Built' site plan(s) showing Post Construction BMP. Provide a copy of marked record set with red pencil identifying any variations from design documents.
 - 4. Training Documentation:
 - i. Owner attendees sign off training sheet.
 - ii. Two DVD's of materials covered in the training and components installed.
 - 5. Post-Construction BMP Maintenance Plan: Submit complete Plan per Attachment "A", edit per As-Built conditions and provide missing information.
 - 6. Records of Closed-Circuit Television Inspection: At Substantial Completion submit to the OAR three DVD's of Closed-circuit television inspections performed. Include the following information:

- i. Electronic Media Recordings: Visual and audio record of the entire length of pipe. For existing laterals identify problem areas, such as roots, cracks, fractures, broken pipe, and other unusual conditions found.
- ii. Digital Photographs of the pipe condition, connections, points of interest and defects found. Indicate distance of defects to a point of reference such as face of building or mainline. Provide the Digital Photographs after fixing the defective pipes.
- iii. Inspection Log: Provide written report including:
 - 1) Date and time of inspection.
 - 2) Name of School, Project, Contractor, and operator name.
 - 3) Location, material and size of pipe.
 - 4) Description of defects found and attempts to fix them.

1.06 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic products, pipes, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle all products according to manufacturer's written rigging instructions.

1.08 TRAINING OF OWNER PERSONNEL

- A. At Substantial Completion and when the storm drainage system is fully operational, knowledgeable representatives from the contractor and manufacturer(s) of the components specified and installed at the site shall provide up to 8 hours of training. Date, time and location for the training shall be coordinated through the project OAR. Have Owner attendees sign off training sheet and provide a copy to the OAR.
- B. Training period shall cover but not be limited to the following:
 - 1. Explain the operation of storm drainage system and its design intent.
 - 2. Explain the maintenance requirements of every component of the system.
 - 3. Provide recommendations of practices to minimize or eliminate negative impact on the system.
 - 4. Provide maintenance schedule as recommended by the manufacturers for every component and review it with Owner's Maintenance and Operations staff.
 - 5. Conduct a site walk, identify every component of the system and demonstrate its operation.
 - 6. Training shall be conducted with the use of Maintenance log and Maintenance manual.

1.09 SURPLUS MATERIALS

- A. Provide enough additional materials for each component of BMP that requires replacement or service during the first year.

PART 2 – MATERIALS AND PRODUCTS

2.01 PIPING MATERIALS

- A. General: Minimum 5 feet away from building boundaries. For piping within 5 feet from building boundaries, and interior piping refer to Division 22 plumbing sections. Provide piping system in conformance with Section 207 - Pipe and Section 208 - Pipe Joint Types and Materials of the Standard Specifications for Public Works Construction. All Soil-tight pipes shall be provided with joints that are function of opening size, channel length, and backfill particle size. A backfill material containing a high percentage of fine-graded soils requires investigation for the specific type of joint to be used to guard against soil infiltration, including the requirement for fabric-wrapped joints.
- B. Corrugated, Dual or Triple Wall, Polypropylene Pipe (PP):
 - 1. Corrugated PP Drainage Pipe and Fittings NPS 12 to NPS 60: ASTM F2764, ASTM F2881, or AASHTO M 330, Type S (double-wall) or Type D (triple-wall), for respective diameters. Provide coupling joints with smooth waterway.
 - 2. Approved manufacturers: ADS, Prinsco, or equal.
- C. PVC (Poly Vinyl Chloride) Schedule 40 DWV Pipe:
 - 1. Conform to ASTM D2665, ASTM F794, and ASTM F1866.
 - 2. Installer of PVC Schedule 40 DWV piping system shall carry ASTM D2855 and ASME B31.3 qualification. Installer shall provide proof of these qualifications to IOR prior to commencing work.
 - 3. Containers for solvent and primer shall be clearly marked with manufacturer's data. Solvent and primer shall not be more than one year old. The safety placards must be visible.
 - 4. Blue or red-hot glue shall not be used.
 - 5. Approved manufacturers and products:
 - i. Pipe: Charlotte pipe and foundry, Harvel Plastics Inc., JM Eagle, Spears Manufacturing Company, or equal.
 - ii. Primer: Weld-On P-70 by IPS, Conforming to ASTM F656.
 - iii. Cement: Weld-On 711 (gray) by IPS, Conforming to ASTM D2564.
- D. PVC (Poly Vinyl Chloride) SDR-35 Pipe, 6" through 15":
 - 1. Conform to ASTM D3034
 - 2. Gasketed Joints: Elastomeric gasket joints conforming to ASTM D3212.
 - 3. Gaskets: Chloroprene conforming to ASTM F477.
 - 4. Approved manufacturers: Charlotte pipe and foundry, Harvel Plastics Inc., JM Eagle, Spears Manufacturing Company, or equal.

2.02 BEDDING MATERIAL FOR PIPE

- A. General: Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.
- B. Approved manufacturers and products:
 - 1. Propex Fabrics, Inc.: Geotex 451
 - 2. TenCate Geosynthetics Americas: Mirafi 140N
 - 3. US Fabrics, Inc.: 120NW

4. Equal products

2.03 Stormwater Treatment Systems/BMPs:

- A. FILT-2: Cartridge Media Filters, approved manufacturers and products:
 1. Baysaver Technologies Inc.: Bayfilter
 2. Contech: Storm Filter
 3. OldCastle Precast Inc.: Perk Filter
 4. Equal products
- B. GS-1: Hydrodynamic Separation Devices, approved manufacturers and products:
 1. Approved Manufacturers and products:
 2. ADS-Baysaver Technologies Inc.: Barracuda S Series
 3. Contech: CDS
 4. Hydro International: First Defense HC (High Capacity)
 5. Jensen Precast: JDS
 6. Oldcastle Precast Inc.: DVS
 7. Equal products
- C. GS-2: Catch Basin Inserts, approved manufacturers and products:
 1. AbTech Industries: UUF DI-DO
 2. ADS-FlexStorm: FlexStorm Pure or Catch-it
 3. Aquashield Inc.: Aqua-Guardian
 4. Ecosense International: EcoSense International's Catch Basin Insert
 5. Oldcastle Precast Inc.: FLoGard, or GISB
 6. UltraTech International Inc.: Ultra-Drain Guard
 7. Equal products
- D. GS-3: Downspout Filters, approved manufacturers and products:
 1. Oldcastle Precast Inc.: FLoGard +Plus
 2. Equal products
- E. GS-5: Stormwater Interceptors, approved manufacturers and products:
 1. Jensen Precast: JPHV-stormwater-interceptors-with-bypass.
 2. Oldcastle Precast Inc.: Storm Capture Detention.
 3. Storm Trap: Single-Trap-Detention.
 4. Equal products.
- F. RET-7a: Proprietary Retention/Infiltration BMPs – Polypropylene or Polyethylene
 1. Molded PP or PE with open bottom. Thermoplastic Corrugated Wall Chambers (Chambers): Provide in conformance with ASTM F 2418 "Standard Specification for Polypropylene Corrugated Wall Stormwater Collection Chambers", ASTM F 2922 "Standard Specification for Polyethylene Corrugated Wall Stormwater Collection Chambers", and ASTM F 2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers".

2. Filtering Material: ASTM D 448, washed, crushed stone or ¾" to 2" gravel. For more information refer to plans, and manufacturer installation manual.
 3. Filter Mat, applicable to isolator/main row: Geotextile woven or spun filter fabric, in one or more layers. For more information refer to plans, and manufacturer installation manual.
 4. Provide non-woven geotextile fabric around the entire system to prevent migration of fines into the rock voids. For more information refer to plans, and manufacturer installation manual.
 5. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252 for NPS 10 and smaller, AASHTO M 294 for NPS 12 to NPS 60. Include proprietary fittings, couplings, seals, and filter fabric.
- G. RET-7b: Proprietary Retention/Infiltration BMPs – Reinforced Precast Concrete, approved manufacturers and products:
1. Jensen Precast: Precast-Concrete-Arches
 2. Oldcastle Precast Inc.: Storm Capture _Infiltration
 3. StormTrap: Single-Trap-Infiltration
 4. Equal products
- H. VEG-6: Proprietary Biotreatment Devices, approved manufacturers and products:
1. DeepRoot Urban Landscape: Silva Cell 2
 2. Equal products

2.04 MISCELLANEOUS MATERIALS

- A. Metal Covers, Grates, Frames and Accessories:
1. Conform to Section 206 - Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
 2. Hot-dip galvanize steel parts after fabrication in accordance with Section 210 - Paint and Protective Coatings of the Standard Specifications for Public Works Construction.
 3. Grates and Frames:
 - i. Vandal-proof design and construction.
 - ii. ADA compliant, in conformance to CBC 11B-302.3.
 - iii. Rated for vehicular traffic on areas intended for use by motor vehicles.
 - iv. Hot-dip galvanized.
- B. Concrete, Mortar and Related Materials: Conform to Section 32 1313 - Site Concrete Work.
- C. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

2.05 NAMEPLATES:

- A. stainless steel or aluminium nameplate permanently fastened to BMP showing the following information:
1. BMP ID number and BMP type.
 2. Next service day followed by a 1-inch by 4-inch long blank space.
 3. Manufacturer name, model number, telephone number and stock ID number.
 4. Installation or production date.

5. 1-inch by 4-inch blank space for Owner's use.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Contractor shall arrange for a preconstruction meeting with the manufacturer's representative to review the basic principles for proper installation of Underground BMP type products prior to any installation.
- B. Underground Concrete modules shall be installed in accordance with manufacturer's instructions and the current ASTM C891 procedures.

3.02 EXCAVATION, BACKFILLING AND COMPACTING

- A. Conform to the requirements of Section 31 2313 - Excavation and Fill or Section 31 2323 - Excavation and Fill for Utilities, as required.

3.03 INSTALLATION OF PIPE

- A. Conform to Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.
- B. Non-ferrous drainpipe installed with less than 12 inches of cover to finish grade shall be provided with a 4-inch thick concrete pipe encasement.

3.04 DRAINAGE APPURTENANCES

- A. Catch basins, junction chambers, manholes, box culverts, outlet chambers and other drainage structures: Construct as indicated on Drawings and as specified in Section 32 1313 - Site Concrete Work, and in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- B. Ensure that Post Construction BMP have a visible identifying manufacturer tag with product identification, manufacturer contact information, date of last service and date of next service due.
- C. Provide storm drain stencil per City or County requirements as applicable.

3.05 ABANDONED DRAINAGE LINES AND STRUCTURES

- A. Cap or plug existing drain lines that are cut and abandoned and remove existing drainage structures that are abandoned.

3.06 CLOSED-CIRCUIT TELEVISION INSPECTION

- A. Coordinate with OAR time and date of inspection. Project Inspector shall be present during the CCTV inspection.
- B. Clean laterals by hydraulic jet.
- C. Perform internal closed-circuit television inspection of lateral from the building to the public mainline. Record drain line in its entirety with no breaks or interruptions. Move camera at a speed no greater than 30 feet per minute, stopping for a minimum of ten seconds to record pipe connections, defects, and points of interest.
- D. Maintain technical quality, sharp focus and distortion free picture. Pan, tilt, and rotate as necessary to best view and evaluate connections, defects and points of interest.
- E. Minimum Requirements for Closed-circuit Television Equipment:
 1. Television camera specially designed for pipe inspections, and operative in 100 percent humidity conditions.

2. Camera and television monitor capable of producing minimum 470H-line resolution color video picture.
 3. Camera capable to inspect lines as small as three inches up to 70 feet from storm drain mainline.
 4. Camera lighting shall be suitable to allow clear picture of inner wall at least ten feet in front.
- F. Defective Work:
1. New Lines: Defective Work found shall be repaired at Contractor's expense. Perform a new closed-circuit television inspection at no cost to Owner.
 2. Existing Laterals:
 - i. If roots, sludge, or sediment material or other defect not related to the Work of this project impedes inspection, withdraw camera, restart inspection from opposite end and notify OAR of defects found.
 - ii. If obstruction or stoppage was caused by Work related to this project, remove obstruction at no cost to Owner. Perform a new closed-circuit television inspection at Contractor's expense.

3.07 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.
- B. Maintain Post Construction BMP after installation and keep a maintenance log to be turned over to OAR at Substantial Completion.

3.08 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION