

**ELECTRICAL SPECIFICATIONS
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SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. Electrical General Provisions and Requirements for electrical work.
 - 3. Division-1; General Requirements; General Conditions.
- B. The Contractor shall include strategic planning and execution of the construction so that critical park operations remain functional during hours indicated by the College Representative.

1.02 GENERAL SUMMARY OF ELECTRICAL WORK

- A. The Specifications and Drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.
 - . Before submitting a bid, the Contractor shall become familiar with all features of the existing Building which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.
- B. If there are omissions or conflicts between the Drawings and Specifications, clarify these points with the College Representative before submitting bid and before commencing work.
- C. Provide Work and Material in conformance with the Manufacturer's published recommendations for respective equipment and systems.

1.03 LOCATIONS OF EQUIPMENT

- A. The Drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.
- B. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without cost to the Contract, providing the change is ordered before the conduit runs, etc., and work directly connected to same is installed and no extra materials are required.

- C. The location of the existing utilities, building, equipment, and conduit shown on the Drawings is approximate. Investigate existing attic spaces above ceilings to determine and plan best locations to run new conduits prior to core drilling or installing conduits.

1.04 QUALITY ASSURANCE

- A. Work and Materials shall be in full accordance with the latest Rules and Regulations as indicated on the drawings. The publications shall be included in the Contract Documents Requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the Requirements describing the more restrictive provisions shall become the applicable Contract definition. The Contractor shall also comply with the following Standards:
 - 1. Electrical Installation Standards National Electrical Contractors Association (NECA) and National Electrical Installation Standards (NEIS):
 - a. NECA/NEIS-1: Standard of Practices for Good Workmanship in Electrical Contracting
 - b. NECA/NEIS-101: Standard for Installing Steel Conduit (Rigid, IMC, etc.)
 - c. NECA/NEIS-407: Recommended Practice for Installing Panelboards
- B. All Material and Equipment shall be new and shall be delivered to the site in unbroken packages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized Testing Laboratories, where such listings are available. Comply with all Installation Requirements and restrictions pertaining to such listings.
- C. Work and Material shown on the Drawings and in the Specifications are new and included in the Contract unless specifically indicated as existing or N.I.C. (not in Contract).
- D. Keep a copy of all applicable Codes and Standards available at the job site at all times for reference while performing work under this Contract. Nothing in Plans or Specifications shall be construed to permit work not conforming to the most stringent of Building Codes.
- E. Where a conflict or variation occurs between applicable Codes, Standards and/or the Contract Documents, the provisions of the most restrictive provision shall become the Requirement of the Contract Documents.

1.05 SUBMITTALS

- A. Within 15 days of Notice to Proceed submit a proposed time schedule of construction that complies with the College's restrictions on access to the facility and acceptable times for power outages to occur. Indicate proposed sequence of installation for various system components to meet the overall project schedule and comply with restrictions on power outages.
- B. General
 - 1. Review of Contractor's submittals is for General Conformance with the design concept of the Project and General Compliance with the information given in the Contract Documents. Any action shown is subject to the Requirements of the Plans and Specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.
 - 2. The Contractor shall review each submittal in detail for compliance with the Requirements of the Contract Documents prior to submittal. The Contractor shall clearly

and specifically identify each individual proposed substitution, substitution of equal or proposed deviation from the Requirements of the Contract Documents with a statement "THIS ITEM IS A SUBSTITUTION". The burden of research, preparation of calculations and the furnishing of adequate and complete Shop Drawings information to demonstrate the suitability of Contractor's proposed substitutions and suitability of proposed deviations from the Contract Documents is the responsibility of the Contractor.

3. The Contractor at no additional cost or delays to the Contract shall remove any work, material and correct any deficiencies resulting from deviations from the Requirements of the Contract Documents not approved in advance by the College prior to commencement of work.
 4. The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all Code Requirements relating to clear working space about electrical equipment prior to submitting for review.
 5. It shall be the responsibility of the Contractor to ensure that all material and equipment is ordered in time to provide an orderly progression of the work. The Contractor shall notify the College's Representative of any changes in delivery, which would affect the project completion date.
- C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the Contractor's substitution of; or changes to; the specified Contract Materials and Work.
- D. Maintenance and Operating Manuals
1. The Contractor shall furnish maintenance and operating manuals for all electrical equipment to the College.
 2. Manuals shall be delivered to the College's Representative, with an itemized receipt.
- E. Portable or Detachable Parts: The Contractor shall retain in his possession and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of Contract Work. These parts shall then be delivered to the College's Representative with an itemized receipt.
- F. Record Drawings)
1. Provide and maintain in good order a complete set of Electrical Contract prints. Changes to the Contract to be clearly recorded on this set of prints. At the end of the project, transfer all changes to one set of Drawings and deliver PDF copy to the College's Representative.
 2. The Contractor shall keep the "Record" prints up to date and current with all work performed.

1.06 CLEANING EQUIPMENT, MATERIALS, PREMISES

All Parts of the Equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.07 JOB CONDITIONS - PROTECTION

Protect all Work, Materials and Equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. Provide for the safety and good condition of all the work until final acceptance of the work by the College and replace all damaged or defective work, materials, and equipment before requesting final acceptance.

1.08 POWER OUTAGES

- A. All Electrical Services (line voltage, low voltage/signal and fire alarm) in all occupied facilities of the Contract work are to remain operational during the entire Contract period. Any interruption of the electrical services for the performance of this work shall be at the convenience of the College and performed only after consultation with the College's Representative.
- B. Work involving circuit outages shall be only at such a time and of such a duration as approved in writing. Work involving circuit outages for the work required to connect new equipment and disconnect existing equipment shall be performed at the convenience of the College.
- C. Provide overtime work; double shift work; nighttime work; Saturday, Sunday, and holiday work to meet outages schedule.
- D. Provide temporary electrical power if required to meet the Requirements of this Article.
- E. Any added costs to Contractor due to necessity of complying with this Article shall be included in the Contract Scope of Work.
- F. When electrical work involving power disruptions to existing areas is initiated, the work shall proceed on a continuous basis without stopping until electric system power is restored to the affected areas.
- G. Request in writing to the College's Representative a minimum of 3-weeks in advance, for scheduling proposed electrical systems outage.

1.09 ASBESTOS, POLYCHLORINATED BIPHENYL (PCB) OR HAZARDOUS WASTE:

- A. It is understood and agreed that this Contract does not contemplate the handling of asbestos, PCB or any hazardous waste material. If asbestos, PCB or any hazardous waste material is encountered, notify the College's Representative immediately. Do not disturb, handle or attempt to remove.

1.10 IDENTIFICATION

- A. Equipment Nameplates
 - 1. Panel shall be properly identified by means of descriptive nameplate permanently attached to the front of the door.
 - 2. Nameplate shall be engraved laminated phenolic. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws or machine screws. Self-adhering or adhesive backed nameplates shall not be used.
 - 3. Provide black laminated plastic nameplate with white characters engraved in minimum ¼-inch high letters to correspond with the designations on the Drawings.
- B. Wire and Cable Identification
 - 1. Provide colored phase identification tape on individual feeder conductors terminated on new equipment.
- C. Cardholder and card shall be provided for circuit identification in panel. Cardholder shall consist of a metal frame retaining a clear plastic cover permanently attached to the inside of panel door. List of circuits shall be typewritten on card. Circuit description shall include description of load and area served.

1.11 ELECTRICAL WORK CLOSEOUT

- A. Prepare the following items and submit to the College's Representative before final acceptance.
 - 3. Copies of Record Drawings.
 - 4. Copies of all receipts transferring portable or detachable parts to the College's Representative when requested.
 - 5. Notify the College's Representative in writing when installation is complete and that a Final Inspection of this work can be performed. In the event any defect or deficiencies are found during this Final Inspection they shall be corrected to the satisfaction of the College's Representative before final acceptance can be issued.

END OF SECTION 26 05 00

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SECTION 26 05 01
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
1. Examine all other Sections for work related to those other Sections and required to be included as work under Division 26.
 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS

Submit Manufacturer's data sheets for all receptacles.

PART 2 PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

- A. General:
1. Junction boxes shall be sized to comply with the following:
 - a. Code Requirements size based on the conduit quantities, conduit sizes and wire-fill connected to the junction box.
 - b. Junction box minimum size shall be as required to contain the device and wiring contained inside and as required by code.

2.02 RECEPTACLES

Receptacles shall be duplex grounding type, NEMA 5-20R, UL listed and labeled, and shall conform to NEMA-WD1 and WD6. Receptacles shall be compatible with the surface raceway system specified in Section 26 0525, as manufactured by Panduit, or equal.

PART 3 EXECUTION

3.01 GROUNDING (ADDITIONAL REQUIREMENTS)

- A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State of California and local Authorities Having Jurisdiction.
- B. Each pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

3.02 RECEPTACLES

- A. Provide outlet boxes for all receptacles.
- B. Installed receptacles in raceways per Raceway Manufacturer's instructions.
- C. Install and screw attach devices into outlet boxes and wireways.
- D. Provide ground circuit connections to all devices.
- E. Provide branch circuit connections to all devices.

3.03 OUTLET AND JUNCTION BOXES

- A. Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.
- B. Surface mounted outlet boxes shall be attached to stud walls with screws.

END OF SECTION 26 05 01
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SECTION 26 05 30 CONDUIT AND WIRE

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 2. Examine all Sections and Drawings related to Methane control and required to be included as work under this Section.
 3. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

Submit product data sheets for conductors only. No submittals are required for conduits.

PART 2 PRODUCTS

2.01 CONDUIT

- A. General
1. Steel conduits and fittings shall have protective corrosion resistant finish.
 2. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards (NPS) and shall comply with ANSI-B1.20.1.
 3. Provide conduit bonding/grounding jumper from metal enclosures with "concentric ring" knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.
 4. The conduit and fittings shall be watertight and airtight without cracks and pinholes.
- B. Electrical Metallic Tubing (EMT)
1. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).
 2. EMT fittings:
 - a. Connectors and couplings for terminating, connecting, and coupling to EMT conduit shall be non-threaded steel fabrication. Connectors and fittings shall be compression type and weatherproof.
 - b. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.
- C. Flexible Metal Conduit (FMC)
1. FMC shall comply with ANSI-C33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.
 2. FMC Fittings
 - a. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); UL 514.

2.02 CONDUIT SUPPORTS

- A. General
 - 1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized. Unistrut or equal.
 - 2. Supports shall be free of "BURRS" and sharp edges.
 - 3. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.
- B. Conduit Support Channels
 - 1. "C" channels shall be factory preformed with a minimum 12-gauge thickness metal. The channel shall be factory "punched" with regularly spaced slotted holes for fastener attachments along the length of the channel.
 - 2. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).
 - 3. Conduit support channels shall connect to structure fasteners with threaded connectors.
- C. Fasteners
 - 1. Channel fasteners shall "prelocate" and lock into the channel "turned lips" and channel "walls". A separate metal strap shall "tie" each conduit to each channel with conduit channel fasteners.
 - 2. Structural fasteners for wall mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.

2.03 ELECTRICAL POWER WIRE AND CABLE

- A. General
 - 1. All wire and cable shall be single-conductor, annealed copper, insulated 600 volt, #12 AWG minimum unless specifically noted otherwise on the Drawings.
 - 2. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded.
- B. Conductor Insulation
 - 1. 600 Volt AC and/or DC insulated conductors installed entirely inside conduits, or enclosed inside wireways, or enclosed inside raceways, insulation shall be dual rated THHN/THWN or THW-2.
- C. Insulation Color Coding and Identification
 - 1. Neutral . . . White (Tape feeder neutrals with white tape near connections)
 - 2. Phase Conductors:
 - 120/208 Volt
 - Ground Green
 - Phase A Black
 - Phase B Red
 - Phase C Blue
 - 3. Existing branch wiring shall be identified as to phase or leg in each panel and junction location with color tape
- D. All wiring shall be copper: Aluminum conductors shall not be permitted.

PART 3 EXECUTION

3.01 GROUNDING

- A. Grounding shall be executed in accordance with all applicable Codes and Regulations, both of the State and local Authorities Having Jurisdiction.
- B. Where nonmetallic conduit is used in the distribution system, the Contractor shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.
- C. The maximum ground/bond resistance to the grounding electrode shall not exceed 25 ohms from any location in the electrical system.
- D. Each panel, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

3.02 CONDUIT

- A. General
 - 1. The sizes of the conduits for the various circuits shall be as indicated on the Drawings, but not less than the conduit size required by Code for the size and quantity of conductors to be installed in the conduit.
 - 2. Conduits shall be provided complete with conduit bends, conduit fittings, outlet boxes, pullboxes, junction boxes, conduit anchors/supports, grounding/bonding for a complete and operating conductor/wire raceway system.
 - 3. Metal and nonmetal conduits shall be provided mechanically continuous between termination connection points. Metal conduit shall be provided electrically continuous between termination connection points.
 - 4. Metal conduit terminating to nonmetal enclosures; terminating into metal enclosures with "concentric ring" knockouts; terminating into metal enclosures with knockout reducing washers, including but not limited to equipment housings, outlet boxes, junction boxes, pullboxes, shall be provided with a ground/bonding lug integrated with the conduit termination conductor fitting construction, by the Fitting Manufacturer. The lug shall provide for connection of a grounding/bonding conductor (insulated or uninsulated). The grounding lug shall be located on the fitting, inside the termination enclosure.
 - 5. The type of conduit, type of conduit fittings, and type of conduit supports, and method of conduit installation shall be suitable for the conditions of use and conditions of location of installation based on the Manufacturer's recommendations; based on the applicable Codes and based on the Requirements of the Contract Documents.
- B. FMC Installation Locations

FMC conduit and FMC fittings may be installed only concealed above suspended ceilings and only in lengths less than 6 feet. Other locations shall be EMT.
- C. Conduit Installation
 - 1. Securely and rigidly support all above ground conduits from structure. Conduits shall be supported independently by means of "C" channels and pipe clamps.

2. Conduit shall be run at right angles or parallel to the walls or structures. All changes in EMT conduit directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds, OZ or equal. Conduits run exposed to view shall be painted to match surrounding surfaces.

3.03 WIRE AND CABLE

- A. Branch circuit and fixture joints for #10 AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by 3M-"Scotchlok".
- B. Branch circuit joints of #8 AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, tapered half-lapped and at least the thickness equivalent to 1.5-times the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.
- C. Use UL listed pulling compound for installation of conductors in conduits.
- D. Correspond each circuit to the branch number indicated on the panel schedule shown on the Drawings except where departures are approved by the City's Representative.
- E. All line voltage wiring shall be installed in conduit.
- F. Neatly group and lace all wiring in panels with plastic ties at 3-inches on centers. Tag all spare conductors.

END OF SECTION 26 05 30

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SECTION 26 05 40
SURFACE MULTIOUTLET RACEWAY

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section, complete as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Sections for work related to those other Sections and required to be included as work under this Section.
 - 2. General Provisions and Requirements for electrical work.
- B. Provide wall mounted and floor mounted raceway system to contain both line and low voltage wiring and outlets, and space for future low voltage wiring.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit product data sheets for raceways and all component parts and accessories required for the complete installation.
- B. Submit data indicating compatibility of raceway system with outlets and wiring specified in other sections to be installed in raceway including computer jacks and duplex receptacles.

PART 2 PRODUCTS

2.01 GENERAL

- A. Multioutlet raceways shall consist of a base, removable cover, wire-clips, fittings, transitions, elbows, couplings, connectors, tees, blank end fittings, dividers, outlets, outlet boxes, mounting hardware, conductors and wiring devices, complete per Manufacturer's recommendations.
 - 1. Raceway system shall comply with UL-5 and National Electrical Code. Suitable for circuits operating at not more than 600-volts AC or DC.
 - 2. Raceway corners elbows and bends provide internal shields to ensure bend-radius of cables and wire comply with Cable/Wire Manufacturer's recommendations.
- B. Raceway system shall be standard 5-feet or 10-feet lengths, custom length field cut, and installation locations as shown on the Drawings. The raceway system and covers shall be fabricated of non-metallic PVC housing raceway and cover, high impact, UL-94V-0 listed non-flammable and self-extinguishing.
- C. Wall mounted surface multi-outlet raceways shall be Panduit "Panway-T70" series or equal by Legrand. Raceway system and all outlet connectors contained in the raceway shall be white in color.

2.02 WALL MOUNTED RACEWAYS

- A. General
 - 1. Raceways shall be surface mounted on existing walls.

2. Raceways shall be suitable for installation of power and low voltage conductors.
 3. Snap on raceway cover, self-grounding, the entire length of the raceway, with cutouts for outlets and devices shown on the Drawings. Raceway cover material shall be the same material as the respective raceway.
 4. Provide device bracket support frames and sub-coverplates for each outlet shown in the Drawings. Coverplates for computer outlets shall be sized for "RJ" style outlet jacks unless noted otherwise.
- B. Provide two internal continuous divider barriers the length of the raceway, to form three wiring channels: one for line voltage wiring and the other two for low voltage wiring.

2.03 FLOOR MOUNTED RACEWAYS

- A. Raceway shall be ADA approved for the application.
- B. Raceway shall be compatible with and shall connect to wall mounted raceway as indicated on plans.
- C. Provide termination box on raceway at College-furnished A/V rack in center of room. Coordinate exact type of box with rack so that all wiring is concealed from view outside the rack.

2.04 OUTLET BOXES (ADDITIONAL REQUIREMENTS)

- A. Outlet boxes on wall mounted raceway for line voltage receptacles and computer jacks shall be mounted to the side of raceway so connector devices are outside the main body of the raceway.
- B. Provide outlet boxes where outlets are shown on the drawings.
- C. Provide dividers in outlet boxes for each raceway with internal dividers. The outlet box divider quantity shall match the quantity of dividers in the corresponding raceway, to maintain separation of circuits in outlet boxes and raceways.

2.04 CONDUCTORS (ADDITIONAL REQUIREMENTS)

- A. The Drawings do not indicate the size or quantity of the electrical power branch circuit conductors inside the multioutlet raceways. Provide the quantity and size of conductors required for the outlets and branch circuits shown on the Drawings.
- B. Provide a separate dedicated neutral conductor for each individual 120 volt branch circuit in the multioutlet raceway. Do not use a common shared neutral conductor for multi-conductor electrical power branch circuits in the raceway.
- C. Provide internal conductor retention clips 36-inches on center, within 6-inches of each side of wiring devices in the raceway and at each change of direction in the raceway routing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Multioutlet raceways shall be installed parallel and perpendicular to adjacent building surfaces.
- B. Attach and anchor multioutlet raceway base to building structure not less than 16-inches on center. Raceway attachment anchor shall be made directly to building wall, wall stud,

masonry surface, or structural member. Do not anchor raceways to drywall, plaster or tile surfaces as the only support for the raceway.

- C. Provide additional wiring outlet devices and circuits in multi-outlet raceway as shown on the drawing. The raceway outlet locations shown are approximate. Verify exact installation locations with the College Representative prior to installation.
- D. Where multioutlet raceways extend through existing ceiling tiles, cut around existing tiles so raceway will pass thru. Provide trim angle around cut edges of tiles.

3.02 GROUNDING ADDITIONAL REQUIREMENTS

- A. Provide a #10 AWG (minimum) copper ground/bond conductor in all raceways (one in each divided raceway, where a raceway divider is installed). Connect the ground conductor to each section of the raceway base. Connect the ground conductor to the metal feeder raceways(s) supplying the multi-outlet raceway and to the ground/bond conductor in the feeder raceways(s).

3.03 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

Computer outlet coverplates shall be labeled per Section 275000 Structured Cabling.

END OF SECTION 26 05 40

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SECTION 26 24 00

PANELS

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
 - 2. General Provisions and Requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Provide Manufacturers catalog data for panels and circuit breakers.
- B. Provide Shop Drawing showing panel circuit arrangements, size, voltage, amperage, and over-current protective devices. Drawings shall indicate physical dimensions, weight, and anchor-bolt provisions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Panels shall be flush mounting with group-mount circuit protection devices as shown on panel schedule, hinged lockable doors, index cardholders, and proper bussing.
 - 1. Panelboards shall comply with the latest versions:
 - a. NEMA – PB1.
 - b. UL – 50 and 67.
 - c. CEC/NEC.
 - d. ASTM-B187.
- B. Housing and Painting
 - 1. Shall be finished with one coat of rust inhibitor zinc chromate and coat of primer sealer after a thorough cleaning.
 - 2. Finish color paint shall match wall color. Prime coated panelboard shall be painted to match surroundings after installation.
 - 3. Shall be fabricated of sheet steel of the following minimum gauges.
 - a. Full height hinged, locking door. Trim #12-gauge steel; enclosure - Code gauge steel.
 - 4. NEMA-1 Metal Housing, for indoor locations.
 - 5. Fasten the trim to panel by means of concealed, bolted or screwed fasteners accessible only when the door is open.

- C. Panels 120/208-volt, three phase, 4 wire, S/N shall be "column width" narrow construction to fit flush in existing wall between studs, as manufactured by Eaton, Siemons, GE, or Square D.
- D. Panel Dimensions:
 - a. Shall be 9-inches wide.
 - b. Depth shall be 6-inches nominal. Height of panel as required for devices.
- E. Panels shall have a circuit index cardholder removable type, with clear plastic cover mounted on the inside of the panel door. Index card shall have circuit numbers imprinted to match circuit breaker numbers.
- F. Panel shall have an identification nameplate mounted on the inside face of door indicating the respective panel name as indicated on the Drawings.

2.02 SHORT CIRCUIT RATING

Panel short circuit ratings shall be 10,000 AIC.

2.03 CIRCUIT BREAKERS

- A. General
 - 1. NEMA-AB1 and AB3, comply with latest revision.
 - 2. UL-1087, UL-489 and IEC-60.947.2 rated devices, comply with latest revision.
 - 3. 5Hz AC closing and 3Hz AC trip and clear.
 - 4. Circuit breakers shall be Molded Case Circuit Breakers.
- B. Manufacturer
 - 1. Circuit breakers shall be manufactured by the same Manufacturer as the rest of the panel.
- C. Configuration
 - 1. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the Drawings.
 - 2. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs, which can readily be changed from front of panel, will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.
 - 3. Panelboard circuit protection devices shall be bolt on type for connection to panel bus. Removable and installable without disturbing adjacent devices.
 - 4. Provide conductor wire terminations (lugs) on each circuit protection device for incoming main feeder, branch circuits and outgoing feeder circuits. Dual rated copper/aluminum and compatible with the respective conductor size, type, and quantity.
 - 5. Where 2-pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.
 - 6. Branch circuit panels shall be field convertible for bottom entry main incoming feeder or top entry main incoming feeder.

2.04 BUSSING

A. Bus Material

1. Bussing shall be rectangular cross section tin-plated copper or alternately silver or tin-plated aluminum.
2. Bussing shall be non-tapped, full length of the enclosure.

B. Ground Bus

1. Each panel shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. Provisions

1. Provide space and all hardware and bus mounting attachments for future devices as indicated on the Drawings.

PART 3 EXECUTION

3.01 MOUNTING

- A. Flush mounted panels shall be secured to wall studs at two locations on each side on housing.
- B. Panels shall be installed to ensure the top circuit protective device (including top compartment control devices) are not more than 6-feet-6-inches above finish floor in front of the panel and the bottom device is a minimum of 18-inches above the floor.

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SECTION 27 50 00

STRUCTURED CABLING

PART 1 GENERAL

1.01 SCOPE

- A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:
 - 1. Examine all other Specification Sections and Drawings for related work required to be included as work under Division 26.
 - 2. General Provisions and Requirements for electrical work.
- B. Provide new Category 6A copper computer jacks in surface raceways as indicated on drawings. Provide Category 6A homerun cable from each jack to an existing IDF rack. Provide new patch panels in existing IDF rack.
- C. Provide new patch panels in existing IDF rack as required to terminate all new cables.

1.02 BIDDER QUALIFICATIONS

- A. The existing computer network cabling system is covered by a 25-year Panduit Certification PLUS™ System Warranty for all copper and fiber permanent cabling. Contractor to perform the work of this section shall be a current Panduit ONESM Partner that has completed the Structured Cabling Deployment Training (Panduit Certified Installer).
- B. Contractor must have at least 5 years documented experience installing and testing structured cabling systems of similar type and size.
- C. Contractor shall have offices and service personnel based within a 65-mile radius of the College.
- D. Contractor shall employ at least one BICSI Registered Communication Distribution Designer (or equivalent) to sign-off on all designs offered.
- E. Contractor shall have the responsibility to obtain any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
- F. At least 30% of the Technicians on the job must have a current Panduit Certified Copper Technicians certificate, or accepted substitute Manufacturer, to install copper distribution systems.
- G. Contractor Project Manager must be Manufacturer certified in the copper and fiber information transport systems to be installed.

1.03 WARRANTY

- A. General
 - 1. Contractor shall provide a 25-year Panduit Certification PLUS™ System Warranty on all new copper computer outlets.
 - 2. It is understood the Certification PLUS™ Warranty is a system performance warranty guaranteeing for 25 years from acceptance that the installed system shall support all

data link protocols for which that Category of copper cabling system is engineered to support according to current and future IEEE and TIA Standards.

3. The Certification PLUS™ System Warranty may be invoked only if the cabling channel links are comprised of continuous Panduit/General Cable components, including patch cords, equipment cords and fiber jumpers.
4. Upon acceptance of Warranty, Panduit will mail a notification letter to the Installer and a notification letter and warranty certificate to “Cypress College”.

B. Contractor Warranty Obligations

1. Installation firm (Contractor) must be a current Panduit ONE Partner or approved equivalent Manufacturer in good standing.
2. Contractor shall name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in Panduit Technician Certification Training, or approved equal, and according to all Standards cited in the Regulatory References section of this document.
3. Contractor liaison (Project Supervisor) shall have a current, up-to-date Panduit Certified Technician (PCT) certificate in both copper and fiber.
4. All UTP cable pulled and terminated shall be Category 6/6A cable and connectivity whether new or legacy systems.
5. All UTP terminations shall be terminated using the T568B pin-out (wire map). Legacy additions shall match the copper pin-out of the facility to which cabling is being added-to or upgraded.
6. Contractor shall install all racking and support structures according to cited Standards in such fashion as to maintain both cited Industry Standards as well as Manufacturer recommendations for uniform support, protection, and segregation of different cable types,
7. Contractor is responsible for maintenance of maximum pulling tensions, minimum bend radius, and approved termination methods as well as adhering to industry accepted practices of good workmanship.
8. Contractor is responsible for understanding and submitting to Panduit all documents required prior to project start to apply for the Panduit Certification PLUS warranty. These include but are not limited to the project information form and SCS warranty agreement.
9. Contractor is responsible for understanding and submitting to Panduit all documents required at project end. These include, but are not limited to completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
10. Test results shall be delivered in the tester native format (not Excel) and represent the full test report, summaries shall not be accepted. Contact your Panduit Representative for a current list of approved testers, test leads and latest operating systems.
11. The Communications Contractor will correct any problems and malfunctions that are warranty-related issues without additional charge to the College for the entire warranty period.
12. The warranty period shall commence following the final acceptance of the project by the College and written confirmation of Warranty from Panduit.

1.04 APPLICABLE REGULATORY REFERENCES

- A. Contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
- B. ANSI/TIA:
 - 1. ANSI/TIA-568.0-D (September 2015) Generic Telecommunications Cabling for Premises (supersedes TIA-568-C.0 and TIA-568-C-1)
 - 2. ANSI/TIA-568-C.2 (August 2009) Balance Twisted Pair Communications and Components Standards
 - 3. TIA-568-C.2-1 (July 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 1: Specifications for 100 Next Generation Cabling
 - 4. TIA-568-C.2-2 (November 2014) Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing
 - 5. ANSI/TIA-568.1-D (September 2015) Commercial Building Telecommunications Infrastructure Standard (supersedes ANSI/TIA-C.1)
 - 6. ANSI/TIA-569-D (April 2015) Telecommunications Pathways and Spaces
 - 7. ANSI/TIA-606-C (June 2017) Administration Standard for Telecommunications Infrastructure
 - 8. ANSI/TIA-607-C (November 2015) Generic Telecommunications Bonding and Grounding (Earthing) for Premises
 - 9. ANSI/TIA-758-B (March 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
 - 10. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - 11. ANSI/TIA-942-B (July 2017) Telecommunications Infrastructure Standard for Data Centers (will be superseded by ANSI/TIA-942-B after balloting)
 - 12. ANSI/TIA-1005-A (May 2012) Telecommunications Infrastructure Standard for Industrial Premises
 - 13. ANSI/TIA-1005-A-1 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
 - 14. ANSI/TIA-1183 (August 2012) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
 - 15. ANSI/TIA-1183-1 (January 2016) Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183
 - 16. ANSI/TIA-1152 (September 2009) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - 17. ANSI/TIA-4966 (May 2014) Telecommunications Infrastructure Standard for Educational Facilities

18. TIA-5017 (March 2016) Telecommunications Physical Network Security Standard
19. TIA-TSB-162-A (November 2013) Telecommunications Cabling Guidelines for Wireless Access Points

1.05 SUBMITTALS (ADDITIONAL REQUIREMENTS)

- A. Submit Manufacturer's standard catalog data for each component. The submittal shall be arranged in the order of the Specification and shall list the name, the proposed model and Manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure. The Manufacturer's data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of items. The data sheet shall completely describe the proposed item. Where modification to the equipment is necessary to meet the Operational Requirements of the Contract Documents, the brochure shall include complete Mechanical and Electrical Shop Drawings, detailing the modification. The brochure shall include a listing of the Outlet Rough-In Requirements for every device and equipment item.
- B. Provide proposed nameplate and outlet identification/color coding system. Indicate proposed identification naming sequence and methods to match existing in the building.
- C. Submit bidder/installer qualifications and proposed Panduit warranty statements.

PART 2 PRODUCTS

2.01 COPPER WIRE CABLES (TWISTED PAIRS)

- A. Conductors shall be copper wire, individually insulated and color-coded, with multiple conductors arranged in twisted pairs. Outer sheath color shall be blue to match existing cables in the building.
- B. Category-6A cables shall be tested and shall pass the ANSI/TIA test recommendations for Category-6A.
- C. Cables shall be UL listed, complying with CEC California Electrical Code, National Fire Protection Agency and NFPA Requirements for each installation location shown. ETL tested and certified to comply with or exceed Specified Requirements.
- D. The cable insulation and jacket shall be listed and labeled "Limited Combustible Cable" (LC or LCC) and shall comply with the latest published revision of all of the following Additional Requirements.
 1. Limited combustible "FHC-25/50" per UL-2424.
 2. CEC: CMP, additional listing/labeling where the install location is an environmental air plenum, copper wire "FHC-25/50-CMP".
 3. NFPA-90A; ceiling cavity plenums, wall cavity spaces and raised floor cavity plenums, limited-combustible.
 4. NFPA-5000; defines combustible material including wire and cable.
 5. UL listed and labeled for installation in air plenums.
 6. Cables shall qualify as 100% recyclable materials disposal, RoHS regulation complaints.
 7. The outer cable jacket shall be imprinted with date, Manufacturer's model and catalog number and agency (AHJ) listing identification.

8. Copper wire Electronic Network Systems Infrastructure cable shall be a product of the same Manufacturer, including portable patch cables.

2.02 COPPER WIRE OUTLET CONNECTORS

A. General

1. Connectors shall comply with FCC part-68 Subpart F for gold plating.
2. Connectors shall be UL listed and shall comply with UL94V-0.
3. Copper wire outlet connectors shall be white in color.
4. Copper wire outlet connectors shall be UL listed, complying with National Electrical Code, ETL tested and certified to comply with or exceed Specified Requirements, ANSI/TIA-568C including related Standards, Amendments and TSB.

B. Equipment Rack Mounted Patch Panel

1. Standard 19-inches wide metal panel, Manufacturers standard color. Prepunched for copper wire outlet connectors. Panel shall mount on an EIA Standard 19 inches wide enclosed or open frame equipment rack assembly. Quantity of connectors as required for total quantity of jacks indicated on plans..
2. The patch panel shall provide the following self-contained functions.
 - a. Copper wire cable termination including conductor/shield termination and strain relief.
 - b. Plug-in copper wire outlet connectors for port to port patching with copper wire portable patch cords.
3. Patch panel height and width shall fit within the existing space of the existing IDF rack.
4. The copper wire connector installed in the patch panel shall be the same configuration, Manufacturer and type as the corresponding copper wire connector provided in the remote workstation outlet locations connecting to the respective patch panel outlet.

2.03 WORKSTATION OUTLETS

A. General

1. Label outlet cover plates with the port number corresponding to the port number at the new patch panel.
2. The outlet cover plates shall be factory prepunched and formed to accommodate the installed outlet connector with attachment screws.
3. Workstation outlets shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements, ANSI/ TIA-568C including related Standards, Amendments and TSB.
4. The outlets shall be the same configuration and type as the corresponding connector provided in the copper wire patch panel outlet, unless noted otherwise.
5. The copper wire outlet connectors for twisted pair wire connections in computer workstation outlets shall be universal outlet connector RJ-45 type.

- B. Outlet boxes shall be provided on surface raceways per Section 26 25 00 Surface Raceways.

2.04 PORTABLE PATCH CORDS

- A. Provide portable patch cord for each new Category 6A jack installed. One cable shall be 6-feet long and the second cable shall be 3-foot long.
- B. Patch cords shall be factory assembled tested and certified with factory terminated plugs at each end. Field terminated portable patch cords shall not be permitted. Terminated plugs shall incorporate integral bending radius limiting molded “boots” and strain relief. Patch cord assemblies shall be rated for "heavy duty", “high-abuse” service.
- C. Patch cords shall be UL listed, complying with National Electrical Code, ETL Tested and Certified to comply with or exceed Specified Requirements. ANSI/T1A 568C related Standards, Addendums and TSB.
- D. Patch cords shall be delivered to the Owner in cardboard boxes. The patch cords shall be neatly bundled and tied together. Mark each box with quantity and type of cords contained in the box.
- E. Patch cords shall comply with the same Cable Communication Performance, Requirements, Protocol Requirements and Testing Requirements as the respective infrastructure cables and outlets to which the patch cords are intended to be connected (plug-in). Patch cords shall be the product of the same Manufacturer.
- F. The outer jacket of each portable patch cord shall be blue in color and imprinted with date, Manufacturer’s model and catalog number.
- G. "Male" eight position modular "RJ" male style jacks install on each end of the patch cord cable. The jack shall be provided with a rear "fin" to prevent the plug tab from snagging when pulled backwards through adjacent wiring.
- H. RJ-45 style “male” jack, typical unless noted otherwise.

PART 3 EXECUTION

3.01 CABLE INSTALLATION

- A. Cables connecting to equipment racks shall be installed with not less than 6-feet of slack cable. The slack cable shall be coiled and supported on the back-board and/or cable tray.
- B. Provide “horizontal wiring” cables installed from individual equipment locations and workstation outlets to existing IDF. Cables shall be continuous without cutting or splices.

3.02 CABLE TERMINATIONS

- A. Polarity and color-coding of cable connections at splices, terminations, and outlets shall be consistently maintained and match existing cabling system.
- B. Terminate all cables onto respective outlets connectors, interconnection couplers and terminals. Terminations shall comply with Manufacturer's recommendations, ANSI/TIA-568C related Standards, Amendments and TSB.
- C. Cable terminations shall be performed to maintain the data transmission rates specified for respective entire system.
- D. Pin assignment for wiring terminations shall comply with ANSI/TIA 568C type T568A or Type T568B as required for compatibility with the existing electronic network equipment. The termination type shall be consistent throughout the Project Contract area.

- E. Copper wire terminations shall be performed to maintain the transmission rates specified for the respective entire system.

3.03 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

- A. Copper wire cables shall be identified in each panel and computer workstation outlets.

3.04 NETWORK CABLE TESTING AND COMMISSIONING

- A. In addition to the testing recommended in ANSI/TIA and related Standards, Amendments and TSB. Provide End-to-End test 100% of all new copper wire jacks after all wiring installation is completed. Provide any additional tests required for warranty.
- B. The test equipment and (Tester) shall comply with the Accuracy Requirements for Field Testers as defined in the ANSI/EIA standards for the specific cable type. The Tester including the appropriate interface adapter shall meet the specified Accuracy Requirements. The Tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy. The Tester shall be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor.
- 3. The Pass or Fail condition for the channel pathway link-under-test is determined by the results of the required individual tests (ANSI/TIA) any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass. A Pass or Fail result for each parameter is determined by comparing the measured values with the ANSI/TIA test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field test. The Field Test Equipment Manufacturer shall provide documentation as an aid to interpret results marked with asterisks.
 - a. Provide all test equipment, certified testing personnel, and setups. Testing shall comply with ANSI/TIA and Equipment Manufacturer's recommendations and standards of practice.
 - b. The Contractor shall repair or replace equipment, cables, outlets, connectors, splices, terminations, etc. identified during testing as not complying with the Contract Documents, without additional cost to the Contract. Retest all replaced or repaired components at Contractor's expenses.

END OF SECTION 27 52 00
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