

DIVISION 26 - ELECTRICAL SPECIFICATION

26 05 01.00 - COMMON WORK RESULTS FOR ELECTRIC

The General Provisions of the Contract including the General and Supplemental Conditions and General Requirements apply to the work in this section. Before submitting a bid, examine documents of all other trades, visit the site and get acquainted with all conditions that may in any way affect the execution of this contract. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Note dimensions convey desired locations for devices. Coordinate with owner representative on site prior to deviating from noted dimensions for any reason. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the Owners representative on job site shall be followed.

Whenever the words "contractor", "this contractor", etc. appear on drawings or in these specifications for the Electrical Work, it shall refer to the Electrical Sub-Contractor. Whenever the word "Provide" appears in these documents, it shall be interpreted to mean "Furnish and Install". Whenever the word "Relocate" appears in these documents, it shall be interpreted to disconnect electrical feed, make safe including lock out, store and protect device, re-install, rework and extend conduit and wire to new location, re-energize and test.

The exact mounting height of devices shall be determined in the field with relation to architectural details and equipment being served. It shall be the responsibility of this contractor to coordinate outlet location with equipment. The Owners representative shall be permitted to relocate any outlet prior to installation within a 15 foot limit at no additional charge in contract price. All fasteners, hangers and methods of hanging exposed work in finished areas shall be submitted to the Owners representative for approval before installation.

The contract includes all items of material and labor required for the complete installation and full operation of the electrical work as shown on the drawings and hereinafter specified. All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet the approval of local inspection authority having jurisdiction. The latest edition of NFPA 70 (NEC/National Electrical Code) shall be the minimum requirement for all work. Examine the drawings and specifications for compliance with the above codes, regulations and ordinances and base bid and work accordingly. Obtain and pay for all permits and inspections related to this work. A certificate of approval for work under inspection authority shall be given to the Owner before first acceptance will be given by Owners representative.

All work, materials, and equipment shall have a one-year warranty after acceptance of the work by the Owner. Any defective items shall be removed and replaced at the electrical sub-contractor's expense and to the satisfaction of the engineer and owner's representative.

Perform work under this contract in close harmony with other contractors so completed work shall present a neat and workmanlike installation. Exposed finished materials and equipment shall be carefully cleaned and wiped to remove grease, smudges, fingerprints, dust and other spots and left smooth and clean. During the progress of the work, the electrical sub-contractor shall carefully clean the job site and shall leave the premises and all portions of the building in which he is working free of debris and in a clean and safe condition.

This contractor shall be responsible for the training of owner's representative of each system to the satisfaction of the Owners representative.

The Electrical Contractor shall consult the Plumbing, HVAC and Structural plans (where applicable) in all instances before installing his work so that his work will not interfere with those branches. In the event of a conflict, this contractor shall report to the Owners representative at once and do no further work to be installed until a satisfactory arrangement is decided upon. Any work done, or equipment placed in position by this contractor, creating a conflict in violation hereof, shall be rejected to the satisfaction of the Owner's representative at the expense of the contractor. The decision of the Owners representative shall be final in regard to changes due to conflicting work. The Contractor shall complete his work or any part thereof at such time as may be designated by the Owner, so that it can be used for temporary or permanent use and such use of the system shall not be construed as an acceptance of same by Owner.

Two sets of electrical drawings shall be provided as record drawings which shall be separate, clean, copies reserved for the purpose of showing a complete picture of the work as actually installed. These drawings shall also serve as work progress report sheets and the electrical contractor shall make any notations, neat and legible thereon daily as work proceeds. The drawings shall be available for inspection at all times and shall be kept at the location designated by the Owners representative. At the completion of the work, these record drawings shall be signed by the electrical contractor, dated and returned to the Owners representative. Final payment of contract will not be made until receipt and review of said drawings.

Provide two neatly bound (with tabbed sections) copies of maintenance books, instruction books and parts list pertaining to all equipment furnished. Submit to the Owners representative for approval. Final payment will not be made until drawings for record, maintenance and instruction manuals are delivered to the Owners representative.

26 05 02.00 - COMMON ELECTRICAL MATERIALS AND METHODS

All materials and equipment shall be new. All materials, apparatus and equipment shall bear the seal of Underwriters Laboratories Inc. or a similar credible testing agency label where regularly supplied. Careful manufacturers of materials and equipment to be specified in these documents shall be detailed according to this material. The contractor shall be responsible for furnishing and installing this material and equipment.

Where more than one make of material or equipment is specified, the contractor shall state in his bid which make or type of material or equipment shall be furnished. All material and equipment shall be furnished by the contractor for Engineer approval. This approval to be obtained prior to shipment of equipment.

Hold raceways in new buildings as tight as possible to structure above. Obtain approval of owner's representative prior to installation. Do not install any electrical work within 6 inches of roof deck.

Neatly dress all work. Install all work parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible, keep conductor splices to minimum. Install splice and branch points which possess equivalent or better mechanical strength than conductors being spliced. Use splices and tap connectors which are compatible with conductor material. All wires shall

be run continuous from outlet to outlet/luminaire to luminaire. Insulation value of joints shall be 100% in excess of wire. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors no larger than 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

Maintain a uniform elevation for all cable runs wherever possible. All cables shall be supported/anchored at maximum 4-foot intervals and within 12" of box or outlet and shall not sag. Install cables in a manner that prevents overheating. Cables shall be fastened directly to the structure using factory clamps/cips specifically designed for the respective cable (Caddy or equal).

Keep conductor splices to minimum. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary. Increase wire sizes to offset voltage drop as/it required.

Branch subfeeder circuits shall be installed as shown on the floor plans. Where outlets are indicated by letters on plans, they shall be controlled by corresponding switches.

Outlets shall be located approximately as shown on the plans and shall be wired to provide control of outlets indicated. All wires of any one circuit shall be run in the same conduit.

Mechanical wire splices shall be Scotchlock insulated type, Tan@ Stakon or approved equal. The conductors terminating at each wired outlet shall be left not less than 8" long at their outlet fittings to facilitate installation of devices or luminaires. Friction and rubber tape conform to Federal Specifications HH-T11 and HH-T-111. Plastic electrical tape shall be Scotch #33+ or approved equal.

Do not stretch neutrals when amongst multiple branch circuits or with multi-wire branch circuits.

Provide grounding electrode conductors for service entrances and derived systems.

Provide all feeders and branch circuits with insulated (green covering) equipment grounding.

Only install conduit exposed on rooftops when it is impossible to do otherwise, or only if specifically indicated for such installation case-by-case elsewhere in documents. Installation convenience, financial considerations, lack of coordination with other trades and similar rationale are not sufficient reasons for doing so. In cases where conduits must be installed on rooftops, de-rate conductors and modify conduit sizes as needed to accommodate this condition. Provide expansion fittings, which are UL listed and labeled for the respective applications, at all building expansion joints and at maximum distances of 100 feet. Paint all such conduits with at least two coats of UV-resistant weatherproof associated component/conductors. Provide UV-resistant weathering in color, and for otherwise-colored roof finishes that are not visible from the building interior or from the ground outdoors. Elsewhere select colors to match surrounding surfaces; submit colors to Architect for review in advance of procuring paint.

Maintain a uniform elevation for all cable runs wherever possible. All cables shall be supported/anchored at maximum 4-foot intervals and within 12" of box or outlet and shall not sag. Install cables in a manner that prevents overheating. Cables shall be fastened directly to the structure using factory clamps/cips specifically designed for the respective cable (Caddy or equal).

Provide all cutting and catching required for the admission of work. Any damage done by this contractor to the building during the progress of work shall be made good at contractor's own expense. All patching shall be done by a skilled craftsman in that respective trade. It shall be the responsibility of this contractor to supervise the installation of, and pay for all additional members, wood or metal and labor which may be required to support any type of permanent or temporary electrical apparatus employed in the execution of this contractor's work.

Access Doors: Do not use access doors unless special prior written permission is granted from the Owner's Representative. Install pull boxes, junction boxes, etc. in areas which are accessible after completion of construction. Do not install pull boxes or junction boxes above gypsum board or similar inaccessible ceiling systems. Where there is no other recourse but to provide an access door/panel, and where approval of Owner's Representative has been obtained, provide required access doors/panels as required for a complete code-compliant electrical installation as defined below. Provide access doors in fire/smoke ratings that meet or exceed the surrounding surface that is being penetrated.

Seal all new floor, ceiling, wall, slab, etc. penetrations to match or exceed existing assembly fire ratings. Provide sleeve seals for all sleeves, provide sleeves for all penetrations. All penetrations of walls or smoke-rated wall, floor ceilings, etc. shall be sealed immediately after raceways are installed. All new electrical raceway systems shall be supported directly from building structural members. New electrical raceway systems shall not be supported from ceiling work, ceiling work using ceiling supports, or from conduit support.

26 05 03.00 - SUBMITTALS FOR ELECTRICAL SYSTEMS

Submit submittals in accordance with the Contract Documents. In addition to Division 01, the Contractor is required to review and comply with the requirements articulated herein each Division and within each section of each Division.

Some Divisions may include a division-specific "Submittal Requirements for ..." section. Where this section exists, it articulates additional requirements for submittals that apply to the work of that Division. The following requirements help to identify, track and keep the project organized for all parties involved. They are necessary to ensure a timely, transparent and an appropriate technical review. Submittals that do not conform to the administrative requirements are rejected and returned, without technical review.

Supply submittals for each section: Submittals shall be supplied on a section-by-section and type-by-type basis. For example, independent product data submittals shall be furnished for each section that requires product data submittals. Independent shop drawing submittals shall be furnished for each section that requires shop drawings. Separate PDF file packages shall be supplied for each section, for each submittal type. Each PDF shall represent a single standalone submittal.

Include a transmittal. Transmittals shall enumerate each submittal for each section of each type and iteration.

Include cover sheet / title page. The cover sheet shall include the information identified in the contract documents. It shall be included as the first page of each electronic and/or hardcopy document-based submittal. An editable and printable PDF form created with editable fields and specification compliant appearance is available from KHLH upon request. It is also downloadable from the KHLH website at www.klhengrs.com.

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Include an index. The index shall enumerate the contents of the submittal.

Include checklists. Where checklists are included with the specifications, complete and include them within the appropriate submittal. Supply complete submittals: Complete submittals of each type are required. Partial submittals will be rejected. Where a section requires a product data submittal, all product data for that section shall be supplied together at one time, as one complete submittal. When resubmittal is required (e.g. Revise and Resubmit) the revised submittal shall be more complete, more accurate and more contract-compliant than its rejected predecessor. The submittal number (for each section and type) shall increment for each subsequent submittal (00 - Original submission; 01 - First Resubmission; 02 - Second Resubmission, etc.). Resubmittals shall include a copy of the reviewers comments supplied with the prior submittal rejection and shall be amended with a description of the specific action taken to comply with the reviewer's comments. The absence of this on resubmittal is cause for rejection.

Name electronic files to match the submittal ID and cover sheet: The electronic file name of submittals shall match the submittal ID included on the submittals cover page. For example, the original/first product data submittal for Section 260519 would be labeled as "260519-00-PD-00", the first resubmittal of same shall be labeled "260519-00-PD-01". The original/first shop drawings submittal file for the same section would be labeled "260519-00-SD-00", the first resubmittal of same shall be labeled "260519-00-SD-01".

If expressly permitted by the Owner and the terms of the Contract, editable electronic drawings may be made available for the creation of shop and as-built drawings upon request. Drawings will be made available at the discretion of the Engineer.

"Request Drawings" form can be accessed, filled out and submitted at http://www.klhengrs.com (right hand side of page - Contractor Resources). Direct access to this form can be found here: http://files.klhengrs.com/requestdrawings.rtf

26 05 19.00 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

Submittal Requirements: Product Data: For each type of conductor and cable.

Furnish and install all necessary cable of the size and type indicated on the drawings or specified hereinafter. All wire shall be copper. All wiring shall be new. No wire smaller than #12 AWG shall be installed unless specifically designated. Use of #14 color coded wire will be allowed for control circuits only. Provide stranded conductors for all sizes unless indicated otherwise.

Provide THHN/THWN-2 insulation for all conductors as appropriate for the locations where installed. Provide color coded insulation/jacket for phase identification. All wires shall be rated at 900 volts. Provide type XHHW-2 insulation for all wiring below grade or subject to moisture.

Unless specifically indicated otherwise on drawings, provide grounded ("neutral") conductors that are at least party-sized with corresponding phase/line conductors for all applications.

All conductors shall be rated for 90 deg. C. minimum. Provide all full length raceways in finished areas. Provide all equipment ground conductors of compatible steel fittings with integral red plastic insulated through-bushings. Cables shall be 90 deg. C. rated and all components and fittings listed for grounding and compliant with the following: UL Std. 83, ANSI E119 and E141; NFPA 70.

Cables: Route cables perpendicular and parallel to the building's architectural lines, separate from structural members, keeping cables to a minimum and following surface contours wherever possible. Maintain uniform elevation for cable runs wherever possible. Support and anchor cables at maximum 4-foot intervals and within 12" of box or outlet in a manner that prevents sagging. Install cables in a manner that prevents overheating. Fasten cables to the structure using factory clamps and clips. Fasteners shall be UL listed and labeled for the respective applications (Caddy or equal). Cables may be utilized only if code approved, and for use and in the limited applications defined below.

Type MC Cable: Cladding: Form from minimum length of spirally twisted steel, internally and zinc-coated or galvanized (inside and outside) strip steel or aluminum jacket, with strong copper conductors with 90 deg. C THHN insulation (Type THWN-2 for final connections to luminaires) that are installed in accessible tile ceiling systems (limited to 6' maximum length and limited to "whips" from building electrical system junction boxes down to luminaires). Do not install Type MC cable from fixture to raceways are installed. All new electrical raceway systems shall be supported directly from building structural members. New electrical raceway systems shall not be supported from ceiling work, ceiling work using ceiling supports, or from conduit support.

Some Divisions may include a division-specific "Submittal Requirements for ..." section. Where this section exists, it articulates additional requirements for submittals that apply to the work of that Division. The following requirements help to identify, track and keep the project organized for all parties involved. They are necessary to ensure a timely, transparent and an appropriate technical review. Submittals that do not conform to the administrative requirements are rejected and returned, without technical review.

26 05 26.00 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

All metallic conduit, surface raceways, wireways, supports, cabinet and equipment shall be grounded.

26 05 29.00 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

It shall be the responsibility of the electrical contractor to supervise the installation of and pay for all additional members, wood or metal and labor which may be required to support any type of permanent or temporary electrical apparatus employed in the execution of the electrical contractor's work. Provide supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment as required. Locations and routing that may be shown on plans are schematic and diagrammatic in nature.

Conduit shall be supported by approved straps, fasteners and hangers. Hangers shall be suspended from rods. Perforated straps will not be acceptable. Fasteners shall be lead expansion shields in block or concrete, toggle bolts in hollow walls, machine screws on metal surfaces and wood screws on wood construction. At building expansion joints and where connection is expected, conduits shall be provided with expansion fittings with bonding jumpers. Conduits passing through structural

members shall be provided with stub and coupling or sleeve in the member. Where moisture conditions are encountered, a sleeve shall be drilled at the lowest point in the conduit run. Also provide shields for all fire wall and smoke partition penetrations (sealed accordingly).

All conduit shall be supported independently from all other building systems and shall be supported directly from structural components. Electrically related work shall not be supported from ductwork, ductwork hangers, ceiling supports, existing conduit supports, etc.

Use of synthetic or plastic "tie-wraps", "zip ties", "wire ties" and similar products are not permitted as a permanent means of anchoring, securing, supporting or otherwise installing any cables, conductors, conduits, raceways, devices, equipment or other electrical work.

Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

All conduits, raceways and cables (where applicable) shall be routed parallel and perpendicular to building structural members. Any and all non-compliant work installed by the electrical contractor shall be removed and reinstated by the electrical contractor to the satisfaction of the Owner's representative and the Engineer, at the expense of the electrical contractor. At building expansion joints, where deflection is expected, provide conduits with expansion fittings with bonding jumpers.

Conduits passing through structural members shall be provided with stub and coupling or sleeve in the member. Where moisture conditions are encountered, a hole shall be drilled at the lowest point in the conduit run. Provide shields for all fire wall and smoke partition penetrations (sealed accordingly).

Stem lengths of all pendant fixtures shall be as directed by the owner's representative. All fasteners, hangers and method of hanging exposed work in finished areas shall be submitted to the owner's representative for review before installation. Fasteners shall be zinc-coated, type, grade, and class as required for a neat finished installation.

Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Install anchor bolts to elevations required for proper attachment to supported equipment. Provide female expansion anchors, and install studs and nuts after equipment is positioned. Provide bushings for floor/wall-mounted equipment anchors to allow for resilient media between anchor bolts/studs and mounting hole in concrete.

Touchup Painting: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.

Provide supports for multiple raceways capable of supporting combined weight of supported systems, equipment, connected systems and associated component/conductors. Provide adequate torsion, tension, shear, and pullout force to resist maximum loads. All installed equipment for this project, with a minimum structural safety factor of five times the applied force.

Coordinate installation of curbs, exposed supports, and penetrations.

Steel Support Systems: Comply with MFMA-4 or factory-fabricated components and assembly. Construct with 5/16" dia. holes, nominal 1/2" c. on top surface with standard factory finish, and with the all necessary fittings, brackets and match with UL-channel. Provide metallic coatings are hot-dip galvanized after fabrication and applied according to NFPA 70. Provide all equipment ground conductors of compatible steel fittings with integral red plastic insulated through-bushings. Cables shall be 90 deg. C. rated and all components and fittings listed for grounding and compliant with the following: UL Std. 83, ANSI E119 and E141; NFPA 70.

Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

Riser clamps for supporting rigid metal conduit: Galvanized steel, with 2 bolts and nuts, and 4" ears.

Clevis hangers for supporting rigid metal conduit: Galvanized steel with 1/2" dia. hole for round steel rod.

Galvanized steel clamps: 1/2" rod size.

Galvanized steel clamps: 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2".

Two-hole conduit straps for supporting 3/4" rigid metal conduit: Galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.

Offset conduit clamps for supporting rigid metal conduit: Galvanized steel.

Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armor electrical conductors or cables in resdering conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

Mechanical Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete. Anchors that are selected for capacities appropriate for supported loads and building materials in which used. Where specified on drawings as a corrosive area, expansion anchors shall be stainless steel. Provide anchors by Hill Inc. or equal.

Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 1B, complying with MFMA-4 or MSS SP-58.

Clamps for Attachments to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

Toggle Bolts: All-steel galvanized springhead type, 3/16" x 4".

Hanger Rods: Threaded steel, Galvanized steel rods; 1/2" dia min.

Clevis hangers: For supporting rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod.

Galvanized steel rod reducing couplings, 1/2" x 5/8".

Galvanized steel clamps: 1/2" rod size.

Galvanized steel clamps: 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2".

Hexagon nuts for 1/2" rod size; galvanized steel.

Lead expansion anchors, 1/2".

Minimum Hanger Rod Size for Raceway. Minimum rod size shall be 1/4 inch in diameter.

Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps, or single-bolt conduit clamps using spring friction action for retention in support channel as applicable.

Overhead Electric Work: Install work so that no raceway or cable is within six inches below roof deck(s). Support and support overhead electrical work from roof trusses and joists/stud girders only at panel points, at top cord only, unless otherwise indicated.

Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

Mounting To Wood: Fasten with lag screws or through-bolts. Provide Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2. Lumber dried to a moisture content of not more than 19 percent. Do not use marine grade products where subject to moisture conditions. Provide Simpson Strong Tie (or equal) expansion screw anchors. Location and placement of grounds, nailers, blocking, and anchorage accessories, and equipment. Select fastener sizes that will not penetrate members in opposite walls to be exposed to view or will not penetrate materials in light conditions between members. Install fasteners without staining wood members. Attach to substrates as required to support applied loads.

Attachments to Wall/Structural Members: Provide bolts and nuts through members.

Mounting To New Concrete: Provide channel-type concrete inserts and bolt to inserts, or provide expansion anchors for applications where inserts are not practical.

Mounting To Existing Concrete: Expansion anchor fasteners. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight aggregate concrete or for slabs less than 4 inches thick. Do not use for work adjacent to newly installed concrete. Only use this method where other methods cannot or should not be used, and only after receiving case-by-case permission from Owner and design professionals.

Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

Mounting To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

Mounting To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, or beam clamps

(MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, clamped to flanges of beams or on upper truss chords of bar joists.

Mounting To Light Steel: Sheet metal screws.

Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, panel junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

Fabricated metal equipment support assemblies: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

Roof Decks: Do not suspend overhead hangers, or support any other overhead electrical work, from roof decks.

Plywood Equipment Boards: Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent. Provide plywood panels, APA C-PLUGS, with 1/2" with exterior glue; thickness as indicated, or if not indicated, not less than 3/4 inches deep. Provide marine grade plywood where subject to moisture conditions. Unless otherwise noted, boards shall be painted with two coats of good grade weatherproof flat gray non-conductive fire-retardant paint on all sides and edges (prior to mounting) and plumbed in a true vertical position. Provide nominal 1/2" rustproof spacers between back of plywood and wall. Maintain at least 4 inches from bottom of plywood equipment boards and the finished floor surface. Unless directed otherwise in field, plywood equipment boards shall be 8 feet high by 3/4 inches deep by length shown on drawings (as dimensioned or as scaled) or length as required to accommodate equipment if not indicated on drawings. Provide plywood equipment boards at locations as shown on drawings. Unless directed otherwise in field, plywood equipment boards shall be provided for all surface mounted panelboards and systems "head-end" equipment for all applications where located in mechanical or electrical rooms and only where specifically shown on drawings for all other applications.

26 05 33.00 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

Complete system power feeders and branch circuits shall be installed in separate raceways from emergency system power. All wiring for different power voltages shall be installed in raceway systems separate from each other. All wiring for the various electrical systems shall be installed in raceway systems separate from each other.

All conduit installed indoors shall be galvanized steel EMT (3/4" minimum); all fittings shall be set-screw or compression type steel, with insulated throats. Unless indicated on drawings or in other parts of the electrical specifications, all wiring of all systems shall be installed in conduit.

Conduit shall be cleaned inside before any wires are pulled. Conduit ends shall be capped and plugged with standard accessories as soon as conduit has been permanently installed. Conduit installed without conductors shall be provided with sweep bends and bailing wire for pulling.

All joints shall be made tight with watertight couplings matching conduit and all corners shall be made with round radius elbows. The ends of all conduits shall be cut square and reamed and all joints brought to a shoulder. Conduit shall be continuous between outlets to make a complete installation and to provide a continuous ground. Suitable supports and fastening shall be provided for conduit.

All raceways shall be entirely free of plaster, mortar, water and other foreign matter before installing conductors or cables.

In general, gang type outlet boxes shall not be used. The outlet box locations indicated on drawings shall be considered approximate, and therefore, it shall be incumbent upon the contractor to study the general construction with relation to spaces and equipment surrounding each outlet. All outlet, switch and junction boxes shall be made of code approved steel, comply with rings and screw cover plates and located where shown and noted on drawings. Where conduit is concealed, boxes shall not be less than 4" square x 1-1/2" deep. All boxes shall be equipped with proper covers to bring flush with finished wall surface.

Where outlet boxes occur in block, cinder, or concrete walls, opening for other material boxes occur in block, cinder, or concrete walls, opening for the box shall be cut neatly and of the size that the cover plate will cover all parts of the opening. Condulets shall be used on exposed raceways. In general, junction boxes shall be constructed of #12 gauge steel with removable front fastened on with counter top head screws or other approved fasteners. For special applications, junction boxes shall be noted, details and included on the drawings and the field as required.

Prior to rough-in verify all device mounting heights and locations in field with Owner's Representative. In general, where not located at counter top, the base of boxes shall be finished floor to center of boxes shall be as follows, unless otherwise indicated on plans. In cases where device having a non-operable component higher than 48 inches above finished floor, all boxes lower as needed so that uppermost part of operable component is no higher than 48 inches.

Receptacles: 16" (unless counter height)
Telephone Outlets (Desk phones): 15"
Data Cable Outlets: 16"
Other devices: As directed in field.

26 05 53.00 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

Provide manufacturers standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide. Where applicable, install on all concealed raceways at connection to all junction boxes, pull boxes, equipment, wall/floor/ceiling penetrations, etc. Unless otherwise indicated or required by applicable regulations, provide orange tape with black letters. Provide circuit identification bands for all cables and conductors. Provide manufacturers standard color coding for cable/conductor jacket and/or insulation for all cables and conductors of all systems. Match identification with marking system used in existing systems (where applicable), shop drawings, contract documents, and similar previously established identification for projects electrical work. Provide on all conductors of all systems.

The following insulation color code shall be used for system and voltage identification. This shall apply to both feeder and branch circuit wiring. Interchange of colors shall not be permitted.

208Y/120V System: Black, Red, Blue and White (Neutral)
Equipment Grounding Systems: Green
To match existing where applicable - verify in field.

Provide engraved plastic-laminate sign on major units of electrical equipment, including panelboards, disconnects, starters, control panels, etc. Except as otherwise indicated, provide single line of text, 1/2" high lettering, on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Unless determined otherwise in field, provide text matching terminology and numbering of the contract documents and shop drawings. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

All equipment and system identification nomenclature shown on drawings or listed herein is shown for general design and installation reference only. The actual nomenclature, etc. nomenclature for this project shall be verified by electrical contractor in field prior to fabrication and where applicable, shall be an extension of existing nomenclature used on the site as determined in field by electrical contractor.

Equipment to Be Labeled: All enclosures for all electrical equipment furnished or installed under Divisions 26 and 28; Remote-controlled switches, dimmer modules, and control devices, via engraved wall plates; Miscellaneous Control Stations, Access Doors and panels for controlled electrical work; Other smaller equipment as designated by owner's representative, architect or engineer in field.

26 05 84.00 - MECHANICAL EQUIPMENT

Provide all necessary electrically related work as required to render all mechanical equipment (including plumbing, heating, ventilating and air conditioning equipment) fully operational and fully compliant with all local and national codes. This includes, prior to ordering materials or commencing with rough-in, reviewing equipment submittal data and coordinating with installing contractors to ensure the correct size, rating and quantity of conductors are provided.

Locations of equipment and devices are shown only for schematic indication of wiring requirements.

Refer to all contract documents for additional electrical requirements and concerns, and for further representation of this work.

Provide raceway, wiring, connections, and terminations for power and interlocks for electrically operated equipment.

Provide disconnect switch ahead of all equipment, including controls, and provide the mechanical equipment comes with integral disconnect(s) that are compliant with NFPA 70. Provide NEMA 3R enclosures where installed outdoors and where installed indoors in areas subject to moisture. Ground metal frames of equipment by connecting frames to the grounded metal raceway and to a full size green ground conductor or both. Provide the necessary electrical connections between the specified equipment and the junction box near equipment with flexible metallic conduit (indoor/outdoor) and matched connectors (see Section 26 05 33). Where mechanical equipment lugs cannot accommodate conductor sizes shown on drawings, provide ILSCO Clear-Tap Insulated Multi-Tap Connectors.

Labels: Provide labels for all electrical equipment and wiring shown on drawings and on the respective equipment design base manufacturers. If different manufacturer(s) or model(s) are supplied, provide necessary coordination in field (prior to ordering materials and prior to rough-in) and provide the necessary size of related electrical equipment, wiring, conduit, etc.

Prior to furnishing submittals and prior to rough-in, determine exact electrically related characteristics, loads, voltages, disconnect and starter