DIVISION 26 - ELECTRICAL SPECIFICATION

26 05 01.00 - COMMON REQUIREMENTS FOR ELECTRIC

General Requirements:

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. Fed dimensions are reasonably accurate and should govern in setting out work. 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, reinstall, 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 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 from inspection authority shall be given to the Owner before final 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-contractors 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 representatives 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 readjusted 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 conditions. 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.

Obtain the latest The North Face Design and Construction Standards document(s) from the Owner. Comply with all Owner-specific requirements in addition to requirements set forth in these specifications and accompanying drawings. Should there be a conflict, the Owner's standards shall take precedence, unless prevailing codes and regulations mandate otherwise.

Record Drawings and Operating Instructions and Service Manual:

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 job at a 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. (UL), or a similar credible testing agency, label where regularly supplied. Certain manufacturers of material and equipment are specified and plans are detailed according to this material. This contractor shall base his bid on furnishing and installing this make of material and equipment.

Where more than one make of material or equipment is specified, the contractor shall state in his bid which make he proposes to furnish. Shop drawings shall be submitted on material and equipment to be furnished by the contractor for Engineers approval. This approval to be obtained prior to shipment of equipment.

Hold routing of new raceways in new and existing buildings as tightly as possible to the structure above. Obtain approval of owner's representative prior to installation. Do not install any electrical work within 6 inches of roof decking.

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 tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice 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/clips 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 per NFPA 70 to offset voltage drop as/if 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 splicers shall be Scotchlock insulated type, TandB 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 installment of devices or luminaires. Friction and rubber tape conform to Federal Specifications HH-T-11 and HH-T-101. Plastic electrical tape shall be Scotch #33+ or approved equal.

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

Provide grounding electrode conductors per NFPA 70 for service entrances and derived systems.

Provide all feeders and branch circuits with insulated (green covering) equipment grounding conductors per NFPA 70.

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 per NFPA 70. 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 paint. Provide white paint on flat rooftops that have finishes white 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 purchasing 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/clips specifically designed for the respective cable (Caddy or equal).

Only where installed for non-utility circuits; all wiring for emergency system feeders and receptacle branch circuits shall be in conduit (EMT), no exceptions.

This contractor shall provide all cutting and patching required for the admission of his work. Any damage done by this contractor to the building during the progress of his work shall be made good at his 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 contractors work.

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 fire-rated or smoke-rated wall, floors ceilings, etc. shall be sealed immediately after raceways are installed. All new electrically related work shall be supported directly from building structural members. New electrically related work shall not be supported from ductwork, ductwork hanger, ceiling supports, existing conduit support, etc.

26 05 03.00 - SUBMITTALS FOR ELECTRICAL SYSTEMS

General:

Provide submittals in accordance with the Contract Documents. In addition to Division 01, the Contractor is advised to review and comply with the requirements articulated within each Division and within each section of that 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 turnaround and an appropriate technical review. Submittals that do not conform to the administrative requirements are rejected and returned, without technical review.

Submittal Requirements:

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 KLH upon request. It is also downloadable from the KLH website at www.klhengrs.com.

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".

Use of Electronic Drawings from the Owner's Design Team:

Plan drawings for the project were created with Revit.

Revit files are not available. If expressly permitted by the Owner and the terms of the Contract, editable electronic versions of published two-dimensional plan drawings may be made available for the creation of shop and as-built drawings for a nominal surcharge by sheet series for projects that were designed in Revit and must be converted to an AutoCAD or Navisworks format.

Due to the proprietary nature of internal design systems, editable native-software versions of some drawings, including but not limited to system diagrams and details will not be made available in an editable form. In these cases, electronic versions of the drawings may be made available only in PDF, JPG or similar non-editable electronic form, at the sole discretion of the Design Professional.

The Request Drawings form can be accessed, filled out and submitted at the following internet address (scroll down to bottom of home page): http://www.klhengrs.com.

26 05 05.00 - EXISTING CONDITIONS

General Requirements:

It is not the intent of electrical documents that existing conditions be accurately shown. Existing electrical work is shown to a very limited extent on drawings and is shown for general planning reference only. Locations and information were derived from cursory visual observations or from portions of documents that were prepared for previously installed work (not from record drawings or "as-builts").

Perform a detailed pre-bid walk-through field inspection to review the existing structures and premises, to accurately determine existing conditions, and to determine scope of required electrically related work. Include applicable accessible ceiling cavity areas in this inspection.

Minimize risks to individuals and property throughout the duration of the project. Coordinate with and obtain approval from the Owner and Design Professional for all materials, methods, steps, locations, installations, etc. prior to commencement of work. Determine and employ means and methods as required to safely and securely implement all related work.

Do not reuse removed electrical materials unless specifically indicated in project documents. Existing wiring systems may be utilized only to the extent indicated in project documents, or as directed by Owner's representative in field.

Determine which existing branch circuits must remain active. Reconnect (or maintain in operation where applicable) and schedule them. Completely re-type panelboard directories for panelboards affected by this project using accurate "as-built" information. Where applicable ensure that reconnected shared neutrals are properly balanced with the correct phase conductors. Where applicable, provide correct color-coding for installation of reconnected conductors in a manner compliant with NFPA 70.

If required to accommodate construction related activities temporarily remove, store in protected location on site, and reinstall conflicting electrical equipment, luminaires, or devices that are to remain or to be relocated. The following applies to electrical materials that will remain or be reused under this project: Protect during construction activities; Clean and re-lamp luminaires immediately prior to occupancy of the finished construction area; Clean and service (if service is required) equipment in the construction area immediately prior to occupancy of the area.

Provide and maintain temporary partitions and dust barriers adequate to prevent the spread of dust and dirt to adjacent finished areas and other system components. Protect adjacent installations during cutting and patching operations. Remove protection and barriers after demolition operations are complete. Prevent airborne dust and particulate matter resulting from electrical work from entering occupied spaces, and from entering air intakes to operating HVAC systems. Make required electrical openings through walls and floors immediately prior to installation of work. Properly and permanently seal electrical openings immediately after installation of work. Provide temporary seals for applications where penetrations are made but cannot be permanently sealed within four hours. Meet with HVAC installer to determine special IAQ requirements related to electrical that may apply to this project. Cooperate fully with HVAC IAQ requirements that affect electrical work and are affected by electrical work.

Inspect existing electrical work in areas accessed under this project and bring into compliance with NFPA 70. This applies only to the extent that such work is uncovered in the immediate project areas affected by construction activities, and only to the limited extent that it applies to pre-existing general installation methods such as missing junction box plate, open junction box knockout, minor conduit re-anchoring and minor exposed wiring/connections. If more extensive code or safety violations are discovered, immediately bring them to the attention of the Owner's representative (detailed in writing) along with proposed cost for corrections and impact (if any) on the construction schedule.

Power Continuity Requirements:

The following notes broadly define some of the specialty base bid scope of work required to provide special temporary power for new and existing facilities to accommodate utility power interruptions. Field verify all specifics and provide materials, normal time labor, premium time labor, services, etc. for all work under base bid, including but not limited to the following.

Locate, identify, and protect electrical services passing through demolition areas and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, provide temporary services for affected areas. It is recognized that there may be some conduit systems rendered inactive by demolition, causing disconnection of "downstream" outlets, etc. Investigate these types of conditions (for all systems) prior to demolition. Provide necessary corrective electrical work prior to demolition to ensure that such "downstream" devices remain permanently active throughout demolition, during new construction, and after project completion.

Provide work in a manner that ensures existing systems and components remain fully operational in occupied spaces during occupied periods. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner's representative. Provide temporary service during interruptions to existing facilities. Schedule momentary outages when necessary for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove related wiring that has been abandoned.

Carefully coordinate work and system shutdowns in advance with Owner's representative, and with affected trades so that normal building activities and other construction trades are minimally affected. Perform electrically related construction work, which will affect an occupied area (including those which are located outside the immediate area of project work) at special times as directed by Owner's representative in field.

During construction related electrical outages, switchovers, disconnections, reconnections, etc. provide all temporary insulated conductors, taps, jumpers, etc. to and from existing and new or temporary electrical equipment, including but not limited to, conductors, splices, lug fittings, rework, premium time, security and safety measures, etc. Schedule all outages in advance with Owner, at days of week and times of day or night as directed by Owner, as necessary to accommodate all construction related electrical outages, switchovers and related connections and disconnections.

Interim Life Safety Work:

Provide interim electrical fire alarm and life safety protection in demolition and construction areas as indicated below. Contact Design Professional if further definition is needed. Remove all temporary life safety work when no longer needed.

Provide temporary UL 924 compliant exit and egress lighting along egress routes affected by this project. Remove this work when no longer needed.

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

General:

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 600 volts. Provide type XHHW-2 insulation for all wiring below grade or subject to moisture.

Provide the following minimum wire sizes based on distances from panel to first device of a 15 or 20 ampere general lighting or receptacle branch circuit. In addition to upsizing conductors as required for voltage drop, provide minimum #10 AWG conductors to the last device for branch circuits more than 150 feet in length.

Distance	AWG Wire Sizes
Up to 60 feet	#12
61 to 90 feet	#10
91 to 150 feet	# 8
151 to 240 feet	# 6

Provide the following minimum AWG conductor sizes for general branch circuiting grounds that are not indicated on drawings, based on using copper conductors. Where applicable increase as required to accommodate voltage drop and to accommodate special conditions. Do not derate any grounded (neutral) conductors. Temperature ratings listed below pertain to both wire and terminations.

Source Breaker/Fuse	60 Deg. C Rating AWG Wire Size	Equipment Grounding AWG Wire Size
15 Ampere	#12	#12
20 Ampere	#12	#12
25 Ampere	#10	#10
30 Ampere	#10	#10
35 Ampere	# 8	#10
40 Ampere	# 8	#10
45 Ampere	# 6	#10
50 Ampere	# 6	#10
60 Ampere	# 4	#10
70 Ampere	# 4	#8
80 Ampere	# 3	#8
90 Ampere	# 2	#8
100 Ampere	# 1	#8

All conductors shall be rated for 90 deg. C. minimum. Provide with full parity sized green insulated equipment ground conductor. Provide compatible steel fittings with integral red plastic insulated throat bushings, compliant with NFPA 70, article 330. Cables shall be 90 deg. C. rated with all components and fittings listed for grounding and compliant with the following: UL Std.4 and UL Std. 83; ANSI E119 and E814; NFPA 70, Articles 250 and 330.

, with stranded copper conductors with 90 deg. C THHN insulation system .

Route cables perpendicular and parallel to the building architectural lines, surfaces and structural members, keeping offsets to a minimum and following surface contours where possible. Maintain a 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 directly to the structure using factory clamps and clips (tie-wraps, ties and like products are not permitted) specifically designed for the respective cable (Caddy or equal). Type MC Cable may be used only if NEC and AHJ (Authority/Authorities Having Jurisdiction) approved for the intended use and in the listed applications defined below.

Provide for final connections to luminaires that are installed in accessible ceiling systems (limited to 6' maximum in length and limited to "whips" from building electrical system junction boxes down to luminaires). Do not install Type MC cable from fixture to fixture unless a special properly listed and labeled UL approved system is specifically indicated.

Provide for new 15 through 30 ampere branch circuit work. This applies only under all of the following circumstances and conditions: Provide only where concealed (Install wiring for exposed applications in raceway).

26 05 26.00 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

All metallic conduit, surface raceways, wireways, supports, cabinet and equipment shall be grounded in accordance with the latest adopted issue of the NFPA 70.

26 05 29.00 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

General:

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. Layout and install all electrical work in strict compliance with Chapter 1, Part B, Section 110.26 of the latest adopted edition of NFPA 70. 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 deflection 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 hole shall be drilled at the lowest point in the conduit run. Also provide sleeves 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 noncompliant work installed by the electrical contractor shall be removed and reinstalled 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 and 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 sleeves 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 components/contents. Provide supports adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

Coordinate installation of roof curbs, equipment supports, and roof penetrations.

Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly. Construct with 9/16" dia. holes, nominal 2" o.c. on top surface, with standard factory finish, and with the all necessary fittings which mate and match with U-channel. Provide metallic coatings that are hot-dip galvanized after fabrication and applied according to MFMA-4. Provide channel dimensions that are selected for applicable load criteria. Comply with NECA 1 and NECA 101 unless requirements in this or other specification sections are stricter.

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-armored electrical conductors or cables in riser 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.

Mounting, Anchoring, and Attachment Components:

Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout 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 Hilti Inc. or equal.

Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

Clamps for Attachment 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 coupling 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".

Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70 as a minimum. 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 30 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.
Install work so that no raceway or cable is within six inches below roof deck(s). Suspend and support overhead electrical work from roof trusses and joists/joist 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 and Anchorage of Surface-Mounted Equipment and Components:

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 WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. 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 marine grade products where subject to moisture conditions. Provide Simpson Strong Tie (or equal) expansion screw anchors. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members. Attach to substrates as required to support applied loads.

Attachments to Wood Structural Members: Provide bolts installed through members.

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

To Existing Concrete: Expansion anchor fasteners. Instead of expansion anchors, powder/gas-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 anchored 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.

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

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.

To Light Steel: Sheet metal screws.

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

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-D PLUGGED INT, 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.

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