16010 - ELECTRICAL GENERAL REQUIREMENTS

1.1 SCOPE:

a. Applicable requirements of the General Conditions of the Contract, Amendments, Supplementary General Conditions, and Special Conditions govern work under this Division.

b. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 RECORD DRAWINGS:

a. During construction of this project, the Contractor shall maintain one complete set of electrical contract drawings, on which shall be recorded all significant changes. This set of drawings shall be used for no other purpose. Upon completion of the work, the Contractor shall submit these drawings to the Architect/Engineer for approval and presentation to the Owner.

1.3 REGULATIONS AND COMPLIANCE:

a. The requirements of the NORTH CAROLINA Building Code which includes the National Electrical Code, and of all other State and Local codes, ordinances, regulations and interpretations by authorities having jurisdiction are binding upon this Contractor, and nothing contained in, or inferred by, those specifications or the applicable drawings may be construed as waiving those requirements. The latest edition of the National Electrical Code, referred to herein and on the drawings as "N.E.C.", forms a part of these specifications; and under no circumstances may the installation fail to meet the minimum requirements therein.

A. All materials and equipment shall bear the approval label, and shall be listed by the Underwriters' Laboratories, Inc.

2.1 GENERAL:

a. Except where reuse of existing items are specifically indicated or permitted, all materials and equipment shall be new and shall conform with the standards of the National Electrical Manufacturer's Association and Underwriters' Laboratories, Inc. In every instance where such a standard has been established for the item involved.

b. It is the intention of these specifications and drawings to call for finished work, tested and ready for operation. Whenever the work "provide" is used, it shall mean "furnish and install complete and ready for use".

3.1 COORDINATION:

a. This Contractor coordinate the work of all subs and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

b. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

3.4 PROTECTION AND CLEAN-UP:

a. Protect all material and work from damage during construction. Equipment installed in the building prior to its being closed in and dried out shall be protected from the elements in the same manner as previously specified for stored materials. Protect finished surfaces from splattering of mortar, paint, dirt, plaster, etc.. Do not install device plates, face plates, canopies, flush cabinet trims, or fixtures on walls or ceilings until after painting or cleaning of the surface has been completed, and arrange for such items that are required to be field painted to be painted before being mounted. Repair, clean and touch-up, or replace, all damaged material. At the completion of the project, remove all dust from finished surfaces, including lighting fixtures, lenses and lamps.

b. The Contractor shall keep premises free of debris resulting from his work.

3.5 PAINTING AND FINISHING:

a. Suitable finishes shall be provided on all items of electrical equipment and materials which are exposed. This shall consist of either an acceptable finish as manufactured and supplied to the job or application of suitable finishes after installation.

b. Where installed in finished areas, exposed equipment and materials shall be supplied with prime coat, and shall be professionally painted or enameled as directed to match or blend with adjacent surfaces.

c. In unfinished areas such as equipment rooms, exposed equipment shall be furnished with suitable factory applied finishes (e.g. standard gray enamel finish for panelboards, etc.).

16030-EQUIPMENT CONNECTIONS AND COORDINATION

1.1 SCOPE:

a. The connection of all equipment provided under any Division of these specifications or by the owner requiring electrical connection shall be provided as part of this Division, unless otherwise indicated or specified. Special outlets, where indicated, are considered to be electrical connection to the equipment.

b. Drawings indicate approximate equipment capacity (including motor horsepower) and approximate location of connection. It is the responsibility of this Contractor to determine the exact characteristics of equipment actually being supplied; and to provide proper branch circuit connections, conductors protection, and grounding.

2.1 GENERAL:

a. Heating, Ventilating, Air Conditioning, Refrigeration and Plumbing Equipment: Unless otherwise indicated, provide all power wiring, including feeders and branch circuits, to the terminals of the equipment, including mounting of motor starters; feeder and branch circuit over-current protection; disconnecting means within sight of each motor and each starter, whether or not specifically indicated on drawings.

b. Individually mounted motor starters: Unless otherwise indicated, individually mounted motor starters will be furnished as part of the Division furnishing the driven equipment. Unless otherwise indicated, remote control wiring for Heating, Ventilating, Air Conditioning, and Plumbing equipment will be provided as part of those respective Divisions.

16100-BASIC MATERIALS AND METHODS

1.1 WIRING METHOD:

a. Unless otherwise indicated or specified, the Wiring Method for this project shall consist of copper conductors with 600 volt insulation installed in metal raceways.

b. The word "Raceway" and the word "Conduit" (or abbreviation "C") used herein or on the drawings include Rigid Metal Conduit, and where permitted, Intermediate Metal Conduit, Electrical Metallic Tubing, Flexible Metal Conduit or Liquidtight Flexible Metal Conduit.

c. Reference to "Rigid Conduit" or "RMC" indicates heavy-wall Rigid Metal Conduit only.

d. Reference to "IMC" indicates Intermediate Metal Conduit.

e. Reference to "EMT" or "Tubing" indicates Electrical Metallic Tubing.

f. Reference to "Flex" or "Flexible Conduit" indicates Flexible Metal Conduit or, where required, Liquidtight Flexible Metal Conduit.

1.2 FASTENING METHODS:

a. Acceptable fastening methods include wood screws and nails on wood construction, toggle bolts on hollow masonry, expansion bolts and lead anchors in brick and concrete, and machine screws on metal surfaces.

b. Explosive fasteners may be used in steel and concrete in accordance with the manufacturer's recommendations.

c. Wire-inserted metal strips, and wooden plugs are not acceptable as fastening material.

d. Materials used shall be good quality, made of zinc or cadmium coated steel or other non-corroding material.

e. Materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher, and shall be in full compliance with the seismic protection requirements of the N.C. State Building Code.

f. Fixtures, raceways, and equipment shall be supported from the structure. Nothing may be supported on suspended ceiling unless definitely noted so on the Drawings or specifically permitted by the Architect/Engineer.

g. Equipment and raceways attached to outside walls, or interior walls subject to permanent moisture, shall be shimmed out with non-corrodible material so as to provide 1/4" air space between wall and equipment or raceway.

1.3 NAMEPLATES:

a. Suitable nameplates shall be provided for the identification of electrical equipment.

b. Nameplates shall be of engraved white core plastic laminate, not less than 1/16" thick. For 120/208 volt systems, nameplates shall have white letters on black backgrounds.

c. Engraving shall be of professional quality, with block style letters, minimum 1/4" high.

d. Nameplates shall be attached with sheet metal screws. They shall be sized to allow for installation of screws without obscuring text.

16110-RACEWAYS AND FITTINGS

1.1 MATERIALS AND APPLICATIONS:

a. Rigid Metal Conduit shall be zinc coated steel or alloy 6063-T42 aluminum with threaded couplings and fittings. Termination at sheet metal enclosures shall consist of double locknuts and insulating bushings. Rigid Steel conduit shall be used for all exposed and concealed work except where other raceways are indicated or permitted. Aluminum conduit complete with aluminum fittings may be used in lieu of steel conduit except in wet locations, underground, or in poured concrete. Steel and aluminum shall not be mixed in the same run of conduit.

b. Intermediate Metal Conduit (IMC) with threaded couplings and fittings may be used for exposed and concealed work in lieu of rigid metal conduit except underground outside the building foundation, or where supporting lighting fixtures, or in hazardous locations, or where exposed to severe impact or injury. Termination at sheet metal enclosures shall consist of double locknuts and insulating bushings.

c. Electrical Metallic Tubing (EMT) of 2" maximum size may be used for concealed work in lieu of Rigid Metal Conduit except underground or in poured concrete. EMT of 2" maximum size may be used for exposed work in lieu of Rigid Metal Conduit except outdoors, or above a roof, or where supporting lighting fixtures, or where exposed to severe impact or injury, or in hazardous locations, or less than 10 feet above a floor or platform in other than in electrical, mechanical, or communications closets or equipment rooms.

d. Flexible Metal Conduit shall be of zinc coated steel of minimum length, and shall be used in lieu of Rigid Metal Conduit for connections to moving or vibrating apparatus, recessed lighting fixtures, dry-type transformers, and motors. Flexible Metal Conduit may be used where rigid connections are impractical due to obstructions or space limitations. Flexible Metal Conduit used in wet, damp, or corrosive location shall be PVC jacketed liquid-tight complete with liquid-tight connectors.

e. Fittings for steel conduit and tubing shall be of zinc coated steel or malleable iron. Insulating bushings of plastic provided for Rigid and Intermediate Metal Conduits shall be rated for 150oC. Bonding bushings shall be steel or malleable iron with non-removable plastic throats rated 150oC. EMT fittings shall be of the compression type. Set-screw, indentor, pressure cast, and die cast fittings are not acceptable. Connectors for EMT, Flexible Metal Conduit and Liquid-tight Flexible Metal Conduit shall be the insulated throat type. Connectors for Flexible Metal Conduits shall be of the "Tite-Bite" design.

f. Conduit expansion fittings shall be of zinc coated cast or malleable iron and steel conduit, complete with flexible bonding straps. Expansion fittings shall allow longitudinal conduit movement of 4 inches.

g. Minimum raceway size shall be 1/2". Other raceway sizes, unless indicated on the drawings, shall be determined by the Contractor in accordance with NEC requirements for type THW insulated conductors, or the actual insulation used if it is thicker than type THW.

2.1 INSTALLATION:

a. Rigid and Intermediate Metal Conduits shall be made up with full threads, to which a conducting compound (O & B Kopr-Shield or equal) has been applied, and butted in coupling. Terminations at sheet metal enclosures in industrial locations shall be made with double locknuts and an insulating bushing. Terminations at sheet metal enclosures in outdoor, damp, and wet locations shall be made with threaded conduit hubs of zinc coated malleable iron.

b. Conduits shall be rigidly supported not more than 8 feet on center and shall be concealed within walls, ceilings, and floors, except as indicated or specifically approved by the Architect/Engineer; kept at least 6" from flues and steam or hot water pipes; and protected against the entry of dirt, plaster, or trash. Raceways shall be supported independently of the suspended ceiling members and suspension wires.

c. Suspended EMT shall be provided with additional supports at elbows, bends, and where necessary to avoid strain at couplings and connectors.

d. Exposed conduits, where permitted, shall be run parallel or perpendicular to walls, structural members and ceilings; with right-angle turns consisting of symmetrical bends or cast metal fittings with threaded hubs. Hubs may be used where necessary provided that they are of minimum length.

e. Conduits crossing expansion and contraction joints shall cross perpendicular to the joint and shall be provided with expansion fittings. Conduits shall not be embedded in the concrete slabs at the expansion and contraction joints.

16120-CONDUCTORS

1.1 MATERIALS:

a. Unless otherwise indicated, wire and cable conductors shall be copper.

b. Conductors shall be not smaller than #12 AWG except that #10 AWG minimum is required for the entire length of 120 volt branch circuits whose length, to the center of the load exceeds 75 feet. #14 AWG may be used for signal and remote control circuits. #16 AWG may be used for taps to fluorescent recessed lighting fixtures on circuits protected by over-current devices rated at 20 amperes or less and contained within flexible metal conduits that do not exceed 6 feet in length. Other conductors smaller than #14 AWG may be used only where specifically indicated on the drawings or specified herein.

c. Conductors #10 AWG and smaller shall be solid, dual rated type THWN/THHN.

d. Conductors #6 AWG and larger shall be stranded, dual rated type THWN/THHN.

e. Each conductor shall bear easily readable markings along entire length, indicating size and insulation type.

f. Insulation on conductors #10 AWG and smaller shall be suitably colored in manufacture.

g. Conductors in any location subject to abnormal temperature shall be furnished with an insulation type suitable for temperature encountered.

h. Where no indication is made of wire size, the conductor shall be of N.E.C. size to match its overcurrent protective device, but in no case smaller than #12 AWG.

2.1 SPLICES, TAPS, AND CONNECTIONS:

a. Splices in conductors #10 AWG and smaller shall be made with twist-on spring steel devices UL listed as Pressure Cable Connectors, with integral insulating covers rated 75oC. at 600 volts.

b. Splices in copper conductors #8 AWG and larger shall be made with mechanical devices UL listed as Pressure Cable Connectors and insulated with thermoplastic tape UL listed for use as sole insulation. Tape may be omitted from connectors supplied with securely fastened insulating covers which completely enclose the connector and the conductors. Insulating covers shall be rated 75oC at 600 volts.

2.2 COLOR CODING:

a. All wiring shall be color coded.

b. On 120/208V, 3 phase, 4 wire power systems, conductors shall be color coded Black (Phase A), Red (Phase B), Blue (Phase C), and White (Neutral). On 277/480V, 3 phase, 4 wire systems, conductors shall be color coded Brown (Phase A), Orange (Phase B), Yellow (Phase C), and Gray (Neutral).

c. Conductors #8 AWG and larger may be identified with two or more bands of proper color plastic tape applied near each splice and termination. Painting of wire will not be acceptable.

d. Phase sequence shall be "A", "B" and "C" from left to right, top to bottom or front to back when facing equipment.

2.3 BRANCH CIRCUIT RACEWAY WIRING:

a. Three-phase circuits shall be limited to one such circuit per raceway. They shall consist of three different phase wires, and a neutral where required.

b. A neutral shall not serve more than one circuit. The neutral carrying all or any part of the current of any specific load shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current.

c. Circuits shall be connected to panels as shown in the panel schedules.

d. Under the above requirements and with required color coding system no raceway shall contain more than one wire of the same color, except for switch legs and control conduits.

e. Conductors supplying lighting outlets may be combined in the same raceways with conductors supplying receptacles; but lighting outlets and receptacle outlets shall not be connected to the same circuits unless specifically indicated on the drawings.

2.4 FEEDER CONDUCTORS:

a. Unless specifically shown otherwise, each set of feeder conductors shall be installed in a separate raceway.

b. Where paralleling of conductors is shown for feeders, it is absolutely required they be exactly the same length between terminations.

c. Where feeder conductors are so installed that the conductor markings cannot be read without disturbing the installation, two wires of each phase they shall be provided with suitable tags indicating the conductor size and insulation.

16122-METAL-CLAD CABLE SYSTEMS

1.1 SCOPE:

a. Furnish and install a complete system of Metal-Clad Cables for branch circuit, signal, and remote control wiring as specified herein. Comply with Section 16100 BASIC MATERIALS AND METHODS.

b. Types AC cable is not permitted.

1.2 APPLICATION:

a. Metal-Clad Cables may be used in lieu of wire in metal raceway only for concealed work in dry locations above suspended ceilings and within stud partitions.

b. Cables may not be run in or through concrete or masonry, fire-rated partitions, smoke partitions, or floors.

1.3 SUBMITTALS:

a. Submit for approval manufacturer's data sheets for metal-clad cable systems.

2.1 MATERIALS:

a. Metal-Clad Cables shall be UL listed as type MC with copper conductors, THHN insulated; with full size green insulated grounding conductors. Minimum sizes shall be #12 AWG for branch circuits, #14 AWG for signal and remote control. Maximum size shall be #10 AWG.

b. Cable connectors shall be UL listed for grounding the metal sheath. Connectors shall be of steel or malleable iron with insulated throats.

c. Cables shall be color-coded in manufacture. Color-code shall comply with Section 16120 CONDUCTORS.

3.1 INSTALLATION:

a. Cables shall not be run exposed. Conduit skirts may be provided on surface mounted panelboards to conceal cables between panel tops and ceilings.

b. Except where installed in continuous rows, lighting fixtures shall be individually connected to a concealed outlet box. Cables may not be looped from fixture to fixture.

c. Cables above ceilings shall be supported from overhead structure clear of ductwork, suspended ceilings, and ceiling hanger wires.

16130-GROUNDING AND BONDING

1.1 SCOPE:

a. The neutral of each separately derived system, and all non-current-carrying metal parts, raceways, and enclosures shall be permanently and effectively grounded.

b. Grounding and bonding shall be provided in strict accordance with the National Electrical Code, and as specified herein and on the drawings.

c. The Contractor shall note that required grounding conductors and connections are not all shown on the drawings. NEC requirements apply.

2.1 MATERIALS AND APPLICATIONS:

a. Grounding conductors shall be of THWN insulated copper, unless otherwise indicated.

b. Grounding bus bars in distribution equipment shall be bare copper.

c. Clamps for attaching conductors to water pipes and ground rods shall be of bronze. Ground rod clamps shall be U.L. listed for direct burial.

d. Clamps for attaching conductors to building steel shall be of steel, bronze, or malleable iron.

e. Threaded hubs for bonding metal raceways to the contained grounding electrode conductors and to the water pipe clamps shall be of bronze or malleable iron. Similar hubs shall be used to bond the same raceways to the conductors and to sheet metal equipment enclosures.

f. Driven grounding electrodes shall consist of copper clad steel rods. Rods shall be 8 feet long and 5/8" diameter unless otherwise indicated.

g. Bonding bushings shall be of steel or malleable iron with non-removable plastic throats rated 150oC.

h. Bonding locknuts and wedges for service conduits shall be of zinc coated steel.

3.1 EQUIPMENT GROUNDING:

a. All non-current-carrying metal parts, raceways, and enclosures of the electrical system and of equipment supplied through the electrical system shall be permanently and effectively grounded.

b. Equipment grounding conductors shall be provided for each feeder and for each branch circuit and shall be contained within the same raceways as the feeder and branch circuit conductors. The equipment grounding conductor shall be THWN insulated copper, not smaller than #12 AWG.

c. Copper bonding strips normally included in small sizes of liquid-tight flexible metal conduit and dependent upon the terminal connectors for bonding continuity will not be accepted in lieu of the equipment grounding conductors specified herein.

d. Where metal raceways enter sheet metal enclosures through knockouts provide bonding bushings and jumpers to the enclosure under any of the following conditions:

1. Branch circuit conduit exceeds 1" in size.

2. Feeder conduit regardless of size.

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MSWG PROJECT #20-027

NORTH CAROLINA REGISTERED 12490 PROFESSIONAL ENGINEER MARK P. ARRINGTON

08-07-2020

Drawn	MDK
Checked	MPA
Date	August 7, 2020
Revisions	

Brown Hall Renovation

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SCO ID No. 20-22082-01A

Project Number 106

Title
Specifications

Sheet
E500

Plans of