SECTION 16050 - ELECTRICAL GENERAL

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
1. Provide all materials, tools, and labor for a complete electrical installation as shown on the contract documents and indicated in the specifications
2. Procure all permits and licenses
3. Coordinate the electrical installation with the following:
   a. Architect
   b. Contractors of other trades
   c. Local Electrical and Building Inspectors, or the authority having jurisdiction
   d. Local Utility companies serving the project

B. Related Documents:
1. Electrical, "E-", drawings
2. All working drawings included in the contract documents
3. Specifications of the following divisions/sections:
   a. Division 1: General Requirements
   b. Division 3: Concrete
   c. Section 07840: Fire stopping
   d. Division 11: Equipment
   e. Division 15: Mechanical

1.2 ABBREVIATIONS:

A. The following abbreviations are used throughout Division 16 specifications:
1. AFF: Above Finished Floor
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing and Materials
4. HVAC: Heating, Ventilating and Air Conditioning
5. IEEE: Institute of Electrical and Electronic Engineers
6. IES: Illuminating Engineering Society
7. ITL: Independent Testing Laboratories
8. NEC: National Electrical Code
9. NECA: National Electrical Contractor Association
10. NEMA: National Electrical Manufacturers Association
11. NFPA: National Fire Protection Association
12. NIC: Not in contract
13. UL: Underwriters Laboratories, Inc.
14. WP: Weatherproof
15. ADA: Americans with Disabilities Act

1.3 DEFINITIONS:

A. "Provide" means to furnish and install, complete with all accessories so that component is functional

1.4 CODES AND STANDARDS:

A. Comply with the following codes and published standards which are applicable to the electrical installation of this project:
1. NFPA 70 - National Electrical Code, latest applicable edition with Georgia Amendments
2. International Fire Code, latest applicable edition with Georgia Amendments
3. International Building Code, latest applicable edition with Georgia Amendments
4. Underwriters Laboratories Electrical Construction Directory ("green book")
5. Underwriters Laboratories Electrical General Information ("white book")
6. NFPA 72, latest applicable edition
7. Georgia Accessibility Code
8. Americans with Disabilities Act

1.5 STANDARDS FOR MATERIALS AND WORKMANSHIP:

A. Use material that are new and, where UL or ITL has established standards, listed and/or labeled
B. Organize and execute work so that finished appearance is neat; mechanical, plumb when vertical and level when horizontal.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Provide equipment, products and materials shown on the drawings, as specified in the specifications or added by addendum.

2.2 SUBSTITUTION OF MATERIALS:

A. Refer to Contract Conditions.

2.3 CONCRETE:

A. Refer to Division 3 specifications.

2.4 PLYWOOD BACKBOARDS:

A. ¾" x size indicated on the drawings, A/D grade, paint two coats gray enamel.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS:

A. Cover fixtures, equipment and apparatus for protection against dirt, water, chemical or mechanical damage before and during construction.
B. Keep all conduit and other openings protected against entry of foreign matter.
C. Restore the original finish, including chop coat, of fixtures, apparatus or equipment that has been damaged prior to substantial completion.

3.2 COORDINATION:

A. Prior to rough-in of any materials, coordinate with subcontractors the physical clearances for and sequencing of Division 16 work as it interfaces with and relates to architectural, structural, plumbing and HVAC systems.

3.3 OPERATIONAL TEST

A. At the time of the substantial completion job observation, perform a test of all light fixtures, electrical systems, equipment, machinery and appliances, in the presence of the Architect or his representative, which demonstrates that all of Division 16 systems are operational.

3.4 OWNER INSTRUCTION AND ASSISTANCE:

A. At substantial job completion job observation, instruct the Owner's operating personnel in the operation, sequencing, maintenance, and safety/emergency provisions of the electrical systems.

3.5 AS-BUILT DRAWINGS:

A. Record on one set of electrical drawings all changes, deviations and underground conduits.
Deliver same to architect as per Division 1.

END OF SECTION 16050

SECTION 16450 - GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
1. Provide a grounding system for each feeder, separately derived system, panelboard, and radiating to every electrical power controlling and consuming device in the system.

B. Related sections:
1. Section 16050: Electrical General
2. Section 16110: Raceways
3. Section 16120: Conductors
4. Section 16460: Transformers

1.2 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.1 GROUND CLAMPS:

A. Bronze, UL listed, with configuration to match application

B. Acceptable Manufacturers:
1. Burndy
2. Ilsco
3. Thomas & Betts
4. O.Z. Gedney

PART 3 - EXECUTION

3.1 EQUIPMENT GROUNDING CONDUCTOR:

A. General: Install a separate insulated copper conductor, color coded green, form respective switchboard or panelboard ground bus to controller and/or device. Provide an additional equipment grounding conductor to insolated grounding receptacles. The isolated ground conductor shall be green with a yellow tracer.

3.2 ADDITIONAL EQUIPMENT GROUNDING CONDUCTORS:

A. Wiring Devices: At both switches and receptacles, provide a grounding jumper from the device to a screw on the device box.

3.3 EQUIPMENT GROUNDING CONDUCTOR ROUTING:

A. Route equipment grounding conductor with respective feeder or branch circuit conductors (within the same conduit).

3.4 CONDUITS:

A. All grounding electrode conductors, equipment grounding conductors and bonds where not internal to equipment enclosures shall be install in conduit to within 6" of terminating clamp or exothermic weld.

END OF SECTION

SECTION 16130 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
1. Provide electrical boxes or, where prescribed, conduit bodies for devices, outlets, splice connection points, raceway junction and conductor pulling points complete with supports, covers and accessories.

B. Related Sections:
1. Section 16050: Electrical General

C. Standards:
1. Underwriters Laboratories labeled and listed for application specified.

1.2 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.1 INTERIOR OUTLET BOXES AND EXTENSIONS:

A. Galvanized steel, UL listed for application with conduit knockouts and threaded holes for mounting devices and/or coverplates:

B. Minimum Sizes:
   a. Single Device: 3"Hx2"Wx2"D
   b. Gang Device: 3"Hx2"W(per gang)x2"D
   c. Octagonal: 4"Wx1-1/2"D
   d. Square: 4" Squarex1-1/2"D

C. Acceptable Manufacturers:
1. Appleton
2. Raco
3. Steel City
4. American Electric

2.2 CONCRETE BOXES

A. Galvanized steel for encasing in concrete with conduit knockouts and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.3 MASONRY BOXES:

A. Galvanized steel for mounting in masonry walls with conduit knockouts and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.4 CAST BOXES:

A. Cast malleable iron, cadmium/zinc plated finish, NEMA 3R, threaded conduit entries, neoprene coverplates gasket and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.5 JUNCTION AND PULL BOXES:

A. Dry Locations: Galvanized sheet steel, NEMA 1, welded seams and cover held by stainless steel screws or bolts.

B. Damp or Wet Locations: Cast malleable iron with corrosion-resistant finish, NEMA 3R, threaded conduit entries, neoprene coverplate gasket, and coverplate held by stainless steel bolts.

C. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.6 FLOOR BOXES:

A. As specified on the drawings for a particular application

PART 3 - EXECUTION

3.1 DEVICE APPLICATIONS

A. Boxes for switches, receptacles, dimmers (designed for device box mounting) and future devices:
1. For dry locations:
   a. When recessed:
      1) For construction other than concrete or masonry, use interior outlet box
      2) For concrete: Concrete box
      3) For masonry: Masonry box or square interior box with masonry extension
   b. When surface: Cast box
2. For damp or wet locations:
   a. When recessed:
      1) For concrete: Concrete box
      2) For masonry: Masonry box or square interior box with masonry extension
   b. When surface: Cast box
3. For hazardous areas: Hazardous area boxes

3.2 GENERAL APPLICATIONS

A. For lighting fixtures, equipment connedtions, pullboxes for conduit 1" and smaller, and junction boxes for conduits 1" and smaller.
1. Recessed Interior Box:
   a. For construction other than concrete or masonry, use octagonal or square interior outlet box
   b. For concrete: Concrete box
   c. For masonry: Concrete box or square interior box with masonry extension
2. Box above an accessible ceiling: Octagonal or square interior outlet box
3. Exposed interior box:
   a. Above 7'-0": Octagonal or square interior outlet box or conduit body.
   b. 7'-0" and below: Cast box or conduit body.
4. Exterior Box:
   a. When recessed in vertical element or ceiling:
      1) For concrete: Concrete box.
      2) For masonry: Concrete box or square interior box with masonry extension.
      3) For construction other than concrete of masonry, provide square interior box.
   b. Flush mounted in ground: Cast junction box.
   c. Exposed: Cast box or conduit body.

B. Hazardous Locations: Hazardous are box

C. Integrally Mounted Boxes: Boxes which are an integral part of an equipment assembly from the manufacturer and UL listed for the application may be used in liew of the boxes prescribed above.

3.3 JUNCTION BOXES AND PULL BOXES (conduit larger that 1"):

A. Junction boxes re conduit bodies where junction is exposed.

3.4 SUPPORT

A. General: Support each box from the building structure independently of conduit as follows, utilizing a support system capable of carrying 300% of load.
1. Surface:
   a. Structural steel: Bolted directly to steel member or bolted to spring clip which is clipped to steel member.
   b. Concrete: Power driven fastener or bolt to expansion anchor set in drilled hole.
   c. Wood: Screw or bolt to wood.
2. Suspended: Bolted to engineered spring clip which is clipped to suspended ceiling system.
3. Recessed:
   a. Concrete: Set in concrete prior to pour.
   b. Masonry: Set or cut into masonry during masonry erection. Grout in around box.
   c. Drywall: Attach directly to stud or joist by screw or bolt; or directly to a galvanized steel support which is attached directly at each end to stud or joist by screw or bolt.
   d. Earth: Compact earth around box.

3.5 INSTALLATION:

A. Outlet locations indicated on the plans are approximate. Coordinate and determine the exact location at the building. The architect reserves the right to shift the exact location of any outlet 10 feet before it is permanently installed.

B. Install boxes plumb when vertical, level when horizontal and flush adjacent surface when recessed.

C. Where an outlet occurs in an architectural feature, center the outlet in same.

D. Where the mounting height of a wall outlet is not shown, mount at height directed by Architect. Mounting heights are from finished floor to box centerline.

E. The contractor may, with Architect's approval, slightly vary an outlet's mounting height so that the box's top or bottom occurs at a masonry joint.

F. Where outlets at different levels are shown adjacent, install them on the same vertical line.

G. Space wall switch outlets with the first gang box 4" from door trim on the installed strike side.

H. Locate boxes and conduit bodies so that covers are accessible and removable.

I. Limit masonry cuts from outlet boxes so that coverplate covers the cut.

J. Provide plaster rings for all boxes set in plaster walls or ceilings.

K. Match configuration to application.

L. Utilize box size (capacity) based upon NEC.

M. For devices, utilized boxes designed to support the device independently of coverplate and so install.

N. Cover unused conduit openings with metal covers for sheet steel boxes and threaded plugs for cast boxes.

O. Prior to pulling conductors or installing devices, clean boxes of dirt, debris and water.

P. Cover all boxes and secure with screws or bolts.

Q. Install pull boxes to limit pulling distance and/or pulling bends.

END OF SECTION

SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
1. Provide continuous color coded conductors beginning at service point to distribution equipment and to each outlet and each piece of electrical energy consuming equipment

B. Related Sections:
1. Section 16050: Electrical General
2. Section 16420: Service Entrance

1.2 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.1 CONDUCTORS:

A. Copper Conductors:
1. Soft drawn annealed copper, 98% conductivity, without weld, splice or joint throughout its length; uniform in cross section without flaws, scales, or other imperfections with THHN/THWN or XHHW insulation.
2. Acceptable Manufacturers:
   a. Anaconda
   b. Phelps Dodge
   c. Pirelli Cable
   d. Senator
   e. Southwire
   f. Triangle

B. Aluminum Conductors:
1. Soft drawn, compacted construction, XHHW insulation, 250 kcmil and larger
2. Acceptable Products:
   a. Alcan "STABILOY"
   b. Pirelli "XLPE"
   c. Southwire

C. Configuration:
1. No. 10 and smaller: Solid
2. No. 8 and larger: Stranded

D. Insulation - 600 Volts:
1. No. 6 and smaller: THHN, THWN
2. No. 4 and larger: XHHW

E. Jacket Color:
1. No. 8 and smaller: Uniform colored jacket
2. No. 6 and larger: Black

F. Jacket Markings:
1. Voltage
2. Insulation type
3. Conductor size
4. Conductor type

2.2 COLOR CODING TAPE:

A. Vinyl ¾" wide with uniform color and adhesive backing.

B. Acceptable Manufacturers:
1. Brady
2. 3M
3. Plymouth
4. Thomas & Betts

2.3 SPLICE AND TAP MATERIALS:

A. No. 10 and smaller:
1. Crimp type: Cylindrically shaped conductor sleeve for crimping copper conductors. Insulated with nylon or plastic cover.
2. Twist on: Inner spiral spring or threads for holding and making electrical contact between copper conductors and with outer long skirted insulated cover of nylon or plastic.

B. No. 8 and larger
1. Set-screw or bolted type: Metal connector for joining copper to copper, with bolts or set-screws to apply pressure to conductors. Insulate with nylon or plastic cover or with electrical tape.
2. Pressure type: Metal connectors for joining copper to copper, copper to aluminum, or aluminum to aluminum with power operated crimping tool. Insulate with nylon or plastic cover or with electrical tape.

C. Acceptable Manufacturers:
1. AMP
2. Burndy
3. Ideal
4. Ilsco
5. Panduit
6. 3M
7. Thomas & Betts

2.4 CONDUCTOR TERMINALS:

A. Copper conductors: High conductivity copper terminals designed to hold conductor and make electrical contact by bolt, setscrew or power crimp and with spade to match equipment receiving conductor.

B. Aluminum conductors: High conductivity terminal designed to hold aluminum conductor and make electrical contact by crimping and with spade to match equipment receiving conductor in physical shape, physical size and material.

C. Acceptable Manufacturers:
1. Burndy
2. Ideal
3. Ilsco
4. Panduit
5. Thomas & Betts

2.5 CONDUCTOR HARNESS:

A. Plastic or nylon self-locking straps (commonly referred to as zip-ties or tie-wraps).

B. Acceptable Manufacturers:
1. Panduit
2. Thomas & Betts

2.6 WIRE PULLING LUBRICANTS:

A. Lubricating, insulating and chemically neutrall to conductors, conductor insulation and conduits.

B. Acceptable Manufacturers:
1. Greenlee
2. Ideal
3. Polywater

2.7 ELECTRICAL TAPE:

A. Vinyl plastic; moisture tight, resistant to ultraviolet radiation, alkalis, acids and corrosion; chemically neutral to conductors and conductor insulation: fire retardant; and single thickness dielectric strength equal to or greater than 10,000V.

B. Acceptable Manufacturers:
1. Scotch
2. 3M
3. Plymouth

2.8 ALUMINUM OXIDE INHIBITING COMPOUND:

A. Compound shall inhibit the formation of aluminum oxide on clean aluminum conductors without deteriorating the conductors.

B. Acceptable Manufacturers:
1. Burndy
2. Thomas & Betts

END OF SECTION

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SPECIFICATIONS

PROJECT # **1715**
DESIGNER:

DATE: **1/24/2018**
REV. DATE: **2/16/2018**

E5.2

SECTION 16440 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Description
   1. Provide disconnect switches in configurations as indicated on the drawings complete with enclosures and accessories.

B. Related Sections
   1. Section 16050: Electrical General
   2. Section 01330: Submittals
   3. Section 16170: Motor and Equipment Connections

1.2 SUBMITTALS

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers as follows:
   1. General Electric
   2. Siemens/ITE
   3. Square D
   4. Cutler Hammer

2.2 DISCONNECT SWITCHES:

A. Disconnect switches shall be heavy duty (NEMA Type HD) and Underwriters Laboratories Listed.

B. All switches shall have blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to the line side lugs. Lugs shall be front removable and UL listed for 60 degrees C or 75 degrees C, aluminum or copper wires.

C. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operation handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is ON or OFF.

D. Switches shall be furnished in NEMA 1 general purpose enclosures unless specified as NEMA 3R on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges, NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatize steel.

E. Switches shall be horsepower rated for as and/or dc as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of UL listed rejection scheme. The UP listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UP listed short circuit rating of 200,000 rms symmetrical amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switch adjacent to equipment it serves or as located on the plans.

B. Anchor enclosures firmly to wall and/or structural surfaces. Coordinate mounting of disconnect to roof top mechanical equipment with supplier/installer.

END OF SECTION

SECTION 16110 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
   1. Provide continuous conduit systems - beginning at the service point, to all distribution equipment and to every outlet and piece of electrical equipment with conduits, couplers, supports, hangers, fittings, bushings and accessories.

B. Related Sections:
   1. Section 16050: Electrical General

1.2 SUBMITTALS

A. Manufacturers' Product Data Sheets.

PART 2 - PRODUCTS

2.1 RIGID STEEL AND INTERMEDIATE METALLIC CONDUIT

A. Conduit:
   1. Rigid ferrous steel pipe, hot-dipped galvanized or sherardized with smooth interior.
   2. Acceptable Manufacturers:
      a. Allied
      b. Triangle
      c. Wheatland

B. Couplings and Connectors:
   1. Couplings:
      a. Hot-dipped galvanized or sherardized ferrous steel, threaded.
   2. Connectors:
      a. Steel or malleable iron, threaded with throat bushings, lock nuts and, where prescribed, grounding lugs
   3. Erickson:
      a. Malleable iron, concrete tight
   4. Acceptable Manufacturers:
      a. Appleton
      b. Crouse Hinds
      c. Steel City
      d. Thomas & Betts

C. Joint Compound:
   1. Anti-seize lubricant with rust and corrosion inhibitors and colloidal copper
   2. Acceptable Manufacturers:
      a. Thomas & Betts

D. Expansion Fittings:
   1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper
   2. Acceptable Products:
      a. Crouse Hinds "XJ"
      b. O. Z. Gedney "AX" or "DX"
      c. Appleton "XJ"

2.2 ELECTRICAL METALLIC TUBING

A. Conduit:
   1. Thin wall ferrous steel tubing, hot-dipped galvanized, smooth interior, square and reamed ends
   2. Acceptable Manufacturers:
      a. Allied
      b. Wheatland
      c. Triangle

B. Couplings and Connectors:
   1. Couplings:
      a. Steel, compression type, installed where exposed to moisture
      b. Steel, setscrew type, when installed indoors
   2. Connectors:
      a. Steel, compression type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed where exposed to moisture
      b. Steel, setscrew type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed indoors.

C. Expansion Fittings:
   1. Steel with three cap nuts, phenolic bushings, packing ring, metallic copper grounding ring and copper bonding jumper.
   2. Acceptable Products:
      a. Crouse Hinds "XJ"
      b. O.Z. Gedney "AX" or "DX"
      c. Appleton "XJ"

2.3 RIDGID NONMETALLIC CONDUIT:

A. Conduit:
   1. Schedule 40 Polyvinyl Chloride (PVC), resistant to crushing, moisture, low temperature, and corrosive agents in standard trade sizes

B. Couplings and Connectors:
   1. Couplings: Schedule 40 PVC
   2. Connectors: Schedule 40 PVC

C. Expansion Fittings:
   1. Schedule 40 PVC with grommet inner cylinder and outer sleeve

D. Joint Cement:
   1. PVC solvent
   2. Acceptable Manufacturers:
      a. Carlon
      b. Wheatland
      c. Allied

2.4 LIQUIDTIGHT FLEXIBLE CONDUIT:

A. Conduit:
   1. Galvanized steel single strip, interlocked, smooth inside and out, with liquid-tight flexible polyvinyl chloride outer jacket
   2. Acceptable Manufacturers:
      a. Carlon
      b. Wheatland
      c. Allied

B. Fittings:
   1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing, liquid tight, locknuts and external Ground lugs
   2. Acceptable Manufacturers:
      a. Appleton
      b. O.Z. Gedney
      c. Thomas & Betts

2.5 FLEXIBLE METAL CONDUIT:

A. Conduit:
   1. Galvanized steel single strip, interlocked, smooth inside and out
   2. Acceptable Manufacturers:
      a. AFC
      b. Aflex
      c. General Cable

B. Fittings:
   1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing and lock nuts
   2. Acceptable Manufacturers:
      a. Appleton
      b. O.Z. Gedney
      c. Thomas & Betts

PART 3 - EXECUTION

3.1 APPLICATIONS:

A. Provide Rigid Metal Conduit or Intermediate Metallic Conduit for service entrance, feeders, in slab on grade, areas where exposed to moisture, exposed on exterior surfaces, and exposed interior from floor to 10'-0" or where exposed to physical abuse.

B. Provide Electrical Metallic Tubing (EMT) for interior power circuits, branch circuits and system circuits in walls, elevated concrete slabs (those not on grade), plenums, attics or exposed above 10'-0", where not exposed to moisture.

C. Provide Rigid Nonmetallic Conduit for service ground, in slab on grade, in direct contact with earth, exposed in corrosive environments above 10'-0" above floor, or service entrance when encased in concrete.

D. Provide Liquid-tight Flexible Metal Conduit for final connecting link (minimum of 12", maximum of 36") to the following:
   1. Plumbing equipment
   2. Kitchen equipment
   3. Exterior Mechanical equipment

E. Provide Flexible Metal Conduit for:
   1. Final connection link (minimum of 12", maximum of 36") to:
      a. Motors
      b. Transformers
      c. Mechanical equipment
   2. Connections between junction boxes and accessible recessed lighting fixtures.

3.2 CONDUIT SUPPORT

A. Intervals: Maximum 10 feet on center and within 3 feet of each outlet box, junction box, cabinet or fitting.

B. Conduits ¾" and smaller
   1. Method
      a. When single conduit: Attach directly to building structure of suspend with ¼" rod
      b. When multiple parallel and adjacent conduits and:
         1) When horizontal at structure: Attach directly to structure or to support framing attached to structure
         2) When horizontal suspended: Attach to support framing, suspended from building structure
         3) When vertical: Attach to support framing attached to building structure, wall structure or suspended from building structure
   2. Conduit attachment:
      a. When direct to structure or single conduit suspended: Spring steel friction, spring steel latching or clamped with bolts or screws
      b. When on support framing: Two section bolted conduit clamp
   3. Structural steel attachment
      a. When single conduit: Spring steel friction, clamp with bolt or bolted
      b. When hanger rod: Clamp with bolt or bolted
   4. Concrete attachment: Steel preformed conduit clamp. Attach clamp with expansion anchor installed in drilled hole or with power fastening anchor designed to meet concrete specification. In either case, design support of 300% or greater of load
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load

C. For 1" or larger:
   1. Method:
      a. When single conduit: Attach directly to building structure or suspend with threaded rod
      b. When multiple parallel and adjacent conduits: Attach to support framing attached to building structure, wall structure or suspended from building structure
   2. Conduit attachment:
      a. When single conduit: Bolted Clamp
      b. When on support framing: Two section bolted conduit clamp
   3. Structural steel attachment: Beam clamps with bolted or bolted directly to steel
   4. Concrete attachment: Provide preset insert prior to concrete pour or coordinate drill location with Architect. When drilling provide expansion anchors. In either case, maintain design support of 300% or greater of load.
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load

D. Framing:
   1. Attachment, suspension and bearing members capable of supporting 300% of load

3.3 INSTALLATION:

A. For conduit layout follow, generally, the diagrammatic layout shown on plans. Provide offsets and routing changes to avoid structural, architectural or equipment elements.

B. Provide ½" minimum size conduit.

C. Conceal all conduit except where shown to be exposed. Install conduit concealed above a lay-in ceiling with clearance to allow easy removal of ceiling panels.

D. Install exposed conduit parallel with or perpendicular to building walls at greatest height possible. Paint exposed conduit two coats of color directed by Architect.

E. Extend homeruns from outlets shown to panel designated. Do not combine homeruns.

F. Use benders designed for the size and type of conduit. Limit each bend to 90 degrees or less with a radius 10 time conduit diameter or greater for telephone system and 6 times conduit diameter or greater for all other systems.

G. Provide insulated bushings at each end of every conduit run.

H. Provide joint compound on rigid steel conduit and intermediate metallic conduit joints.

I. Provide an Erickson type coupling where two segments of a conduit run must be joined and neither can be rotated.

J. Close all conduit ends during construction with plastic conduit plugs.

K. Install conduit no greater than 1" trade size in concreter slabs. Route conduit between top and bottom reinforcing steel and space parallel runs a minimum of 3" apart.

L. Install conduit above water and steam piping where possible.

M. Maintain grounding of metallic raceways with clean and tight connections. Provide grounding conductor in plastic and flexible conduit.

N. Provide ground lugs on all conduit connectors to service equipment enclosures.

O. Provide grounding wedge lugs or locknuts designed to bite metal on conduit connections to panel cabinet or pull boxes.

P. Seal all conduits which extend from the interior to the exterior of the building to prevent the circulation of air.

Q. Provide a thru wall waterproof seal on each conduit that penetrates a wall at a below grade level.

R. Provide an expansion fitting in each conduit crossing a building expansion joint and locate the fitting at the joint. Also provide expansion fitting in building conduits exceeding 100 feet at intervals of 100 feet.

S. Where liquids are present, form drip loops in liquid-tight flexible conduit to prevent liquid from running into connections.

T. Blow out and swab all conduit clear of trash and water prior to pulling wire.

U. Provide a nylon pull cord in all empty conduits.

V. In mechanical equipment room where a piece of equipment is located more than 2 feet away from walls or columns, serve equipment from underfloor or provide a vertical conduit, minimum 1", attached to floor and ceiling with conductors entering and exiting conduit through conduit bodies.

W. Coordinate conduit supports in precast or cast-in-place concrete prior to pour.

3.4 UNDERGROUND INSTALLATION

A. Where exterior of building bury conduit a minimum of 30" below finished grade.

B. Encase conduit in 3" concrete envelope where it passes under driveway, roadways or entrances to PCHing lots.

C. When under interior slab on grade seal vapor barrier around conduit penetrations.

END OF SECTION

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 Summary:

A. Description:
   1. Identify the following electrical equipment with a nameplate or directory indicating load served or equipment name:
      a. Panelboards, Main and Branch Breakers
      b. Disconnect Switches and Motor Starters
      c. Contactors, Time Switches and Relays

1.2 Submittals:

A. Sample of Nameplate.

PART 2 - PRODUCTS

2.1 Nameplates:

A. 120 Volts, 208 Volts, and 240 Volts - Bakelite label, black face, white core.

B. 277 Volts and 480 Volts - Bakelite label, red face, white core.

C. Lettering:
   1. Main Service Disconnect - ½" high letters.
   2. All others - ¼" high letters.

2.2 Panelboard directory:

A. Panelboard manufacturers directory in plastic sleeve on inside of panel cover door.

PART 3 - EXECUTION

3.1 Installation:

A. Securely mount each nameplate to its respective equipment with screws or epoxy type cement. Double sided foam core type tape is not acceptable.

B. Type in the branch breaker load information onto the manufacturers' panel directory. Mark all spares in pencil. Install in plastic sleeve on inside of panel cover door.

C. Label all junction box covers with the circuit number installed in the box with a permanent marker.

END OF SECTION

SECTION 16170 - MOTOR AND EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Description:
   1. Provide power wiring to each motor, all mechanical equipment, all kitchen equipment, and all miscellaneous equipment included in the contract documents. Power wiring is the system of conductors from the energy source to the equipment that conducts the electrical energy which does work or provides heat.
   2. Provide a disconnect switch, fused where prescribed, for each motor or piece of equipment.

B. Related Sections:
   1. Section 16440: Disconnect switches
   2. Section 16050: Electrical General

PART 2 - PRODUCTS

2.1 STARTERS:

A. Provided under other divisions except where specifically prescribed in Division 16 documents.

2.2 MOTORS AND EQUIPMENT:

A. Motors, mechanical equipment, kitchen equipment, etc., provided under other divisions.

2.3 CONTROL AND INTERLOCK WIRING:

A. Control wiring, (i.e., HVAC controls, remote pushbutton stations, thermostats, etc.), is excluded except where specifically prescribed in Division 16 documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate all rough-in and final power wiring and equipment connection with other subcontractors
B. Install and connect individually mounted starters provided by other subcontractors
C. Label each disconnect switch and starter with name of equipment it serves. Refer to Section 16195
D. Coordinate over-current device rating with nameplate or motor or equipment.

END OF SECTION

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SPECIFICATIONS

PROJECT # **1715**
DESIGNER:

DATE: **1/24/2018**
REV. DATE: **2/16/2018**

E5.3

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