

PLUMBING GENERAL PROVISIONS

1.0 GENERAL INFORMATION:

The General Requirements and Supplementary Conditions are part of this contract and govern this division.

The permanent heating system shall not be used for construction until final sheetrock taping and sanding is finished and unless the system is made dust free with filters at all return openings. Filters shall be replaced as needed to maintain a clean system. If the system is found dirty it shall be cleaned before final acceptance. All extended warranties will need to cover the time in use and before final acceptance to the owner.

If the mechanical contractor finds any discrepancies in the plans or specifications that should be brought to the attention of the consultant, he will do so before bidding the project. Questions are to be submitted to Mechanical Concepts LLC, (Richard Bowman) E-mail rb@richardbowman.us PHONE 316-733-2718 or FAX 877-839-4680.

1.1 MECHANICAL SCOPE OF WORK:

Provide all mechanical systems indicated by the drawings, specified or as reasonably implied. Unless specified otherwise, provide all labor, materials and equipment necessary for a complete and operations system. Provide all incidental items required as part of the work even though not specified or indicated.

1.2 GENERAL CONTRACTOR SCOPE OF WORK PERTAINING TO MECHANICAL CONTRACT:

- A. PAINTING: All painting except as specified under other sections. Paint all exposed ductwork in finished areas.
- B. FLOOR, ROOF, CEILING AND WALL OPENINGS, SLEEVES, AND CHASES: Provide all cutting and patching for Mechanical and Plumbing. openings and chases with proper framing and reinforcing as required for Mechanical equipment. Patch all floors, walls and ceilings caused by the mechanical renovation.

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- C. STRUCTURAL FRAMING/REINFORCING: Provide additional structural framing and reinforcing as required for all roof mounted or suspending mechanical equipment. Coordinate with Mechanical Contractor for sizes and weights.
 - D. ACCESS PANELS: Provide and install access panels where required to be furnished under this division.
 - G. ROOFING: Mop In all mechanical curbs and vents provided by the Mechanical Contractor.
 - H. CEILINGS: Remove and replace acoustical ceilings as required by the mechanical contractor for him to install his work.
 - G. CUTTING AND PATCHING OF CONCRETE AND ASPHALT PAVING: Cut and patch concrete and asphalt paving required to install Mechanical Work.
 - H. LANDSCAPING: Re-seed all grass areas and replaces all damaged landscaping caused by construction.
 - I. ROOFTOP SUPPORTS: Provide pipe columns, structural steel members design by metal building provider to support rooftop units.
- 1.3 ELECTRICAL CONTRACTOR SCOPE OF WORK PERTAINING TO MECHANICAL CONTRACT:
- A. Provide all power wiring as required by mechanical equipment. Control wiring by TCC.
 - B. Provide all disconnects and starters to mechanical equipment if said equipment doesn't have these as an integral part or is not called out by these specifications to be provided by the Mechanical Contractor.
 - C. Provide all smoke detectors and wiring associated with them.
 - D. Provide and install switches and interlocks for exhaust fans.
 - E. Provide 115/1/60 utility outlets as required by code for maintenance of mechanical equipment.
 - F. TCC to mount all thermostats and control devices provided by Mechanical contractor and provide a technician to work with the Mechanical

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Contractor to assure a working temperature control system. E.C. to provide conduit and boxes.

- G. Coordinate with the Mechanical, Plumbing, lighting layout and Electrical requirements.
- H. The Mechanical Contractor shall furnish to the Electrical Contractor all wiring diagrams and locations of the mechanical equipment. The Mechanical Contractor shall work closely with the Electrical Contractor so as to avoid conflicts with lighting and panels.

1.4 DEFINITIONS:

- A. Contractor: The contractor performing, furnishing and installing of the work under this Division of the specifications.
- B. Provide: Contractor is responsible to furnish and install components completely in every respect.
- C. Manufacture: Acceptable Manufactures listed in the specifications and on the plan sheets.
- D. Plan Sheets and Specifications: Plans and specifications are complimentary. Requirements indicated in either are binding and the most stringent is to be used.
- E. Other work: Mechanical contractor is to review the entire set of plans and specifications and to notify the Architect if discrepancies are found and obtain written instructions for changes necessary. Any changes in the work covered by this Division of the Specifications made necessary by the failure or neglect of the Contractor to report such discrepancies will be made by, and at the expense of the Contractor.

1.5 QUALITY ASSURANCE:

- A. Acceptable Manufactures: Acceptable Manufactures are listed in applicable sections of the Specifications and on the drawings. The basis of design shall be the manufacture listed on the equipment schedules. All other manufactures are required to meet all of the requirements of the contract documents, and standards of quality and performance as established by the basis of the design manufacture's product.

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1.6 REGULATORY AGENCIES:

- A. Permits and Fees: Pay for all permits and fees necessary as required by the City or Local regulatory agency. Development fees, and/or assessments due to be paid by the owner.
- B. Codes: All work shall comply the all federal, state and local codes and ordinances and regulations. All work shall comply with the latest adopted editions of the Uniform Plumbing Code, International Mechanical Code, International Building Code and National Fire Protection Association. In addition, work will be in conformance with generally accepted practices of ASHRAE and SMACNA.

1.7 SUBMITTALS AND SHOP DRAWINGS:

- A. Submit (7) copies of shop drawings for all major pieces of equipment as indicated in respective sections. Two (2) copies shall be returned to the contractor. Shop drawings are to be marked Job Specific and reviewed and signed by the Contractor.
- B. The intent of the shop drawings by the Contractor is to demonstrate to the Architect / Engineer that the Contractor understands the design concept and demonstrates his understanding by indicating and detailing fabrication methods to be used.
- C. Provide electrical schematic and connection diagrams for each motor, control or other electrical system.
- D. If deviations, discrepancies or conflicts between the shop drawings submittals and contract documents the Contract documents shall take precedent.
- E. The Architect/ Engineer will review shop drawings and indicate any corrections. Engineer's review shall not relieve contractor of the responsibility of compliance with contract documents or errors in shop drawings. The Contractor/Supplier shall have responsibility with quantities and physical clearances of the respective equipment.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Make provisions the delivery and safe storage of all material and make the required arrangements with other trades to coordinate moving large pieces of equipment into the building.

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- B. All material stored outside are to be covered and protected from the elements.
- C. All material to be "Furnished by Others" to the Contractor for installation shall be checked and their delivery noted. After delivery Contractor is responsible for its safekeeping.

1.9 **JOB CONDITIONS:**

- A. Examination of Premises: Examine the premises prior to bidding and become fully familiar with the existing conditions.
- B. Plans are schematic in nature. Layout of ductwork is based on best available information. The contractor shall field verify all structural conditions for ceiling space and exact duct route before fabrication.
- C: Provide electrical contractor with all amperage loads to equipment, and changes to any equipment if substitutions are furnished, failure to provide the above information may result in additional cost the Electrical Contractor and will be paid by the Mechanical Contractor.
- D. Existing Utilities: Verify existing utilities and the actual location of them in reference to the proposed work. Any deviation between the actual conditions and the plan locations shall be reviewed with the Architect. Notify Kansas One Call and have all utilities staked before any excavation.
- E: Housekeeping: Maintain housekeeping for the Mechanical portion of work. If General Contractor has to provide cleanup after Mechanical Contractor, he can expect compensation if he so desired.
- F. Protection: Protect new material and equipment from damage before, during and after installation. Clean all equipment of dirt and debris which may have accumulated during construction.

1.91 **EXCAVATION AND BACKFILLING:**

- A. Do all excavation for water, gas, sewer, drainage etc. Notify Kansas One Call and have all utilities staked before any excavation.
- B. Contractor shall do all shoring and bracing necessary per OSHA requirements to perform the work as required for safety.

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- C. Backfill and tamp the earth around pipes and bring to required level.
- D. Fill carefully to prevent future settlement.
- E. Provide all necessary fill material, sand, crushed rock, gravel as needed to assure prevention of settlement.
- F. Contractor shall warrant excavation against settling for a minimum period of one year.

1.92 WELDING:

All welding shall be by a certified welder and said welder shall have current certification papers upon site for inspection.

1.94 TESTING:

- A. Furnish testing equipment and test all piping and duct systems under methods and conditions as specified, in the applicable piping or duct sections.
- B. Make all necessary replacements and repairs and repeat tests until entire system is approved and satisfactory.

1.95 GUARANTEE:

Guarantee all materials, workmanship and the successful operations of all equipment against defects for a period of one (1) year from date of final acceptance by the owner. Guarantee to repair or replace at Contractor's expense any or all work which may be defective during that time provided that such defect is, in the opinion of the Architect/ Engineer, due to imperfect materials or workmanship and not to carelessness or improper use. Turn over to the owner at time of final acceptance all extend warranties provided by manufactures.

2.0 PRODUCTS:

- A. All mechanical equipment shall be listed and manufactured according to UL, ETL, AGA or other approved independent testing authority. Air conditioning equipment shall be ARI certified.
- B. It shall be the responsibility of all pressure vessel manufactures to provide an ASME stamp on their products when called for by ASME Code for Kansas State Law.

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- C. All plumbing fixtures and accessories designated as such on drawings, shall conform with the requirements of the American With Disabilities Act.
 - D. System design is based upon the first manufacture listed on the plans and other named manufactures are considered equivalent. Any cost attributed in changes in ductwork, piping, plumbing, space clearances or other trades is to be borne by the Contractor when another manufacture is used in lieu of the manufacture listed.
 - E. Unless specifically mentioned, all material and equipment shall be of best quality used for the purpose in commercial practice. All material and equipment shall be new, unused and without damage.
- 2.1 SUBSTITUTION OF EQUIPMENT AND MATERIALS:
- A. Unless request for changes in base bid specifications are received and approved ten (10) days prior to the opening of bids, the successful Contractor will be held to furnish specified items under the base bid.
- 2.2 WORKMANSHIP:
- A. All work shall be performed by skilled craftsman in a through and workman like manner. Attention of detail shall be followed in regard to maintenance clearances, other trades, exact location of lighting, fixtures, ceiling grid etc. Coordinate ceiling cavity space carefully with all trades as ceiling space is limited.
 - B. Layout and size all chases, openings, anchors and recesses required for the proper installation of the work.
 - C. Piping and equipment located in areas subject to low temperature shall be installed in a manner preventing freezing. Install all piping on warm side of building insulation to prevent freezing.
 - D. Seal all floor, wall and roof penetrations watertight with suitable sealant. Seal penetrations through fired rated assemblies with minimum 1" thickness 3M brand fire barrier caulk CP-25 (or approved manner) to maintain rating of assembly. Provide chrome plated escutcheons at all piping penetrations to finished materials.
 - E. Install fresh air openings with a minimum of 10'0" away from any exhaust opening, plumbing vent, flue, and gas relief opening.

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- F. Check all interior mounted accessories such as turning vanes, dampers etc. to lose connections that could result in rattles. After installation failure to check these items could result in rework at Contractor's expense.
- G. If HVAC is separate from Plumbing, provide Plumbing Contractor with all BTU ratings on all equipment, verify floor drain locations where r required by mechanical equipment and verify duct locations in relation to plumbing.
- H. Startup equipment per manufactures' instructions. Review equipment and instruct owner in proper operation of the equipment.

2.25 OWNER'S MANUAL:

- A. Provide (3) manuals to the Architect before final inspection. Manuals shall be 8 1/2 by 11 3 ring binders including the following
- B. Submittals, operation and maintenance instructions, parts list, wiring diagrams, sequence of operation.
- C. Cover or cover sheet shall include the name addresses and telephone numbers (business and emergency) of the responsible contractors.
- D. Manual shall have index and tab dividers for each major equipment section.

3.0 **COMMISSIONING:**

- A. The contractor shall perform commissioning activities with the owner. This shall include a manufacturer's service technician representative to start-up equipment and verify that it meets all manufacturer guidelines. The contract documents shall spell out the scope of the commissioning process. The commissioning process will occur prior to Final Acceptance.
- B. The intent is to obtain a more rapid "shakedown" of project HVAC systems to prevent the multi-year problems, with the intended goal being a fine-tuned fully functional project HVAC system for the district. At a minimum, the following will be a part of the commissioning:
 - 1. Starting equipment
 - 2. Balancing equipment

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3. Education of owner

4. Organize training with Supervisor of Building Equipment and Grounds

C. Operational training:

Train.

1. On-site engineer or custodian or Owner

4.0 REQUIRED SUBMITTAL

A. Operation and maintenance manuals (3 sets)

B. Equipment shop drawings (7 sets)

C. Control layout and operations (7 sets)

D. Schedule of equipment warranties (7 sets)

E. Balancing report (3 sets)

End of Section 15020

15110

PLUMBING BASIC MATERIAL AND METHODS

1.0 ACCEPTABLE MANUFACTURES:

VALVES: Crane, Apollo, Nibco, Milwaukee, Grinnell, Jenkins, Rockwell, Jamesbury, Watts

1.5 MATERIALS

Service: ABOVE GROUND DOMESTIC HOT AND COLD WATER

- A. Pipe: Copper Tube, Type L, hard drawn, ASTM B88, PEC tubing at contractor's option.
- B. Fittings: Wrought copper, solder-joint, ANSI B16.22
- C. Joints 2" and smaller: 95-5 tin/antimony solder ASTM B32
2-1/2" and larger: Englehard "Silvabrite 100" solder, tin/copper/silver composition, lead/antimony free.
- D. Valves Globe Valves 3" and smaller: Threaded ends, 150-pound, bronze body, union bonnet, rising stem, renewable disk.
Ball Valves 2" and smaller: Treaded ends, 150-pound, bronze body, two-piece design, chrome plated brass ball, brass stem Teflon seats. Vinyl covered steel handle. Blowout proof stem. Extended stem length where insulation occurs.

Service: ABOVE GROUND DOMESTIC HOT AND COLD WATER

Butterfly Valves: 2 1/2" and larger:

Lug Type: 200-pound, ductile iron or cast-iron body, aluminum bronze disc, stainless-steel one-piece stem EPDM seat. Provide with hand lever operator for sizes 4" and smaller.

Service: BELOW GROUND DOMESTIC WATER

- A. Pipe: Copper Tube, Type K, soft drawn, ASTM B88, FMRC approved PVC Class C900.
- B. Fittings: Wrought copper, solder-joint, ANSI B16.22

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- C. Joints: No joints allowed.

Service: SANITARY DRAIN, AND WASTE PIPING

- A. Pipe: Below 1st floor Sch. Sch. 40 PVC or service weight cast iron.
Above Floor Service weight cast iron shall be used.
- B. Fittings: Sch. 40 PVC or cast iron below first floor. Service weight cast iron shall be used. above floor
- C. Joints: PVC socket. Cast Iron Tyseal joints below grade, no hub fittings maybe used for vents.

Service: SANITARY VENT PIPING

- A. Pipe: Sch. 40 PVC service weight Cast iron or Sch. 40 galvanized steel.
PVC is not allowed as the ceiling is a return air plenum
- B. Fittings: Sch. 40 PVC service weight cast iron or galvanized steel shall be used.
- C. Joints: No hub fittings or galvanized threaded fittings maybe used for vents.

Grooved Mechanical-Joint Couplings: Ductile iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

- D. Flanges: Cast-Iron Threaded Flanges, Forged steel, 150-pound, raised ground face, bout holes spot faced.
Cast Bronze Flanges: ANSI B16.24 Class 150, raised ground face, bout holes spot faced.

End of Section 15110

16120

WIRES AND CABLES, LOW VOLTAGE

PART 1- GENERAL

1.1 DESCRIPTION:

- A. This section includes the furnishing, installation, and connection of the power, lighting, system, and control wiring.

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING):

- A. Cable and Wire: Fed. Spec. J-C-30, except as hereinafter specified. All conductors shown on plans are sized for copper. UL label required. American, Southwire, Essex, or equal, rated 600 volts, finished with fadeless color coding and bearing Underwriters label.

All cable and wiring shall be continuous between electrical equipment. Splices shall not be added except as required for taps in branch circuits or as approved by the engineer. No splices will be allowed within panelboards and switchboards.

- B. Single Conductor:
 - 1. Soft annealed copper.
 - 2. All conductors #8 gauge and larger shall be stranded unless noted otherwise. All conductors #10 gauge and smaller may be solid or stranded unless noted otherwise on the drawings. Stranded conductors may be used only on devices and lugs that are U.L. listed for use with stranded conductors.
 - 3. Minimum size No. 12, except where larger sizes are shown. (Size No. 14 minimum for controls).
- C. Insulation:
 - 1. Wires for general use within the building shall be type THHN or type THWN, 90 degree rated except where called for otherwise on the drawings. Type THHN or type THWN shall be used at the temperature rating of equipment termination lugs, environmental conditions, and as

Code allows. Wires for other than general use shall be as hereinafter specified for specific services.

D. Multiconductor Cables:

1. Comply with NEMA WC 70; Exterior sheath shall be color coded to distinguish between cable voltages and quantity of phase conductors.
2. Type AC Cable, Armored cable, shall comply with UL 1479 and UL 4 with green grounding conductors in addition to Armor/Bond wire ground combination. Cables shall be listed for use in environmental air space in accordance with NFPA 70 Article 300.
3. Type MC Cable, Metal-clad cable; shall comply with UL 1479 and UL 1569 with green grounding conductors. Cables shall be listed for use in environmental air space in accordance with NFPA 70 article 300.

E. An equipment grounding conductor, sized per NEC Article “Grounding”, shall be installed in each conduit containing phase conductors.

F. Color Code:

1. All conductors shall be identified by circuit number and color coding at all termination points and splices. All conductors shall be identified in all pull and junction boxes by the following method of color coding. Means of identification shall be permanently posted at each branch circuit panel with a nameplate identifying color coding system used in that panelboard.

Phase	208/120V	480/277V	240V.	240/120V
A	Black	Brown	Black	Black
B	Red	Orange	Red	Red
C	Blue	Yellow	Blue**	
Neutral	White	Gray*		White
Ground	Green	Green	Green	Green
Iso. Grd	Green w/Yellow	Green w/Yellow	Green w/Yellow	Green w/Yellow

* or white with colored (other than green) tracer.

**Identify ‘High Leg’ per N.E.C.

2. Use solid color compound or solid color coating for No. 6 and smaller branch circuit conductors and neutral sizes.

3. Phase conductors No. 4 and larger color code using one of the following:
 - a. Solid color compound or solid color coating.
 - b. Colored as specified using 3/4-inch wide tape. Apply tape in two layers, half overlapping turns for a minimum of three-inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type. Where any conductor is or can be supplied from an emergency system, the Contractor shall mark each conductor with an additional two layers, one-half lapped, of purple colored vinyl electrical tape.
 - c. Yellow stripe on isolated ground may be 1/4-inch wide yellow tape on top of green.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Provide plastic engraved color code legend on each panelboard and switchboard per NEC Article "Branch Circuits", "Identification Of Ungrounded Conductors".
6. All improperly color coded conductors will be completely replaced at no additional cost to Owner.
- F. See riser diagrams and/or other sections of the Specifications for types and ratings for sound, fire alarm, control and other special cables.
- G. Where quantities of conductors in a raceway system are not specifically indicated, provide the number as required to maintain function, control and number of circuits as indicated.
- H. All isolated ground circuits shall be provided with separate phase, neutral, and ground conductors (no shared neutrals or grounds). All isolated ground circuits shall be installed in separate raceways from all other circuiting.
- I. Where multiple sets of conductors are indicated, do not install the same phase conductors in the same raceway. Each raceway shall be provided with A, B, C phase conductors, neutral (if indicated), and ground (if indicated).
- J. Where GFCI circuit breakers are used, provide a separate neutral conductor for the GFCI circuit. (Not a shared neutral with another circuit).

2.2 SPLICES AND JOINTS:

- A. In accordance with UL 486 A, B, D and NEC.
- B. Splices and taps for #6 and larger conductors shall be made with block type terminations (with insulating jacket) or with split bolt connectors, covered and completely insulated with a minimum of three half-lapped layers of Scotch No. 33+ (105 degree C) plastic electrical tape or by approved insulated fastener. All splices and taps having irregular surfaces shall be properly padded with Scotchfil putty before application of insulating plastic tape. Scotchlok electrical pre-insulated spring pressure connectors or equal may be used for up to #8 conductors.

2.3 CONTROL WIRING:

- A. All control wiring shall be copper, solid or stranded, #14 Ga. or larger depending upon current requirements, with insulation type for 90 C. rating. Where stranded conductors are used, provide with spade type insulated copper terminals. Unless noted otherwise on the Mechanical drawings or herein, all mechanical control wiring for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit). All line and low voltage mechanical control wiring, conduit, connections, and/or terminations are by the Electrical Contractor unless specifically noted otherwise within the bidding documents.

2.4 WIRE LUBRICATING COMPOUND:

- A. The cable pulling lubricant shall be compatible with all cable jackets. The lubricant shall be UL (or CSA) listed. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes.
- B. A 200-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105 degrees C, shall not spread a flame more than three-inches beyond a point of ignition at a continued heat flux of 40 kW/m². Total time of test shall be one-half hour.

- C. Approved Lubricant is:

Dyna Blue

Polywater J available from:

American Polywater Corporation

Equal by Quick Slip from Buchanan
CCR Wire Pulling Lube from CRC
Poly-X from American Colloid.

2.5 FIREPROOFING TAPE:

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and 3/4-inch wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

- A. Install in accordance with the NEC, and as specified.
- B. Unless noted otherwise on the Electrical drawings or herein, all feeders for all systems shall be routed within conduit, shall be of the same insulation type and shall be continuous between outlets and boxes (with no splices or taps into conduit). This shall include but not be limited to:
 - Service Entrance feeders
 - Exposed Feeders
 - Feeders concealed in ceilings, walls, partitions and crawl spaces.
 - Feeders below slabs-on-grade and underground.
- C. Branch circuits concealed in ceilings, walls and partitions: Single conductors in raceways. Type AC and Type MC in locations limited to the following:
 - 1. Type AC and Type MC are acceptable for the following applications:
 - a. Install cables for lighting fixtures whips and for branch circuits above ceiling to the j-box located in the vicinity of devices and fixtures being

- served. All MC cable shall be routed neatly throughout the ceiling. MC cable shall be allowed in the web of the metal stud.
- b. Fixture whips shall be limited to 6' lengths. Each individual fixture whip must terminate from each fixture to a junction box.
 - c. Use only single-circuit cable (i.e. two wire plus ground). For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit or use color code multi circuit MC to match circuit colors connected.
2. Type AC and Type MC are not acceptable for the following applications; instead provide single conducts in rigid raceway:
- a. Homeruns to panelboards.
 - b. Branch circuits and feeders serving HVAC equipment, elevator equipment, and kitchen loads (other than receptacle branch circuit located in the kitchen).
 - c. Within mechanical, electrical or communication rooms.
 - d. Exposed branch circuits within areas that do not have ceilings (i.e. exposed to structure) or rooms with cloud ceilings that have exposed structure around the perimeter of the room.
- C. Splices and taps in outlet boxes shall be twisted joints. U.L. approved pre-insulated spring pressure connectors shall be used for branch circuit connections. Connectors shall be installed so that all conductors are properly insulated.
- D. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes. Do not splice cables in panelboards, switchboards, disconnects, etc.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, and tie all cables.
- G. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 2. Use ropes made of nonmetallic material for pulling feeders.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Engineer.
4. Pull multiple cables into a single conduit with a single continuous pull.
5. Always use wire lubricant per this specification.

3.2 SPLICE INSTALLATION:

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Where the Engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Owner.

3.3 CONTROL, COMMUNICATION, AND SIGNAL WIRING INSTALLATION:

- A. Unless otherwise specified in other sections of these specifications, install wiring as described below. Wiring shall be connected to perform the functions shown and specified in other sections of this specification.
- B. Except where otherwise required, install a separate power supply circuit for each system, or control equipment, or control power. Circuit to nearest 120 volt panel or nearest emergency panel if equipment controlled is connected to emergency system. Provide 20 Amp breakers in panels where none are designated. Verify all requirements with actual equipment supplied in field.
- C. Install a breaker lock-on clip on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- D. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.
- E. Wire and cable identification:
 1. Install a permanent wire marker on each wire at each termination, outlet box, junction box, panel, and device.
 2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
 3. Wire markers shall retain their markings after cleaning.

3.4 FIELD TESTING:

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Test shall be performed by meggar and conductors shall test free from short-circuits and grounds.
- C. Test conductors phase-to-phase and phase-to-ground.
- D. Meggar motors after installation but before start-up and test free from grounds.
- E. The Contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION 16120

16400

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes all low voltage disconnect switches either stand alone in NEMA enclosures, fusible and non-fused, in panelboards, switchboards, or switchgear.

1.2 APPROVED MANUFACTURERS:

Square 'D'
General Electric
Siemens/ITE
Cutler Hammer

Disconnect switches shall be by the same manufacturer as the remainder of the distribution equipment on the project. No mixing of manufacturers on the project.

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 800 AMPERES AND LESS:

- A. Quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.
- B. Shall be capable of accepting UL and NEMA standard fuses.
- C. Shall have the following features:
 - 1. Switch mechanism shall be the quick-make, quick-break type.
 - 2. Copper blades, visible in the OFF position.
 - 3. An arc chute for each pole.
 - 4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.

5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
 6. Fuse mounting for the size and type of fuses specified. Furnish switches completely fused. Furnish a complete set of spare fuses for each size and type of fuse being installed.
 7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
 8. Enclosures:
 - a. Shall be NEMA 1 for interior, NEMA 3R for exterior and other types shown on the drawings for the switches.
 - b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.
 9. All fuse holders shall have rejection features to reject all fuses not specified. Provide fuse rejection kits as required.
- D. Unless indicated otherwise, switches shall be heavy duty, horsepower rated for the load served, and provided with ground kit.
- E. All disconnect switches shall be fused except for disconnect switches that have individual fuse protection at point circuit receives its supply.
- F. Provide dead front type for all exterior disconnects on grade level when so required by local code.
- G. All fused disconnect switches shall have a minimum rating of 100,000 A.I.C. with fuses installed unless noted otherwise on the drawings.

2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 800 AMPERES AND LESS:

- A. Shall be the same of Low Voltage Fusible Switches rated 800 amperes and less, except it shall not accept fuses.

2.3 THERMAL OVERLOAD SWITCHES:

- A. Provide/install toggle type switches, voltage and horsepower rated for the load served 20 or 30 Amp for all small mechanical equipment as indicated.

2.4 FUSES:

- A. This paragraph applies to all fuses provided under Division 16.
1. Cartridge type fuses of proper size and type as required shall be furnished and installed for all switches and panelboards throughout and an additional supply of three spare fuses of each size and type shall be furnished in original packages to the Owner. Furnish NEMA 1 enclosure with hinged cover equal to Bussmann Type SFC or Edison ESFC, for storing all spare fuses located adjacent to main service equipment. Fuses for motor and mechanical equipment shall be sized per nameplate data and N.E.C.
 2. Fuses shall be manufactured by Bussmann Mfg. Co., Ferraz-Shawmut Co., Littelfuse or approved equal by Engineer. Fuse types shall be installed as follows:

Main Service and Distribution Feeder Protection:

	Bussman	Littelfuse	Ferraz Shawmut
601 amps and larger 600 volts and less (Class L)	KRP-C/KTN	KLPC	A4BQ
600 amps and less 250 volts and less (Class RK1)	LPN-RK	LLN-RK	A2D-R
600 amps and less 600 volts and less (Class RK1)	LPS-RK	LLS-RK	A6D-R

Motors and Primary Feeders for Transformers:

250 volts and less (Class RK5)	FRN-R	FLN-R	TR-R
600 volts and less (Class RK5)	FRS-R	FLS-R	TRS-R

3. Class T fuses will not be accepted, unless they are a part of a manufacturers assembly or approved by the Engineer. Class J fuses may be used as an alternate to the Class R fuses listed above.
4. Fuses installed on project shall be by one manufacturer only. (Do not intermix Manufacturers.)

2.5 EQUIPMENT CONNECTIONS:

- A. For 120 volt motors 1/2 HP- and less, 15 amperes and less, Contractor shall provide Bussmann "SSY" box cover unit for indoor application and "SSN" box cover unit for outdoor applications, or equal by Perfect-Line, with fustat plug fuse and integral toggle switch for motors 1/2 HP-120V. and less. Fustats for cord and plug equipment with fuses 15 amperes and less shall be Bussmann "SRY" box cover unit, or equal by Perfect-Line, with fustat plug fuse. Mount fustats in housings of equipment served wherever possible. Plug fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.
- B. For 3/4 HP-120V. motors, Contractor shall provide (1) 20 amp 1 pole 120 volt toggle disconnect switch with a Bussmann 'HPD' fuse holder and 'FNQ-R' fuse at each unit. Switch and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. For 3/4 HP-120V. motors that are provided with cord and plug, Contractor shall provide 20 amp 120 volt duplex receptacle with (1) 20 amp 1 pole 120 volt toggle disconnect switch on line side of receptacle, and Bussmann 'HPD' fuse holder and 'FNQ-R' fuse on line side of receptacle. Switch, receptacle, and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. Fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.
- C. For connections to 277 volt equipment, Contractor shall provide (1) 20 amp 1 pole 277 volt toggle disconnect switch with a Bussmann 'HPD' fuse holder and 'FNQ' fuse at each unit. Switch and fuse holder to be mounted in cover of a 4" square, 2 1/8" deep junction box at each unit. Fuses for motors shall be sized based upon 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC and as shown on the drawings.
- B. Enclosures shall be of the NEMA types shown on the drawings. Where the NEMA type is not shown, they are to be the NEMA type most suitable for the environmental conditions where the equipment is to be installed.
- C. No piping, ductwork, or equipment foreign to the electrical installation shall be located in the electrical distribution equipment dedicated space as defined in

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Wichita, Kansas*

N.E.C. Article 110.26 (F) (1). The Mechanical Contractor and Fire Sprinkler System Contractor shall locate ductwork and piping to clear the electrical distribution equipment dedicated space.

END OF SECTION 16400