DIVISION 16 - ELECTRICAL
SECTION 16010
GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The General Conditions, Supplementary Conditions, and General Requirements apply to the Work specified in this Section.

1.02 DESCRIPTION
A. This Section defines the General Provisions which are common to all Sections of Division 16.
B. Work Included:
1. All electrical work herein specified and/or shown on Drawings unless noted otherwise.
2. Installation shall be complete from location designated by the Electric Utility Company as point of service connection, to the final connection of motors, fixtures, devices, apparatus or pieces of equipment, unless modified by Drawings or these Specifications.
3. The Electrical Drawings and Specifications shall be understood to cover complete operating system. The Drawings and Specifications are to be taken together. Work specified and not shown, or Work shown and not specified shall be performed or furnished as though mentioned in both Drawings and Specifications.
4. Minor items and accessories reasonably inferred as necessary to the complete and proper operation of any system, shall be provided by this Contractor or Subcontractor for such systems.
C. Description of Systems:
1. Complete power wiring to switchboard, panels, motorized equipment, motors, equipment cabinets, and miscellaneous outlets.
2. General wiring for power, lighting, and miscellaneous systems.
3. Materials and equipment for electrical work.
4. Motor and equipment wiring.
5. General and emergency lighting and power systems.
6. Wiring of equipment furnished by others.
7. Motor Starters.
8. Empty conduit system and backboxes for telephone system.
9. Reconnection of all relocated electrical equipment (where applicable).
10. Power and empty conduit system and backboxes for Owners security system.
11. Power and empty conduit system and backboxes for Owners computer/POS system.
12. Power, empty conduit system, backboxes and wiring for Owners CCTV system.
13. Power and empty conduit system and backboxes for Owners sound system.
14. Power and empty conduit system and backboxes for Owners telephone system.
15. Power and empty conduit system and backboxes for Owners Checkpoint EAS system.
16. Fire, smoke, and heat detection system where required by local code authorities.
17. Energy management system.
18. Door bell system.
19. Power and empty conduit system and backboxes for Owners employee timecard system.
20. Temporary Electrical for construction.
21. All other equipment, material, devices, accessories required and/or shown on the Drawings.
D. Definitions - As used within the Contract Documents:
1. The term "Contractor" shall be understood to mean the Electrical Contractor or Electrical Subcontractor.
2. "Circuitry" shall mean any electric work (not limited to light and power distribution) which consists of wires, cables, raceways, and/or specialty wiring method assemblies taken all together complete with associated junction boxes, pull boxes, outlet boxes, joints, couplings, splices and connections, except where limited to a lesser meaning by specific description.
3. "Wiring" shall mean the same as Circuitry.
4. "Package Unit" shall mean an item of equipment having one or more motors or other electric energy consuming elements integrally factory mounted on a single base, complete with all associated control devices and interconnecting wiring.
5. "Normal Electric Work Conditions" means locations within building confines which are neither damp, wet, nor hazardous, and which are not used for air handling.
6. "Raceway" shall mean any pipe, duct, extended enclosed, or conduit (as specified for a particular system) which is used to contain wires, and which is of such nature as to require that the wires be installed by a "pulling in" procedure.
7. "Concealed" (as applied to circuitry) means covered completely by building materials, except for penetrations(by boxes or fittings) to a level flush with the surface as necessitated by functional or specified accessibility requirements. Unless specifically directed otherwise, all outlet boxes in walls are to be concealed.
E. Fees and Permits:
1. Obtain all permits and pay all inspection fees required for the complete electrical system.

1.03 QUALITY ASSURANCE
A. Qualifications:
1. Only new products will be acceptable unless otherwise noted.
2. The Electrical Contractor and his Subcontractors shall only employ workmen who are skilled in their respective trades.
3. All equipment, material, fixtures, devices, articles, accessories or products included in the Contract shall be of the exact make, model or catalog number, size, form and of the characteristics specified.
B. Requirements of Regulatory Agencies:
1. All electrical work shall be in accordance with the National Electrical Code (N.E.C.), (check with local inspector for edition), and other governing bodies which have jurisdiction over this project.
2. Where applicable, all fixtures, equipment and materials shall be as approved or listed by the following agencies:
a. Factory Mutual Laboratories.
b. National Fire Protection Association.
c. Underwriters Laboratories, Inc. (UL)
d. National Electrical Manufacturers Association (NEMA)
e. Americans with Disabilities Act (ADA)
C. Allowable Tolerances:
1. Review Architectural, Structural and Mechanical Drawings for all dimensions, locations, partitions and walls, structural details, and location of mechanical pipes and ducts so that the electrical installation shall be in harmony with that of the other trades.
2. Exact size, location, and electrical requirements of equipment furnished by other trades and wired by this Contractor shall be obtained from the Drawings of the other trades. Report all discrepancies at time of bidding.

1.04 SUBMITTALS
A. A minimum of 3 copies of all shop drawing submittals shall be submitted to the general contractor a minimum of 3 weeks prior to the start of any construction.
B. Shop drawings shall consist of installation, maintenance and operating manuals and instructions for all equipment.
1. Submit cut sheets of all devices
2. Provide shop drawings for all distribution equipment including panelboards, transformers, disconnects and starters.
3. Fire alarm equipment and diagrams in accordance with section 16721.

1.05 APPROVAL DRAWINGS
A. Prepare and submit for approval to local code authorities such additional electrical drawings, diagrams, and specifications as are required by:
1. Local Fire Prevention Bureau
2. Local Building Department - Electrical Inspection Section
3. Local Utility Company Metering Department

1.06 EXAMINATION OF THE SITE
A. All Contractors submitting proposals for this work are requested to visit the existing site. Failure to visit the existing site will in no way relieve the successful bidder from the necessity of furnishing any materials or performing any work that may be required to complete work in accordance with Drawings and Specifications without additional cost to the Owner.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING
A. Exercise care in transporting and handling to avoid damage to fixtures, equipment and materials.
B. Store materials on the site so as to prevent damage.
C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.
D. Where items of electrical equipment and/or materials are furnished by others for installation by Electrical Contractor, Electrical Contractor will be held responsible for the unloading of such equipment and/or materials from the delivery truck. He shall check equipment and/or materials upon receipt and notify party furnishing item of any damaged or missing equipment. He shall coordinate installation with Contractor providing equipment.

1.08 GUARANTEE
A. Provide one year guarantee for all fixtures, equipment, materials and workmanship, upon final acceptance by Owner.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Refer to individual Sections of Division 16.

PART 3 - EXECUTION

3.01 INSTALLATION/APPLICATION/PERFORMANCE/ERECTION
A. Excavating and Backfilling:
1. The Electrical Contractor shall do all excavating and backfilling required for the installation of any and all parts of his work requiring excavation. He shall also do all sheathing and bracing required for the installation of his work. He shall provide and operate pumping equipment, if required, to keep the trenches free of standing water. All work shall comply with requirements given in Section 02200.
2. The above shall include all excavation of every character, including rock, if encountered. Contractor shall visit the premises and determine for himself, by actual observations, boring, or other means, the nature of the soil conditions. The cost of all such inspections, boring, etc., shall be borne by the Contractor.
3. All excavations are to be so conducted that no walls or footings shall be disturbed or injured in any way.
4. Remove all surplus earth not needed for filling and dispose of same as specified under architectural division of work.
5. All backfilling shall be thoroughly tamped and settled in a manner as is proper for the particular type of work.
6. Where it is necessary to install work in or across roads, pavements, curbs, sidewalks, etc., this Contractor shall restore the present construction to its original or better condition if disturbed by his operation at no additional cost to the Owner.
B. Application, Installation:
1. In the event that conflicts, if any, cannot be settled rapidly and amicably between the affected trades, with work proceeding in a workmanlike manner, then the Architect/Engineer shall decide which work is to be relocated and his judgement shall be final and binding on this Contractor.
2. No measurements of a Drawing by scale shall be used as a dimension to work by. The Drawings are not intended to show complete or accurate details of the building in every respect. Exact locations and relations are to be defined in the field and shall be satisfactory to the Architect/Engineer. This Contractor shall take all field measurements and shall be responsible therefore.
3. Compare Drawings and Specifications, checking all measurements and determine intent of Contract Documents. Discrepancies shall be brought to the Architect/Engineer's attention for interpretation prior to any installation.
4. The right is reserved to make any reasonable change in location of outlets and equipment prior to roughing-in without involving additional expense. Any change from the Electrical Drawings as is necessary to make the work of this Contractor conform to the building as constructed and to fit the work of other trades shall be included in Contractor's Contract and installed without extra cost.

3.02 FIELD QUALITY CONTROL
A. Testing:
1. After wires are in place and connected to devices and equipment, the system shall be tested for shorts and grounds.
2. All hot wires, if shorted or grounded, shall be removed and replaced.
3. A voltage test shall be made at the last outlet on each circuit. If drop in potential is excessive, Contractor will be required to correct the condition by locating partly grounded conductor or high resistance splice.
4. All grounds, shorts and high resistance splices shall be rectified.
5. Any wiring device, electrical apparatus or lighting fixture furnished under this Contract, if grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing all defective parts or materials as directed.
6. Service ground to be tested per National Electrical Code requirement. Grounding pole of all receptacles to be tested.
7. All motors shall be tested under load with ammeter readings taken in each phase, and the RPM of motors recorded at the time. All motors shall be tested for correct direction or rotation. Electrical Contractor shall be responsible for testing running of all motors and shall verify that proper overload devices have been installed.
8. All meters, instruments, cable connections, equipment or apparatus necessary for making all tests, shall be furnished by this Contractor at his own expense.
9. Contractor shall submit proof of all tests to the Architect before final acceptance of the work.

3.03 ADJUST AND CLEAN
A. Cleaning Equipment, Completed Work and Premises: After the completion of all installations, each system shall be thoroughly cleaned to remove all paint, oil and other foreign material. Contractor shall also clean all foreign paint, grease, oil, dirt, labels and stickers, etc., from all fixtures, equipment, etc. The Contractor shall remove all rubbish, debris, etc., accumulated from his operations from the premises.
B. Demonstration: At the conclusion of the work and before final contract payment is made demonstrate and explain to the Using Agency's personnel, the function, operation and maintenance of all equipment and systems installed by this Division of the work and provide a copy of all tests performed.
C. Protect all equipment and systems against harmful exposures to, or accumulations of dust and moisture, flooding, corrosion or other forms of damage and clean and restore damaged finishes as may be required to place installations in a "like-new" condition before acceptance by the Architect.

3.04 SCHEDULES
A. Equipment Schedules: See Drawings for schedules of lighting fixtures, motor and equipment connections, switchboard, panelboards, distribution equipment, and related items.

3.05 APPROVALS
A. Obtain all permits and approvals from the governing bodies which have jurisdiction over this project.

3.06 IDENTIFICATION AND TAGGING
A. Provide all distribution switches and/or circuit breakers, starters, etc. whether individually mounted in panelboards, switchboards, etc., with suitable identification. The designation, using proper nomenclature, shall indicate the load served. Provide all feeders with suitable identification as to their designation in all junction boxes, pull boxes, gutter spaces through which they pass, and at their terminal points of connection. Identification of distribution switches or circuit breakers in panelboards shall be by means of panelboard directories. Identification of distribution switches or circuit breakers and starters individually mounted or in switchboards shall be by means of engraved lamacoid nameplates permanently fastened on the front face of the housing, showing 1/4" high white lettering on a black background. Identification of feed cables shall be by means of engraved fiber tags suitably fastened to the cables.

3.07 SLEEVES
A. Provide coring in walls and floor slabs for the passage of all conduits, pipes and ducts installed.
B. Cored holes in floor shall be provided with sleeves extended one inch above finished floor level and made watertight.

3.08 PAINTING
A. All equipment, panelboards, switchboards, etc., shall be factory finished in baked enamel or lacquer, or as specified. Standard factory finishes shall be approved. Any scratches shall be neatly touched up by the installing Contractor.
B. All metal work installed by this Contractor exposed to the weather and not factory finished shall be painted with two coats of oil paint of color selected by Architect.
C. All finish painting shall comply with the Painting Section of the Specifications.

3.09 CUTTING AND PATCHING
A. Perform all cutting and patching required to complete the Work, except where specifically shown on the Architectural or Structural Drawings.
B. Refer to Section 01070 for additional requirements.

3.10 TEMPORARY ELECTRIC SERVICE:
A. The electrical contractor shall provide temporary electrical wiring for construction use as follows:
1. Temporary service entrance and feeder as required with a fused main disconnect.
2. The electrical contractor shall provide temporary lighting and power throughout the space as required for construction use.
3. Contractor shall utilize existing electrical utilities where ever feasible.

3.11 STRUCTURAL CONDITIONS:
A. Notching and boring of structural members will not be permitted. If any conduit, boxes, etc need to be hung from structural steel, only hang from top flange of beams and top chords, and only panel points of joists and trusses.

SECTION 16100
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION
A. This section defines the Basic Material and Methods which are common to all Sections of Division 16.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Conduit:
1. Electrical Metallic Tubing: EMT, "Thin wall" conduit shall in general be utilized where permitted by Code except where described herein.
2. Heavy-wall steel conduit shall be either hot dipped galvanized or sherardized.
3. Flexible conduit shall be Greenfield type except, where exposed to oil, grease, or water - then conduit shall be Sealtite.
4. Conduit Fittings:
a. Rigid & IMC: Threaded.
b. Thin-Wall: Compression Type.
c. Flexible: Connectors shall be compatible with flexible conduit used.
5. Conduit shall be as manufactured by Allied, National Electric, Republic or Triangle.
6. Flexible liquid tight conduit as manufactured by Anaconda, Simplex, or International Metal Hose.
7. Minimum conduit size is 3/4". Contractor shall utilize larger conduits where required and/or specified.
B. Wires and Cables:
1. All wire shall be type THHN/THWN copper.
2. Wire smaller than # 10 shall be solid; # 10 and larger, stranded.
3. Where light fixtures are wired in continuous rows, wire pulled through fixtures shall be type SF2.
4. Final connections to heating equipment where shown, type SF2.
5. Cable and wire shall be as manufactured by Alcoa, Anaconda, General Cable, Triangle, Simplex, Hatfield, Bell, Alpha, and Coleman Cable and Wire.
C. Color Coding: Color coding shall be used throughout the entire electrical system:
For 120/208V., 3PH. systems
1. "A" Phase - Black - all gauges.
2. "B" Phase - Red - through #6. Larger black with phase markers.
3. "C" Phase - Blue - through #6. Larger black with phase markers.
4. Neutral - White - through #6. Larger black with phase markers.
5. Grounding Wire - Green, insulated.
6. Isolated Ground wire - Green with yellow stripe
7. Control Wire - Colors other than above.
D. Wire Pulling Lubricant: Use of wire pulling lubricant is optional; but, if needed to prevent damage to the conductors, it must be listed by Underwriters Laboratories and be of such consistency that it will leave no obstruction or tackiness that will prevent pulling out old wires or pulling in new wires or additional wires.
E. Electrical Connections, Terminals and Splicing shall be in accordance with Section 110-14 of the NEC. Connection materials and equipment must be given special attention when using dissimilar metal conductors, etc.
F. Outlet, Pull and Junction Boxes:
1. Boxes shall be 12 gauge or heavier steel, sherardized or galvanized to prevent rusting and shall have readily removable knockouts.
2. Pull boxes and pull fittings shall be accessible with removable covers secured with machine screws.
3. Junction boxes shall be minimum 4" square or octagon, not less than 2" deep, deeper if required by the number of wires or construction, with appropriate covers. Provide with 3/8" stud where lighting fixture is suspended from box.
4. All switch and receptacle outlets shall be equipped with minimum 4" box. Gang boxes shall be provided where groups of switches occur. All boxes shall be equipped with proper raised covers, mounted at heights shown on Drawings, or as directed. The approximate location of outlet boxes is shown on the Drawings, but care shall be taken to install all outlets with proper relation to equipment or material to be installed by other trades. Special outlets shall have proper boxes to accommodate special equipment. Outlet boxes in masonry shall be or proper depth to allow conduit to be installed without cutting of shell of blocks, etc.
5. Outlet boxes shall be as manufactured by Appleton, Steel City, Raco or Crouse-Hinds.
6. Boxes for all exterior conduit, or conduit mounted in exterior walls, shall be cast iron boxes, type "FS" or "FD", as manufactured by Crouse-Hinds, Appleton, Pyle National, Or Killark and provided with gasketed watertight covers. Fittings shall be pull type with gasketed covers.
7. Flush floor boxes in above grade floors shall be shall be Hubbell # B2529 series steel shallow floor box with # SF3925 Brass Duplex flap cover. Provide S3925 where carpet flange is not required. Provide all necessary trim and adjustment components.
8. Flush floor boxes in floors in contact with earth shall be shall be Hubbell # B2524 cast iron series shallow floor box with # SF3925 Bras Duplex flap cover with integral carpet flange. Provide S3925 where carpet flange is not required. Provide all necessary trim and adjustment components.
8. Flush mounted poke through devices shall be Hubbell # PT7FSDBRS2A with standard prewired duplex receptacle and brass duplex flap cover with carpet flange. Utilize Hubbell # PT7IGFSDBRSA with isolated ground prewired duplex receptacle and brass duplex flap cover with carpet flange.
9. Utilize one piece poke through device with single 3/4" knockout for cashwrap power feeds where appropriate. Provide Hubbell # PT7FFSDGY.
10. Utilize large capacity poke through device with single 2" knockout for cashwrap low voltage feeds where appropriate. Provide Hubbell # PT2FIT with adapter from 2" knockout to 1 1/4" conduit.
G. Disconnect Switches:
1. Switches shall meet NEMA enclosed switch standards KS1, current edition. Switches shall be quick-make, quick-break so that operation of the contacts shall not be capable, during normal operation of the switch, of being restrained by the operating handle after the opening or closing of the contacts has started.
2. All safety switches shall be heavy duty of voltage matching equipment served, NEMA 1 for indoor use and NEMA 3R for outdoor use. All switches shall utilize 75 C terminations. Switches shall be as manufactured by Cutler Hammer, General Electric, Square D, or Siemens ITE.
H. Fuses: Furnish and install all fuses. Fuses shall be Bussman "Fusetron", dual element, current limiting type, unless specifically noted otherwise.
I. Switches:
1. Except where otherwise specified, wall switches shall be mounted in suitable outlet boxes in the walls, partitions, or as shown on Drawings.
2. Wall switches shall be located as indicated on the Drawings, arranged singly or in gangs and at the height specified or indicated and shall have proper covers with finishes specified herein. Switches shall be as follows unless otherwise called for on Drawings or hereinafter specified. (Contractor shall check architectural drawings for additional information.)
a. Light switches shall be toggle 20amp, 120/277 Volt Specification grade.
b. SPST Hubbell #1221; P & S #20AC1; Leviton #1221
c. 3-way Hubbell #1223; P & S #20AC3; Leviton #1223
d. 30A-SPST (Motor Disconnect): Hubbell #3031; P & S #30AC1; Leviton #3031. Coordinate location with mechanical trades.
3. Verify door swings before installing switchboxes and install the boxes on the latch side of the door unless otherwise directed by the Architect.
4. Color of devices shall be black where installed on box car wood siding or ceilings and white where installed on drywall finished. Coordinate all finishes with architect prior to ordering.
J. Receptacles:
1. Receptacle shall be located as shown on the Drawings and at the heights specified or indicated. Receptacle and power outlets shall be of the grounding type and as manufactured by Hubbell, Pass & Seymour, or Leviton.
2. Duplex Convenience Receptacles: 20A.,2 Pole, 3 Wire, 125 Volt, (NEMA designation 5-20R) Specification Grade.
a. Pass & Seymour #5362
b. Leviton # 5362
c. Hubbell # 5362
3. Special Receptacles and Floor Boxes: As indicated on Drawings.
4. Color of devices shall be black where installed on box car wood siding or ceilings and white where installed on drywall finished. Coordinate all finishes with architect prior to ordering.
5. Ground fault circuit interrupter to be provided for receptacles outdoors, in toilet rooms, and within 6' of sinks.
K. Switch and Receptacle Plates:
1. Plates for switches and receptacles shall be thermoplastic type and of finish to match outlet or device.
2. Provide multigang or combination plates for devices grouped in gang or combination.
3. Provide plate with separate spring type cover for each outlet of waterproof duplex receptacles mounted on FA or FD box. All outdoor plates shall be weatherproof while in use type.
L. Circuit Breakers:
1. All circuit breakers serving lighting fixtures shall be switch rated "SWD".
2. Circuit breakers shall be as manufactured by Cutler Hammer, Square D, General Electric or Siemens ITE. Where existing equipment is being utilized, new circuit breakers shall be provided of type, size, manufacturer and AIC rating to match existing.
M. Motors, Control Panels, Etc., Furnished by Others:
1. Check the Drawings and Specifications covering all branches of the work to ascertain what equipment is furnished by others. It will be this Contractor's responsibility to furnish the necessary labor and materials to receive and wire said equipment. Check the Plumbing and Mechanical Drawings and Division 15 of the Specifications carefully for wiring by the Electrical Contractor.
N. Motor Starters: Furnish, install, and wire all motor starters as shown on Drawings. Characteristics are as follows:
1. Each 3 phase starter shall be in a NEMA 1 enclosure, combination, magnetic across the line as scheduled on the Drawings. Each starter shall have H.O.A. feature and 120 volt control transformer.
2. Each starter for 120 volt motors as shown shall be in NEMA 1 enclosure and of the thermal toggle type. Where pilot lights are indicated, same shall be built into enclosure. Flush boxes shall be provided where starters are shown in finished areas.
3. Starters shall be as manufactured by Cutler Hammer, Square D, or General Electric or Siemens ITE.
O. Floor boxes: Furnish, install, and wire all floor boxes as shown on Drawings. Characteristics are as follows:
1. Floor boxes shall be stamped steel with adjustable floor leveling screws as manufactured by Wiremold 885B shallow service type.
2. Provide Wiremold 895TCAL 5 1/4" carpet flange for all specialty floor installations including hardwood floor applications.
3. Finish shall be brushed brass.

PART 3 - EXECUTION

3.01 PREPARATION/INSTALLATION/APPLICATION
A. Conduit:
1. Installation - conduit:
a. Conduit to be run exposed in unfinished areas such as mechanical, electrical room, stock rooms, and Urban Outfitters Sales floors. All other conduit shall be concealed. Provide trapeze support structure as detailed on electrical drawings to carry all exposed conduit back to stock area and back of house.
b. Run parallel or perpendicular to exterior walls of building.
c. Locate to avoid equipment, fixtures, ductwork, piping, etc.
d. Layout and install work in advance of the laying of floors, walls, etc., and furnish and install all sleeves that may be required for openings through floors, walls, etc.
e. Where conduit is to be run exposed, furnish and install all inserts and clamps for the supporting of conduit.
f. If contractor does not properly install all sleeves and inserts he will be required to do the necessary cutting and patching later at his own expense, and to the satisfaction of the Architect.
g. Do not obstruct openings or passageways.
h. Where conduit passes through floors or through smoke and fire walls, space between conduit and floor or wall shall be filled with cement grout.
I. Radius of bends shall be not less than six(6) times internal diameter. Any run of conduit shall not include more than the equivalent of four(4) quarter bends.
j. Sales floor of Urban Outfitters shall be completely hard piped with EMT. MC cable or flexible conduit shall not be utilizied except where specifically detailed. Layout of conduit must be reviewed with general contractor and UO CPM to confirm layout is acceptable. Conduit routing on the sales floor is an aesthetic piece of the architectural design of the store. Contractor shall receive approval from the architect and construction manager prior to any installation of conduit on the sales floor.
k. Provide expansion fittings for all conduits at expansion joints.
l. MC cable may be utilized within wall cavities and back of house areas where permitted by local code authorities.
2. Cutting Conduit:
a. Measure and cut conduit from job site conditions, not from Drawings.
b. Conduit shall be cut square and butted solidly into fittings.
c. On rigid conduit, cut conduit full and clean with sharp dies. Ream ends of pipe after cutting and before assembly to remove burrs.
d. Ream thin-wall conduit (EMT) after it is cut.
3. Liquid Tight and Flexible Conduit:
a. Liquid tight flexible conduit shall be installed in such a manner that liquids tend to run off the surfaces and not drain toward the fittings.
b. All runs of flexible conduit shall be as short as practical, of the same size as the conduit it extends and with enough slack to reduce the effects of vibration. A minimum of 24 inches of flexible conduit shall be installed.
c. Where the fittings are brought into an enclosure with a knockout, an insulated throat type fitting with liquid sealing "O" ring shall be used.
d. Flexible metal conduit shall be installed for all final equipment connections to transformers, light fixtures (lay-in type) and all other devices where so required.
4. Type of Conduit:
a. The following areas shall be galvanized steel heavy wall conduit or IMC:
1) In earth fill.
2) Exposed in wet areas.
3) Exposed outdoors (Provide watertight fittings & boxes).
4) Outside masonry walls.
5) Within building confines run in concrete slab. Couplings for conduit run in poured concrete shall be concrete tight.
b. Conduit run in dry areas within building confines shall be EMT. Dry areas are inside partitions, ceiling cavities and areas not subject to damage. Outside walls are not considered dry areas.
5. Supporting of Conduit:
a. All conduits must be independently supported from structure. No conduits shall be supported from the ventilating ducts, ceiling hangers, mechanical piping or their hangers.
b. All surface run conduit one inch(1") and smaller shall be supported every five feet with one hole straps with clamp backs. Perforated strap hangers will not be permitted.
c. Hangers shall be proportioned for the weight of the conduit(s) supported. All rods, clamps and/or hangers shall be galvanized, bonderized, plated or painted. Where factory supplied, with one of the above rust resistant finishes, all field cuts and threads are to be painted and covered with a grey finishing paint.
d. Trapeze type hangers may be used where several conduits occur at the same elevation. The spacing of such trapeze hangers shall be determined by the electrical code spacing requirements for the smallest conduit in the run.
e. Approved type inserts for support of work in cast or concrete construction.
f. Approved type steel beam clamps in the case of steel construction.
6. Where holes or recesses must be cut in walls, floors, ceilings, or any part of the building to admit apparatus, conduit or other work of this Contractor, he must have it done by a competent mechanic in a neat and workmanlike manner. The portions cut must be restored to their original condition at the expense of this Contractor. This Contractor shall provide for all of his own cutting and patching.
7. All conduits run in or below any grade slab shall be heavy wall conduit and entirely encased in 2" of concrete. In no case shall conduit be laid in fill below slab. Conduit shown as plastic shall be schedule 40.
8. 3/4"D. minimum conduit shall be utilized.
9. Provide:
a. Supplementary angles, channels, plates, etc., where supports are required between building's structural members, spanning the space and attached to building structural members, by welding, bolting or with concrete anchors.
b. All rods, angles, rails, struts, brace plates, platforms, etc. required for suspension or support of conduit and equipment.
c. Straps, clamps, threaded rods, turnbuckles, anchors, etc., and all miscellaneous specialties for the attachment of hangers and supports to the structure.
10. Unless otherwise noted on the Drawings, the following shall apply:
a. Convenience outlets shall be placed on separate circuits from motor and lighting outlets.
b. Motors shall be placed on separate circuits from lighting outlets.
c. Convenience outlets shall not be installed back to back.
B. Motor and Equipment Wiring:
1. Unless indicated or specified elsewhere perform the following:
a. Connect and wire to each motor and piece of electrically operated equipment shown on the Drawings or as specified in these Specifications.
b. Furnish, install and connect all starters, controller selector switches, pilot lights, pushbuttons' stations for each motor and piece of electrically operated equipment shown on Drawings, or as specified in the Specifications, unless otherwise indicated.
c. Furnish and install all wiring from the current source to all starters and from starters to motors, except in the case of factory installed wiring packaged equipment. Wire to the line side of all prewired equipment.
d. Furnish and install a disconnect switch ahead of all prewired package equipment. Coordinate with Mechanical Trades Contractor.
e. Install all roughing-in pertaining to each item of equipment furnished under other Sections of the Specifications or by the Owner. Locations of electrical outlets for this equipment are indicated on the Drawings in their approximate locations. The supplier furnishing the equipment will furnish dimensional drawings accurately locating all roughing-in required for his equipment.
f. Receive, set and align motors which are shipped loose if local union or trade jurisdiction practice requires doing so.
g. Provide all control circuit and interlock wiring and connections for all mechanical equipment as indicated and scheduled on the Drawings.
2. If a disconnect switch is required by the enforcing code and not indicated on the Drawings or in the Specifications, it shall be furnished and installed.
3. Where specific locations of switches and starters are not shown on the Drawings, these shall be placed near the motor.
C. Thermostats:
1. Refer to energy management section of specifications for thermostat specification as well as details on plan drawings for energy management system.
2. Provide a 4" square backbox with plaster extension ring with 3/4" conduit and associated wiring from each thermostat to appropriate mechanical equipment. Refer to wiring diagrams on drawings for additional information.
C. Conductors, Cables:
1. Except where otherwise shown on the drawings all wiring shall be installed in conduit.
2. Conductors and cables shall not be installed in conduit or raceways until same are free from moisture and debris.
3. Leave a minimum of six inch(6") length of cable and conductor slack at each outlet.
D. Expansion Fittings:
1. Expansion fittings shall be installed in all conduits crossing expansion joints. Refer to Architectural drawings for locations.
E. Prohibited wiring methods:
1. BX, AC, NM, NMC, NMS, UF, USE, SE, FCC.

SECTION 16400
SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. The General Conditions, Supplementary Conditions, and General Requirements apply to the Work specified in this Section.
B. Section 16010, "General Provisions - Electrical", applies to the work specified in this Section

1.02 DESCRIPTION
A. Work Included:
1. Complete electrical service and secondary distribution system.
2. All charges by the Local Utility Company for construction related work. Owner charges will be paid by the Owner.
3. System Grounding per the local Utility Company and the N.E.C.
4. Main distribution panelboards and lighting panelboards as scheduled.
5. Utility approved current transformers and meter fittings.
6. Utility Company transformer support pad and primary conduit(s).
7. Complete secondary 120/208 volt, 3 phase, 4 wire or 277/480 volt, 3 phase, 4 wire 60 hertz service from the secondary side of pad mounted transformer into the building main service overcurrent protective device.
8. Tenant metering where shown and required.

PART 2 - PRODUCTS

2.01 EQUIPMENT
A. Main Distribution Panelboards:
1. Shall be as scheduled on the drawings.
2. Panelboard shall be enclosed in steel cabinet of rigidity and gauge of steel per UL Standard 50 for cabinets.
3. Acceptable manufacturers are Cutler hammer, Siemens ITE, General Electric and Square D.
4. Bus structure shall be copper not exceeding density of 1000 amps per square inch of cross section. Buss supports shall be adequate to withstand 42,000 amperes symmetrical short circuit stresses minimum.
5. Provide with a copper ground bus. The ground bus shall be fastened and bonded to the framing member in an approved manner. The ground bus shall be grounded in a manner meeting all code requirements.
6. Panelboard shall be braced for short circuit capacities as scheduled by the local Utility Company; however, the minimum bracing shall be 42,000 A.I.C. symmetrical.
7. Each circuit breaker shall be equipped with an approved nameplate which indicates the name of the equipment (motor, panelboard, etc.) to which the feeder conductors are connected.
B. Building Metering: For metering furnish and install on the C.T compartment or on the exterior wall a mounting panel with all meter accessory equipment for mounting thereon the associated Utility Company's meter requirements.
C. Lighting and Appliance Panelboards:
1. Panels shall be type indicated on the Drawings, with main lugs, main breakers, bolt-on branch breakers, spares and spaces as scheduled. Ground fault interrupter (GFI) circuit breakers shall be provided where noted.
2. Panels shall comply with U.S. Federal Specification WP115a, Type I, Class I. Where applicable, provide with copper bus of density not exceeding 1000 amps per square inch.
3. The Electrical Contractor shall balance all circuits within 10 % phase to phase. All conductors shall be continuous without splicing from last outlet to their terminals in cabinet. All circuit conductors in cabinet shall be installed with sufficient amount of length to reach the most remote breaker connection from its point of entrance.
4. Panelboard fronts shall be fabricated from a flat piece of full finished code gauge sheet steel with door cut out leaving a trim of proper width around the door. Provide a latching mechanism controlled by a chrome plated vault-handle on doors twenty-four inches(24") or over in height. All Locks to be keyed alike to the panel manufactures's standard key. Two(2) Keys shall be furnished with each cabinet.
5. Contractor shall provide a directory of circuits for cabinet. Directory shall be typewritten designating room or equipment and circuit numbers. Directory frame, lock, hinges, etc., are to be secured to inside of door and trim in such a manner that screws, holes or welds, etc., are not visible on the door panel or trim.
6. The width and height of cabinets shall be sufficient to provide a wiring gutter at the two sides and at the top and bottom of not less than 4". Additional width or height shall be provided, if required for entering conduits. Additional wiring gutter space shall be provided, if required for main or sub-feeder cables passing through to feed other cabinets.
7. Where 2 or 3 pole breaker units are called for, they shall be one unit with common trip and not single pole units with handle ties. Capacity of main busses shall be as shown on the Drawings.
8. Provide with a copper ground bus. The ground bus shall be fastened and bonded to the framing member in an approved manner. The ground bus shall be grounded in a manner meeting all code requirements.
9. Provide with a copper isolated ground bus where specifically indicated on the panel schedules. The ground bus shall be isolated from the framing member in an approved manner. The ground bus shall be grounded in a manner meeting all code requirements. Provide an isolated ground conductor to point of service ground within raceway(s) containing feeder conductors.
10. Acceptable manufacturers are Cutler Hammer, Square D, General Electric and Siemens ITE.
11. Panelboards shall be braced for short circuit capacities as scheduled by the local Utility Company with no less than 14,000 AIC for 277/480 volt panelboards and 10,000 AIC for 120/208 volt panelboards. All panelboards shall be fully rated for the available fault current. Series rating of panelboards is not acceptable.
12. All breakers utilized for switching lighting shall be labeled switching duty type.
D. TRANSFORMERS
1. All transformers shall be 115 degree C temperature rise above a 40 degree C ambient.
2. Sound levels shall not exceed Nema Standards.
3. All windings shall be aluminum.
4. All transformers shall be energy star compliant and NEMA TP-1 rated for energy efficiency.
5. Provide a 6" concrete pad for floor mounting of each transformer. Provide a vibration isolation pad for each transformer.
6. Provide a conduit with grounding electrode sized per NEC to point of service ground.
7. Acceptable manufacturers are Cutler Hammer, Square D, General Electric and Siemens ITE. Transformer shall match panelboard manufacturer.

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