SECTION 16000 - GENERAL PROVISIONS AND REQUIREMENTS

PART 1 – PERMITS, CODES, INSPECTIONS, APPROVALS, ETC.

a) The Contractor shall obtain all permits necessary and shall bear all costs involved. The contractor shall bear all costs associated with electrical utility work.

b) All electrical work shall be performed in accordance with the requirements of the latest revision of the National Electrical Code (NFPA 70), National Electrical Safety Code, and Ky. Building Code. Similarly, all electrical equipment, where applicable, shall conform to all other NFPA Pamphlets, NEMA, ANSI, IPCBA and U.L. requirements. Whenever and wherever the design or State and local regulations require higher standards than the current National Electrical Code, then these shall be followed. Division 1 of the Architectural specifications shall apply to all electrical work.

c) The Architect/Engineer shall be notified twenty-four (24) hours in advance when any tests are to be made and before any work is concealed. The Contractor shall notify the Architect/Engineer when he is ready for final inspection.

d) The fronts of all electrical panels shall be removed for final punch list inspection.

e) All electrical items on this project shall bear the Underwriters Laboratories (UL) label and/or FM (Factory Mutual).

f) Provide electrical inspection by a licensed and recognized Electrical Inspector. Notify Electrical Inspector in writing, immediately upon start of work with a copy of notice to Architect. Schedule inspections for rough work as well as finished work. Approval from Electrical Inspector will not be allowed as reason for deviation from Contract Documents. All costs incidental to Electrical Inspection shall be borne by Contractor. Prior to final acceptance of work and release of final payment, deliver to Architect the certificate of final inspection.

g) The contractor shall install the fire alarm system, if applicable for this project, per the state approved drawings. The contractor is responsible for submission to the state.

PART 2 - CLEANING AND PAINTING

a) The Contractor shall remove all temporary stickers, tags, etc. from all items installed under this Contract and shall thoroughly clean all equipment or materials installed under this Contract. Scratched and damaged paint and/or other finishes shall be touched up and/or repainted as required. All equipment shall be cleaned and made ready for painting by others.

b) Upon completion of the work, the Contractor shall thoroughly clean and lubricate all equipment.

c) Surplus material, rubbish and equipment resulting from the electrical work shall be removed from the building and premises by the Contractor upon completion of the work in accordance with the Architectural specifications.

d) All permanent nameplates on equipment shall be kept clean and exposed for easy reading. If field conditions warrant (in the opinion of the Architect) the Contractor shall vacuum clean all equipment and installed materials.

PART 3 – IDENTIFICATION OF ELECTRICAL EQUIPMENT

a) The equipment services, feeder and branch circuits shall be marked in accordance with the National Electrical Code. Mark with moisture and fungus resistant wire markers and nameplates. All conductors that are not color-coded shall be marked with colored tapes to denote phases.

b) Identification of main entrance switchboard and branch circuit panelboards shall be labeled with a machine cut lamacoid plate with ¼" high letters, indicating the panel designation, voltage and phase (i.e.: Panelboard "A" - 120/208V., 3-Phase, 4W). Branch panelboards in finished areas shall have plate installed inside of door.

c) All switches or breakers in main switchboard shall be labeled to indicate equipment served with ½" wide machine cut lamacoid plate with 1/8" high letters.

d) All remote disconnects, safety switches, motor starters, etc. shall have the name of the motor/equipment which it is controlling engraved on lamacoid plate, ½" wide with 1/8" high letters. Exact name of system or motor shall be coordinated with Architect/Engineer prior to manufacture.

e) Identify circuits contained in each box on exterior cover w/permanent marker.

f) Mark all conduit housing currents with greater than 300 volts phase to phase every 20'. ½" high letters to be used.

g) All lighting and power panels shall have each breaker (including spares and spaces) identified with typed directory cards covered in plastic. Indicate type and location of load based on actual room numbers (verify final room number designation with Owner and Architect).

PART 4 – SLEEVES, ESCUTCHEONS AND INSERTS

a) Sleeves shall be installed through masonry and concrete walls and floors for the passage of electrical raceways, cables, etc. Sleeves shall be placed and sized to permit installation and removal of the assembly. All electrical raceways larger than 1" shall be sleeved. Sleeves are not required where raceway bends into wall.

b) Cast iron sleeves shall be installed through all walls where conduit enters the building below grade. All other sleeves shall be standard weight steel. Sleeves shall be flush with each face of the wall. Sleeves for conduit through outside walls shall be packed with oakum for weatherproofing.

c) All sleeves through floors shall extend ¾" above finished floors. All sleeves shall be ½" larger than the outside diameter of the duct or conduit. All sleeves shall be equal to Schedule 20 pipe or heavier.

d) Escutcheon shall be installed around all openings in exposed finished area. This includes all raceways whether they are sleeved or not. Escutcheon shall be equal to Benton & Caldwell, No. 40 or equal.

e) Inserts shall be installed as required, with location coordinated with other Contractors.

PART 5 - CIRCUIT NUMBERS AND CIRCUITRY

a) Circuit numbers, and breaker numbers shall be coordinated on panel identification card as shown on the Drawings.

b) The exact routing of circuits as shown on the drawings from receptacle to receptacle, light to light, etc. is schematic only. If the Contractor desires to change the routing of any circuits, he may do so within the scope of good engineering practice, and with the permission of the Architect/Engineer. All outlets shall be on the same circuit number as shown on the Drawings. Any change in routing shall be shown on the "Record" Drawings.

c) Circuits shall NOT share the same neutral. All circuits shall be provided with a separate dedicated neutral. Circuits on the construction drawings are shown individually. If the contractor chooses to combine circuits in the same raceway the circuits shall be sized and derated per NEC.

PART 6 - SPARE CIRCUITS/CONDUIT

a) All spare breakers or switches shown in the Panelboard Schedule shall have conduits stubbed above ceiling and/or down below slab as described hereinafter.

1) Recessed Panels - All spare conduit shall be stubbed above ceiling. If area has no ceiling, spare conduit shall ell out 2" below slab above.

2) Surface Panels - Spare circuits shall have knockouts only in top of tub available for spare circuits.

b) Contractor shall provide three-3/4" conduit to accessible ceiling space. Cap all spare conduits for all recessed panelboards.

PART 7 - PROTECTION

a) All work, equipment and material shall be protected at all times. All conduit openings shall be closed with caps or plugs during construction. All equipment and accessories shall be tightly covered and protected against dirt, water or other injury during period of construction.

b) The Contractor shall cover all installed receptacles, switches, etc. with a plastic or equal cover prior to the painting of the areas. No device plate shall be installed prior to the finish painting. Any receptacle, switch, device plate, etc. with paint on it shall be removed and replaced by this Contractor. It shall be the Contractor's responsibility to

coordinate with the Painting Contractor with regard to the scheduling of the installation of switches, outlets, device plates, etc.

PART 8 – TESTING AND ADJUSTING

a) When the work included is complete, the Contractor shall start up and adjust all parts of his system. All equipment items of the various systems shall be adjusted for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.

b) No equipment shall be operated for any purpose until properly lubricated and brought into service condition.

c) The Contractor shall provide all equipment, materials and labor required to make the necessary tests.

d) The Architect/Engineer reserves the right to require the services of an authorized representative of the manufacturer in the event the Contractor is unable to so adjust any piece of equipment. The Contractor shall arrange for such services and bear all incurred costs thereof. After completion of adjustments, the Contractor shall advise the Architect/Engineer that the work is ready for the final acceptance test.

e) Upon completion of the installation, the Contractor, at his expense, shall conduct complete performance tests in the presence of the Architect/Engineer and Owner to fully demonstrate the capacity and all other characteristics of the systems. The test shall be run for a length of time sufficient to demonstrate the ability of each system to perform as required by design drawings and specifications.

f) The Electrical Contractor shall perform the following tests:

1) All branch circuits of No. 8 wire and larger and main feeders shall be megged for ground and insulation resistance before connecting to equipment. (Megger to be 500 volts).

2) All motors larger than ½ HP shall be megged before conductors are connected thereto and again after they have gained running temperature.

3) A record of all megging shall be delivered to the Engineer before final acceptance. Architect/Engineer shall be notified in advance so that he may witness the test.

g) Refer to respective equipment sections for special tests such as Sound Systems, Fire Alarm, Television, etc.

PART 9 - CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

a) The Architectural, Structural, Electrical, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications are complementary to one another.

The Contractor shall rough-in for and furnish all labor and materials necessary to make final connections to all equipment furnished by the Owner or any other Contractor or Sub-Contractor which requires electrical connections, including heating controls and all control and interlock wiring.

b) The Contractor making the required connections shall be responsible for any damages caused by erroneously connected equipment.

PART 10 – MOTORS AND APPARATUS BY OTHER TRADES

a) The Contractor shall obtain from the other trades all necessary information regarding motors, and wiring connections of apparatus furnished by these trades.

b) Furnish and install all necessary wiring and raceways required for satisfactory testing and operation of all controllers, starters, motors, control boards, alarm boards and related equipment, etc. The other trades supplying apparatus on which there are motors will supply and deliver to the Contractor at the sidewalk or building receiving quarters all control equipment specified under their section of the specifications for erection and connection of all such equipment in their designated places under this section of the specifications. (The equipment furnished by others is shown on the Motor Schedule).

c) The Contractor shall carefully examine the Architectural, Structural, Plumbing, Heating, Ventilating and Air Conditioning Drawings and Specifications to determine the extent, type and locations of all wiring required and shall obtain from the respective Contractors the wiring diagrams and other necessary information to properly install his part of the work.

d) Motor sizes shown on the Drawings are nominal sizes with some variation anticipated in the final installations. Under this section of the specifications, the Contractor is to coordinate the work with all other trades by obtaining all final data from each supplier and install wiring, circuit and motor protection and equipment in accordance with the actual equipment nameplate data regardless of sizes, etc. shown on the drawings. Undersized wiring, conduit, disconnects, etc. connected to equipment shall be the responsibility of the Contractor. Coordinate with the Engineer on any differences found between drawings and actual load data.

PART 11 – ELIMINATION OF NOISE AND VIBRATION

During the construction of this project, if any system or piece of equipment produces noise or vibration, which, in the opinion of the Architect is objectionable to the Owner, the Contractor shall, at his own expense, make changes in equipment and do all work necessary to eliminate the objectionable noise or vibration.

PART 12 – GROUNDING OF SYSTEM

a) All metallic conduit, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code and as shown on the Drawings.

b) The size of the grounding conductor for service equipment shall not be less than that given in Article 250-94 and 250-95 of the National Electrical Code or as shown on the Drawings.

c) Ground bus and non-current carrying metallic parts of all equipment and conduit shall be securely grounded by connection to common ground bus insofar as possible or as shown. Jumper all noise or vibration isolators to insure ground potential.

d) The above ground bus shall not be less than #350 MCM copper or as per code with all connections made with pressure connectors.

e) No ground wires smaller than No. 12 solid copper shall be used; all wires larger than No. 8 shall be bare copper, stranded cable. All flexible conduit shall have a green insulated jumper bonded at each end.

f) The main ground electrode shall be a bare #350 MCM (or as shown on the drawings) copper conductor laid in bottom of footer trench. This electrode shall be as shown, but no less than 100' long and shall be thermal welded to building steel at each column it passes with both ends tied back to ground terminal in main gear. Ground resistance shall not exceed 5 ohm. (If ground electrode cannot be installed in bottom of footer trench, then the Contractor shall provide ground rods necessary, (minimum of six (6)), no less than 15' (center to center) to meet the ohmic value mentioned above).

g) The main water pipe shall be bonded to the service equipment enclosure, the grounded conductor at the service and the grounding electrode conductor in footer trench.

h) All connections to main ground conductors shall be thermal welded.

i) All raceways with ground lug bushings shall be grounded to their respective boxes with an approved jumper wire.

j) All EMT runs to receptacles, light fixtures, power outlets or any equipment shall have a code size insulated green ground wire connected to respective receptacle, light fixture outlet or equipment. All PVC (if allowed) shall have code sized ground wire.

PART 13 - SAMPLES

Provide samples as required by the Architect under this section of the specifications if a substitution is questioned. Any samples, if approved, submitted may be subsequently installed on the project providing it is approved.

PART 14 – SHOP DRAWINGS

Submit Shop Drawings in bound sets on all items furnished under this Contract in sufficient number to satisfy the Architect's requirements. Shop Drawings should be submitted within 30 days after the work order to proceed. All shop drawings submitted for review shall bear an "approved stamp" and signed by the Contractor. All shop drawings not bearing the Contractor's "approved" stamp will be returned without comment.

PART 15 – CUTTING AND PATCHING

a) Any cutting and patching in the building required to install the equipment, etc. shown on Drawings shall be accomplished by the Contractor. He shall meet all requirements of the Architectural Section and at his expense.

b) The Contractor shall be responsible for all openings and chases he may require in floors, walls or ceilings of any type construction (whether under construction or existing). All work necessary as a result of failure on the part of the Contractor to provide the required openings and chases and to set sleeves and inserts shall be performed at his own expense. When shown, these openings and/or chases will be formed or provided for in the work of the General Contractor. However, the Contractor shall be responsible for cooperation with the General Contractor in locating and sizing such openings. Openings required and not shown on Drawings shall be brought to the attention of the General Contractor promptly and the Architect/Engineer for approval.

PART 16 – ACCESS DOOR

a) The Contractor shall refer to the Architectural Drawings to ascertain which rooms have removable ceilings. Where removable ceilings are specified, access to equipment may be obtained by removing the ceiling pieces. Where non-removable ceilings are specified, the Contractor shall furnish all required access doors for servicing disconnect switches, etc.

b) Access doors shall be equal to L.M. Walsh Company "Way-Loctor". No. 3 shall be used for concrete block or tile walls having no plaster finish and No. 2 shall be used for plastered walls and ceilings for acoustical tile ceilings. All doors shall be prime coated and key operated and keys.

c) Installation of doors will be shall be the same for plumbing and heating work. Doors by Miami or Milcor or equal quality will be acceptable done by the General Contractor. However, the Contractor shall be responsible for the correct location of them for servicing equipment. These access doors shall be sized large enough to service the equipment with a minimum size of 20"x20".

PART 17 – COORDINATION OF WALL OUTLETS

The Contractor shall plan his work in such a manner that wall outlets that are adjacent to each other or within a given area shall be installed at the same height, and with a symmetrical appearance.

PART 18 – EXCAVATION AND BACKFILLING

a) General

1) Refer to Special Conditions in the Architectural Specifications and bid the rock and earth excavation in accordance with the requirements listed.

b) Excavation

1) Rock excavation shall be made to a depth of 4" below conduit or ducts or as shown on the drawings. All conduit and/or ducts shall have 4" of dense graded aggregate installed above and below. The Contractor shall be responsible for locating in the field the lines shown on the drawings. The Contractor shall use reference points as shown on the drawings for locating control points on the lines. Trench bottom shall follow uniform grades insofar as possible and shall be relatively flat from side to side.

2) Minimum depth of bury for all lines outside the building shall be 24" to top of pipe or as shown on the Drawings. The width of the trench above that level shall be as wide as necessary for sheathing and bracketing. All conduit under slab shall be deep enough to allow vertical code bends.

c) Dewatering And Shoring

Trenching and other excavation shall be maintained adequately free of water and shall be adequately shored, where necessary to protect workmen, materials, equipment, and adjacent structures. Discharge from pumps, drains or bailing shall be placed in ditches, storm drains or natural drainage ways. No extra will be paid for this work.

d) Backfilling

1) Under all backfill conditions with exceptions as listed below, earth shall be hand-placed to a height of at least 6" above the top of the dense graded aggregate. After backfilling and tamping with earth to a depth of 6" above the top of the dense grade aggregate, the backfilling operation may be continued by a machine in 12" layers, compacted with approved mechanical tampers. Any trenches improperly backfilled, or where settlement occurs, shall be re-opened to the depth required and compacted with the surface restored to the required grade and compacted and smoothed off. All trenches which run under sidewalks, roadway, etc. shall be filled to sub-grade with dense graded aggregate.

2) Dense graded aggregate shall be crushed limestone blended into a homogeneous mixture and graded in conformance with Article 208.2.0 of the latest edition of the Standard Specifications of the Kentucky Department of Highways.

e) Surplus Materials

All surplus material, particularly rock, resulting from this operation shall be removed from the grounds. Disposal from the site of such materials is the responsibility of this Contractor. Earth shall be disposed of only after rock has been removed from the site.

f) Blasting

All blasting on this project shall be done as set forth in the Architectural Specifications.

PART 19 – FOUNDATIONS AND ANCHOR BOLTS

a) The Contractor shall be responsible for the location of all concrete pads required for all equipment installed under this Contract. All pads required will be poured at the expense of the Contractor.

b) The Contractor shall furnish anchor bolts for all equipment installed on concrete slabs and/or bases. Bolts shall be placed in exact positions prior to pouring concrete. Sizes of bolts shall be determined by the manufacturer's recommendations for the equipment served.

c) Contact utility for exact requirements of transformer concrete pad.

PART 20 - OPERATING AND MAINTENANCE INSTRUCTIONS

Deliver to the Architect three (3) copies of shop drawings and all Operating and Maintenance Instructions for all equipment furnished and installed under this Contract, including parts lists for all new major equipment items. Each set shall be provided in a hardback binder with table of contents and divider for each section.

PART 21 - FIRESTOPPING

All openings required for conduit in walls, floors, ceilings, partitions, etc., where such construction is required for fire protection, shall be firestopped to preserve the fire rating of the construction. Firestopping shall be mineral wool or other non-combustible insulating material tightly placed and filling the space around such conduit. All materials used shall be approved for use as fire stop equal to 3M Fire Barrier. (Caulk CP-25, putty 303 and 7904 Barriers), or equal by Hilti (Caulk CS240, putty CB 120 Foam, CS2420 barrier material. Firestopping shall be installed after the installation of all wiring and cabling, etc.

PART 22 – SUSPENDED CEILINGS

a) The Contractor shall insure that framing numbers of suspended ceiling systems used to support fixtures shall be securely fastened to each other and shall be securely attached to the building structure at necessary intervals (NEC).

b) If the above items are not covered, the Contractor shall immediately alert the Architect. Fixtures shall not be installed until all questions concerning the above are answered.

c) All recessed light fixtures shall be clipped to ceiling structure. All 2x4 light fixtures shall be independently suspended from the ceiling grid at a minimum of opposite corners.

PART 23 – ELECTRICAL DRAWINGS AND SPECIFICATIONS

a) The drawings and specifications are intended to cover all work enumerated under the respective headings. The drawings are diagrammatic only as far as final location of

raceways, equipment, etc. is concerned. Any item of work not clearly included, specified and/or shown, any errors or conflict between plans (Mechanical, Electrical, Architectural or Structural) specifications, codes and field conditions, shall be clarified by a written request to the Architect by the Bidder before bidding; otherwise, the bidder shall, at his own expense, supply the proper labor and materials to make good any damages or defects in his work caused by such error, omission or conflict.

b) Schematics, risers and details shown on the drawings are for the equipment specified. All revisions, modifications or changes in circuitry, accessories, etc. due to using equipment of a different manufacturer than specified hereinafter, shall be the responsibility of the Bidder and shall be made at no additional cost to the Owner. All modifications or changes shall be submitted to the Architect in writing and meet his approval before the equipment is released for shipment.

c) The Contractor shall be responsible for all revisions, modifications or changes necessary in the Structural, Architectural or Mechanical/Electrical systems to accommodate the equipment to be furnished under this section of the specifications. This shall be made at no additional cost to the Owner.

d) Contractor shall provide arc flash study and breaker coordination study/arc fault study.

PART 24 – APPLICATION FOR PAYMENT

a) Line items and description of electrical work shall be as follows:

Item No.	Description of Work
1	Bond & Permits
2	Mobilization
3	Electrical Service and Phone Site work
4	Distribution Equipment Material
5	Distribution Equipment Labor
6	Lighting Material
7	Lighting Labor
8	Outdoor Lighting Material
9	Outdoor Lighting Labor
10	Gas Island Equipment Hookup and Labor
11	Conduit & Boxes
12	Wiring (material and labor)
13	Excavation & B.F.
14	Electrical Inspection
15	Utility company coordination and fees

END OF SECTION

SECTION 16025 – SCOPE OF WORK

PART 1 - GENERAL

Except as otherwise hereinafter specified, the work under this Contract consists of furnishing all labor, materials, tools, elevating apparatus, transportation permits, certificates and equipment and performing all operations relevant to the installation of the Electrical Systems complete and working (unless otherwise noted) in strict accordance with this Specification and the applicable drawings, and all applicable codes, and subject to the terms and conditions of the Contracts. All systems shall be turned over to the Owner in a workable and usable condition.

PART 2 – WORK INCLUDED

Without restricting the generality of the foregoing, the work to be performed under this Contract shall consist of furnishing, installing and connecting the following items:

a) Power and Lighting Distribution.
b) Conduit, Fittings, Pull Boxes, Junction Boxes, Terminal Boxes.
c) Safety Switches as required by Code.
d) Wire and Cable installations and terminations.
e) Installation of Wiring of Starters, Switches, other electrical equipment and kitchen equipment furnished under other sections of these Specifications or Owner.
f) Receptacles and Lighting Outlets.
g) Lighting Fixtures and Lamps.
h) Motor Controls.
i) Grounding.
j) Megger testing of all wiring.
k) Connection to equipment furnished by others.
l) Voice/Data System – Rough-in only. .
m) Arc flash study and breaker coordination study/arc fault study.
n) Parking Lot Lighting

END OF SECTION

SECTION 16050 - BASIC MATERIALS AND METHODS

PART 1 – RACEWAYS (CONDUIT, ETC.)

a) Rigid

Rigid, threaded steel conduit shall be used in concrete, underground in hazardous locations or where called for on the Drawings. All wiring above 600V. shall be rigid, unless otherwise noted.

b) Electric Metallic Tubing (EMT)

Metallic tubing may be used where permitted by code, except for underground panel feeders or unless otherwise noted as rigid. No raceway smaller than ¾" will be permitted except for vertical drops to switch legs, or receptacles which may be ½".

c) PVC Conduit

Nonmetallic schedule 40 PVC rigid conduit conforming to ANSI, NEMA specifications with each length U.L. labeled may be installed as noted below when the following conditions are adhered to:

1) Install rigid steel conduit where under-floor conduits enter the building and penetrate the slab and above floor.

2) Install equipment-grounding conductors as required by N.E.C. and size conduits for number of conductors installed.

3) P.V.C. conduit may be used for telephone and television service entrance. (Encased in 3" concrete under roadways). Use long radius steel ells.

4) P.V.C. conduit may be used for primary service (from service pole to transformer) (Encased in 3" concrete under roadways). Use long radius steel ells.

5) P.V.C. conduit shall not otherwise be allowed unless shown or noted on drawings.

d) All metallic conduit shall be electro-galvanized, sheradized, hot-dipped galvanized or metallized galvanized. Conduit shall be concealed for all new work whether on existing walls or new structure. All (exposed and concealed) runs of conduit shall have supports spaced not more than 8' apart and shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends as shown on the Drawings. Expansion fittings or other approved devices shall be used to provide for expansion and contraction where conduit crosses expansion joints. Jumper for ground continuity in all cases. Conduit shall be installed so as to insure against trouble from collection of trapped condensation.

f) Flexible conduit for motors shall be liquid tight single strip; neoprene covered, and shall be used from motor terminal boxes to outlet or conduit for vibration purposes. Lengths of this flexible conduit shall not exceed 24" and shall be installed in such a manner so as to isolate vibration from the conduit. Connectors, as manufactured by Efcor, Thomas and Betts, Appleton or approved equal will be acceptable.

g) All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above suspended ceiling. All steel conduit installed below grade or slab shall be coated with an asphaltum tar manufactured for this purpose and approved by the Architect (conduit under stone fill shall be considered below slab and shall be so painted). This includes all conduit for outside lighting. (Pre-coated conduit may be used).

h) Runs of conduit shall not have more than the equivalent of three (3) 90-degree bends. Junction boxes shall be installed in conduit runs exceeding 80', whether shown on Drawings or not. Length requirement does not apply to underground circuits to outside lights.

i) MC Cable is allowed on this project except for lighting circuits and "in wall" circuits for size 12 wire and as called out in the drawings. Mc Cable shall not be installed where exposed.

PART 2 – CABINETS, OUTLETS AND JUNCTION BOXES

a) Cabinets, Junction And Pull Boxes

1) Cabinets for lighting and power, telephone, clocks or any other purposes specified or shown on the Drawings shall be constructed of panelboard code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes constructed with sheet metal screws or bolts will not be accepted.

2) Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends for cables, supports, taps, troughs and other similar applications and shall also be constructed as specified above.

3) All cabinets and boxes shall be provided with knockouts as required by the manufacturer, or shall be cut in the field by approved cutting tools, which will provide a clean symmetrically cut opening. Such boxes shall be provided with code gauge fronts, which shall have hinged doors with ¼ turn fasteners.

b) Outlet Boxes

1) Lighting fixture outlet boxes shall be galvanized steel, 4" octagonal, not less than 2-1/8" deep, with lugs or ears to secure covers and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable.

2) Outlet boxes for switches, receptacles, telephone, etc., installed in walls of glazed tile, brick or other masonry which will not be covered by wood wainscot or paneling shall be 4"x4"x1½" with masonry extension and they shall be

completely covered with plates or lighting fixtures. All exposed boxes shall be FS type. No box will be allowed with the ears on the outside. The Contractor shall cooperate with the brick layers and carpenters to insure that the outlet boxes are installed straight and flush in the walls. Jumbo plates will not be allowed.

3) Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

4) Outlets for use on this project shall have only the holes necessary to accommodate the conduits at the point of installation and shall be rigidly secured in position.

5) The location of fixtures, outlets and/or equipment, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon the Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to coordinate this work with the work of others and in order that when the fixtures, outlets and/or equipment are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture layout shall be coordinated with the Architect before the change is made.

6) Refer to separate articles for any special outlet boxes, etc. required for individual equipment.

PART 3 - CONDUCTORS

a) All conductors on this project shall be copper. All circuits shall be sized as the load requires or as shown on the drawings. No conductor shall be less than #12 AWG. All conductors shall have THHN/THWN insulation. All conductors within fixture or equipment housing shall have temperature rating not less than recommended by fixture or equipment manufacturer.

b) Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes of wire shall be stranded. The pulling of all wires and cable on this project shall be performed in strict compliance with Section 300 of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. (See NEC).

c) All wire on this project shall be new, in good condition, and shall be delivered in standard coils. The color of the wire shall be selected to conform with the latest edition of the National Electrical Code with conductors phase color-coded at each termination (red, blue and black). Neutral to be white and ground wire to be green. #12 and #10 wiring shall be supplied with colored insulation.

d) Refer to separate sections of this specification for any special conductors required.

PART 4 – SUPPORTS AND HANGERS FOR CONDUIT AND FIXTURES

a) The Contractor shall be responsible for the support of all fixtures specified hereinafter. He shall not relocate them from the locations shown on the Drawings for the purpose of supporting them from existing angles, tee bars, bulb tees, etc.

b) Recessed fixtures supported from suspended ceiling framing members shall be securely fastened to the ceiling-framing member as per N.E.C.

c) Raceways shall be run at least 6" from steam pipes, or hot water and refrigeration pipes. Raceways shall be supported each 8' unless special conditions require closer spacing. Individual horizontal runs of raceways shall be supported by Kindorf's C-144, C-147, C-149, C-247, C-248, C-249, HS-100, HS-400, HS-900, or equivalent as approved. Exposed runs shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings, and have all right angle turns consisting of constant radius bend or threaded fittings. Where two or more conduits run parallel or where specified, a rack shall support them, trapeze or framework constructed of B-900 series channel. Wherever hanger rods are used in conjunction with channel to form a trapeze, B-900 series channel with holes such as B-903, B-905-2A, B-905, B-907 and B-995 shall be used and, in all cases, rigid conduit shall be fastened to the channel with C-105 straps, E.M.T. and C-106 straps, and O.D. tubing with C-107 straps.

d) Copper or steel wire hangers will not be acceptable to support any item under this Contract.

e) Strap iron, properly installed, may be used for 1¼" conduit and smaller.

f) Where pipe supports and inserts have been specified by a particular manufacturer, pipe supports and inserts of equal quality and size, as manufactured by Elcen Metal Products or the Auto-Grip Division of Automatic Sprinkler Corporation will be acceptable.

PART 5 - SPECIALTIES

a) All EMT terminations at junction boxes, panels, etc. shall be made with locknuts, case hardened, and appropriate fittings as manufactured by Thomas and Betts, Efcor, or ETP. All rigid conduit shall have double locknuts.

b) All conduit, except main and branch feeders, shall have insulated metallic bushings equal to OZ Type B. All branch and main feeders #6 and larger and all raceways entering a box thru concentric knockouts shall have insulated bushings with grounding lugs equal to Type BL as manufactured by OZ. Jumper ground lugs to box. All rigid conduit fittings shall be threaded metal type, not set screw type.

c) All EMT terminations shall have insulated throat fittings equal to Thomas and Betts "Insulined" fittings.

d) All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equal to Efcor.

e) All EMT fittings shall be compression type, malleable or equal. Pressure cast or die cast fittings will not be acceptable.

f) Dead spring type pressure connectors will not be acceptable on this project. All connections shall be made with insulated pressure type connectors (live spring) as manufactured by Thomas and Betts, or approved equal, (connectors with rigid body will not be acceptable). All connections on conductors No. 8 and larger shall be made with Burndy Type KS.

g) Items as manufactured by OZ, Gedney, Thomas and Betts, Midwest, Efcor, or ETP will be considered equal.

PART 6 – BASIC METHODS

a) Unless indicated otherwise, install all wiring in rigid metallic conduit, electric metallic tubing or flexible metallic conduit specified herein or as indicated on Drawings.

b) Install recessed fluorescent fixtures with flexible metallic conduit at approximately 6 feet in length to permit relocation flexibility.

c) Empty conduit systems shall have conduit bushings and pure wire installed.

END OF SECTION

SECTION 16140 – WIRING DEVICES

PART 1 - GENERAL

a) The work under this section consists of furnishing and installing all materials, equipment and services necessary for the installation of all wiring devices shown on the drawings and herein specified.

b) All receptacles and switches, insofar as possible, shall be of one (1) manufacturer.

c) Colors of receptacles and switches shall be per the Architect.

d) All receptacles shall be grounded type.

e) All device plates shall be thermoplastic except in the garage area which shall be stainless steel.

f) All outlets behind water coolers shall be concealed by water cooler when viewed from the front of the cooler. Refer to Shop Drawings furnished by Mechanical Contractor.

PART 2 – DUPLEX RECEPTACLES

a) Duplex receptacles shall be 20 amp, 120 volts, 2-pole, 3-wire, NEMA 5-20R configuration, unless otherwise shown. Receptacles shall have the following characteristics:

1) "T" Type contacts for phase and neutral female connection.

2) Female ground connection shall be riveted to the bridge.

3) The bridge shall be of hot dipped steel.

4) The receptacle body shall be of heat resistant thermoset material.

5) Rivet connecting the face plate to bridge shall be spun brass.

b) Duplex receptacles shall be 5352 Series equal to Hubbell, Arrow Hart, Bryant, P&S, or Leviton. Surge suppressed receptacles shall be equal to Hubbell HBL420

c) Weatherproof receptacles shall be the same as "B" above with Hubbell, #5206-WO lift cover plate.

PART 3 – GROUND FAULT INTERRUPTER RECEPTACLES

a) Ground fault interrupter receptacle shall be duplex type suitable for mounting in a standard outlet box, rated 20 amps., 125 volts, 2-pole, 3-wire grounding type.

b) Device shall have a nominal sensitivity to ground leakage current of five milli-amperes and shall function to interrupt the current supply for any value of ground leakage current above five milli-amperes on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th. of a second. All receptacles within 6 foot of a sink shall be GFI type, as well as other locations shown on the drawings. All kitchen general use receptacles shall be GFI type.

c) Device shall be equal to Hubbell, #GF-5352 or P&S 2091-S.

PART 4 – SAFETY/TAMPERPROOF RECEPTACLES

a) Device shall be designed to accept either two or three wire plugs. Receptacle shall have six-inch pigtail leads for wiring, no exposed metal parts for wiring terminations. Shutter type devices will not be accepted.

b) Receptacles shall be 5-20R, 20A, 125V Hubbell SG62H series.

PART 5 – FLOOR RECEPTACLES

a) Flush Floor Receptacles

1) Floor boxes on or below grade shall be P.V.C. type.

a) Concrete pours greater than 3" shall be Hubbell B2536 fully adjustable.

b) Concrete pours 2-3" shall be Hubbell B2537.

2) Floor boxes above grade shall be P.V.C. type.

a) Concrete pours greater than 3" shall be Hubbell B2527 fully adjustable box.

b) Concrete pours 2-3" shall be Hubbell B2529 box.

c) Floor depth to be determined by Contractor from Architectural drawings.

3) Covers

a) Where indicated for flush mounting - use S3925 cover and Hubbell 5352 receptacle with proper box for tile floor.

b) For carpet - use S3925 cover + 5352 Hubbell receptacle with proper box and carpet flange S3182.

b) Pedestal Type Floor Receptacles

1) Use Hubbell cover S2525 with housing SC3098, cover plates SS309-D for duplex with Hubbell 5352, with appropriate box.

2) If communication pedestal use SC3098 with SS309-T with appropriate box.

PART 6 - SWITCHES

a) All switches shall be rated 20 amps. for 120 and 277 volt lighting circuits and shall be specification grade, back and side wired, with automatic ground clip and one piece contact arm. Switches shall be single pole, three or four way, or furnished with pilot where shown on the drawings.

b) Switches shall be equal to Hubbell 1221 Series, Arrow Hart, 1990 Series, Bryant 4900 Series, P&S Series 20AC or Leviton Series 1220, or GE # 5951 Series.

c) Mullion Switch - shall be a P&S 20A., 120-277V. single pole (#2241-S) or three-way (#2243-S) with vertical opening plate (301 stainless steel) #SWK-4-IN and #347 bracket.

PART 7 - DEVICE PLATES

a) All outlet boxes shall have a cover plate.

b) All device plates shall be thermoplastic except where called out to be stainless steel in the specifications.

c) All unused telephone outlets shall have a one-hole cover plate.

d) Mechanical rooms, kitchen and janitor closets wall plates shall be metal corrosion resistant 302 stainless steel.

PART 8 – TECHNOLOGY OUTLET COVER PLATES & INSERTS – Not used.

PART 9 – REQUIRED SUBMITTALS

Submit manufacturer's data on all wiring devices and cover plates.

END OF SECTION

SECTION 16400 - DISTRIBUTION EQUIPMENT

PART 1 - INCOMING SERVICE

1.1 Service to this building shall originate from pad mounted transformer as shown on utility site plan, and riser diagram. All conduit, duct system, secondary cable, cable connectors, opening and closing of primary and secondary trenches, and concrete transformer pad to be provided by this contractor. Contractor shall also provide primary conduit with pull string. Utility company will supply and install the primary conductors and transformer. Service to this building shall be 277/480V., 3 Phase, 4W. 60 Hz. Electrical utility company is Jackson RECC. .

PART 2 - DISTRIBUTION PANELBOARDS

2.1 CIRCUIT BREAKER

A. Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the drawings. Each panelboard, as a complete unit, shall have a short circuit rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawing. Panelboards shall be listed by UL. When required, panelboards shall be suitable for use as service equipment.

PART 3 - BRANCH PANELS (120/208V)

3.1 Furnish and install circuit breaker panelboards as indicated in the panelboard schedule and where shown on the plans. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or drawings. The panelboard is to be 20"W x 5-3/4"D and shall be listed by UL. Panelboards shall be Square D type NQOD or equal. Cutler/Hammer, G.E., Siemens are acceptable manufacturers. All outdoor panels shall be type NEMA 3R

PART 4 - BREAKERS

4.1 Breakers for branch panels shall be molded case bolt-in type. Single pole breakers in branch panels shall have an interrupting capacity of not less than 10,000 Amp. symmetrical at 208/120V. unless otherwise noted on plans. Tandem breakers will not be allowed.

4.2 Breakers used for switching of lights shall be rated for switch duty and so noted.

PART 5 - DISCONNECT SWITCHES (NOT IN MAIN SWITCHGEAR)

5.1 Provide disconnect switches where indicated on drawings or where required by Code although not indicated on Drawings.

5.2 Disconnect switches shall be fused or unfused as required by Code as indicated on the Drawings or as specified. They shall be housed in an enclosure suitable for the location in which they are installed. For instance, all outdoor units shall be NEMA 3R.

5.3 All fusible switches shall be heavy duty. All unfused switches shall be general duty.

PART 6 - REQUIRED SUBMITTALS

6.1 Submit manufacturer's data on all panelboards and disconnect switches.

END OF SECTION

SECTION 16500 - LIGHTING

PART 1 – GENERAL REQUIREMENTS

a) Lighting fixtures shall be of the types, sizes, etc. as specified in light fixture schedule. The lighting fixtures specified are intended to indicate the general fixture type required. All fixtures shall be U.L. listed. All general requirements shall be required unless otherwise noted in detail specifications for each fixture.

b) The necessary precautions shall be exercised during the course of construction to protect the fixtures from dirt, dust, and debris. All fixtures shall be cleaned before the project is accepted.

c) The Contractor shall install lamps in all lighting fixtures and they shall be of one manufacturer such as Osram/Sylvania, General Electric, or Westinghouse.

d) Fixture housing, chassis and/or channel shall not be less than 20 gauge steel of rigid construction and shall be finished with a baked-on white enamel over a zinc phosphate undercoating. Wiring shall be secured by clips or similar means. All doors shall be extruded aluminum with a positive type latch.

e) Reflectors separate from housings for fluorescent fixtures shall not be less than 22 gauge steel furnished with baked-on white enamel with not less than 0.85 initial reflection factor unless otherwise specified.

f) Each ballast shall be designed to start and satisfactorily operate the type of lamp required in the particular fixtures. Ballasts shall be securely fastened in place with mounting surface of ballast making as complete contact with surface of ballast mounting area of fixture as practical. Ballast shall be high power factor, rapid start or 800 ma. ETL, CBM, "P" rated. Refer to individual fixture if special ballasts are required.

g) Refer to Section on "Fuses" for fixture fuses.

h) Fluorescent Lampholders

1) Fluorescent lampholders shall be of such design that lamps will be held firmly in place, electrically and mechanically secure and shall permit easy insertion or removal of lamps.

2) Lampholders shall be rigidly (19 gauge) and securely fastened by bolts or screws to the mounting surface with necessary provisions to prevent lampholders from turning.

Snap-in type holders will not be allowed. The dimensions of lampholders shall be such as to position lamp tube not less than 1/8" from mounting surface of reflector. All lampholders in the industrial, open fixtures shall be spring loaded, turret type, heavy duty.

i) Metal Halide Sockets

All mercury and metal halide (250 watts and above) shall be split type to insure that lamps will not freeze in socket. The center contact shall be spring loaded.

j) Lamps

1) Fluorescent

a) Rapid Start – T8, 4100K.
b) 32W TRT

2) H.I.D.

a) All mercury to be deluxe white, color corrected.

b) All metal halide to be phospor coated.

3) Incandescent

All incandescent lamps shall be inside frosted rated for 2500 hours life.

k) Lens

1) Refer to each fixture for type of lens used.

l) All recessed fixtures shall be securely fastened to ceiling framing member by mechanical means such as bolts, screws, nuts or clips manufactured for this purpose. (Wire lashing of each fixture to roof or floor structure above will be acceptable).

m) Substitutions

1) Fixture substitutions must be made through the equipment supplier's representative ten (10) days prior to the bid date. The equipment supplier's representative is to furnish the Engineer with original fixture brochures, photometrics and point by point computer printouts for consideration of written prior approval.

n) Light Fixture Schedule (See Electrical Plans)

Catalog numbers are for style and quality only. The Contractor shall be responsible to determine the type of ceiling that fixtures are to be installed and to so order fixtures even though catalog numbers may indicate other type of ceiling. Refer to the drawings for the light fixture schedule. Any substitutions for the light fixtures specified shall be submitted to the Engineer 10 days prior to bid date. All submissions shall include light fixture cutsheets and point by point illumination level printouts of each area of the building.

m) LED Fixtures

Where LED fixtures are shown, provide per schedule shown on the drawings.

PART 2 – EMERGENCY LIGHTING SYSTEM

a) Exit and emergency light luminaires shall be connected to unswitched circuits with emergency power from emergency battery packs.

b) Provide self-contained battery powered emergency lighting units in areas indicated on Drawings with a permanent conduit connection to housing. Battery chargers shall be solid state.

PART 3 – GENERAL INSTALLATION REQUIREMENTS

a) Delivery lighting fixtures individually wrapped in factory-fiberboard type containers.

b) Install lighting fixtures of types indicated, where indicated, and at indicated heights; in accordance with lighting fixture manufacturer's written instructions and recognized industry practices to ensure that fixtures comply with requirements and serve intended purposes. Comply with NEMA standards, and requirements of NEC pertaining to installation of lighting fixtures.

c) Set lighting fixtures and equipment plumb, square, and level and secure to structure support members of building. Provide all steel supports necessary for lighting fixtures in addition to those specified under general building construction. Recessed and semi-recessed fixtures shall be supported independent of suspended ceiling system. Secure fixtures in suspended ceilings to framing members in accordance with NEC by using standard clips made for the purpose. Sheet metal screws are not acceptable.

d) Mounting heights specified as indicated shall be to bottom of fixture. Coordinate exact mounting of lighting fixture with type, style and pattern of ceiling being installed.

e) Clean interior lighting fixtures of dirt and debris upon completion of installation. Protect installed fixtures from damage during remainder of construction period.

f) At date of substantial completion, replace lamps in lighting fixture which are observed to be inoperable or noticeably dimmed after Contractors use and testing, as judged by Architect/Engineer.

g) Set time switches for operation as directed by the Owner and/or Architect/Engineer.

PART 4 – REQUIRED SUBMITTALS

Submit light fixture shop drawings and manufacturer's data booklet form with a separate sheet for each fixture, assembled in luminaire type alphabetical order as shown in the light fixture schedule, with proposed fixture and accessories clearly indicated on each sheet.

END OF SECTION

SECTION 16900 - CONTROLS

PART 1 – MAGNETIC STARTERS

All motor starters shall be steel mounted, front wired with all terminals accessible for wiring directly from the front. No slate or ebony asbestos will be permitted on any size starter. All contacts shall be double break, solid silver cadmium oxide alloy, or approved equal, which will not require any filing, dressing or cleaning throughout the life of the control equipment. Bare copper or silver flashed copper contacts which require periodic filing or cleaning maintenance will not be permitted. Operating coils shall be pressure molded and so designed that if accidentally connected to excessive voltage, they will not expand, bubble or melt. When a coil fails under this condition, the starter shall definitely drop out by gravity and not freeze the starter in the "On" position. All motor starter coils shall be rated 120 volts unless shown otherwise on the Drawings. All magnetic motor starters shall have control transformers (one side fuse, the other grounded to box). Each magnetic starter shall be provided with one (1) spare N.O. and one (1) N.C. auxiliary contact. Transformer shall be sized to handle the loads shown in the Schedule and Schematics. No starter smaller than Size "0" shall be utilized. NOTE: ADDITIONAL CONTACT SHALL BE PROVIDED TO OPEN THE STARTER AND DE-ENERGIZE THE EQUIPMENT UPON SIGNAL FROM DDC(HVAC) CONTROL SYSTEM. THE SAME DDC CONTROL SYSTEM SIGNAL SHALL ALSO ENERGIZE THE EQUIPMENT VIA THE STARTER.

PART 2 – OVERLOAD RELAYS

a) Overload relays shall be of the melting alloy, hand-reset, trip-free variety. All overload relays shall be equipped with a trip indicator, visible from the front, which will indicate which motor has tripped. Overloads shall be installed in all ungrounded legs.

b) Taking into account the temperature rating of the motors, overloads shall be sized for one of three conditions:

1) Temperature at starter is the same as motors.
2) Temperature at starter is lower than at motor.
3) Temperature at starter is higher than at motor.

All overloads shall be sized from data on motor nameplate taking into consideration the above three (3) items. The sizing of overloads is the responsibility of the Contractor. Submit written list of overload vs. motors FLC to Engineer on all motors.

c) It shall be possible to field add two (2) extra N.O. or N.C. contacts in all motor starters without removing existing wiring or removing the starter from the enclosure.

PART 3 – PUSHBUTTONS, SWITCHES, PILOT LIGHTS, ETC.

a) Pushbuttons and switches shall be heavy duty, double-break silver contacts. Buttons shall have means of installing metal plate to designate function.

b) Pilot lights shall be press-to-test, 120 volts incandescent. Refer to Drawings for typical control diagram.

c) Unless otherwise shown, all pushbuttons, switches, pilot lights, etc. shall be mounted in the face of the respective starters. Remote buttons, etc. shall be flush mounted where shown.

PART 4 – MANUAL STARTERS

Furnish and install, where shown on Drawings, 1 or 2 pole toggle operated manual starters. Starters shall be surface unless otherwise shown and shall have neon pilot lights. Starters shall be in a NEMA 1 enclosure. Heaters shall be sized from motor nameplate data.

PART 5 – AC COMBINATION STARTER

a) General

Combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes and horsepower ratings. Disconnect switch combination starters shall consist of a visible blade disconnect switch and a motor starter. Combination starters shall be mounted in general purpose enclosures unless otherwise indicated on the plans.

b) Starters

All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.

c) Thermal Units

Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

d) Disconnect Handle

The disconnect handle used on combination starters shall always be in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

PART 6 – REQUIRED SUBMITTALS

Submit manufacturer's data on all starters, relays and other control devices.

END OF SECTION

Section	Section Title	Pages
ELECTRICAL		
16000	General Electrical	10
16025	Scope of Work	1
16050	Material	5
16140	Wiring	3
16400	Distribution Equipment	2
16500	Lighting	3
16900	Controls	2