DIVISION 26 - ELECTRICAL
SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1.00 GENERAL

1.01 SCOPE

A. The scope of work is as indicated on electrical drawings and includes but is not limited to the following:

B. Demolition:
1. Disconnect and remove existing fire alarm system and peripheral devices.
2. Disconnect existing mechanical and plumbing equipment for removal by others.
3. Disconnect and remove all existing interior/exterior electrical devices including but not limited to receptacles and junction boxes
4. Disconnect and remove all interior/exterior electrical equipment

C. Power:
1. Provide panel, safety disconnect switches and associated feeder(s).
2. Provide receptacles, special outlets, junction boxes, and their associated branch circuits.
3. Provide branch circuits associated with all mechanical and plumbing system equipment, including all accessories such as motorized dampers, valves, fan interlocks, ionization, etc.

D. Fire Alarm:
1. Provide smoke detectors at all control panels, voice evacuation panels and booster panels.
2. Provide duct mounted smoke detectors for all air units with greater than 2000 cfm air flow.

1.02 GENERAL CONDITIONS

A. The General Conditions and Supplementary General Conditions are a part of this section of these Specifications. The Contractor is cautioned to read and be thoroughly familiar with all provisions of the General Conditions. These conditions shall be complied with in every aspect.

1.03 DEFINITONS:

A. The word "shall" where used, is to be understood, as mandatory and the word "should" as advisory. "May" is used in the permissive sense.

B. Concealed: Concealed areas are those areas that cannot be seen by building occupants.

C. Exposed: Exposed areas are all areas that are exposed to view by building occupants, including areas below counter tops, inside cabinets and closets, inside all equipment rooms, and areas outside the building exterior envelope.

D. Feeder: Feeder consists of both conduit and wiring installed above or below grade

E. Provide: Provide shall including furnishing, installing, and connecting the item or items referenced unless specifically indicated otherwise.

1.04 QUALITY ASSURANCE

A. General:
1. Every effort has been made by the Engineer to clearly indicate all devices/equipment requiring an electrical/data connection. It is the intent of the Engineer that all light fixtures be powered and controlled, that all devices and equipment be circuited to a panelboard of appropriate voltage and breaker of MOCP not exceeding manufacturer's specifications. That all communications, security, and fire alarm devices are installed, wiring, and functioning properly.
2. Where there is a conflict between the contract document and an applicable Code. The Code shall govern except where the requirements of the contract documents are more stringent. The most stringent requirement shall apply.
3. All work shall be concealed unless specifically noted to be exposed.
4. Coordinate the exact locations of electrical outlets and equipment with building features and equipment as indicated on architectural, structural, mechanical, plumbing, landscape, and food service drawings. Review any/all proposed changes in electrical device/equipment locations with Architect prior to rough-in. Architect may direct relocation of outlets before rough-in, up to ten (10) feet from the position indicated, without additional cost. Remove and relocate outlets placed in unsuitable locations when requested by the Architect, at no additional cost.
5. Resolve, in writing, any code violation discovered in contract documents with the Engineer prior to bidding. After award of the contract, Contactor shall make any correction or addition necessary for compliance with applicable codes at no additional cost.

B. An approved contractor for the work under this division shall be:
1. A licensed electrical contractor in the jurisdiction in which the work shall be performed.
2. Able to furnish evidence of having contracted for and installed not less than three (3) systems of comparable size and type that have served their Owners satisfactorily for no less than three (3) years.

C. All work, materials and equipment shall comply with the latest applicable codes, local ordinances, and UL requirements.

D. Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type product specified. All new products shall be listed for the use shown on drawings.

E. Equipment shall be delivered with a factory-applied finish so that no additional field painting is required.

F. Equipment shall be selected to conform the building space limitations. Do not provide equipment that cannot meet the arrangement requirements shown on plans. Contractor shall submit room layouts with submitted items shown drawn to scale. Submittals will be rejected without floor plan Drawings showing submitted items.

G. All equipment included in the service and distribution specifications shall be provided by the same manufacturer.

H. Manufacturer names and model numbers are subject to change. Contractor shall verify them with manufacturer's representative prior to ordering any product or equipment.

1.05 GENERAL REQUIREMENTS

A. The Contractor is referred to all of the Drawings for building construction as well as the electrical Drawings.

B. The Contractor shall examine the site and shall verify to his own satisfaction the location of all utilities, and shall adequately inform himself as to their relation to his work before entering into a Contract and he shall base his bid on any conditions, which may be encountered during the progress of the work.

C. The Contractor shall furnish and install properly all materials, devices, equipment, supports, controls, appurtenances, etc., mentioned or required to make complete or satisfactory installations in working order whether shown or not. All electrical equipment shall be connected in accordance with manufacturer's instructions. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance when completed.

D. The Contractor shall provide finished to match approved samples; all exposed finishes shall be approved by the Architect. Submit color samples as required.

1.06 APPLICABLE GENERAL CODES AND REGULATIONS

A. All electrical work and equipment, in whole or in part, shall conform to the applicable portions of the following specifications, codes and regulations in effect on that date of invitation for bids, and shall form a part of this specification.

B. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition.

C. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   1. NFPA 70, National Electrical Code
   2. National Fire Codes:
      a. NFPA 70E, Electrical Safety Requirements for Employee Workplaces
      b. NFPA 72, National Fire Alarm Code
      c. NFPA 77, Static Electricity
      d. NFPA 99, Health Care Facilities

e. NFPA 101, Life Safety Code
f. NFPA 110, Emergency and Standby Power Systems

3. Occupational Safety and Health Regulations (OSHA).
4. NFPA Standards in effect shall be as listed or adopted by the appropriate authority having jurisdiction.
5. American National Standards Institute (ANSI)
6. Institute of Electrical and Electronics Engineers (IEEE)
7. Local, City and State Codes and Ordinances
8. Regulations and standards of the Electric Utility Company
9. National Electrical Safety Code (NESC)
10. National Electrical Manufacturers Association (NEMA)
11. Insulated Power Cable Engineers Association (IPCEA)
12. International Building Codes (IBC)
13. International Energy Conservation Codes (IECC)

D. Equipment that has been inspected and approved by the Underwriter's Laboratory shall bear its label or appear on its list of approved apparatus.

1.07 DRAWINGS

A. Plans and detail sketches are submitted to limit, explain, and define conditions, specified requirements, conduit sizes, and manner of erecting work. The Contractor is cautioned to field check and verify all existing conditions before bidding, as no extra compensation will be allowed for conditions found different than represented in the construction drawings and/or specifications. Written approval of the Architect shall be obtained prior to any alterations or additions to specified work.

B. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required, but specified sizes and requirements necessary for satisfactory operations shall remain unchanged.

C. The drawings and these specifications are complementary to each other and what is called for by one shall be binding as if called for by both.

D. General arrangement of work is indicated on plans. Due to the small scale of the drawings, offsets, fittings, and boxes required are not all indicated; provide fittings, boxes, etc., as needed in accordance with codes and accepted practices.

1.08 SUPERVISION

A. The Contractor shall personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, he shall keep the same foreman and workmen throughout the project duration.

B. During its progress, the work shall be subject to inspection by representatives of the Architect or Engineer, at which times the Contractor shall furnish required information.

C. It is not the Architect's or Engineer's duty to direct or guarantee the work of the Contractor, but to assist the Owner in obtaining a complete building in accordance with plans, specifications and addenda and to furnish engineering services in accordance with recognized practices.

1.09 PRIOR APPROVALS

A. The Contractor shall base his proposal on materials as specified herein. Any references to a specific manufacturer or trade name is made to establish a standard of quality and to define a type of product and in no way is intended to indicate a preference for a particular manufacturer. It is the intent of these specifications to allow all manufacturers of equipment, products, etc., judged equal to the specified product to bid on a competitive basis.

1.10 MEASUREMENTS

A. The Contractor shall verify all measurements and shall be responsible for the correctness of same, before ordering any materials or doing any work. No extra charge or compensation will be allowed for any differences between the actual measurements and those indicated on the drawings.

1.11 LAWS, PERMITS AND FEES

A. The entire electrical work shall comply with the rules and regulations of the City, Parish, and State, including the State Fire Marshal and State Board of Health, whether so shown on plans or not. The Contractor shall pay fees for permits, inspections, etc., and shall arrange with the inspecting authorities all required inspections.

1.12 SITE INSPECTION

A. The Contractor shall visit the site and familiarize himself with difficulties attendant to the successful execution of the work before bidding. Failure to visit the site shall not relieve the Contractor of the extent or conditions of the work required of him.

1.13 TEMPORARY FACILTIES

A. The Contractor shall provide all temporary power and lighting for construction purposes. Installation of temporary power shall be in accordance with NEC Article 527.

B. Temporary facilities, wire, lights, and devices are the property of the contractor and shall be removed by the Contractor at the completion of the Contract.

C. Prior to shutdown of existing power, provide at minimum 120/240 volt, 1-phase, 3-wire electrical service to provide temporary power to all critical loads as identified by Owner including but not limited to all security systems, fire alarm panel and associated remote power supplies. Contractor shall coordinate directly with local utility regarding temporary

power service and metering and shall provide all necessary permits and fees at no cost to the Owner.

PART 2.00 PRODUCTS

2.01 MATERIAL AND EQUIPMENT

A. All materials, equipment, and accessories installed under this Contract, whether approved or not, shall be new and shall conform to all rules, codes, etc., as recommended or adopted by the National Association(s) governing the manufacture, rating and testing of such materials, equipment, and accessories.

B. Product Substitutions

1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

2.02 SHOP DRAWINGS & SUBMITTALS

A. Shop drawings shall be taken to mean detailed drawings with dimensions, schedules, weights, capacities installation details, and pertinent information that will be needed to describe the material or equipment in detail.

1. Shop drawings shall be prepared using computerized digital software compatible with AutoDesk's AutoCAD
2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01. Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format on Flash Drive. Files contained shall be named to correspond with the sheet names contained in the hardcopy set. Files on shall include both AutoCAD compatible source files and files printed to Portable Document Format (.pdf).

B. Submittals shall be taken to mean catalog cuts, general descriptive information, catalog numbers, and manufacturer's name.

C. Review of submittals or shop drawings shall not remove the responsibility for furnishing materials or equipment of proper dimensions, quantity and quality; nor will such review remove the responsibility for error in the shop drawings or submittals.

D. Assume all costs and liabilities, which may result from the ordering of any material, or equipment prior to the review of the shop drawings or submittals, and no work shall be done until the shop drawings or submittals have been reviewed. In case of correction or rejection, resubmit until such time as they are accepted by the Owner's representative and such procedures will not be cause for delay. After the final review, 6 copies will be supplied if requested.

E. Shop drawings and submittals will be returned unchecked if the specific items proposed are not clearly marked, or if the general Contractor's approval stamp is omitted.

F. Shop drawings, unless mark-ups are very trivial, will not be returned, "No Exception Taken". They will be returned for re-submittal as many times as necessary, however, the Contractor shall be back charged for engineering review time beginning with the second resubmittal. Therefore, the Contractor should make every effort to comply with the requirements of this Project on the first submittal in order to avoid project delays.

PART 3.00 METHODS OF INSTALLATIONS

3.01 CONTRACTOR COORDINATION

A. The Drawings are diagrammatic in nature. Cooperate with other trades so the interferences of facilities and equipment will be avoided.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping installed at required slope. So, connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

3.02 OPENINGS, CUTTING AND PATCHING

A. Cut all openings as required for the electrical work. Patching will be done by the various

crafts whose work is involved. Furnish and install all necessary sleeves, thimbles, hangers, inserts, etc., at such times and in such a manner as not to delay or interfere with the work of other Contractors. Caulk, flash or otherwise make weatherproof all penetrations through the roof and exterior walls.

B. Where conduit, cable or other items that are provided for under this contract penetrate fire rated walls or floors, the Contractor is to seal around the item to maintain the integrity of the rated system.

3.03 PAINTING

A. Painting shall be performed as described in the painting specifications. No painting will be required by the Contractor except for touch-up of factory finishes on equipment furnished under this contract.

3.04 INSTALLATION

A. Housekeeping Pads: All floor and ground mounted electrical equipment - panels, switchboards, motor control centers, transformers, etc. shall be installed with a reinforced concrete housekeeping pad, whether shown on the drawings or not. The pad shall extend 4" above either the finished floor or final grade (as applicable), have 45 degree chamfered edges, and be constructed of 3000psi concrete. The pad shall extend 4" beyond the edge of the respective electrical equipment. Concrete shall have smooth steel trowel finish.

B. Equipment must be leveled and set plumb. Use corrosion resistant mounting hardware. For sheet metal enclosures mounted against a wall provide corrosion-resistant spaces to separate the wall by 1/4 inch or by 3 inches of air for freestanding units.

C. Unused knockouts on panels and boxes shall be covered with approved cover plates manufactured for the purpose.

3.05 TESTS AND INSPECTIONS

A. The Contractor shall assist in making periodic inspections or tests required by the Architect or Engineer. When requested, the Contractor shall provide the assistance of foremen and qualified craftsmen for reasonable duration of each test, etc.

B. The contract will not be declared to be substantially complete until all of the following conditions are satisfied.
   1. the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.
   2. The "As-Built" drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner's Construction Representative.

3.06 SAFETY PRECAUTIONS DURING CONSTRUCTION

A. It shall be the Contractor's responsibility to furnish and install proper guards and instruction signs for prevention of accidents and to provide and maintain for the duration of

construction any installations needed for safety of life and property.

3.07 CONNECTIONS

A. This Contractor shall be responsible for providing electrical service to all devices of the heating and air conditioning system, and is referred to the mechanical plan for the exact location of the various devices.

B. Mechanical Controls: Provide 120VAC power connections as required to components of Mechanical Control system. Coordinated quantity of circuits, connection requirements and locations between trades and with provisions of Divisions 21, 22, and 23 sections.

C. Security and Access Control: Where the Drawings indicate a 120VAC circuit in a general area labeled for security or access control use, the intent is for this circuit to be extended and connected to the security or access control device in that general area in coordination with other trades. Coordinated connection requirements and locations between trades and with Owner's Security vendor prior to installation.

D. Motors and Motor Connections: Motors for driven equipment are specified in Divisions 21, 22, and 23. Provide connections as follows, unless otherwise indicated:
   1. Equipment provided with factory installed disconnecting means: Upon installation of motor and associated equipment, Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
   2. Equipment furnished with factory disconnecting means: Upon installation of motor and associated equipment, Install factory furnished disconnecting means and provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
   3. Equipment not furnished with factory installed disconnecting means: Provide disconnect switch required in accordance with NFPA 70 or as indicated on the Drawings. Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.

3.08 LOAD BALANCING

A. Balance load on all phases in each panel to within 10% of respective phase loads.

3.09 IDENTIFICATION OF EQUIPMENT

A. Identification of Equipment:
   1. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to all disconnect switches, panelboards, switchboards, starters, bus ducts, fire alarm panels, etc.
      a. Life Safety, Equipment Branch, and Optional Stand-by loads shall include suffix on label indicating the equipment as such.
      b. Utility Power: White letters on black background
         Generator Power (Emergency): White letters on red background
         UPS Power: White letters on blue background

b. Identifying nameplates shall have ½-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation.

c. Each switchboard, distribution panel, and motor control center branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters.

d. Each section of multiple section panelboards shall also indicate panelboard section number

2. Panelboards: Cardholders and directory cards shall be furnished. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear heat-resistant plastic front. Circuit lists shall be typewritten. Removing and attaching panel schedules from the Drawings is not acceptable.

   a. Contactors & Lighting Control Panels: Identify circuits controlled by contactors using a separate notation for each contactor used.

3. Junction Box, Outlet Box & Wireway/Gutters: Identify conduits, pull boxes, junction boxes, and outlet boxes with the complete circuit number contained there-in.

   a. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.

   b. Emergency circuit junction boxes shall have a red painted cover. Circuit identification shall be clearly marked on the cover.

   c. Fire alarm circuits (only) shall be marked with a half red painted junction box and noted "Fire Alarm" on the cover.

4. Pull Boxes, Transformers, Disconnect Switches, etc.: Label each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. Nameplates shall also indicate where panel is fed from.

5. In-Grade Pull Boxes: Cover shall be custom engraved to indicate contents of box. i.e. "POWER", "SECURITY", "COMMUNICATIONS"

6. Underground Warning Tape: Provide Thomas and Betts or approved equal to six-inch-wide plastic tape, with suitable warning label describing buried electrical lines; telephone lines and data lines. Tape shall be buried at a depth of six (6) inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits. All underground conduits shall be marked with warning tape.

7. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.

8. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and at load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits.

3.10 COMPLETION

A. The Contractor shall leave all electrical equipment with proper connections, and in proper working order. He shall test the entire electrical system to show that it is properly installed. Contractor shall leave all panels and switches completely fused or complete with circuit breakers.

3.11 RECORD DRAWINGS

A. The Contractor shall furnish one (1) complete set of drawings on which any changes in the work shall be shown. In addition to changes in work contractor shall clearly indicate routing of all feeders both above and below ground. All underground conduit shall be noted on drawings to show "as built" locations. These drawings must be turned over to the Architect prior to final acceptance of the work.

3.12 GUARANTEE

A. The Contractor shall guarantee to keep the entire electrical system as installed by him or his subcontractors in repair and in perfect working order for one (1) year from the date of the final Certification of Final Acceptance, and shall furnish free of cost to the Owner, all material and labor necessary to comply with the above guarantee; said guarantee shall be based upon defective material and workmanship. In any case where equipment has a factory warranty exceeding this one-year limit, the full extent of the warranty shall apply.

3.13 CLEANING

A. When all work has been finally tested, the Contractor shall clean all fixtures, equipment, conduits, ducts, and all exposed work. All cover plates and other finished products shall be thoroughly cleaned.

3.14 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.15 INSTRUCTION MANUALS

A. The Contractor shall provide three (3) operating and maintenance instruction manuals on all systems and equipment installed in the electrical work.

B. The Contractor shall provide (3) copies of all warranties and guarantees for systems, equipment, devices, and materials.

3.16 CONTRACTOR SPECIAL NOTE

A. The Contractor is again cautioned to refer to all parts of these Specifications and all Drawings, not just electrical sections, and the individual cross references made to other standard specifications or details describing any electrical work, which may be required under these other sections. The Contractor is cautioned to note carefully any other sections which may reference electrical work in order for this Contractor to fully understand the wiring requirements and electrical work that is required. Any conflicts found between

the electrical sections of these Specifications or Drawings shall be immediately directed to the General Contractor for clarification.

A. These Specifications and the electrical Drawings size equipment, wire, conduit, etc. based on the horsepower of motors and/or wattages of equipment as shown on the plans or specified herein. The Contractor shall install electrical raceways, conductors, fuses, safety switches, breakers, contactors, starters or any other electrical equipment with the capacities to suit the horsepower and/or wattages of the equipment actually furnished and installed. The Contractor shall not furnish or install any electrical raceways, conductors, safety switches, contactors or motor starters of sizes smaller than those shown on the Drawings or specified herein. The Contractor shall coordinate with the various sections of the Specifications and/or Drawings and with the various Sub-Contractors to provide the properly sized equipment without additional cost to the Owner.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 26 05 05 - ELECTRICAL DEMOLITION

PART 1.00 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Provide all labor, material and equipment to perform all electrical demolition as specified and as shown on the Drawings.
2. All equipment selected for demolition shall have power and communication cables de- energized and disconnected. All disconnected cables shall be removed.
3. All Power and Lighting panels circuit breakers shall be relabeled as spare where power was once fed to demolished equipment.
4. All conduit shall be disconnected and removed from demolished equipment.
5. All concrete encased conduit and underground conduit shall remain in place. All concrete encased conduit and underground conduit that stubs through floors and walls shall be cut flush and concrete shall be patched.
6. Contractor is responsible for making equipment scheduled for demolition safe for removal.

B. Related Documents:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Owner's General Requirements, apply to this Section.

PART 2.00 PRODUCTS Not Used

PART 3.00 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements and circuitry arrangements are as shown on the Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition work indicated on drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing any existing installation.

D. The Contractor accepts existing conditions by starting demolition work.

E. Contractor shall familiarize himself with the existing electrical site systems and with the work of all other trades and include all work necessary to comply with the intent of this section.

F. It shall be understood that field conditions may be encountered during the execution of this

contract which will require extension or relocation of existing systems or equipment which are not specifically shown on the drawings, but, which are required to meet the stated intent that the existing electrical system continue to function unaffected by the demolition and associated new construction. Contractor shall include such work as would normally be expected to accomplish the work.

G. The bidder is required to visit the project site prior to submitting bid to verify the exact configuration of the electrical items being removed, relocated, or modified. No claims for extra work shall be accepted after awarding of bids for discrepancies between verifiable field conditions and the items shown on drawings if these items are readily verifiable.

H. Should this contractor encounter field conditions which, in their opinion, were not verifiable by visual inspection of the site prior to submitting bids, they shall notify the Engineer immediately, in writing, and request a decision as to the scope of work. The Engineer shall provide the necessary interpretations and instructions in a reasonable time.

3.02 PREPARATION

A. Coordinate electrical power outages with appropriate utility company and Owner. All outages must be scheduled with owner a minimum of 2-weeks in advance. Outages shall be scheduled as to minimize disruption and outage duration.

B. Investigate the existing conditions of electrical system in walls, floors and ceilings scheduled for removal.

C. Disconnect and deliver to the Owner those items requested to remain the Owner's property.

D. Provide temporary wiring and connections to maintain existing systems in service where needed. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

E. Prior to any digging, boring, drilling or excavating on or adjacent to this site, identify location of existing utility lines through the services of a utility location outfit.

3.03 DEMOLITION OF ELECTRICAL FACILITIES

A. Demolish electrical work under provisions of this section. All electrical items indicated to be removed shall remain Owner's property unless stated otherwise. All removed electrical items that the Owner does not wish to keep shall become Contractor's property and removed from the site.

B. For demolition in buildings that are to be removed as part of demolition work:
   1. Remove abandoned wiring to source of supply.
   2. Disconnect electrical devices and equipment serving equipment that has been (or will be) removed.
   3. Fill with compacted soil any trench, hole or cavity created by the relocation or removal of any existing conduit, and pole concrete base.

C. For demolition in buildings that are to remain in service after completion of demolition work:
   1. Remove exposed abandoned raceways.
   2. Repair adjacent construction and finishes damaged during demolition and extension work.
   3. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
   4. Where new construction conflicts with existing electrical work which is to remain, relocate the electrical work involved.
   5. Where existing circuits are interrupted by demolition or new work, extend and reconnect those systems. Where those systems must remain in service during the execution of this contract, provide temporary connections until final connections are complete.
   6. Any parts of existing construction which are to remain and which are damaged during demolition and preparatory work or new construction work on the project shall be patched to match existing adjacent surfaces. Patching and finishing of such areas shall conform with all applicable requirements of other technical sections of these specifications, and shall match existing work in material, type, finish, etc.
   7. Equipment, circuits and utilities that remain, but that are served by feeders or circuits being removed or altered shall be reconnected in accordance with the methods required by this specification and the NEC, without extra cost to the Owner.
   8. All materials and equipment noted to be reused or relocated shall be cleaned, retested, repaired if necessary, modified if required, prepared for reuse, and be stored and protected from the outdoor environment on the site until it is time for re-installation.
   9. Fill with compacted soil any trench, hole or cavity created by the relocation or removal of any existing conduit, and pole concrete base.
   10. Remove all abandoned data cabling located above ceilings that are exposed during demolition.
   11. Where demo of electrical equipment is shown this shall include demolition of any unused supports, housekeeping pads, and associated conduit/conductor.
   12. Disconnect and remove all abandoned equipment including but not limited to panelboards, and disconnect switches.
   13. Where labeling is required by project specifications contractor shall trace and label all circuits to remain that are affected by construction or demolition.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Transport demolished materials off Owner's property and legally dispose of them.

3.05 CLEANING AND REPAIR (FOR FACILITIES TO REMAIN IN SERVICE)

A. General

1. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION

DIVISION 26 - ELECTRICAL
SECTION 26 05 50 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1.00 GENERAL

1.01 GENERAL REQUIREMENTS

A. All material furnished shall be new and shall conform to all rules and codes as recommended or adopted by the National Association governing the manufacture, rating and testing of the material. All electrical equipment shall be UL listed for the intended use.

PART 2.00 PRODUCTS

2.01 RACEWAYS AND FITTINGS

A. Raceways permitted on this project shall be aluminum rigid conduit; electrical metallic tubing (EMT); flexible metallic tubing; liquid-tight flexible metal conduit; and rigid polyvinyl chloride (PVC) conduit. All conduits shall be new and shall bear the inspection label of the Underwriter's Laboratories, Inc.

B. Metallic conduit shall be metalized, or hot-dipped galvanized. Non-metallic conduit shall be schedule 40 PVC.

C. Fittings for conduit shall be an approved type specially designed and manufactured for their purpose. EMT fittings shall be water tight, compression type. Rigid metal conduit fittings, bushings, and other components shall be aluminum. All fittings for rigid steel or aluminum conduit shall be threaded and coupled unless specifically approved otherwise by the Engineer.

D. Where conduit connects to an outlet box, it shall have an insulated throat type connector.

2.02 EXPOSED CONDUIT

A. Exposed conduit shall be firmly supported on galvanized hangers; on brackets, hangers, or pipe straps; or by beam clamps. Conduit installed exposed shall be neatly aligned and run at right angles to the building walls or walls of the rooms in which installed. All exposed conduit shall be located to avoid all conflicts with architectural or mechanical components.

2.03 FLEXIBLE CONDUIT

A. Liquid-tight flexible metal conduit shall have a spiral wound, flexible, galvanized steel core and a tough extruded synthetic moisture-tight outer covering. All flexible conduits shall be UL listed.

2.04 ALUMINUM CONDUIT

A. Each piece of conduit shall be straight, free from blisters and other debris, cut square and taper reamed, and furnished with coupling in 10 foot length threaded each end. exterior

locations.

C. Boxes for lighting fixtures shall be 4 inches octagon, not less than 1-1/2 inches deep, with fixtures stud fastened through from back box. Where boxes are installed in a concrete slab, boxes designed for this application shall be used.

D. Outlet boxes for switches in concealed work shall be standard switch boxes of required number of gangs. Outlet boxes for receptacles, telephone, and communication use in concealed work shall be 4 inch square, not less than 1-1/2 inches deep. Outlet boxes for switches and receptacles installed in exposed conduit system shall be cast type FS or FD, number of gang as required. Outlet boxes for telephone and communication use in exposed systems to be cast, 4 inches square, not less than 1-1/2 inches deep.

E. Boxes shall not to be installed back to back in walls. Offset with connecting conduit as specified. Do not use long, extended boxes that would effectively couple light and sound between adjoining spaces.

2.07 WIRE (600 VOLT AND BELOW)

A. All conductors used in the work shall be of soft drawn annealed copper having a conductivity of not less than 98% of that of pure copper. Conductors shall be standard code gauge in size, insulated and shall have insulation rated for use at 600 volts.

B. Unless noted otherwise or specified, insulation shall be type THW, THWN, or THHN for sizes up to and including No. 2 AWG. Insulation for wire sizes larger than No. 2 AWG shall be type THW, XHHW, or THHN. Lighting fixture wire shall be heat resistant type TF (150°C) with 300-volt insulation minimum. Wires shall be of the single conductor type. Sizes No.14 AWG and larger shall be stranded. No wire shall be single strand solid copper.

C. Throughout the system, all conductors shall be identified as to the phase and voltage of the system by color-coding in accordance with NEC 210.5. Color-coding shall be continuous the full length of the wire with surface printing at regular intervals on all conductors and for neutral conductors.

D. Color coding shall be as follows:

3phase, 480V System	3phase, 208V System
Phase 1-Brown	Phase 1-Black
Phase 2-Orange	Phase 2-Red
Phase 3-Yellow	Phase 3-Blue
Neutral-Gray	Neutral-White
Ground-Green	Ground-Green

2.08 WEATHERPROOF RECEPTACLES

A. Weatherproof receptacles shall be GFCI duplex receptacles as specified under WIRING DEVICES, mounted in a cast iron type FD conduit box and fitted with gasketed metal cover

with spring. Weatherproof receptacles shall be flush mounted in exterior walls.

2.09 WIRING DEVICES

A. Wiring devices shall be as listed. The color of device shall match color of outlet cover plate. It shall be the responsibility of the Contractor to provide plugs, receptacles and fittings required for any equipment furnished or installed or connected under the contract. Color as selected by the Architect.

	Leviton	P & S	Hubbell
Toggle Switches: 20A 120/277V			
Single pole	1221-I	20AC1-I	1221-I
Three-way	1223-I	20AC3-I	1223-I
Duplex Receptacle: 20A, 125V,			
NEMA 5-20R	5362-I	5362-I	5363-I
Ground Fault Circuit Interrupter:			
20A, 125V, Feed Through,			
NEMA 5-20R	6899-I	2091-S	GF-5362-I

B. Quad receptacles shall be 20 amp, 125 volt rated, NEMA 5-20R, with two (2) duplex receptacles or single four-plex device.

2.10 OUTLET COVER PLATES

A. Unless otherwise specified, all outlets shall be fitted with cover plates. Cover plates shall be standard size, uniform in design and finish for switches, receptacles and other outlets requiring cover plates. Plates shall be one piece of the required number of gangs. All cover plates shall be lexan unbreakable type. Architect shall select coverplate color.

2.11 SPECIAL PURPOSE RECEPTACLE

A. Provide receptacles for special purpose devices as indicated on the plans. Refer to equipment specification for proper receptacle to be supplied. Provide stainless steel cover plate.

2.12 FIRESTOPPING PRODUCTS

A. The Contractor shall provide and install at all fire-rated wall through-penetrations, a non-hardening, conformable firestop system. The system shall consist of a water insoluble putty and suitable damming materials (where required). The non-hardening putty shall be a two-staged intumescent and capable of expanding up to 8 times its original volume. This putty shall contain no asbestos, no fiberglass, no solvents nor corrosive mineral salts of any kind. It shall remain soft during its installed life and shall be capable of being removed and reinstalled to facilitate the addition of cables or pipes. The putty shall exhibit aggressive adhesion to all common building materials and penetrants and shall allow reasonable movement of penetrants without being displaced. The firestop system shall be tested to the time/temperature requirements of ASTM E119 and shall be tested to UL 1479

(ASTM E814) and Classified for up to 3 hours.

PART 3.00 EXECUTION

3.01 WIRING - GENERAL

A. Unless otherwise specified, all wiring shall be installed in conduit. No wire shall be smaller than No. 12 unless noted otherwise. Wiring for low voltage control may be #14 AWG. Wire for each branch circuit shall be of single size and type from the branch circuit protective device the last outlet of the circuit. BX wiring shall not be allowed.

B. Feeders, motor circuit conductors and main service entrance conductors shall run their entire length without joints or splices. Wiring for branch circuits shall run the entire length without splices, with splices and joints made only at outlets or in accessible junction boxes only when absolutely necessary and approved by the Engineer. Joints and splices in branch circuit wiring shall be made with compression type solderless connectors.

C. Connectors of the non-metallic screw on type are not acceptable. Terminations or splices for conductors No. 6 AWG and larger shall utilize bolted connecting lugs. All splices and terminations shall be insulated in an approved manner by an integral or separate cover or by taping to provide insulating value equal to that of the conductors being joined.

D. Type THW or THWN conductors may be connected directly to recessed fixtures only when the fixtures are equipped with outlet boxes listed by Underwriter's Laboratories, Inc. for use with wire having insulation rated for maximum operating temperatures of 75°C (167°F); otherwise, for fixtures not rated for 75°C directly connection, use 125°C insulated conductors from the fixture to an outlet box placed at least one (1) foot, but not more than four (4) feet from the fixture.

E. Branch circuit home run numbers shown on the drawings shall be used as a guide for connection of circuit wiring to similarly number protective devices in branch circuit panelboards. Requests for changes in the plans shall be directed to the Architect. No changes shall be made without approval from the Architect.

F. Each circuit shall be furnished with its own neutral conductor. There shall be no sharing of neutral conductors.

G. In instances where a junction box, wireway, etc. contains three (3) or more branch circuits, the feeders shall be labeled within the junction box, wireway, etc. with circuit location, including panel name and breaker number. Labeling shall be neatly typed and affixed to each feeder. Labeling shall meet all applicable Code requirements.

3.02 ELECTRICAL SERVICE GROUNDING

A. Main electrical service equipment, conduit work, motors, panelboards and all other electrical equipment shall be effectively and permanently grounded. Grounding connections and conductor sizes shall be in accordance with requirements of the National Electrical Code, Article 250 and local or State ordinances.

B. All conduit entering panelboards shall be grounded to the panelboard by means of a grounding type locknut installed on the inside of the panelboard. Where the continuity of the metallic conduit system is interrupted by a run of non-metallic conduit, a separate grounding conductor, sized in accordance with NEC Table 250.122 shall be run in the conduit with the insulated conductors. A separate grounding conductor, as described above or as called for on the plans, shall be run in the conduit with the circuit conductors for all circuits serving multi-outlet assemblies.

C. Conduit runs shall be increased in size where necessary to accommodate the grounding conductor in addition to circuit conductors. The grounding screw on all grounding type receptacles shall be securely grounded to the outlet box using a No. 12 green insulated conductor attached to the outlet box with lug screw.

D. All switch legs shall include a green ground conductor connected to the circuit ground conductor and terminated in the switch outlet box.

3.03 CONDUIT - MATERIALS AND METHODS

A. Conduit shall be installed as per NEC and NEMA regulations and the manufacturer's recommendations. Conduit shall be as follows:

B. Rigid Steel Conduit shall be used for all conduits exposed to the weather, and underground conduit except where non-metallic conduit is specified or approved. Underground and under slab runs are to be watertight. All horizontal runs of underground conduit shall utilize rigid steel elbows on vertical risers. Conduits used for receptacles and run under the building slab, shall be hot dipped galvanized rigid steel and shall be 3/4" minimum size.

C. All conduits routed underground shall not be placed in building slab. Conduits larger than 1" routed under building slab shall be routed below the vapor barrier. Minimum conduit size allowed to be routed underground shall be 3/4". Conduits routed under building slab may be PVC. All conduits rising vertically out of slab or out of ground shall be type RMC to 48" above finished floor.

D. Electrical Metallic Tubing shall be used for all other feeders, branch circuit and communications and control wiring where rigid steel or non-metallic conduit is not specified.

E. Non-metallic conduit, minimum schedule 40 PVC, shall be permitted to be installed underground. Non-metallic conduit shall not be used in any environmental air plenum. If PVC conduit is run, a full sized grounding conductor shall be pulled with the circuit conductors. PVC conduit shall not be run exposed. Where PVC conduit is run underground, it shall be encased in concrete or run minimum 24" below grade, or at the depth below grade shown on the drawings.

F. Flexible metallic tubing and EMT shall only be permitted in spaces above finished ceilings

and within enclosed walls within the interior of buildings. Flexible metallic tubing shall only be permitted for the final four (4) feet of conduit runs to fixtures located above finished ceilings. No flexible metallic tubing or EMT will be permitted exposed. Also, EMT may not be installed in or below concrete slabs.

G. Flexible metal conduit or liquid-tight flexible metal conduit shall be used for the final connection of runs to motors. Flexible conduit shall be at least twelve (12) inches, but not more than 48 inches long. Where used, an external grounding conductor shall be run with conduit unless conductor is made as a part of the conduit.

H. Conduits installed underground and used for communications system wiring shall be reviewed with the communications contractor prior to installation. Conduits below the vapor barrier may require moisture proof wiring to comply with the structured connectivity solution. Conduits may need to be installed above the vapor barrier to maintain connectivity solution compliance.

3.04 CONDUIT - GENERAL

A. Fittings for rigid steel conduits shall be hot-dipped galvanized steel and shall be of a type especially designed and manufactured for their purpose. Fittings for EMT shall be die cast zinc type. Rigid conduit joints for single conduit runs shall be made with threaded fittings made tight with at least five threads fully engaged. Fittings for rigid non-metallic conduit shall be solvent welded.

B. Where they enter boxes or cabinets that do not have threaded hubs, conduits shall be secured in place with galvanized locknuts inside and outside the cabinet and shall have bushings inside. Conduits larger than 1-1/4 inch shall have galvanized locknuts and galvanized bushings.

C. All conduits shall be installed concealed or as indicated or scheduled on the drawings and shall be of sufficient size to accommodate the required number of insulated conductors including equipment grounding conductor where such grounding conductor is required or specified.

D. Conduit runs shall be straight; elbows and bends shall be uniform, symmetrical and free from dents or flattening. Exposed conduit shall be firmly supported on galvanized hangers; on brackets, hangers, or pipe straps; or by beam clamps. Conduit installed exposed shall be neatly aligned and run at right angles to the building walls or walls of the rooms in which they are installed. All exposed conduit shall be located to avoid all conflicts with architectural or mechanical components.

E. Pull boxes shall be installed as required to permit proper installation of conductors and expansion fittings installed where conduit runs cross building expansion joints.

F. Conduit shall be run no closer than six (6) inches to covering of hot water or steam piping except where crossings are unavoidable. Conduit shall be kept at least one (1) inch from crossing steam and hot water piping.

G. Conduit shall be held securely in place by hangers and fasteners of appropriate design and dimensions for the particular application. Support shall be such that no strain will be transmitted to outlet box and pull box supports. Wire shall not be used, with or without spring steel fasteners, clips or clamps, for the support of any conduit. Conduit shall not be supported by or attached to duct work unless specifically allowed otherwise.

H. Hangers and other fasteners shall be supported on solid masonry with inserts or expansion sleeves and bolts, on wood with wood screws, hollow masonry with toggle bolts, on steel with machine screws or welded threaded studs. Fastenings shall be proof tested by the Contractor for secure mounting.

I. All conduits shall be cut square and reamed at the ends. The conduit system shall be complete and cleaned before any conductors are installed. Open ends of all conduits shall be capped until conductors are installed. A non-metallic fish wire shall be installed in all empty conduits. Empty conduit shall remain capped.

J. Contractor shall refer to National Electrical Code Appendix C, Conduit and Tubing Fill Tables for Conductors and Fixture Wire of the Same Size. Contractor shall refer to the appropriate table for the conduit and wire condition and shall install wiring in accordance with code requirements.

K. Contractor shall provide pull box for every 270 degrees of bend. This shall apply to underground and above ground conduit. Where the run is under slab, contractor shall provide an appropriate pull box for the traffic rating.

3.05 FLEXIBLE CONDUIT

A. Flexible metal conduit may be used for short final connections to equipment where permitted by governing codes. Flexible metal conduit shall be sized and supported in accordance with Article 350 of the NEC or more stringent local codes. A separate equipment-grounding conductor sized in accordance with NEC Table 250.122 shall be installed in flexible conduit unless exceptions are allowed by governing codes and if the fittings used are UL listed for the purpose.

B. Liquid-tight flexible metal conduit shall be used where flexible conduit is permitted and desired and conditions of installation, operation, or maintenance require protection from liquids, vapors, or solids and in other hazardous locations where specifically approved. Flexible conduit for all exterior motor connections shall be liquid-tight. Liquid-tight flexible conduit shall be used with terminal fittings approved for the purpose.

3.06 FIRE-RATED WALL AND FLOOR THROUGH-PENETRATIONS

A. All fire-rated walls or floors penetrated by this Contractor shall be properly sealed with fire stopping materials. All floor through-penetrations shall be fire stopped with a light-weight mortar material. Wall through-penetrations shall be fire stopped with a non-hardening putty material. Contractor shall see that all penetrations are fire stopped and seals are inspected.

3.07 SUPPORTS AND FITTINGS

A. The Contractor shall furnish and install all supports for equipment under this contract. Supports shall be spaced at intervals of eight (8) feet maximum for rigid conduit and five (5) feet maximum for EMT and as necessary to obtain rigid support. Perforated strap supports will not be permitted.

B. All conduits shall be firmly secured with pipe clamps, conduit straps, or suspension hangers as appropriate. Fasten to steel with screws in tapped holes, to wood with wood screws, and to masonry with expansion anchors. Expansion anchors shall have a minimum pull out load of 1,200 pounds and an ultimate shear load of 1,950 pounds.

C. All conduit, fixtures, and accessories shall be rigidly supported to form a firm, well-braced installation.

D. Joints shall be made tight with standard galvanized or sheradized couplings; corners turned with fittings, elbows, or long radius bends.

E. Low voltage wiring installed above accessible ceilings shall be supported on J-hooks. J-hooks installed for communications system wiring shall not be used for other low voltage system wiring (fire alarm, security, EMS controls, etc.).

3.08 WEATHERPROOF EQUIPMENT

A. All disconnect switches, starters, and other electrical equipment located on the exterior of the building or exposed to the outside shall be enclosed in a rain-tight enclosure.

B. All lighting fixtures or other devices located on an exterior wall of the building shall be mounted on a flush-mounted, cast outlet box.

3.09 MOUNTING HEIGHTS

A. Unless otherwise noted on the drawings or required by the Architect, the following mounting heights shall apply:

Toggle Switches	4'-0"
Receptacles	1'-6"
Panelboards	6'-0" to top
Telephone Outlets	1'-6" (48" for wall phone)
Safety Switches	5'-0" to top
Motor Control Equipment	5'-0" to top
Wiring Devices above counters	0'-6" above counter top
Fire Alarm Manual Stations	4'-0"
Fire Alarm Annunciation Devices	80" or 6" below ceiling (whichever is lower)

B. Upon permission of the Architect, mounting heights may be adjusted to simplify cutting of masonry units or to facilitate furniture and cabinet arrangements. Dimensions above refer to the centerline of the device unless noted otherwise.

END OF SECTION

DIVISION 26 – ELECTRICAL
SECTION 26 20 00 - SERVICE AND DISTRIBUTION

PART 1.00 GENERAL

1.01 SYSTEM VOLTAGE

A. The building service from the utility company shall be 480/3/60.

1.02 TERMINATIONS

A. All wiring shall be sized based on 75°C rated conductors. All connectors shall be rated for 75°C in accordance with N.E.C. Article 110-14 requirements.

PART 2.00 PRODUCTS

2.01 SAFETY SWITCHES

A. Furnish and install safety switches as shown on the Drawings. All switches shall be fused NEMA Heavy Duty Type HD and Underwriter's Laboratories listed. All switches shall have blades that are fully visible in the "OFF" position with the door open. Switches shall be dead-front construction with permanently attached arc suppressers. Lugs shall be UL listed for copper and aluminum conductor and front removable. All current carrying parts shall be plated to resist corrosion. Switches shall be quick-make, quick-break type. During operation of the switch, the movable contacts shall not be able to be restrained by the handle once the closing or the opening action of the contacts has been initiated. Switches shall have cover interlocks to prevent opening of the switch door while the switch is in the "ON" position or closing the switch with the door open. Switch shall have padlocking capabilities in the "OFF" position.

B. Safety switches shall be rated 600 volts for 480 volt service and rated 240 volts for 208 volt service. Switches shall be motor rated when used for motor loads. Switches shall be NEMA 1 enclosed for indoor applications and NEMA 3R for outdoor or wet area locations.

C. Switches used for service entrance shall be service entrance rated. Safety switches shall be furnished complete with fuses.

D. Approved Manufacturers:
1. Eaton
2. Square D (Schneider Electric)
3. ABB
4. Siemens

2.02 FUSES

A. All fuse holders shall be provided with dual-element, time-lag fuses as scheduled on the Drawings or as recommended by the equipment manufacturer. Fuses shall be rated 200,000 AIC. Fuses shall be Buss Fusetron, Economy Econ, or Gould Shawmut Tri-Onic

for component protection and Buss Limitron, Economy Econolin, or Gould Shawmut Amp-Trap for circuit protection.

2.03 CIRCUIT BREAKER PANELBOARDS

A. Panelboards shall be sized as shown on the drawings and schedules, and shall be the bolted breaker panelboard type. Panelboards shall have copper bussing. Panelboards shall have door-in-door trim.

B. All branch breakers are to be quick-make, quick-break (over center toggle device) with trip indication and common trip on all multiple breakers. Trip indication shall be clearly shown by breaker handle taking a position between "ON" and "OFF" position. Breakers shall be ambient compensated to carry full NEC load in 120 degree F room temperature. Panelboards shall have distributed phase busing throughout. Any two adjacent single pole breakers shall be replaceable by a two pole breaker, and any three adjacent single pole breakers shall be replaceable by a three pole breaker.

C. Minimum interrupting capacity of breakers shall be as shown on panel schedules. No breakers shall be rated less than 10,000 RMS symmetrical amperes.

D. Branch breakers shall be numbered 1, 3, 5, etc. from top to bottom beginning at the top of the left hand column so that #1 shall be on phase A, #3 on phase B, and #5 on phase C.

E. Panelboards shall include main circuit breakers where indicated on plans and in the following conditions regardless of designation on plan:
   1. Panelboard is served from a transformer (utility or otherwise.) and no overcurrent protective device exists between the transformer and the panelboard.
   2. Panelboard is served from a wireway and no overcurrent protective device exists between the wireway and the panelboard.

F. Approved Manufacturers:
   1. Eaton
   2. Square D (Schneider Electric)
   3. ABB
   4. Siemens

2.04 DRY TYPE TRANSFORMERS

A. Contractor shall install dry type transformer(s) in the size and at the location(s) as shown on the drawings. Transformers will be used to step down voltage from 480 volts to 120/208 volts. All transformers shall comply and must be tested in accordance with UL, NEMA and ANSI standards. Transformers shall be energy efficient and shall meet NEMA Standard TP-1 requirements.

B. Transformers shall have the KVA ratings shown on the drawings. Transformers shall be three phase type rated for 480 volts primary and 120/208 volt secondary as shown on the drawings. Transformers shall be self-cooled. When transformer is delivering full KVA load continuously, temperature rise shall not exceed 150 degrees C above a 40 degree C

ambient with 200 degrees C temperature class insulation system. The average sound level shall not exceed NEMA standards. Transformers shall have four external type taps, two 2-1/2% FCBN and two 2-1/2% FCAN. Windings shall be copper.

C. Transformers rated larger than 112.5KVA shall be provided with Class 155 or higher insulation system and shall be completely enclosed except for ventilating openings. Transformers larger than 112.5KVA shall comply with NEC Article 450.21(B) Exception No. 2, to allow transformers to be installed inside non fire rated rooms.

D. Transformers shall be floor mounted on isolation pads. Enclosure shall be heavy gauge steel with ventilation openings protected against falling dirt and drip, and shall be shielded against actual touching of live parts. A nameplate in accordance with NEMA standards shall be permanently affixed to the enclosure.

G. Approved Manufacturers:
   1. Eaton
   2. Square D (Schneider Electric)
   3. ABB
   4. Siemens

2.05 SWITCHBOARD

A. General Construction:
   1. Switchboards shall be dead front type, completely metal enclosed, with self-supporting structure independent of wall supports. Switchboard ratings shall be as shown on drawings. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard. The sides shall be covered with removable screw-on plates. All edges of front cover panels shall be formed.
   2. Equipment shall comply with the latest applicable standards of NEMA PB2 and UL 891. Switchboards shall be used as service entrance equipment and shall comply with all NEC and UL requirements for service entrance and a UL service entrance label shall be provided.
   3. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. All control wires shall be marked.
   4. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position.
   5. All bus bars shall be silver plated copper with bolted connections at joints. The bus bars shall be of sufficient size to limit the temperature rise to 65oC rise based on UL tests, and rated to withstand mechanical forces exerted during short circuit conditions when directly connected to a power source having a minimum available fault current as shown on drawings.
   6. A ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. An incoming ground lug shall be furnished. Ground lugs for each breaker circuit shall also be supplied. All hardware used on conductors shall be high-tensile strength and plated. All terminals shall be of the anti-turn solderless type suitable for copper or aluminum

cable of sizes indicated for 75°C cable.

7. All switchboard sections shall be fully bussed at rated switchboard capacity. Bussing shall extend the full length of each section.

B. Protection:

1. Feeder devices 150 ampere frame through 1200 ampere frame shall be panel mounted type construction. Devices over 1200 ampere frame or main devices shall be individually mounted when required. Devices rated 1000 ampere or greater shall include ground fault protection in accordance with N.E.C. requirements.
2. Where a main is required by NEC or where it is shown on plan provide a main protective device in the main device section rated as shown on plan. Breaker shall be stationary type (unless otherwise indicated on drawings), insulated case circuit breaker construction with manual operation. Breakers shall be equipped with micropressor-based trip units designed for true RMS sensing and with fully adjustable characteristics necessary for a selective coordinated system.
3. Branch protective devices shall be molded case circuit breakers. Molded case circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free, with frame, trip, and voltage rating, either 2-pole or 3-pole, as indicated on the plans. All breakers shall be removable from the front of the switchboard without disturbing adjacent units.
4. Branch circuit breakers rated below 70 amps shall be thermal-magnetic trip units with inverse time-current characteristics. Breakers rated 70 amps through 250 amps shall have thermal-magnetic trip units with inverse time-current characteristics and shall have interchangeable trip units. Breakers rated 225 amps and above shall be provided with interchangeable trip units. The interchangeable trip unit shall be selected to carry 100% of circuit rated current.

C. Additional Requirements

1. Engraved nameplates shall be furnished for all main and feeder circuits with designation and circuit number as indicated on the drawing. Furnish master nameplate giving voltage, ampere rating, short circuit rating, manufacturer's name, general order number and item number.

D. Approved Manufacturers

1. Eaton
2. Square D (Schneider Electric)
3. ABB
4. Siemens

PART 3.00 EXECUTION

3.01 COORDINATION

A. Contractor shall coordinate all service and distribution work with other crafts on the project.

3.02 TEST AND BALANCING

A. At such times as the Architect directs, the Contractor shall conduct in the Architect's presence operating tests to demonstrate the electrical systems are installed and will operate properly and in accordance with the requirements of the specifications. The Contractor shall furnish instruments and personnel required for such tests. Any work that is found to be defective, or material that are found to vary from the requirements of the drawings or specifications shall be replaced by the Contractor without additional cost of the Owner.

3.03 EMERGENCY CIRCUITS

A. All wiring for emergency power and lighting circuits shall be run in conduits independent of all other circuits or conductors. Emergency circuit installations shall be made in accordance with National Electrical Code Article 700.9.

3.04 EQUIPMENT FUSING

A. All equipment shall be furnished complete with fuses as described herein and/or as shown on the Drawings. Contractor shall furnish one set of spare fuses for each size fuse furnished on the project. Fuses shall be delivered to Owner prior to acceptance of project.

B. Fusing for protective equipment shall be of the type specifically designed for the intended application. Fuses for service entrance rated equipment shall be Class L. Fuses for branch circuit protection shall be Class RK5 unless specified otherwise. Provide protective fuses as specifically required by the equipment manufacturer.

3.05 INSTALLATION

A. The Electrical Contractor shall place a sign at the Main Switchboard indicating the type and location of the emergency generator in accordance with National Electrical Code Article 702.8(A) requirements.

B. Disconnecting means shall be provided for each motor and motor controller, and shall be located within site from the controller and motor locations in accordance with National Electrical Code Article 430.102 requirements.

END OF SECTION