

SECTION 26 00 00

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including general and special conditions and general requirements, apply to the work specified in DIVISION 26 -ELECTRICAL.

B. Separation of Division 26 into Sections is for convenience only and is not intended to establish limits of work. Sections are as follows:

26 00 00	ELECTRICAL GENERAL PROVISIONS
26 05 00	ELECTRICAL BASIC MATERIALS AND METHODS
26 20 00	ELECTRICAL SERVICE AND DISTRIBUTION SYSTEMS
26 50 00	ELECTRICAL LIGHTING
27 00 00	COMMUNICATIONS
28 31 00	FIRE ALARM

1.2 SCOPE

A. The work under this Section includes furnishing and installing wires, conductors, cables, conduit and conduit fittings, wiring devices, junction and outlet boxes, panelboards, circuit breakers, fuses, time switches, relays, contactors, safety switches, lighting fixtures, lamps, automatic lighting shut-off devices with lighting controls, cabinets, grounding connections, emergency lighting system, TVSS, raceways for voice outlets, raceways for data outlets, fire alarm system, raceways for sound system backboards and incoming service raceways for TV/CATV services, surface metal raceway system, and other equipment specified or necessary for complete installation. The work also includes making building modifications if necessary to get these items to the locations for installation.

B. Also included in the work is the power wiring for items indicated on the architectural plans, as well as power wiring for the equipment specified in DIVISION 23 - MECHANICAL.

C. Removal of existing electrical equipment not being reused.

1.3 CUTTING AND PATCHING

A. Contractor shall do his work in such a way to avoid cutting where possible. Holes cut shall be patched in a suitable manner and shall be refinished to match the existing finish. Holes cut in exterior

walls shall be patched, flashed, and completely waterproofed. Contractor shall patch and/or repair walls, ceilings, and floors where existing equipment is removed.

B. Cutting and patching for the work of this Division shall be in accordance with the requirements of the General Conditions. Openings around conduit penetrations shall be sealed.

C. Work of this Division shall include providing information for any required openings to those responsible for concrete slabs and other concrete members.

D. Field cut openings in concrete shall be located to avoid the reinforcing. Locations shall be subject to approval of those responsible for DIVISION 3 - CONCRETE.

E. No structural members shall be field cut or pierced without the approval of the Architect.

F. Inserts in slabs and beams for fastening work shall be drilled type.

G. For post-tensioned slabs and beams, inserts for fastening work shall be cast in place wherever possible. If additional inserts are required after concrete is placed, drilled type shall be used. Drilling shall not penetrate the post-tensioning tendons. Powder driver fasteners shall not be used.

H. Grouting shall be provided around raceway penetrations through concrete floors equal to the fire rating of the floor using non-shrinking waterproof grout to inhibit water from leaking through the floor.

1.4 DRAWINGS

A. Outlets shown on electrical drawings are located approximately only. Refer to architectural drawings for necessary dimensions. Refer to architectural, structural, and mechanical drawings as well as equipment manufacturer's shop drawings and rough-in drawings, and adjust work accordingly to provide a coordinated installation. Contractor shall install fire alarm devices as near as possible to the locations indicated on the drawings but shall move them as necessary to avoid conflicts with existing equipment and to be located sufficiently away from hot objects.

B. Smoke detectors and heat detectors shall be located so that the maximum distance between detectors is 30'-0", and the maximum distance from walls is 15'-0". Smoke detectors shall also be located within 5' of smoke doors held open. Locations shall conform to other restrictions of NFPA 72 to include the requirement that smoke detectors be kept at least 36" away from HVAC grilles. Contractor shall plan for contingencies in connection therewith to include providing additional smoke detectors (spot, beam, duct, etc.) and heat detectors.

C. Visual signal unit and audiovisual signal unit locations shall be adjusted as necessary to avoid conflicts with other equipment. Contractor shall plan for contingencies in connection therewith to include providing additional signal units.

D. Visual signal unit and audiovisual signal unit locations shall be adjusted as may be necessary to meet NFPA 72 paragraphs 4-4.4.1 and 4-4.4.2.

1.5 LAWS AND PERMITS

A. The National Electrical Code (2008) and State, Parish, City and local building codes shall be considered a part of these specifications, and pertinent articles will not be repeated herein. These codes shall establish the minimum acceptable criteria where more stringent requirements have not been defined in these specifications and/or drawings.

B. The Contractor shall apply for permits and pay inspection fees incidental to electrical work.

C. No work shall be concealed until approved by the local inspector and local regulations shall be adhered to.

D. Upon completion, a certificate of approval from the appropriate regulatory agency shall be furnished to the Architect.

E. Where equipment is located at exterior of buildings or structures, the minimum elevation for their installation shall be the greater of 36" above curb or 12" above the FEMA Base Flood Elevation. Contractor shall obtain this flood elevation from a licensed surveyor and pay the cost associated therewith. Contractor shall provide documentation to the Architect to confirm that this requirement has been met.

1.6 VISITING SITE

The bidder shall visit the site of proposed work so that he may understand the facilities, difficulties, and restrictions attending the execution of the contract. He will be allowed no additional compensation for failure to be so informed.

1.7 INTERRUPTION OF SERVICES

There is an existing temporary service to the existing building which provides power to some lighting fixtures, receptacles, security system, etc., which shall be removed at the appropriate time.

Services in existing building are to be kept in operation at all times, except when specific permission is given to do otherwise. Before any services are interrupted, arrangements shall be made with the occupants to do this work at a time most convenient to them. This procedure may involve working at night, on Saturday or Sunday, or at a special time of the year, with the length of time of the interruption agreed upon in advance. Once any service is interrupted, work to restore the service in the shortest possible time shall be on a continuous basis unless temporary service is provided or approval is obtained from the Owner to do otherwise. Any temporary services required shall be work of this Division. Allowance shall be made in the Contractor's bid for the cost of any overtime work in this connection.

1.8 GUARANTEE

The Contractor shall guarantee materials and workmanship for one year after final acceptance of entire project unless a longer guarantee is indicated hereinafter for specific equipment.

PART 2 - PRODUCTS

2.1 MATERIAL AND WORKMANSHIP

Equipment and materials shall be new and shall be listed by Underwriters Laboratories, Inc. in categories for which standards have been set by that agency. Whenever two or more of the same product are indicated, they shall be of the same manufacturer. In particular, panelboards shall be of the same manufacturer. Methods of installation shall be in full accord with the latest and best electrical and mechanical engineering practices.

2.2 SUBSTITUTIONS

A. Names of manufacturers or catalog numbers are mentioned herein in order to establish a standard as to design and quality. Other products similar in design and of equal quality may be used if submitted to the Architect and found acceptable by him. Refer to General Conditions for additional information.

B. When the Contractor elects to use an acceptable alternate manufacturer's equipment, the Contractor shall be responsible to coordinate the change with the trades affected. The Contractor shall also pay for any additional work required under this Division as well as any other Division if the alternate equipment is used.

C. Lighting fixture substitutions shall also be similar in appearance, construction and photometrics (photometric information shall be based on independent laboratory reports) to specified lighting fixtures.

D. If required by Architect/Engineer because of substitutions, the Contractor shall submit for approval 1/4" scale working drawings of equipment areas with both plan and section views.

2.3 SUBMITTALS

A. Within 30 days after award of contract, the Contractor shall submit for review six copies of descriptive literature or shop drawings for the following material which he proposes to use:

Lamps.	Lighting fixtures.
Wiring devices and plates.	TVSS.
Automatic lighting shut-off devices and control panel.	Surface metal raceway system.
Panelboards.	Contactors.
Time switches.	Fire alarm system.
Fuses.	Raceways for sound system.
Safety switches.	Backboards and raceway system for telephone/CATV systems.

B. In addition, the name of the manufacturer of conduit, E.M.T., and conductors to be used shall be submitted for review.

C. Where applicable, submissions shall include installation drawings and brochures showing locations, methods of anchoring, connections to work of others, wall or ceiling conditions at each particular installation and special floor mounting conditions.

D. Submissions shall be identified with project name, equipment name and number (if assigned a number) same as the name and number indicated on the drawings; shall be properly marked to show model numbers and any accessories being furnished; and shall have the Contractor's stamp showing he has reviewed the submittal and found it to be in accordance with the specifications and drawings. Items of Division 16 to be submitted shall be submitted in one package.

E. Submittals which do not comply with the above will be returned without review, for resubmittal.

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Do excavating and backfilling required for the work of this Division. Removal of obstructions, hidden or otherwise, shall be part of this work. Backfill shall be river sand. Backfilling shall be done in two lifts each thoroughly tamped. Surplus earth shall be removed.

B. Before excavating or trenching, locate and stake out existing underground utilities which may be adversely affected by this work. Work shall be performed in a manner to avoid damage to existing utilities. Repair or replace, at no expense to Owner, any utilities damaged by him. Call 1-800-272-3020 per Louisiana Statutes.

3.2 RECORD DRAWINGS

At the completion of the work, unless noted otherwise in the General Conditions, mark-up a mylar reproducible and two sets of bond prints in a neat and understandable manner to show significant changes made during construction. Wiring and raceways installed shall be indicated (routings, wire size and quantity) on the record drawings even if not indicated on the contract drawings. Underground raceways and wiring shall be measured and dimensioned from above-grade structures. Final payment will be withheld until these drawings are furnished to the Architect. The Contractor shall pay for the reproduction costs.

3.3 OPERATING INSTRUCTIONS

A. Before final acceptance, prepare and deliver to the Architect two bound copies of operating instructions, which shall include:

1. Description of major components of power systems and each special system, including the function of major items.
2. Detailed operating instructions and instructions for making routine minor adjustments.
3. Routine maintenance operations.

4. Manufacturer's catalog data and service instructions and parts list for each piece of operating equipment.

5. Final reviewed submittals.

B. Instruct Owner in the care and operation of equipment and shall provide the services of a competent mechanic for this purpose.

C. Literature shall be substantially bound in a suitable number of volumes so as to permit heavy usage and shall include wiring diagrams, fabrication drawings and other information as may be required.

3.4 MECHANICAL EQUIPMENT

A. Unless indicated otherwise, magnetic starters (including variable speed drives) will be furnished under other Divisions for installation under this Division.

B. Overload elements in starters shall be selected according to actual motor nameplate full load current. Responsibility for this coordination shall lie with the Division under which the particular starter is furnished.

C. Unless indicated otherwise, power disconnect switches and single speed manual starting switches shall be furnished and installed under this Division. Where combination magnetic starters are provided as work of another Division, the associated disconnect switch will be furnished as work of that Division.

D. Where Division 23 schedules indicate that equipment is furnished with a disconnect, the disconnect shall be installed and connected as work of Division 26.

E. Refer to DIVISION 23 - MECHANICAL, and to mechanical drawings for any additional electrical power work required.

3.5 WORK RELATED TO EQUIPMENT NOT FURNISHED AS WORK OF THIS DIVISION

Unless specifically indicated otherwise, any required electrical services for and required electrical connections to items shown on the architectural drawings or specified to be furnished in other Divisions of specifications or by Owner shall be electrically connected as work of this Division.

3.6 PAINTING

Painting, including painting of exposed conduit is specified under DIVISIONS 099113 and 099123. Damaged surfaces of factory-finished items, however, shall be repaired to the satisfaction of the Architect as the work of this Division.

3.7 PROTECTION OF WORK

Protect the equipment, fixtures, and work from damage. Damaged work will be rejected and replaced at the expense of the Contractor. Lighting fixtures, panels and similar equipment shall likewise be protected from damage and from the weather. Provide adequate and proper storage facilities for such items during the progress of the work.

3.8 BUILDING CODE RESTRICTIONS

Contractor shall assure that he does not install electrical equipment including raceways in or through areas restricted by the building codes. These areas include elevator shafts and stairs.

3.9 EXISTING WORK

A. Remove existing lighting fixtures from areas affected by new construction and from areas to be relighted. After completion of work in a given area, the Contractor shall reinstall the existing lighting fixtures or install new lighting fixtures as indicated.

B. Where existing ceilings are being removed, provide new supports for raceways, outlets, junction boxes, and other electrical items which are to remain and which depend upon the existing ceiling suspension system for support. The new supports shall be attached to the structure/slab above.

C. Existing outlets not to be reused shall be removed unless directed otherwise. Where outlets are indicated to remain as junction boxes, wall outlets shall be provided with blank device plates of the type hereinafter specified and ceiling outlets shall be provided with Yorkville #76 covers where fixture studs exist and #176 where there are no studs.

D. Where new wall or ceiling finishes are applied, existing equipment and cover plates for wiring devices, junction boxes, telephone outlets and data outlets, etc., shall be removed and reinstalled. Provide extension rings on outlets to remain, where necessary. New cover plates shall also be installed on boxes that do not contain cover plates. Existing outlets, boxes, etc., are not shown on the drawings; bidder shall visit the site to locate these.

E. Existing exposed conduit and other electrical equipment not to be reused shall be removed. Existing conduit not to be reused and located in accessible attic spaces also shall be removed.

F. Existing conduits in good condition (and of the type and size required) may be reused. Existing conductors, wall switches, receptacles, panelboards, safety switches, etc., which are required to be removed, unless otherwise individually indicated, shall not be reused.

G. Electrical equipment removed and not to be reused shall be stored in one location on the site; any equipment and material which the Owner does not wish to retain shall become the property of the Contractor and shall be removed from the site by him.

H. Where apparent routings of existing raceways are indicated, it is not possible to guarantee that these routings are correct. The Contractor shall allow for contingencies.

I. Where existing raceways are indicated to be reused, it is not possible to guarantee that the existing raceways are in suitable condition to be reused. Before conductors are installed in existing raceways, the raceways shall be cleaned out and a try-plug ¼" smaller than the inside diameter of the

raceway pulled through to assure continuity. Raceways which are found to be broken, blocked, and/or defective in any way shall have the defective sections replaced or entirely new raceway provided with routing subject to approval of the Architect. The Contractor shall allow for contingencies in connection therewith.

J. Where existing equipment including wiring and raceways is in conflict with work of this project, Contractor shall rework/reroute/relocate this equipment as necessary.

- END OF SECTION -

SECTION 26 05 00

ELECTRICAL BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes providing labor, materials and equipment indicated, specified and necessary for a complete and operating electrical system and related systems in accordance with SECTION 26 0000 - ELECTRICAL GENERAL PROVISIONS.

PART 2 - PRODUCTS

2.1 CONDUIT AND TUBING

A. Rigid steel conduit and electrical metallic tubing shall be manufactured by Allied, Triangle-PWC, Republic, Wheatland, or approved equal. Conduit shall be threaded heavy-wall hot-dipped galvanized (inside and out) steel conduit. Electrical metallic tubing shall have galvanized exterior and galvanized or equivalent plastic coated interior to protect against corrosion.

B. Rigid aluminum conduit shall be manufactured by New Jersey Aluminum, or VAW of America from 6063-T42 extruded Schedule 40 pipe. The interior surface shall be coated with special approved lubricating liner.

2.2 CONDUCTORS

A. Conductors shall be copper.

B. Branch circuit wiring shall be #12 AWG or larger (as required for the particular equipment to be fed) with flame resistant insulation. Conductors #8 AWG and larger shall be stranded. Insulation on branch circuit conductors shall be type THHN/THWN, unless indicated otherwise or otherwise required by the particular application.

C. Feeds to surface and/or suspended fluorescent fixtures shall be #12 AWG type THHN/THWN. Wiring through channels of continuous rows shall be #12 AWG and type THHN/THWN, or XHHW. Recessed fluorescent fixtures shall be fed with #12 AWG type THHN/THWN or type XHHW conductors.

D. Recessed incandescent fixtures shall be fed with type SF, PF, or PFF conductors unless complete with prewired outlet box approved for type THHN or THWN conductors. Surface mounted high intensity discharge (HID) lighting fixtures shall be fed with #12 AWG type THHN/THWN unless higher temperature rated conductors are required for the particular fixtures provided. Recessed HID fixtures shall be fed with type SF-2, SFF-2, PF, or PFF unless complete with prewired outlet box approved for type THHN/

THWN conductors. Lighting standards shall be wired with type THHN/THWN from wiring handhole in standard to fixtures unless higher temperature conductors are required for the particular fixtures provided.

E. Feeders shall be of the size as indicated, with type THHN/THWN insulation unless indicated otherwise. However, feeder wiring for emergency systems shall be type RHW, U.L. System 27, 2-hour fire rated (Tyco or equal). Raceways for this wiring shall not be aluminum.

F. Except as may be otherwise indicated, conductors shall be manufactured by Triangle-PWC, American Insulated Wire, Senator, Royal, or approved equal.

2.3 OUTLETS

A. All boxes, fittings and supports (including wireways) shall be galvanized steel.

B. Boxes for concealed wall outlets shall be 4" square by 1½" deep, or larger, with raised device covers, except that 2¾" deep switch boxes may be used, unless noted otherwise, where only one conduit enters a box. Device covers for 4" square boxes in masonry walls which are not plastered or otherwise finished shall be 1" minimum in depth with straight rectangular openings for dry wall type construction. Covers for boxes in sheetrock or wood walls shall be of the same depth as the sheetrock or wood thickness and shall have straight rectangular openings.

C. Where 4" junction boxes are indicated or installed, they shall be complete with raised device covers as hereinbefore specified. Blank plates shall be as specified for devices.

D. Boxes for concealed ceiling outlets shall be 4" octagonal by 1½" deep, or larger. Boxes in plaster ceilings shall have plaster covers. Fixture outlet boxes shall be equipped with fixture studs secured to the boxes. Boxes above lay-in ceilings shall be supported by bar hangers or other suitable means; they shall not be supported by ceiling tiles.

E. Concrete boxes shall be used for fixtures on new concrete ceilings and/or walls.

F. Outlet boxes for exposed work at dry locations inside buildings shall be 4" square x 1½" deep or larger with Appleton ½" deep raised surface metal covers to accommodate the devices indicated. Outlet boxes for exposed work exposed to weather or in damp locations shall be of cast or malleable iron, similar to Crouse-Hinds type FS or FD conduits. Boxes shall have metal covers to accommodate the devices indicated.

G. Floor boxes shall be adjustable type Steel City #68 series, complete with 20A, 2P, 3W, 125V, grounding type duplex receptacles and P60-DS flush hinged brass plate. Edges of boxes shall be installed flush with the finished floor. Carpet flanges shall be provided for locations where carpet is indicated on architectural plans.

H. In walls or ceilings of concrete, tile, or other noncombustible material, boxes and fittings shall be so installed that the front edge of the box or fitting will not set back of the finished surface more than ¼". In walls or ceilings constructed of wood or other combustible material, outlet boxes and fittings shall be set flush with the finished surface. If a fixture canopy or pan is used as an outlet box cover, any combustible wall or ceiling finish between the edge of the canopy and the outlet box shall be covered with noncombustible material.

I. For conduits 1" and smaller, the following shall be the maximum number of conductors permitted in a box:

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<u>Trade Size</u>	<u>Max. No. #12</u>
1-1/2" x 4" octagonal	6
1-1/2" x 4" square	9
1-1/2" x 4-11/16" square	12
2-1/8" x 4-11/16" square	16
2-3/4" x 3" x 2"	6
3-1/2" x 3" x 2"	8

J. Where a fixture stud is installed in box, the number of conductors permitted shall be reduced by one. Where a wiring device is installed in box, the number of conductors permitted shall be reduced by two. A conductor running through the box is counted as one conductor, and each conductor terminating in box is counted as one conductor.

K. Outlet boxes installed flush mounted in stud partitions shall be installed in such a way that boxes between any two studs shall penetrate only one wall face. Outlet boxes that penetrate opposite wall face shall be located between adjacent studs (to reduce noise transmission through walls).

2.4 WIRING DEVICES

A. Wiring devices shall be as manufactured by P&S/Sierra, Hubbell, Leviton, or Eagle. Color of faces of receptacles and switch handles shall be selected by the architect. Comparable catalog numbers of devices furnished shall conform with the following:

1. Duplex receptacles 20A/2 pole, 3-wire, 125 volt, grounding type -- Hubbell #5362. Face shall be nylon or polycarbonate.
2. Isolated ground duplex receptacles 20A/2 pole, 3-wire, 125 volt -- Hubbell #1G5362.
3. GFI duplex receptacles 20A/2 pole, 3-wire, 125 volt, grounding type -- Hubbell #GF5362.
4. Weather-resistant receptacles (used for weatherproof applications and damp locations) shall be 20A, 2-pole, 3-wire, 125 volt, GFI and grounding type Hubbell #GFTR20.
5. Wall switches 20A/1 pole -- Hubbell #HBL1221, or equal.
6. Wall switches 20A, 3-way -- Hubbell #HBL1223, or equal.
7. Switch with pilot light -- P&S #20AC1, -RPL (red, 120-277V) or equal.
8. Clock outlet-- Sierra #2123 or equal, (comes complete with stainless steel Plate.)

9. Dimmer switch, 1500 watts-- Hunt #A-1500, Ideal #56-016 or Lutron #NT-1500; slide type for incandescent.

B. All 20A/2 pole, 3-wire receptacles shall be mounted with a "U" shaped grounding connection at the top, except for weatherproof receptacles.

C. Where duplex receptacles are indicated to be located as required for electric water cooler, they shall be located where indicated on electric water cooler shop drawings.

D. Where receptacles are located in wet or damp locations, they shall be weather-resistant type to meet NEC 406.8.

E. All dimmer switches shall be of the same manufacturer, unless indicated otherwise.

F. Unless indicated otherwise, lighting fixtures within each room shall be switched by the wall switch or switches indicated in the room.

2.5 DEVICE PLATES

A. Plates shall be of the one-piece type, colored nylon. Color shall be selected by the Architect.

B. Where weatherproof switches are indicated, P&S/Sierra type 302 series WP plates shall be used, unless indicated otherwise on drawings.

C. Where weatherproof receptacles are indicated, metal canopy-type weatherproof covers similar to T&B Red Dot Code-Keeper (UL listed for wet locations at all times) shall be used with the weather-resistant receptacles, unless indicated otherwise on drawings.

D. Use multi-gang plates where switches, receptacles, and/or other devices are grouped.

E. Plates shall be installed with the four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16" from the vertical or horizontal.

F. Plates for devices fed with exposed conduit shall be as hereinbefore specified.

G. Wherever a series of switches with pilot lights (minimum of two) and switches (minimum of two) are grouped, the plates shall be furnished with suitable factory engravings (black filled). Where engraving of dimmer switch plates is impractical, engraved phenolic strips may be installed. Engravings shall indicate function/location names not subscript shown on drawings (names shall be approved by Architect).

H. Device plates shall not be installed until painting is completed. Device plates having paint on their surfaces, or having their finish marred by use of paint remover, shall be replaced at no additional cost to the Owner.

2.6 TIME SWITCHES

A. Time switches shall be Tork #7000-ZL Series, astrodial with skip-a-day and reserve power, 277 or 120/240 volt as required, 40 amps, independent 120 volt clock motor circuit and indoor surface enclosure. Mount switches over flush outlets so that raceways will be concealed. Time switches for mechanically held contactors shall be single pole, double throw; other types shall be double pole, single throw, unless noted otherwise on drawings. Provide 120V branch circuit for clock motor. Phenolic nameplate (white with black cut letters) shall be provided to indicate function of time switch.

2.7 LIGHTING CONTACTORS

A. Lighting contactors shall be SQ-D Class 8903, LXG series or equal mechanically held type, 480V, each pole rated 30A, quantity of poles as required plus two spares, 120V coil, NEMA 1 enclosure and HOA switch. Provide two wire interface relay option where contactor is controlled by photocell. Provide 120V branch circuit for coil. Phenolic nameplate (white with black cut letters) shall be provided to indicate function of contactor.

2.8 SAFETY SWITCHES

A. Safety switches shall be of the quick-make, quick-break visible blade-knife switch type. They shall be of the fused or nonfused type as required. Fused switches shall have positive pressure fuse clips. Heavy duty switches shall be fully interlocked, with provision to neutralize the interlock by a screw driver while under load without interrupting the circuit. Switches shall be complete with insulated base, and pressure or solderless lugs (suitable for use with 75 degrees C conductors). Handles shall be front or side operated. Switches shall be horsepower rated, capable of breaking stalled-rotor motor current at these ratings. Unless noted otherwise, outdoor locations shall have NEMA type 3R enclosures; indoor locations shall have NEMA I enclosures. Switches shall have provision for padlocking in the "off" position 600 ampere or smaller switches shall be complete with rejection feature to ensure rejection of fuses other than Class R. Safety switches shall be Square D General Duty type for 208-240 volt non-fused switches and Heavy Duty type for 480 volt switches and 208-240 volt fused switches. Equal equipment as manufactured by GE, Siemens or Westinghouse will be acceptable.

B. Nonfused disconnect switches for single phase motors may be Hubbell #HBL1221I, 20A/1P horsepower rated (for 115V motors) or #HBL1222I, 20A/2P horsepower rated (for 208-240 motors) as required; in outdoor locations these switches shall be mounted in FS condulets with #DS 185 covers and gaskets.

2.9 FUSES

Provide one complete set of fuses, together with 33% spares, for each fuseholder. Fuses 600A and below shall be Buss Low-Peak, Littlefuse Little Peak, or Gould Shawmut Amptrap II, Type RK-1, current limiting and time delay, rejection type, unless noted otherwise. Fuses above 600A shall be Buss Low-Peak, Littlefuse KLP-C or Gould Shawmut Amptrap, UL listed Class L, current limiting and time delay, with 200,000 amp rms interrupting rating, silver plated contact surfaces. Where fuses are used with magnetic starters, fuses shall be reduced in ampere rating (from the sizes indicated) to the maximum rating allowed for each particular starter, as stated on starter nameplate.

2.10 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICE (TVSS)

A. TVSS shall be Liebert, Current Tech or LEA, maximum exposure type, NEMA 1 enclosure with display, internal disconnect and advanced monitoring package. Wiring length to the connection point at the panelboard shall not exceed manufacturer's recommendations (10 feet); wire size shall be per manufacturer's recommendations; connection shall be made per NEC.

2.11 AUTOMATIC LIGHTING SHUT-OFF DEVICES

A. Wall mounted automatic lighting shut-off devices shall be Watt Stopper Series CX-100 or equal, surface mounted in corner of room near ceiling, with passive infrared detection technology.

B. Ceiling mounted automatic lighting shut-off devices shall be Watt Stopper series UT-300/355 or equal, ceiling mounted, low-profile, with 360 degree ultrasonic detection technology.

C. Corridor type ceiling mounted automatic lighting shut-off devices shall be Watt Stopper series WT2250 or equal, ceiling mounted, with 2-way linear ultrasonic detection technology. Mount device so that linear detection range is oriented appropriately for the corridor.

D. Timer type wall mounted automatic lighting shut-off devices shall be Watt Stopper series TS or equal wall mounted, with digital countdown operation on LCD and with audible and blink shut off warning features.

E. Provide power supplies relay packs as and required for control of fixtures in room (except for fixtures indicated to be controlled by manual switches). Provide wiring in raceway as required to interconnect automatic lighting shut-off device(s), power supplies, relay packs, and lighting fixtures.

F. Where automatic lighting shut-off devices control lighting fixtures, the automatic lighting shut-off system shall be compatible with the voltage of the lighting fixtures. Where automatic lighting shut-off devices control lighting contactors, the automatic lighting shut-off system shall utilize same control voltage as lighting contactor coil.

G. Contractor shall meet with the Owner to establish time delay for each automatic lighting shut-off devices.

H. Where an automatic lighting shut-off system is to control a fan, automatic lighting shut-off device (and associated power supplies/relay packs) shall be horsepower rated as required.

I. Ultrasound automatic lighting shut-off devices shall be mounted no closer than 6'-0" from HVAC supply registers. Generally, automatic lighting shut-off devices shall not be mounted in areas with high volume of air flow.

J. Provide Watt/LeGrand series LP24-8-Q-6-115 contactor lighting control panel with programmable screen, eight relays, 12-4 pole contactors, din-rails LP8 interior, Class 1 / Class 2 barriers, low voltage override switches, relay status LED, manual override switches (for relays), lighting control panel schedules, LCP channel automatic schedule, programming specific for this project, keypad, wiring and raceways, and other equipment, whether specifically indicated or not, to provide a complete and operating lighting control system to meet the requirements of the National Energy Code.

K. The main church lighting shall be controlled by control panel to be located in work sacristy (location as directed). The church lighting fixtures to be controlled F3's, F3A's, F4's, F4A's, and F7's. Switches shown in work sacristy shall be low voltage override switches. Provide 120V branch circuit to control panel for power.

L. Contractor shall furnish and install complete automatic lighting shut-off systems including Lighting Control Panel LCP, wiring and raceways, and all other equipment, whether specifically indicated or not, to provide complete and operating systems. Submittal shall be provided to show locations of components, (recommended by the manufacturer of the particular system), wiring, and operation.

M. During submittal preparation, manufacturer should determine if each automatic lighting shut-off device is appropriate for its location and application and make alterations as necessary. Care should be taken when selecting automatic lighting shut-off devices when detecting occupants in rooms which contain windows, partitions, aisles, etc.

2.12 WARNING SIGNS

A. Standard industry "DANGER HIGH VOLTAGE" warning signs shall be provided as required by the National Electric Code and as follows:

1. On other equipment (such as safety switches, time switches, contactors, control panels, etc.) containing energized components which are exposed when door is opened or access panel is removed.

PART 3 - EXECUTION

3.1 METHODS OF WIRING

A. Systems shall be 4-wire, 3-phase, 120/240 volts, A.C.

B. Where a neutral conductor is required for a branch circuit, it shall be dedicated to that branch circuit and shall not be shared by other branch circuits.

C. All wiring run underground or in fill beneath slab shall be contained in rigid threaded heavy wall hot-dipped galvanized (inside and out) steel conduit encased in a 3" minimum thickness concrete envelope. Conduits and concrete envelopes under structural slabs shall be adequately supported from the slab using 3/8" diameter stainless steel rods properly spaced (not greater than 5'-0" spacing between rods) to support the load and to suitably distribute the load within the capacity of the structural slab. The rods shall pass under conduit and rise on both sides to tie into slab.

D. Unless otherwise indicated on drawings or specified hereinafter, wiring installed outdoors (not underground or in fill beneath slab) shall be contained in rigid threaded heavy wall galvanized steel conduit (hot dipped, inside and out).

E. Unless otherwise indicated on drawings or specified hereinafter, other wiring shall be contained in electric metallic tubing for sizes 2" and under, and rigid threaded heavy wall galvanized steel conduit (hot dipped, inside and out) for sizes over 2".

F. Unless specifically indicated otherwise on the drawings, aluminum conduit may be used in lieu of steel conduit, provided same does not run underground or in concrete. Where aluminum conduit is used, fittings, outlet boxes, junction boxes, and accessories shall be aluminum.

G. Raceways shall be concealed where possible and/or unless otherwise indicated. Some areas have inaccessible wall/ceilings and exposed surface metal raceway system shall be required.

H. Branch circuit raceways feeding outlets in masonry walls shall be concealed in the masonry. Where outlet boxes are indicated in bare masonry walls, the box shall be mounted so that two edges of the box or plaster cover will fall in a mortar joint. Where switch boxes will not accommodate the number of conductors required and 4" square or larger boxes are installed, provide device covers 1" minimum in depth with straight rectangular openings for dry-wall type construction. Where grouting is required to fill up improperly cut openings in the masonry, the work will be rejected. The work of this section shall be coordinated with the masonry work to insure a neat and workmanlike job.

I. Solderless spring type connectors similar to Scotchlok connectors, Ideal colored Wingnuts, or Ideal Crimps with Wrapcaps shall be used for branch circuit wiring and fixture splice connections. Solderless connectors of the split-bolt type shall be used for splices on conductors #8 and larger.

J. Splices in low voltage wiring (50 volts and less) shall be made at terminal blocks furnished with the equipment. At junctions or where other splices are required, these splices shall be soldered or made with approved compression connectors.

K. Termination of branch circuit and feeder conductors shall be made using mechanical or compression lugs, unless noted otherwise. Where lugs are not furnished with equipment or are not properly sized (including Owner-furnished equipment), Contractor shall provide lugs as required for a complete installation.

L. Termination of low voltage wiring (50 volts and less) and control/monitor/ instrumentation wiring (120 volts and less) shall be made using compression type (ring or spade) terminals similar to T&B Sta-Kons.

M. Connections to motors and equipment containing motors not equipped with a portable cord shall be made with a short piece of steel flexible metal conduit between rigid conduit system and motor terminal box. Where the motor is located inside a housing, connection between housing and motor terminal box shall be made with a short piece of steel flexible metal conduit, and connection between rigid conduit system and housing shall be with a short piece of steel flexible metal conduit. Ground bond of separate copper conductor shall be made between motor frame and rigid conduit system. In outdoor locations and other locations subject to moisture or water leakage (such as for pumps), liquid-tight flexible metal conduit shall be used. Wiring within these flexible metal conduits shall be stranded.

N. Recessed fluorescent fixtures shall be wired with #12 AWG type RHH, THHN, or XHHW conductors in 4 to 6 feet of ½" flexible metal conduit from a box at least 1 foot from the fixture. Recessed incandescent, compact fluorescent, and H.I.D. fixtures shall be wired with conductors as heretofore specified in 4 to 6 feet of flexible metal conduit from a box at least 1 foot from the fixture, unless the fixture is of the pre-wired type with an integral outlet box approved for the number and type of branch circuit conductors indicated and/or specified. Not more than two individual fixtures shall be connected to any of these outlet

boxes. This box shall be located above the ceiling and shall be accessible from attic, by removing acoustical tile in accessible ceiling or by removing fixture in a non-accessible ceiling. Installing blank covers on ceilings to provide access to such boxes will not be acceptable.

O. Typewritten directory of circuits shall be provided for each panelboard. The room numbers and items served shall be indicated for each circuit. (Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuits in the panelboard shall suit the bussing and branch circuiting to panelboard.)

P. Branch circuit wiring through lighting fixtures shall be in accordance with Articles 410.11, 410.31, 410.32, and 410.33 of the National Electrical Code; however, conductor types shall be as specified hereinbefore.

Q. Unless a larger size is indicated, raceways shall be sized in accordance with Table 1 for the number and conductor size (AWG and MCM) shown or specified. Where combination of secondary (0-600 volt) conductor sizes are indicated, the raceway shall be sized in accordance with Table 2 based on the insulated conductor areas of Table 3, for the project conductor sizes (AWG and MCM) indicated even though the actual diameters and areas of the conductors to be installed may differ from those in Table 3.

Table 1

Maximum Number of Conductors in Trade Sizes of Conduit or Tubing													
	Conduit Trade Size (Inches)												
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6
Conductor Size AWG, MCM													
14	3	6	10	18	25	41	58	90	121	155			
12	3	5	9	15	21	35	50	77	103	132			
10	2	4	7	13	18	29	41	64	86	110	138		
8	1	2	4	7	9	16	22	35	47	60	75	94	137
6	1	1	2	5	6	11	15	24	32	41	51	64	93
4	1	1	1	3	5	8	12	18	24	31	39	50	72
3	1	1	1	3	4	7	10	16	22	28	35	44	63
2		1	1	3	4	6	9	14	19	24	31	38	56
1		1	1	1	3	5	7	11	14	18	23	29	42
0		1	1	1	2	4	6	9	12	16	20	25	37
00			1	1	1	3	5	8	11	14	18	22	32
000			1	1	1	3	4	7	9	12	15	19	28
0000			1	1	1	2	4	6	8	10	13	16	24
250				1	1	1	3	5	6	8	11	13	19
300				1	1	1	3	4	5	7	9	11	17
350				1	1	1	2	4	5	6	8	10	15
400				1	1	1	1	3	4	6	7	9	14
500				1	1	1	1	3	4	5	6	8	11
600					1	1	1	2	3	4	5	6	9
700					1	1	1	1	3	3	4	6	8
750						1	1	1	3	3	4	5	8

Table 2

Dimensions and Percent Area of Conduit and of Tubing										
Trade Size	Internal Diameter Inches	Total 100%	Area – Square Inches							
			Not Lead Covered			Lead Covered				
			2 Cond. 31%	Over 2 Cond. 40%	1 Cond. 53%	1 Cond. 55%	2 Cond. 30%	3 Cond. 40%	4 Cond. 38%	Over 4 Cond. 35%
1/2	.622	.30	.09	.12	.16	.17	.09	.12	.11	.11
3/4	.824	.53	.16	.21	.28	.29	.16	.21	.20	.19
1	1.049	.86	.27	.34	.46	.47	.26	.34	.33	.30
1 1/4	1.380	1.50	.47	.60	.80	.83	.45	.60	.57	.53
1 1/2	1.610	2.04	.63	.82	1.08	1.12	.61	.82	.78	.71
2	2.067	3.36	1.04	1.34	1.78	1.85	1.01	1.34	1.28	1.18
2 1/2	2.469	4.79	1.48	1.92	2.54	2.63	1.44	1.92	1.82	1.68
3	3.068	7.38	2.29	2.95	3.91	4.06	2.21	2.95	2.80	2.58
3 1/2	3.548	9.90	3.07	3.96	5.25	5.44	2.97	3.96	3.76	3.47
4	4.026	12.72	3.94	5.09	6.74	7.00	3.82	5.09	4.83	4.45
4 1/2	4.506	15.94	4.94	6.38	8.45	8.77	4.78	6.38	6.06	5.56
5	5.047	20.00	6.20	8.00	10.60	11.00	6.00	8.00	7.60	7.00
6	6.065	28.89	8.96	11.56	15.31	15.89	8.67	11.56	10.98	10.11

Table 3

Dimensions to be Used for Insulated Conductors		
Size AWG MCM	Approx. Diam. Inches	Approx. Area Sq. In.
Col. 1	Col. 2	Col. 3
18	.146	.0167
16	.158	.0196
14	.204	.0327
12	.221	.0384
10	.242	.0460
8	.328	.0854
6	.397	.1238
4	.452	.1605
3	.481	.1817
2	.513	.2067
1	.588	.2715
0	.629	.3107
00	.675	.3578
000	.727	.4151
0000	.785	.4840
250	.868	.5917
300	.933	.6837
350	.985	.7620
400	1.032	.8365
500	1.119	.9834
600	1.233	1.1940
700	1.304	1.3355
750	1.339	1.4082
800	1.372	1.4784
900	1.435	1.6173
1000	1.494	1.7531
1250	1.676	2.2064
1500	1.801	2.5475
1750	1.916	2.8895
2000	2.021	3.2079

R. Where wall switches for normal system and emergency system are grouped or ganged in an outlet box, permanently installed barriers shall be provided in the outlet box to separate the normal and emergency systems.

S. Approved thread lubricant containing powdered zinc or lubricating graphite shall be applied to the male threads only of aluminum conduit to prevent joint seizure.

T. Other routings than those indicated may not be used without the approval of the Architect, but the Contractor shall make allowance for possible obstruction to routes indicated.

U. Certain areas and hollow spaces between suspended ceilings and slabs above may be used for environmental air and electrical work therein shall be in accordance with Article 300.22 of the National Electrical Code and the New Orleans building code.

V. Raceways shall be supported in accordance with the National Electrical Code for the particular type of raceway; however, for rigid metal conduit and electrical metallic tubing, the maximum spacing between supports shall not exceed ten feet.

W. Wall switches indicated by doors shall be located on the strike side (lock side), 6" maximum from door frame to the side of the outlet box; however, for double doors switches shall be located where shown, usually clear of the door in the full open position.

X. The Contractor shall install additional boxes or fittings in raceways as required to properly install and support conductors. The locations of these boxes or fittings shall be subject to the Architect's approval.

Y. In multi-section panelboards, circuit breakers, fusible switches, and spaces shall be divided equally between sections (unless indicated otherwise).

Z. Where a maximum fuse (or circuit breaker) rating is indicated on the nameplates of the magnetic starters, control panels, contactors, etc. (or equipment containing these components) for the specific mechanical equipment, the Contractor shall reduce ampere rating of fuses (or circuit breaker) to be installed (from the sizes indicated). These ratings shall also be increased as necessary to comply with NEC paragraph 430.52 (C)(1), exception 2.

AA. Suitable waterproof cable identification tags shall be installed on each power feeder in each pull (junction) box.

BB. Where conductors without raceway penetrate smoke partitions and/or fire rated partitions and floors, a conduit sleeve shall be installed rigidly in the penetration so that the conductors can pass through it. A UL listed fire-stop putty such as Nelson Flameseal shall be installed around the sleeve and inside the sleeve after the conductors are installed.

CC. Where roof penetrations are required for conduits supplying roof-mounted HVAC equipment, these penetrations shall be of the piping roof curb type per National Roofing Association standards.

DD. Where variable speed drives are used, the disconnect switch at the motor shall have an auxiliary contact wired to the variable speed drive to turn off the drive when the disconnect is opened.

EE. Where electrical work penetrates or is installed in fire and/or smoke partitions, this work shall be installed per UL standards. Contractor shall use fire rated putty pads as necessary.

3.2 WIRING IN CONDUIT (APPLIES ALSO TO E.M.T.)

A. Where several conduits (concealed and/or exposed) are run parallel to each other, they shall be grouped together on galvanized P-1 000 Unistrut, with suitable clamps, which shall be attached to the wall or hung from the roof or structural ceiling. Where exposed conduit is indicated, the conduit shall be installed parallel with or at right angles to the building walls and/or ceiling (roof) and shall be supported adequately by pipe straps or other approved devices. Where a single conduit is run exposed in a damp and/or wet location, standoff straps of the type which permit a ¼" air space between the conduit and the wall should be used. Fastening of conduit shall be as follows: to wood by means of screws; to masonry by means of threaded metal inserts, metal expansion screws, or toggle bolts; and to steel by means of machine straps, bolts, or power actuated fasteners. Raceway fasteners shall be approved for the purpose (tie wire shall not be used).

B. Conduit in concrete slabs shall be located so as not to affect the structural strength of the slabs. Conduit in general shall be located in the center 1/3 thickness of concrete slabs and when installed in slabs poured on grade or fill shall have at least one inch of concrete between conduit and plastic or other waterproof membrane; conduit shall not be installed under the plastic or other waterproof membrane unless it is to be installed "In fill beneath slab" in which case the installation shall meet the requirements indicated heretofore. The maximum size of conduit that may be run in a slab shall be as directed by the Architect. Conduit larger than ¾", if permitted in reinforced concrete slabs, shall be parallel with or at right angles to the main reinforcement; when at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

C. Conduits which must cross building expansion joints shall, where practicable, cross same in furred ceilings areas rather than in slabs or walls, arranged with sufficient flexibility to accommodate the building expansion. However, where such routing is not possible, galvanized expansion fittings shall be provided in each raceway attached to the structure whenever the raceway crosses an expansion joint. Expansion fitting shall be installed on one side of the joint with its sliding sleeve end flush with the joint and with a length of bonding jumper in the expansion joint equal to at least three times the normal width of the joint. Each expansion fitting shall be zinc-coated steel and contain heavy factory installed packing and internal copper braid packing and shall be complete with UL approved bonding jumper.

D. Underground runs of multiple conduits shall be provided with plastic separators to insure 2" minimum of concrete between adjacent conduits.

E. Unless noted otherwise on drawings, underground runs of conduits shall be installed so that the top of the concrete envelope shall not be less than 42" below grade for conductors operated over 600V and not less than 24" below grade for 600V or less except that under roads and pavements the minimum for 600V or less shall be 30" below grade. In non-concreted areas, encasement around conduit stub-ups shall extend to a location just above grade, and top shall be sloped to drain.

F. Concrete and reinforcing shall conform to DIVISION 033000. Concrete strength shall be 3000 psi unless noted otherwise on drawings. Concrete shall be colored red for underground conduit applications with an approved admixture.

G. Conduits shall be kept at least 6" from runs of hot water piping, flues, or other hot object.

H. Where conduits rise through a concrete floor, the curved portion shall not be visible above the finished floor. Approved waterproof compound or conduit sealing bushing shall be used where underground/above ground conduits enter building.

I. Where conduit fittings are installed, these shall be Crouse-Hinds or Appleton cast type.

J. Connectors and couplings for electric metallic tubing shall be of the compression type (steel or malleable iron). Couplings for rigid heavy wall conduit shall be of the threaded type; two locknuts and one bushing shall be provided where heavy wall conduits enter boxes or equipment. Flexible metal conduit connectors shall be of the squeeze type with screw and locknut. Liquid-tight connectors shall be compression type (steel or malleable iron).

K. Insulated bushings shall be provided for conductors #4 and larger.

L. From each flush panelboard and cabinet (including fire alarm control panels, telephone cabinets, etc.), provide three empty ¾" conduits to elbow out 6" into space above ceiling for future use.

M. No wires shall be pulled in until the conduit system is complete. Only approved type pulling lubricant shall be used.

N. During construction, outlet boxes and conduit stub-ups shall be suitably protected against the entrance of foreign materials.

O. Conduit in suspended ceilings shall be located, where practicable, in the space between the ceiling and the concrete slab above. Raceways shall not be attached to (or supported by) the tie wires used to support the suspended ceilings and/or independent tie wires used to support only raceways. Raceways shall not be installed immediately above accessible acoustical ceiling (restricting tile removal) without written approval of Architect for the specific location. Raceways shall also not be installed in such a manner to restrict or block access to plenums, equipment, etc.

P. Where concrete joist construction is employed, arrange with those responsible for DIVISION 3 - CONCRETE to provide in contact ceilings and in unfinished ceilings such headers as may be required to receive boxes for fixtures.

Q. Where raceways pierce walls of HVAC housings, these penetrations shall be made per requirements of the HVAC housing manufacturer.

R. Where underground raceways stub up on exterior of building, the Contractor shall install two support rods to keep raceways from sinking relative to building. These support rods shall be 3/8" stainless steel, and shall wrap around the horizontal segment of the raceway(s) ahead of elbow, and extend concealed through the concrete encasement into and tied to the concrete slab of the building.

S. Raceways shall not be installed within 24" of VAV units, fan-powered boxes, and other mechanical equipment located above ceilings, except for those raceways that serve these units. Raceways shall be located to allow maintenance personnel to remove ceiling tiles below these spaces to service this equipment.

3.3 WIRING IN SURFACE METAL RACEWAY

A. Surface metal raceways may be used only where indicated and where wiring is to be installed on existing concrete and/or masonry walls and/or ceilings that are inaccessible and that cannot be fished. Contractor shall reuse existing raceways wherever raceways are of proper size and proper condition. Contractor shall review such locations prior to installation with the Architect. Provide drawings indicating surface metal raceway locations for review by Architect. Surface metal raceways shall be of the removable cover type with smooth surface sized as required for the wiring and installed parallel with or at right angles to the building walls. Fittings and boxes compatible with the raceway and of the same manufacturer shall be used as required. The raceway shall be adequately supported by the appropriate clips of the same manufacturer. Raceways shall be approved for use under NEC Article 386. Exposed parts of the raceway system shall be painted to match the existing surface to which it is installed.

B. The raceway system shall be installed flat against ceilings and walls in a neat manner. Junction boxes shall be installed above accessible ceilings as necessary so that a single vertical raceway can be installed from each receptacle to above ceiling where circuits are looped to multiple receptacles.

3.4 GROUNDING

A. The metallic raceway system and the neutral conductor of the wiring system shall be grounded at the service equipment. The insulated copper service grounding electrode conductor shall be extended with no splices in raceway from the service to within 5 feet of the point of entrance of the metal underground water service pipe that is electrically continuous and is in direct contact with the earth for at least 10 feet. Where the raceway routing is via finished areas, it shall be run concealed. Ground connection shall be visible, and connection of raceway and conductor to the water pipe shall be made with an approved ground connector similar to T & B conduit hub and water pipe clamp. Also, see Article 250.50, Grounding Electrode System and Grounding Electrode Conductor of the National Electrical Code for bonding requirements to other items to form the grounding electrode system (this includes bonding to metal frame of building).

B. The above requirements shall be supplemented by grounding to three ¾" diameter by 10' long copper clad ground rods with #3/0 bare copper ground grid between the rods and with cadweld type connections at ground rods and at ground grid.

C. Grounding bushings with bonding jumpers shall be used around concentric or eccentric knockouts on equipment and on raceways stubbed up below switchboards.

D. Grounding pole of each polarized receptacle (non-isolated ground type) shall be bonded to its outlet box with conductor sized in accordance with Table 250.122 of the National Electrical Code and a machine or self-tapping screw, unless the receptacle is of the approved self-grounding type. Grounding pole of each isolated ground receptacle shall be connected to an insulated equipment grounding conductor.

E. Grounding conductors used to bond across flexible metal conduits containing transformer secondary conductors shall be sized per NEC Table 250.66 based on size of the secondary conductors.

F. Each branch circuit and feeder shall be provided with a ground conductor installed with the circuit conductors. Each ground conductor shall be a green insulated copper conductor, sized in accordance with Table 250.122 of the National Electrical Code NFPA-70. These grounding conductors are not shown on the drawings.

G. A 3/4" diameter by 10' long copper clad ground rod shall be installed at service pole, and the raceways installed vertically up the service pole shall be bonded thereto with #2 B.C.

H. Where water pipe grounding connection is made underground, a suitable plastic pipe sleeve and flush metal cover shall be installed to provide access to the connection.

I. Where ground connections are made in walls or inaccessible ceilings, access panels shall be installed. Access panels in walls shall be stainless steel.

J. See drawings for additional grounding requirements.

3.5 MOUNTING HEIGHTS

A. If not otherwise indicated, mounting heights to centerline of outlets shall be as follows:

1. Receptacles -- 18" above floor.
2. Switches -- 48" above floor.
3. Panelboards -- not more than 5'6" from topmost operating handle to floor.
4. Bracket fixture -- 7'0" above floor or, where mounted above exterior door, mirror or medicine cabinet, at a height just sufficient to clear the swing of the door or medicine cabinet.
5. Exit light -- at a height just sufficient to clear the swing of the door, noted otherwise unless
6. Fire alarm pull stations -- 48" above floor.
7. Fire alarm visual units and audio/visual units -- see Section 28 31 00.
8. Voice outlets -- 18" above floor.
9. Data outlets -- 18" above floor.
10. Volume controls -- 48" above floor.

B. The above mounting heights may be adjusted as required to permit bottom or top of plate to align with mortar joints in unfinished masonry walls, provided joints are not raked. Where joints are raked, adjust height as required to insure that center of outlet box will be in the center of masonry unit. Where outlets at different levels are shown adjacent, they shall, where possible, be installed on a common vertical centerline. Where these adjustments are made, 18" shall be the minimum mounting height for receptacles, telephone outlets, and computer outlets.

3.6 MARKING OF STARTERS, SAFETY SWITCHES, AND PANELBOARDS

A. Each surface manual starting switch out of sight of the motor which it controls, and each panelboard, switchboard, transformer, enclosed circuit breaker, automatic transfer switch, contactor, magnetic starter, and safety switch, regardless of location, shall be suitably identified by means of 1/4" high

letters cut in white laminated phenolic strips to show black letters. Strips shall be attached to cover by means of two screws. Device plate for each flush manual starting switch and wall switch used as starting switch or safety switch shall be suitably engraved to identify the equipment controlled. Device plate for each switch for heat trace cable connection shall also be engraved.

B. A permanent plaque/directory (white laminated phenolic to show black letters) shall be provided at each service disconnect location denoting all other services, feeders, and branch circuits supplying the building.

- END OF SECTION -

SECTION 26 20 00

ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes providing labor, materials, and equipment indicated, specified, and necessary for a complete and operating distribution system and related systems, in accordance with SECTION 26 0000 - ELECTRICAL GENERAL PROVISIONS.

1.2 APPLICABLE PARAGRAPHS

Applicable paragraphs of SECTION 26 0500, ELECTRICAL BASIC MATERIALS AND METHODS, shall apply to this Section as though repeated herein.

1.3 EQUIPMENT LOCKS

Panelboards, cabinets, and other electrical equipment having doors with locks, shall be keyed alike.

1.4 SERVICE EQUIPMENT

Safety switches, panelboards, and switchboards used as service equipment shall be Underwriters Laboratories listed and labeled for the application.

PART 2 - PRODUCTS

2.1 LIGHTING BRANCH CIRCUIT PANELBOARDS (120/240V)

A. Unless noted otherwise boxes shall be approximately 20" wide by 5³/₄" deep with 5" minimum side and end gutters. Boxes shall be constructed of code gauge galvanized steel. Feed-through panelboards shall have an additional 4" of side gutter on one side.

B. Fronts shall be for flush or surface mounting as indicated and shall be complete with door and flush chrome-plated combination cylinder lock and catch. Fronts shall be full finish code gauge steel with prime coat and finish coat of baked enamel in manufacturer's standard color, with concealed adjustable trim clamps and directory with transparent covers. Door shall have concealed hinges.

C. Bussing shall be copper, and lugs or main breaker, and branch circuit breakers shall have ampere ratings indicated. Breakers shall be connected to the bus in a sequence phase arrangement using full size breakers (double module breakers shall not be used).

D. Two-pole and three-pole breakers shall have common trip. Branch circuit breakers shall be of the bolted type, quick-make, quick-break, thermal magnetic, 10,000 amp minimum interrupting capacity at 250 volts a.c. Trip position shall be between the "on" and "off" positions to positively identify faulted or overloaded circuits from "off" circuits. Where specifically indicated, breakers shall be complete with ground fault circuit interrupter 15A and 20A one-pole breakers shall be approved for switching duty. Where used to switch H.I.D. lighting, circuit breakers shall be rated (calibrated) to properly carry the inrush current (labeled "HID"). Where used to switch fluorescent lighting, they shall be labeled "SWD" or "HID".

E. Panelboards shall be Square D type NQOD, or equal, factory assembled. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.2 CIRCUIT BREAKER DISTRIBUTION PANELBOARDS

A. Boxes shall be not more than 42" wide by 9½" deep and shall be constructed of code gauge galvanized steel. Ample UL approved wiring gutters shall be provided, and no gutter shall be less than 4" wide. Fronts shall be for flush or surface mounting as indicated and shall be complete with door and chrome-plated combination cylinder lock and catch, with locks keyed alike. Fronts shall be full finish code gauge steel with prime coat and finish coat of baked enamel in manufacturer's standard color, with indicating type adjustable trim clamps and directory with transparent covers. Doors shall have flush hinges.

B. Bussing shall be copper, and lugs or main breaker, and branch circuit breakers shall have ampere ratings indicated. Breakers shall be connected to bus in a sequence phase arrangement.

C. Two-pole and three-pole breakers shall have common trip. Breakers shall be quick-make, quick-break, thermal magnetic (18,000 AIC RMS symmetrical minimum at 240V, and 18,000 AIC RMS symmetrical minimum at 480V unless indicated otherwise) having mechanism insuring full contact pressure until the time of opening, whether actuated either automatically or manually. When automatically actuated, the breaker mechanism shall be trip free of the handle so that the contacts cannot be held closed against a short circuit or abnormal overload. Circuit breaker contacts shall be non-welding silver alloy, housed in arc chambers equipped with arc quencher plates and the circuit breaker mechanisms, enclosed in molded insulating cases, shall be sealed to eliminate tampering. Trip position shall be between the "on" and "off" positions to positively identify faulted and overloaded circuits from "off" circuits.

D. Panelboards shall be Square D type I-Line (rated maximum 600V a.c.) or equal, factory assembled type. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.3 FUSIBLE DISTRIBUTION PANELBOARDS

A. Boxes shall be constructed of code gauge galvanized steel.

B. Fronts shall be surface mounting and shall have door. Sections over side wiring gutters shall be easily removable independent of top and bottom gutters.

C. Fronts shall be finished with primer coat and then a coat of baked enamel in manufacturer's standard color.

D. Fusible switch units shall be of the quick-make, quick-break type, front operated by sturdy cast aluminum handles. Each switch shall be enclosed in a steel box. 30 through 100 ampere units shall be mounted as twin units. Units shall have an interlock to prevent opening the unit while the switch is in the "on" position; provision shall be made to permit release of this interlock with a screwdriver and opening the unit while the circuit is on, so that fuses may be checked without breaking the circuit. Units shall be dual horsepower rated. Fuse clips shall be of copper, having positive pressure, reinforcing springs which automatically grip the fuses. Each switch shall be provided with a white micarta nameplate with black-cut letters. 600 ampere and smaller switches shall be complete with rejection feature to insure rejection of fuses other than Class R. Each switch shall have provisions for padlocking in "OFF" position only, with up to three padlocks.

E. An 8" X 5" white micarta job nameplate with black-cut letters as directed shall be provided; it shall include name of Architects, name of Engineers, name of Contractor, and year.

F. Interiors shall consist of insulated bus bars mounted on a fabricated steel pan which is drilled and tapped to receive any combinations of units. Main bus bars shall extend over the entire pan. Neutral shall be provided unless otherwise indicated. Bus bars shall be copper.

G. Panelboards shall be Square D QMB factory assembled type. Equal equipment as manufactured by GE, Cutler Hammer, or Siemens will be acceptable.

2.4 CIRCUIT BREAKERS

A. Each circuit breaker shall have continuous current rating visible without removing an enclosure cover, and the rating shall be engraved. This may be accomplished by installation of a phenolic label (white with black cut letters) adjacent to the circuit breaker. Circuit breakers shall be suitable for use with 75 degree C conductors. Where circuit breakers are used to supply HVAC equipment having motor group combinations, type HACR circuit breakers shall be used. Where circuit breakers are used to supply lighting fixtures and receptacles in dwelling units, arc-fault type circuit breakers shall be used where required by NEC 210.12(B).

B. Unless indicated otherwise, circuit breaker spaces and spare circuit breakers shall be divided equally between sections of multi-section panelboards.

C. Where ground-fault protection is provided for 3-pole circuit breakers (or fusible switches), performance testing of the ground fault protection system shall be provided after installation. Written documentation for this test shall be provided to the Engineer.

D. Where a circuit breaker with adjustable long time trip (where cover over adjustment is not lockable per NEC 240.6 (C)) is used, conductor size for the protected feeder shall be increased by the Contractor to match maximum long time setting of the circuit breaker.

E. Circuit breakers in panelboards shall be fully rated for AIC; that is, series ratings are not acceptable.

PART 3 - EXECUTION

3.1 OVERHEAD MAIN SERVICE

- A. Arrange with local power company to provide 4-wire, 3-phase, 120/240 volt overhead main service to the point indicated.
- B. Main service feeders shall be furnished and installed from the building service equipment to the connection to the power service as work of this Section.
- C. Metering equipment including current transformers and enclosure, meter, conduit and wiring, shall be in accordance with the power company's regulations.
- D. Work of this Section shall begin at the point where the power company terminates its work.
- E. Fees and charges in connection with the above shall be paid as work of this Section.

3.2 EMERGENCY LIGHTING SYSTEM

- A. Emergency fixtures including internally illuminated exit signs shall be permanently fixed in place and connected to building branch circuits. Fixtures shall contain a rechargeable battery, battery charging means, one or more lamps and other components to be UL approved and meet NEC Article 700.12(F).
- B. Where battery fixtures are used with switched branch circuits, the sensor circuit of each fixture shall be connected ahead of any local switching. This will permit "switching-off" fixture without signaling to sensor circuit that a power failure has occurred and "turning-on" of lamps on battery circuit. A failure of the branch circuit shall cause the lamps to turn on whether the switch is in the on or off position.
- C. Exit fixtures shall not be switched.

- END OF SECTION -

SECTION 26 50 00

ELECTRICAL LIGHTING

PART 1 - GENERAL

1.1 SCOPE

Work described in this Section includes labor, materials, and equipment indicated, specified, and necessary for a complete and operating lighting system and related systems in accordance with SECTION 26 0000 - ELECTRICAL GENERAL PROVISIONS.

1.2 APPLICABLE PARAGRAPHS

Applicable paragraphs of SECTION 26 0500 - ELECTRICAL BASIC MATERIALS AND METHODS, shall apply to this Section as though repeated herein.

PART 2 - PRODUCTS

2.1 EXIT LIGHTS

A. Exit lights shall be Lithonia LRP-BZ-RC-ELN series with red letters on a clear background. Trim shall be cast aluminum. Housing shall have polished brass finish. Each fixture shall have concealed LED's. Unit shall be rated for dual voltage 120/277V. Units shall be UL approved with nicad battery, two-stage solid state charger, pilot light to indicate charging mode, test switch, and accessories (operation in emergency mode shall be 1½ hours minimum). Each shall have an NFPA approved self-test feature that tests the battery at 30 day intervals and provides an audible and visual signal upon sensing a battery failure. See symbol schedule on drawings for mounting details. Fixtures shall meet NFPA 101, with Chevron style arrows.

B. Exit lights for the rectory building shall be Lithonia LES-ELN series with red letters on a metal stencil. Stencil and trim shall be cast aluminum. Housing shall have matte black finish and stencil shall have brushed aluminum finish. Each fixture shall have concealed LED's. Unit shall be rated for dual voltage 120/277V. Housing thickness shall be maximum 1 7/8". Units shall be UL approved with nicad battery, two-stage solid state charger, pilot light to indicate charging mode, test switch, and accessories (operation in emergency mode shall be 1½ hours minimum). See symbol schedule on drawings for mounting details. Fixtures shall meet NFPA 101, with Chevron style arrows.

2.2 OTHER FIXTURES

A. Other fixtures shall be as specified in schedule on drawings.

B. Fluorescent fixtures with multiple lamps shall have lamp sockets arranged so that lamps are equally spaced to provide uniform lamp appearance.

C. Fixtures to be installed in damp or wet locations shall be labeled by Underwriters' Laboratory for that purpose.

D. Recessed incandescent fixtures shall be provided with thermal protectors to automatically deactivate the fixtures due to overheating (fixtures shall be labeled by Underwriters' Laboratory for that purpose).

E. Fixtures shall be finished (painted or other finish as specified) after fabrication.

F. Trims for recessed fluorescent fixtures shall be of the type necessary for compatibility with each ceiling type (such as concealed T, slot grid, flange trim, etc.).

G. Where ceiling tiles are thicker than standard ceiling tiles, fixture throat/trim ring assemblies shall be custom-made to accommodate the ceiling system.

H. Where the lamp manufacturer indicates possible hazardous conditions caused by lamp breakage, fixtures shall contain protective lenses and/or screens to contain parts of broken lamps.

I. Fixture/pole/concrete foundation assemblies shall be provided to meet the local building code for wind loading with minimum requirement of 130 miles per hour at 30 feet above grade. Submittal shall clearly indicate that this requirement will be met.

2.3 LAMPS

A. Lamps shall be General Electric, Philips, or Sylvania. Unless otherwise indicated in fixture schedule, fluorescent lamps shall be T-8, 3500° K, instant start type. Unless otherwise indicated in fixture schedule, incandescent lamps shall be inside frosted. Unless otherwise indicated, metal halide lamps shall be pulse-start type.

B. Where existing fixtures are to be relocated or removed and reinstalled, or to be reused, each shall be completely cleaned and including new lamps, ballasts, lenses, supports, etc. Contractor may need to replace existing fixtures due to the age and/or condition of fixtures being planned to be reused. Contractor shall allow in his bid replacing existing fixtures planned to be reused. Each shall be completely relamped using new lamps.

C. Lamps shall be furnished and installed for fixtures as work of this Division, including fixtures furnished as work of other Divisions.

2.4 BALLASTS

A. Ballasts for fluorescent lamps shall be energy saving, electronic type, Class P, high power factor, full light output type, instant start, parallel lamp operation, 20 KHz minimum, THD of less than 20%, minimum ballast factor of 0.85 for four T-8 lamps and minimum ballast factor of 0.88 for two and three T-8

lamps, manufactured by Advance, Universal, or equal. Ballasts shall be suitable for temperature range at the fixture locations.

B. Ballasts for HID lamps shall be pulse start constant wattage or constant wattage autotransformer, low noise level, and shall be furnished by the manufacturer of each type of particular lighting fixture specified. For metal halide lamps, the ballasts shall also be pulse-start type.

C. Battery backup ballasts shall be manufactured by Bodine or equal to provide a minimum of 1100 lumens per fixture for 1½ hours operation during the emergency mode. Each shall have an NFPA approved self-test feature that tests the battery at 30 day intervals and provides an audible and visual signal upon sensing a battery failure.

D. Ballasts for compact fluorescent lamps shall be high power factor electronic type.

E. Dimming ballasts shall be provided for fluorescent fixtures to be dimmed. These ballasts shall be coordinated with dimmer switches and the proper quantity of conductors shall be provided per manufacturer's requirements.

PART 3 - EXECUTION

3.1 SUPPORTS

A. For any type ceiling which itself does not provide sufficient support for fixtures, either arrange with other subcontractors to strengthen ceiling or support fixtures from structure above independently of ceiling.

B. Suspended fluorescent fixtures in continuous rows shall have one stem at the beginning of the row, one stem at each channel joint, and one stem at the end of the row.

C. Fluorescent fixtures mounted individually on stems shall each have two single stem hangers. Fluorescent fixtures individually surface mounted shall be supported at both ends.

D. Fluorescent fixtures surface mounted in continuous rows shall have one support at the beginning of the row, one support at each channel joint, and one support at the end of the row.

E. Recessed fixtures installed in plaster ceilings and gypsum board ceilings (including ceilings with glue-on acoustical tiles) shall be furnished with metal plaster frames or other suitable mounting frames.

F. Recessed fixtures shall be so adjusted to their supports that their trim flanges fit tightly and evenly against the surface of the ceiling.

G. In acoustical tile ceilings with concealed mechanical suspension systems, recessed fluorescent fixtures (troffers) shall be hung from suitable supporting channels. The placing of the supporting channels by other subcontractors must be coordinated so that they run in the same direction as the lamps and so that one channel will be where a troffer is to be installed and, then, in order to support the troffer, an additional channel must be installed by these other subcontractors, spaced the proper distance from the first mentioned channel. This Contractor shall cooperate with and advise these other subcontractors as to the

exact location of channels desired. After the required channels are in place, troffers shall be supported from the channels by means of the adjustable suspension brackets which shall be used.

H. In acoustical tile ceilings with exposed mechanical suspension systems, recessed fluorescent fixtures shall be lay-in type. Fixtures so supported shall be securely fastened to the ceiling's framing members by approved fixture support clips (4 required per fixture). Metal fixture appendages that simply fold down over the ceiling's framing members are not acceptable. Arrange with other subcontractors to support ceilings at each corner of each of these fixtures (not more than 6 inches from each corner).

3.2 LOCATION OF FIXTURES

A. Work of this Section includes advising other trades of exact location of recessed fixtures so that ceiling construction and/or spacing may be coordinated as necessary to permit symmetrical positioning of fixtures in room.

B. For acoustical tile ceilings, surface and/or suspended fixtures shall be centered on a tile or a tile joint, unless indicated otherwise.

C. The locations of fixtures in Mechanical Equipment Rooms, Boiler Rooms, and Electrical Rooms are approximate. The Contractor shall determine exact locations based on exact locations of mechanical equipment.

3.3 INSTALLATION AFTER PAINTING

Fixtures to be installed in or on painted ceilings and/or walls shall not be installed until painting is completed. Fixtures installed with paint applied over factory finishes will be rejected.

3.4 FLUORESCENT LAMP BURN-IN FOR DIMMABLE FIXTURES

Lamps of dimmable fluorescent lighting fixtures (including compact fluorescent) shall be operated at full output for a minimum of 100 hours before beginning to dim them.

3.5 PROCEDURE

The Contractor shall demonstrate to the Owner at his convenience the proper procedure for relamping each type of fixture.

3.6 CLEARANCE

Thermal or acoustic insulation shall not be installed over the top or within 3 inches of the sides of a recessed (incandescent, HID, or compact fluorescent) fixture enclosure, wiring compartment, or ballast unless the equipment is labelled for the purpose. Thermal or acoustic insulation shall not be installed over the top of a recessed fluorescent fixture. Work of this Section includes advising other trades of this requirement, so that proper clearances are maintained.

3.7 FIXTURE COORDINATION

Lighting fixture submittal shall include data on each type of ceiling suspension system and associated acoustical tile. Information on the ceiling suspension systems shall include types of recessed fluorescent fixture suitable for use with each type as well as recommended installation details.

3.8 FIXTURE ADJUSTMENT

Aim adjustable fixtures during the day for interior fixtures and at night as directed by Architect or his designated representative. Furnish any equipment necessary for aiming fixtures. Equipment shall include but not be limited to bucket trucks, aerial booms, ladders, tools, meters and personnel. Use a factory prepared aiming diagram.

3.9 TAMPERPROOF TOOLS

Provide to the Owner two tools for each type of tamperproof hardware.

- END OF SECTION -

