1. GENERAL REQUIREMENTS

The General Provisions of the Contract including any General and Supplemental Conditions and General Requirements apply to the work in this section. Before submitting a bid, examine all Mechanical, Architectural, and/or Structural documents, visit the site and get acquainted with all conditions that may in any way whatsoever affect the execution of this contract. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the Owner's representative on job site shall be followed.

The contract includes all items of material and labor required for the complete installation and full operation of the electrical work as shown on the drawings and hereinafter specified. All work, materials, and equipment shall have a one year warranty after acceptance of the work by the Owner. Any defective items shall be removed and replaced at the electrical sub-contractor's expense and to the satisfaction of the Engineer.

Perform work under this contract in close harmony with other contractors so completed work shall present a neat and workmanlike installation. Exposed finished materials and equipment shall be carefully cleaned and wiped to remove grease, smudges, dust and other spots and left smooth and clean. During the progress of the work, the electrical sub-contractor shall carefully clean up after his men and shall leave the premises and all portions of the building in which he is working free of debris and in a clean and safe condition.

Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in applicable UL and NEC Standards.

Whenever the words "contractor", "this contractor", etc. appear on drawings or in these specifications for the Electrical Work, it shall refer to the Electrical Sub-Contractor. Whenever the word "provide" appears in these documents, it shall be interpreted to mean "Furnish & Install".

Outlet mounting heights as indicated on the plans are approximate to be used for bidding purposes only. The exact mounting height of outlets shall be determined in the field with relation to architectural details and equipment being served. It shall be the responsibility of this contractor to coordinate outlet location with equipment. The Owner's representative shall be permitted to relocate any outlet prior to installation within a 15 foot limit at no additional charge in contract price. All fasteners, hangers and methods of hanging exposed work in finished
areas shall be submitted to the Owner's representative for approval before installation. If during construction it becomes apparent that certain minor changes in layout will effect a neater job or better arrangement, such alterations shall be made as part of the contract. Engineer's approval shall be obtained before making such changes. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches will not be permitted on any exposed materials, fixtures or fittings. Inside of panels & equipment boxes shall be
left clean.

The system shall ring entirely free from ground when tested out in the presence of the Owner's representative. This contractor shall be responsible for the proper instruction of each system to the satisfaction of the Owner's representative. Upon completion of the job, this contractor shall furnish the Owner with a complete set of operating instructions on all electrical systems installed.

The Electrical Contractor shall consult the plans of all other trades in all instances before installing his work so that his piping will not interfere with those branches. In the event of a conflict, this contractor shall report to the Owner's representative at once and do no further work to be installed until a satisfactory arrangement is decided upon. Any work done, or equipment placed in position by this contractor, creating a conflict in violation hereof, shall be readjusted to the satisfaction of the Owner's representative at the expense of the contractor. The decision of the Owner's representative shall be final in regard to changes due to conflicting conditions.

2. SHOP DRAWINGS

The contractor shall submit shop drawings on all items of material and equipment for approval by the Engineer. The contractor is not authorized to purchase any material until such approval is obtained. A minimum of six separate sets of drawings is required and will be distributed as follows: 1 copy for Engineer's file; 1 copy for Architect's file; 2 copies for the Owner's file; 2 copies for the contractor. Shop drawings shall be neatly bound in a flat ring binder having job name and contractor's name on cover. A single submission is preferred having all items included. Loose sheet or incomplete submittals will not be accepted. All items of material to be supplied which do not require shop drawing submission such as conduit, wire, boxes, etc., shall be listed as separate material showing manufacturer's name and catalog number and type and shall be included with shop drawings submittal.

3. RECORD DRAWINGS AND OPERATING INSTRUCTIONS & SERVICE MANUAL

Two sets of mechanical/electrical drawings shall be provided as record drawings which shall be separate, clean, sepia reproducibles reserved for the purpose of showing a complete picture of the work as actually installed. These drawings shall also serve as work progress report sheets and the electrical sub-contractor shall make any notations, neat and legible thereon daily as work proceeds. The drawings shall be available for inspection at all times and shall be kept at the job at a location designated by the Owner's representative. At the completion of the work, these record drawings shall be signed by the electrical sub-contractor, dated and returned to the Owner's representative. Final payment of contract will not be made until receipt and review of said drawings. Provide two neatly bound (with tabbed sections) copies of maintenance and instruction books, parts list pertaining to all equipment furnished. Submit to the Owner's representative for approval. Final payment will not be made until drawings for record, maintenance and instruction manuals are delivered to the Owner's representative.

4. PERMITS AND REGULATIONS

The latest edition of the National Electric Code shall be the minimum requirement for all work. All electrical materials used in this work and all workmanship and tests performed therein, unless specifically specified shall conform to the latest rules and regulations and specifications of the National Board of Fire Underwriters, local and state codes and authorities having jurisdiction and utility company. Examine the drawings and specifications for compliance with prevailing codes, regulations and ordinances and base bid and work accordingly. Any minor discrepancy between these drawings/specifications and codes, laws, ordinances, rules and regulations shall be corrected by this contractor as required without any additional reimbursement. Major discrepancies shall immediately be brought to the attention of the engineer (in writing), prior to installation, along with the contractor's proposed cost for correction. This contractor shall obtain and pay for all permits or certificates of inspection and approval required for this branch of the work. Owner shall be furnished with certificates of final inspection and approval prior to final acceptance of this branch of the work.

5. DRAWINGS AND SPECIFICATIONS

The specifications and accompanying drawings are intended to describe the scope of all electric/mechanical work. The drawings are an outline to indicate the approximate location and arrangement of raceways, wiring and equipment. The drawings shall be followed as closely as possible in executing of the work. Should there be a conflict between drawings and specifications, this contractor shall refer the matter to the Owner's representative for a decision as to method or material. Electrical Contractor shall refer to drawings of all other trades for details, dimensions and locations of other work and route his work so as not to conflict with any other branch. This contractor shall be responsible for checking quantities of equipment mentioned in the specifications with those shown on the drawings. If discrepancies are noted, provide the greater of the quantities or the better of the qualities as applicable.

6. MATERIALS AND EQUIPMENT

All materials and equipment shall be new. All materials, apparatus and equipment shall bear the Underwriter's Laboratories Inc., label where regularly supplied. Certain manufacturers of material and equipment are specified and plans are detailed according to this material. This contractor shall base his bid on furnishing and installing this make of material and equipment. Where more than one make of material or equipment is specified, the contractor shall state in his bid which make he proposes to furnish.

7. ELECTRICAL IDENTIFICATION

Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2" wide. Where applicable, install on all concealed raceways at connection to all junction boxes, pull boxes, equipment, wall/floor/, etc. Unless otherwise indicated or required by governing regulations, provide orange tape with black letters.

Provide circuit identification bands for all cables and conductors. Provide manufacturer's standard color coding for cable/conductor jacket and/or insulation for all cables and conductors of all systems. Match identification with marking system used in existing systems (where applicable), shop drawings, contract documents, and similar previously established identification for project's electrical work. Provide on all conductors of all systems.

Install engraved plastic-laminate sign on major units of electrical equipment, including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering, on 1-1/2" high sign (2" high
where 2 lines are required), white lettering in black field. Unless determined otherwise in field, provide text matching terminology and numbering of the contract documents and shop drawings. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate. As a minimum provide signs for each unit of the following categories of electrical work where such work exists on the project all starters and disconnects; All remote fixture or equipment switching devices (via engraved wallplates); All System devices, ports, taps, J.B.'s, P.B.s, etc.; Panelboards, electrical cabinets ; Any other equipment designated by Owner or engineer in field.

All equipment & system identification nomenclature shown on drawings or listed herein is shown for general design and installation reference only. The actual nameplate, etc. nomenclature for this project shall be verified by electrical contractor in field prior to fabrication and where applicable, shall be an extension of existing nomenclature used on the site as determined in field by electrical contractor.

In addition to the above, all labeling for all electrical wiring work (for all systems) shall be 3M DCI No. 054007-11954 "SWD" Write-on Tape Dispenser Kit with factory provided special fast drying marker included with kit. All markings shall be clear and legible.

As determined in field, provide color coding for junction boxes, pull boxes and associated plates to match existing building standards. The following insulation color code shall be used for system and voltage identification for feeder and branch circuit wiring.

277/480V System - Brown, Orange, Yellow & Gray (neutral)
120/208V System - Black, Red, Blue & Gray (neutral)
Equipment Grounding - Green
Systems - To match existing - verify in field.

8. GROUNDING

All metallic conduit, surface wireways, supports, cabinet and equipment shall be grounded in accordance with the latest issue of the National Electrical Code and shown on plans. The ground terminals of receptacles shall be connected to the equipment ground bus of the source branch circuit panelboard. All grounding conductors shall be protected from mechanical injury. All connections to equipment or conduit shall be make with an approved conductor and same shall be bolted or clamped to equipment and conduit. All contact surfaces shall be thoroughly cleaned and bright before connections to insure a good metal contact.

All new branch circuiting installed under this contract shall be provided with redundant insulated parity sized green ground wire by this contractor, installed in strict accordance with NEC Article 517. This contractor shall field test all exposed conductive surfaces in all new "Patient Vicinity" areas, and provide all necessary corrective work (if any) to comply with grounding requirements of NEC Article 517. Provide documentation of all testing results to engineer and state electrical inspector.

9. CONDUIT AND FITTINGS

All wiring for different power voltages shall be installed in raceway systems separate from each other (i.e. 24V separate from 120/208V).

Only voice and data cables may share raceways.

All wiring run in finished spaces shall be run in Wiremold surface steel raceway.

All conduit installed indoors shall be galvanized steel EMT (3/4" minimum); all fittings for same shall be set screw type steel, with insulated throats. All wiring of all systems shall be installed in conduit unless specifically indicated otherwise herein or on drawings.

Conduit runs exceeding 100 feet in length or having in excess of three 90 degree turns shall be provided with pull boxes. Conduit fill shall not exceed 30 percent. All conduit systems (including J.B.'s, P.B.'s, etc.) shall be permanently identified. New branch circuit home-run conduits shall be no larger than 1-1/4" diameter. Conduit fill shall not exceed NEC requirements.

Conduit shall be cleaned inside before any wires are pulled. Conduit ends shall be capped and plugged with standard accessories as soon as conduit has been permanently installed. Conduit installed without conductors shall be provided with sweep bends and baling wire for pulling.

All joints shall be made tight with watertight couplings matching conduit and all corners shall be make with long radius. The ends of all conduits shall be cut square and reamed and all joints brought to a shoulder. Conduit shall be continuous between outlets to make a complete installation and to effect a continuous ground. Suitable supports and fastening shall be provided for conduit.

Conduit shall be supported by approved straps, fasteners and hangers. Hangers shall be suspended from rods. Perforated straps will not be acceptable. Fasteners shall be lead expansion shields in block or concrete, toggle bolts in hollow walls, machine screws on metal surfaces and wood screws on wood construction. All conduit shall be supported independently from all other building systems and shall be supported directly from structural components.

Provide sleeves for all fire wall and smoke partition penetrations (sealed accordingly). All raceways shall be entirely free of plaster, mortar, water and other foreign matter. Raceways installed under this contract without conductors shall have baling wire left in raceways from outlet to outlet for future pulling of conductors. Raceways open ends shall be plugged or capped in an approved manner.

Where "rishing" through existing hollow partitions is mandatory, use minimum 3/4" "Greenfield" (steel) for low voltage cabling and metal-clad/armored cable (listed for use in health care facilities) for power. Otherwise type MC/AC cable may not be used for 6' fixture whips, unless case-by-case permission is granted by engineer and owner.

10. METHOD OF WIRING - POWER

Neatly dress all work. Install all work parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible. Keep conductor splices to minimum. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material. All wires shall be run continuous from outlet to outlet/fixture to fixture. Insulation value of joints to be 100% in excess of wire. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

Branch subfeeder circuits shall be installed as shown on the floor plans. Where outlets are indicated by letters on plans, they shall be controlled by corresponding switches. No wire size smaller than No. 12 shall be used for any branch circuit unless otherwise noted on plans for control circuits. Larger sizes shall be used where required and/or indicated on the plans. Distances from panel to first outlet of a 15 or 20 ampere branch circuit shall require the following minimum wire size to the first outlet.

Up to 100 feet:	#12
100 TO 200 FEET:	#10
More than 200 feet:	# 8

All branch circuits more than 200 feet in length shall be minimum No. 10 to the last outlet. Control circuits shall be No. 14 except for runs exceeding 300 feet where they shall be No. 12. Outlets shall be located approximately as shown on the plans and shall be wired to provide control of outlets indicated. All wires of any one circuit shall be run in the same conduit.

All wires shall be run continuous from outlet to outlet. Insulation value of joints to be 100% in excess of wire. Mechanical wire splicers shall be Scotchlock insulated type, T&B Stakon or approved equal. The conductors terminating at each wired outlet shall be left not less than 8" long at their outlet fittings to facilitate installment of devices of fixtures. Friction and rubber tape conform to Federal Specifications HH-T-11 and HH-T-111. Plastic electrical tape shall be Scotch #33+ or approved equal.

Type MC Cable shall be formed from continuous length of spirally wound, interlocked zinc-coated or galvanized (inside & outside) strip steel. All conductors shall be rated for 90 deg. C. minimum. Provide with full parity sized green insulated equipment ground conductor. Provide compatible steel fittings with integral red plastic insulated throat bushings, compliant with NEC 350-5. Cables shall be 90 deg. C. rated with all components and fittings listed for grounding and compliant with the following.

a) UL Std.4 and UL Std. 83.
b) ANSI E119 and E814.
c) NEC Articles 250 and 333.

Type MC cable may be utilized only if NEC approved and if approved by local authority having jurisdiction and if included in the limited applications defined below.

1) All new 15 or 20 ampere branch circuit work. This shall apply only under all of the following circumstances and conditions.
a) Only where concealed (all exposed wiring shall be installed in conduit).
b) Route all cables perpendicular and parallel to the building architectural lines/surfaces/structural members, keeping offsets to a minimum and following surface contours where
possible. Maintain a uniform elevation for all cable runs wherever possible. All cables shall be supported/anchored at maximum 4 foot intervals and within 12" of box or
outlet and shall not sag. Install cables in a manner that prevents overheating. Cables shall be fastened directly to the structure using factory clamps/clips specifically
designed for the respective cable (Caddy or equal).
c) Only where installed for normal utility circuits; all wiring for emergency system feeders and devices shall be in conduit (EMT), no exceptions.

11. COMMUNICATION TECHNOLOGY SYSTEMS

GENERAL

Voice and data cables shall be installed in "J-Hook" style pathway where indicated on drawings. All other wiring/cables of voice/data systems and all other systems shall be installed in conduit, 3/4" minimum. Verify route for "J-Hook" work above ceiling in field in advance with owner.

Provide outlet boxes and conduit stubs for systems as indicated on drawings. Conduit stubs shall be turned out in joist space and, where located in areas with drywall ceilings, shall be extended to the nearest area with no ceiling or with acoustical tile ceiling. Provide conduit, bridle rings and raceways as required. All conduits shall be provided with sweep "L" 90's and insulated throat fittings (or bushings).

Typical outlets shall consist of a flush wall mounted 4" square X 2-1/8" deep box with a double gang plaster ring. Maximum conduit fill for new work shall be 40%, based on manufacture's published data of cable outside diameter.

Cable, terminations, jacks, labeling, hardware, shall be provided by a certified Communication Technology Contractor. Cabling system shall be provided as required for a turnkey, complete working systems.

Determine exact locations of communication technology equipment, equipment outlets, etc. in field. Use caution not to exceed the allowed bending radius for respective cables and not to compromise the integrity of the cables during installation by pulling tie-wraps too tightly, damaging cables, etc. Raceway/Cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant, where necessary; compound must not deteriorate conductor or insulation. Neatly dress all cable work. Work shall be installed in a manner which results in maintaining a minimum distance of 24 inches from feeder/branch circuit raceways and from any ballasted lighting fixture.

Provide color coded jackets to identify runs of different systems. Neatly route cables parallel and perpendicular to building architectural lines. Group cables by system type wherever possible. Verify exact locations of telephone switch, data server(s), head-end equipment, equipment outlets, etc. in field.

Review all termination and labeling requirements with Owner in advance. All cable shall be provided with permanent adhesive labeling identification by this contractor. Provide transparent adhesive coverings over each label, wrapped around the labels at least two times. The long axis of the labels shall installed be parallel to the long axis of the respective cable assemblies. Labels shall be approximately 1-1/2" long by 3/8" high.

Install power cables in a manner which prevents over-heating. Otherwise, wherever possible, bundle cables of the same system together. Also provide color coded jackets, or other approved labelling/identification method, to identify runs of different systems.

All cables which are not routed in conduit shall be neatly bundled, secured at four foot intervals and identified at ten foot intervals. Wherever possible, bundle cables of the same system together. Provide additional wall outlet boxes and additional whips as/if required at systems furniture to achieve same.

"J-Hook" Pathways

Cable distribution bridle rings shall be equal to Caddy #4BRT64 or Mono-Systems Inc. "The Hook" (minimum 4" diameter or 4" square usable internal area) constructed of aluminum or corrosion resistant steel with rolled edges or equivalent to prevent damage to cable jackets and insulation. Provide splits or openings so that cables can be laid in the rings rather than threaded through. Provide maximum 30% fill (in cross section), based on outside diameter of cables. Accordingly, provide multiple sets of rings along any routes as/if required.

Provide rings at four foot intervals and at all offsets. Route rings through corridors and similar open areas wherever possible to minimize wall penetrations. Securely anchor (mechanical - not adhesive) all rings directly to structural components of the building. Rings shall not be anchored to ductwork, conduit, piping, fixtures, equipment, ceiling supports, etc. All rings shall be fully and readily accessible after installation. Neatly route bridle ring paths parallel and perpendicular to building architectural lines and at a consistent elevation wherever possible.

Route all bridle ring paths and cables perpendicular and parallel to the building architectural lines, keeping offsets to a minimum. Install bridle rings in a uniform plane/elevation wherever possible, keeping vertical offsets to an absolute minimum. Prior to installation, submit scaled coordination drawings showing all proposed routing and ring locations for review by Owner. Keep offsets to an absolute minimum. Bridle ring paths shall be routed so that a minimum of 24" exists between any cables and any EMI source such as ballasts, motors, power wiring, etc.

12. OUTLET, JUNCTION AND SWITCHBOXES

Gang type outlet boxes shall not be used. The outlet box locations indicated on drawings shall be considered approximate, and therefore, it shall be incumbent upon this contractor to study the general construction with relation to spaces and equipment surrounding each outlet. All outlet, switch and junction boxes shall be made of code galvanized steel complete with rings and screw cover plates and located where shown and noted on drawings. Where conduit is concealed, boxes shall not be less than 4" square x 1-1/2" deep. All boxes shall be equipped with proper covers to bring flush with finished wall surface.

Where outlet boxes occur in block, cinder, or concrete block, facing tile or other material where such materials form the finished wall surface, the opening for the box shall be cut neatly and of the size that the cover plate will cover all parts of the opening. Conduits shall be used on exposed raceways. In general, junction boxes shall be furnished and required by the National Electric Code, of the proper sizes, and shall be constructed of #12 gauge steel with removable front fastened on with counter sunk head screws or other approved means. For special applications, junction boxes shall be noted, detailed and/or sized on the drawings or in the field as required.

13. HEIGHT OF BOXES

Prior to rough-in, verify all box/device mounting heights and locations in field with Owner's representative relative to equipment being served and relative to existing conditions where applicable. In general, where not located at counter areas, the height of boxes from finished floor to center of boxes shall be as follows, unless otherwise noted on plans:

Switches 4'0"
Receptacles 1'6"
Telephone Outlets (desk phone) 1'6"
Telephone Outlets (Wall phone) 4'0"
Data Cable Outlets 1'6"
Fire Alarm manual pull stations 4'0"
Fire Alarm A/V alarms 6'8" (verify)
Devices at special heights As directed in field.

14. WIRE AND CABLE

Furnish and install all necessary cable of the size and type indicated on the drawings or specified hereinafter. All wire shall be copper. All wiring shall be new. No wire smaller than #12 AWG shall be installed unless specifically designated. Use of #14 color coded wire will be allowed for control circuits only. All wiring shall be in conduit unless specifically indicated otherwise herein. All conductors shall be copper. Provide stranded conductors for all sizes unless indicated otherwise.

Provide THHN/THWN insulation for all conductors size 500 MCM (kcmil) and larger, and no. 8 AWG and smaller. For all other sizes provide THW or THHN/THWN insulation as appropriate for the locations where installed. Provide color coded insulation/jacket for phase identification. All wires shall be rated at 600 volts.

Provide type XHHW-2 insulation for all wiring subject to moisture, for all wiring below grade and for all wiring fed from isolated power systems.

Keep conductor splices to minimum. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material. Increase wire sizes per NEC to offset voltage drop as/if required.

15. WIRING DEVICES

DEVICE COLORS:
Refer to contract documents for specific color requirements.

SPECIFICATION GRADE RECEPTACLES:
Duplex receptacles shall be equal to Leviton #5362 series (NEMA 5-20R).

Ground fault circuit interrupter duplex receptacles shall be equal to Leviton #8899 series (NEMA 5-20R).

Duplex isolated ground receptacles shall be equal to Leviton #5362-IG. Single isolated ground receptacles shall be equal to Leviton #5361-IG (NEMA 5-20R).

Special purpose receptacles shall be of the size, type and manufacturer as indicated on the plans or as determined in field.

SWITCHES:
Single pole switches shall be equal to Leviton #1221-2 series.

Double-pole switches shall be equal to Leviton #1222-2 series;

3-way switches shall be equal to Leviton #1223-2 series;

Occupancy sensor lighting switches shall be manufactured by Watt Stopper.

WALL PLATES:

Provide wall plates with engraved legends where indicated on drawings and/or where required per ELECTRICAL IDENTIFICATION Section. All device wallplates shall be standard size; "midway", "oversized" ("jumbo") or "extra deep" wallplates shall not be acceptable. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates. Wallplates in finished areas shall be commercial specification grade, color as specified in contract documents, with beveled edges, equal to Leviton Type 430 series.

16. SUPPORTS, INSERTS, CUTTING AND PATCHING

This contractor shall do all cutting and patching required for the admission of his work. Any damage done by this contractor to the building during the progress of his work shall be made good at his own expense. All patching shall be done by a skilled craftsman in that respective trade. It shall be the responsibility of this contractor to supervise the installation of, and pay for all additional members, wood or metal and labor which may be required to support any type of permanent or temporary electrical apparatus employed in the execution of this contractor's work.

SEAL ALL NEW FLOOR, CEILING, WALL, SLAB, ETC. PENETRATIONS TO MATCH OR EXCEED EXISTING/NEW ASSEMBLY FIRE RATINGS. PROVIDE SLEEVE SEALS FOR ALL SLEEVES; PROVIDE SLEEVES FOR ALL PENETRATIONS. VERIFY REQUIREMENTS IN FIELD. ALL PENETRATIONS OF FIRE-RATED OR SMOKE-RATED WALLS, FLOORS, CEILINGS, ETC. SHALL BE SEALED IMMEDIATELY AFTER RACEWAYS ARE INSTALLED. ALL NEW ELECTRICALLY RELATED WORK SHALL BE SUPPORTED DIRECTLY FROM BUILDING STRUCTURAL MEMBERS. NEW ELECTRICALLY RELATED WORK SHALL NOT BE SUPPORTED FROM DUCTWORK, DUCTWORK HANGERS, CEILING SUPPORTS, EXISTING CONDUIT SUPPORTS, ETC. ALL CONDUITS (AND CABLE ASSEMBLIES, WHERE APPLICABLE) SHALL BE ROUTED PARALLEL TO BUILDING STRUCTURAL MEMBERS. ANY AND ALL NONCOMPLYING WORK INSTALLED BY THE ELECTRICAL CONTRACTOR SHALL BE REMOVED AND REINSTALLED TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND THE ENGINEER, AT THE EXPENSE OF THE ELECTRICAL CONTRACTOR.

17. LIGHTING FIXTURES

All surface mounted ballasted fixtures shall be mounted with air spaces between fixture and surface per latest edition of NFPA/NEC. All recessed fixtures shall be equipped with necessary plaster frames and surface trim. All recessed fluorescent fixtures shall be equipped and suitably constructed to operate with "P" rated ballasts. All recess mounted incandescent and H.I.D. fixtures shall have UL approved thermal protection per latest edition of NFPA/NEC. All junction boxes and serviceable components (ballasts, thermal protection devices, fuses, etc.) for recessed fixtures shall be readily accessible for service or replacement from below the ceiling, without removing any ceiling components (other than tiles).

Where plaster frames are inferred for lighting fixtures (either by narrative or by catalog number or by application) the actual function shall be taken to mean for mounting within gypsum board or similar type ceiling system (i.e. not within wet plaster ceiling system).

All lighting fixtures utilized for emergency egress lighting shall be connected ahead of switching. All ballasts of the same type shall be of the same manufacturer and catalog number. All lamps of the same type shall be of the same manufacturer and catalog number.

Provide low energy solid state rapid start electronic fluorescent lamp ballasts (less than or equal to 20% THD) specifically designed for operating lamp types indicated. Fluorescent ballasts shall be Motorola or Advance equal.

All fixtures shown on drawings with multi-level switching shall be provided with multiple ballasts to accommodate same. All other fixtures may contain either single ballasts or multiple ballasts as required to fulfill required function and as required to comply with construction schedule.

Incandescent lamps shall be Sylvania or Philips, long life type (3000 hours). All incandescent lamps shall be inside frosted unless specifically directed otherwise. Provide socket adapters/extenders if required for accommodating the specified lamp.

Fluorescent lamp color temperature shall be 3500K (VERIFY).

Compact fluorescent twin tube/dual twin tube lamps shall be Osram or Philips, 82 CRI, minimum 10,000 hours rated. Long fluorescent twin tube lamps shall be Osram or Philips, 82 CRI, 3150 initial lumens, minimum 20,000 hours rated.

F32T8 fluorescent lamps shall be rapid start, energy saving type, minimum 75 CRI, minimum 2850 initial lumens and minimum 20,000 hours rated. Lamps shall be Sylvania, Osram or Philips, equal to Sylvania #FO32/RS.

All surface and recessed ceiling fixtures installed on grid or tile ceilings shall be installed to agree with module of ceiling either displacing a tile, or unit on center of tile, or centered on grid
lines.

Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. All lighting fixtures installed in or on suspended ceiling systems shall be anchored directly to the building structural system above (anchored per NEC). Such anchoring shall be independent of the ceiling support system. All fixtures shall be installed plumb and level. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixture stud.

Replace defective lamps for a period of one year following the time of Substantial Completion. Where used for temporary lighting prior to time of Substantial Completion, replace all incandescent lighting fixture lamps, as well as any lamps which are defective, damaged or burned out.

For all existing fixtures which are scheduled for reuse, remove from existing ceilings during demolition; protect during construction; clean, service (if required), relamp (with lamps to match building standard or per this section as noted) and reinstall at locations indicated.

For all existing fixtures which are scheduled to be removed and turned over to Owner, the fixtures shall be disconnected, carefully removed and turned over to Owner. Transfer such fixtures to storage area as directed in field.

18. MECHANICAL EQUIPMENT

Provide all conduit and outlet boxes as required for all control wiring and thermostats. Furnish and install power wiring and make line connections to all heating, ventilating and air conditioning equipment. Electrical Contractor shall examine the approved drawings of all branches and shall wire and connect all motors, disconnects, control devices and other items requiring electricity for operation. This contractor shall make the necessary electrical connections between the specified equipment and the junction box near equipment with flexible metallic conduit and matched connectors. No flexible conduit shall be exposed in finished rooms. Each motor shall have disconnect switch or manual starter installed by this contractor ahead of motor or motor magnetic starter. The Electrical Contractor shall provide control and interlock wiring as specifically indicated on the drawings. All other control wiring required for operation of the systems shall be provided by the Heating Contractor.

19. ELECTRICAL DISTRIBUTION EQUIPMENT

DISCONNECTS, STARTERS & FUSES:

Subject to compliance with requirements, provide equipment of one of the following (for each type and rating):

Allen-Bradley Co.
General Electric Co.
Siemans/ITE
Square D Co.
Westinghouse/Cutler-Hammer

Disconnect switches shall be equal to Square D Type HD. All Safety Switches/Disconnects shall be heavy duty, safety type, quick make and quick break and externally operated. Unless noted otherwise on drawings or directed otherwise in field, all disconnect switches shall be fused. Unless noted otherwise on drawings or directed otherwise in field, brace all disconnect switches for 200,000 A.I.C. Provide heavy-duty switches, with fuses of classes and current ratings indicated and UL listed for use as service equipment under UL Standard 98 or 869. See Section "FUSES" for specifications. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses. Install disconnect switches within sight of controller position unless otherwise indicated.

Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installations. All starters shall be equipped with pilot lights. All starters shall be sized according to load being served or as noted on drawings, whichever requirement is larger. Manual and magnetic starters thermal overload elements shall be rated between 115% and 125% full load current or as called for under NEC. Install and connect capacitors furnished by HVAC Contractors ahead of overloads where applicable.

Provide single-phase AC fractional HP manual motor starters, of sizes and ratings required. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Equip with thermal overload relay with field adjustment capability of plus or minus 10% variation of nominal overload heater rating, for protection
of fractional HP motors as shown on drawings. Starter shall become inoperative when thermal unit is removed. Provide starters with double break silver alloy contacts, visible from both sides of starter; green pilot lights, and switch capable of being padlocked-OFF. Manual Starters shall be equal to the following.

Manual Starter in Finished Areas:

Square D #2510 or Allen-Bradley Bul. 600-TOX109 flush mounted, 2-pole toggle switch type with neon pilot and NEMA 1 Type B enclosure for flush wall installation.

Manual Starter for Exposed Conduit Installation:

Square D #8536 or Allen-Bradley Bul. 600-TAX109 surface mounted, 2-pole toggle switch type with neon pilot and NEMA 1 Type FG-2P enclosure for surface wall
installation.

FUSES:

Subject to compliance with requirements, provide fuses of one of the following. All fuses shall be of the same manufacturer: Bussman, LittelFuse, Shawmut (A4BQ series).

Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations. Fuses 1 ampere through 600 amperes shall be rejection type. Fuses 601 amperes through 6000 amperes shall be Hi-Cap, bolt type.

Provide factory fuse identification labels, installed on the inside of the door of each switch indicating type and size of fuses installed. For types and ratings required, furnish additional fuses, amounting to 10 percent of fuses supplied, but not less than one set of 3 of each kind.

Each fuse shall be clearly factory marked with classification, characteristics, ampere ratings, voltage ratings, etc. Fuses shall not be shipped installed in switches nor shall they be installed in the equipment until the equipment until the equipment is ready to be energized. All fuses shall be of the same manufacturer.

Prior to installing fuses for protection of specific equipment, motors, etc., verify recommended fuse size/type in field from respective equipment manufacturer. If a conflict in fuse size/type results between manufacturer's recommendations and above specifications, contact engineer. Provide all required fuses under base bid. Install fuses in fused switches.

LIGHTING CONTROLS:

All contactors shall be equipped with external green pilot lights in cover and external H.O.A. selector switches in cover. Lighting contactors shall be wired so that the "AUTO" position is the normal activated condition (i.e. photocell controlled, photocell/time-clock controlled, remote switch controlled, BAS controlled, etc.); the "OFF" position shall be a manual override to turn lighting off; the "HAND" position shall be a manual override to turn lighting on. All contactors shall be equipped with field convertible N.O./N.C. contacts and descriptive nameplates.

Lighting contactors shall be equal to Square D Class 8903 (or Allen-Bradley Bul. 500L-BA*94 series) for tungsten & ballast lighting and resistance heating loads. Lighting contactors shall be electrically held in factory NEMA 1 enclosure, with 120V coil and characteristics as indicated on drawings or as required. "Dry" contacts shall be rated at 30A, 250V or 600V as required. Provide number of poles (minimum of four poles) and number of contactors as required for each application. Verify all coil voltage ratings in field.

Multi-Purpose Time Clock shall be Intermatic #ET90415C (No Substitutions). Time clock shall be programmable 365 day, 24 hour with override controls. Unit shall be 4 channel. Provide all required external contactors, relays, etc. to render the control systems fully operational. Verify zone control requirements in field prior to rough-in. Provide battery backup extended power carryover. Custom programming shall be configured as specified and detailed on plans.

PANELBOARDS:

Subject to compliance with requirements, provide panelboard products of one of the following (for each type and rating of panelboard and enclosure): Square D Company, General Electric Company, Siemens/ITE, Westinghouse/Cutler-Hammer.

Panelboards shall bear UL labels for their specific applications. Panelboards shall be suitable for service voltage with number of branch circuits of capacity scheduled. Unless otherwise indicated, panelboards and sections thereof, if any, shall have main lugs only of capacity equal to, or greater than, the rating or setting of the over the current protective device next back on the line. All circuit breaker panelboard bus assemblies shall be of the distributed (sequence) bussing type throughout, so that any 2 adjacent single pole breakers and/or spaces shall be replaceable by a 2 pole internal common trip breaker, and any 3 adjacent single pole breakers and/or spaces shall be replaceable by a 3 pole internal common trip breaker, 15 amp through 70 amp inclusive, without disturbing any other breaker. All panelboards shall be UL listed and labeled for use as service entrance equipment where being used as such.

Distribution panels shall be Square D I-Line.

480Y/277 volt high voltage panels shall be Square D NF.

208Y/120V Lighting and Appliance panelboards shall be equal to Square D NQOD with bolt-on branch breakers.

All bussing shall be copper.

All branch circuit breakers shall be full ambient compensated thermal magnetic molded case with quick-make and quick-break action and positive handle trip indication, both on manual and on automatic operation. Breakers shall be of the over-the-center toggle operating type with the handle going to a position between "on" and "off" to indicate automatic tripping.

All circuit breakers shall be full size. "Tandem" or "split" breakers shall not be permitted. All multi-pole breakers shall have internal common trip with all load side box lugs of one breaker in the same gutter. All circuit breakers shall have sealed cases to prevent tampering. All 15 and 20 ampere branch circuit breakers shall be UL Listed as SWD (switching duty). All 15-70 ampere branch circuit breakers shall be HACR Type. All GFI circuit breakers shall be UL Class A with maximum threshold of 5 mA. All branch circuit breakers serving all ballasted (fluorescent/HID) lighting loads shall be HID rated. Provide 20 (+/-) non-padlock type breaker lock-on devices and install on branch breakers as directed in field (night lights, computers, security, etc.). Provide detailed typewritten schedules for all panelboards. Circuit breakers shall be furnished as scheduled on the drawings or as otherwise required based on field determinations.

Provide all electrical distribution related equipment with appropriately braced bussing and properly rated breakers, fuses, etc. for the available fault currents.

In existin
g buildings where fault current values are not indicated on drawings, coordinate with existing "upstream" distribution equipment provide equipment AIC ratings to meet or exceed
same.
Fill out panelboard's circuit directory card upon completion of installation work. Directories shall be neatly typewritten. All panelboard directories shall include the actual room names/numbers that are selected for interior signage/designation.

TRANSFORMERS:

Power Distribution Transformers shall be Square D Dry Type. Provide copper windings. Provide 4" high concrete housekeeping pad (with chamfered edges) for all floor mounted transformers. Install units on vibration mounts; comply with manufacturer's indicated installation method.

20. FIRE ALARM WORK

The duct detectors shall be equal to Notifier #DH-100AC/DC/P/ST3 with sample tube spanning 2/3 of the duct. Install the duct detector in an indoor accessible location, positioned in the duct per nfpa.

Provide remote test station, equal to Notifier #APA-451 (with status/alarm/trouble indicating LED's and sounder), on the ceiling or wall beneath the duct detector as indicated on drawings or as directed in field. Provide engraved (or approved equivalent method) plate at each remote station to read: "#### Duct Smoke Detector", where #### is the equipment identification used on drawings.

Provide all required power and control wiring so that upon detection of smoke, the following sequence of operations occurs where applicable.

A/V alarm annunciates at the remote test annunciator.
The HVAC unit shuts down. (For HVAC systems where multiple units share a supply or return air duct or plenum, activation of one duct smoke detector shall shut down