ELECTRICAL WORK

1. GENERAL:

A. The "General Conditions of the Contract for Construction," AIA Document A201, latest edition, and these Specifications as applicable are part of this Contract.

B. All applicable codes, laws and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these Specifications, and their provisions shall be carried out by the Contractor who shall inform the Owner, prior to submitting a Proposal, of any work or material which violates any of the above laws and regulations. Any work done by the Contractor causing such violation shall be corrected by the Contractor.

C. Investigate each space through which equipment must be moved. Where necessary, equipment shall be shipped from manufacturer in sections of size suitable for moving through available restrictive spaces. Ascertain from building Owner and Tenant at what times of day equipment may be moved through all areas.

D. Drawings are diagrammatic and indicate general arrangement of systems and work. Conduit routing is shown diagrammatically and does not show all offsets, drops and rises of runs. The Contractor shall allow in his price for routing of conduit to avoid obstructions. Coordination with existing services, including those of other trades, is required. Maintain headroom and space conditions.

E. Install work to be readily accessible for operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this, but changes that involve extra cost shall not be made without approval.

F. Removal and relocation of certain existing work may be necessary for the performance of the general work. Not all existing conditions can be completely detailed on the drawings. The Contractor shall survey the site and include all changes and charges in making up the work Proposal.

G. Connections to existing work: Install new work and connect to existing work with minimum interference to existing facilities. Temporary shutdowns of existing services shall be performed at no additional charges, at times not to interfere with normal operation of existing facilities and only with written consent of Owner. Alarm and emergency systems shall not be interrupted. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work. Connect new work to existing work in neat and acceptable manner. Restore existing disturbed work to original condition, including maintenance of wiring continuity as required.

H. Disconnect, remove and/or relocate existing material, equipment and other work as noted or required for proper installation of new work.

I. The Contractor shall keep all equipment and materials, and all parts of the building, exterior spaces and adjacent streets, sidewalks and pavements, free from material and debris resulting from the execution of this work. Excess materials will not be permitted to accumulate either on the interior or on the exterior.

J. Seal openings through partitions, walls and floors with mineral wool or other noncombustible material. All penetrations through new and existing rated fire and smoke partitions and/or floors shall be completely sealed using materials and methods described in subsequent "FIRE STOPPING" Specifications Section.

K. Provide all necessary flashing and counterflashing to maintain the waterproofing integrity of the building as required by the installation or removal of conduit and equipment.

L. Provide 4-inch high equipment pads for all floor-mounted equipment:

M. All existing material, equipment and construction debris to be removed under this contract shall become the property of the Contractor with the exception of specific equipment and apparatus requested by the building representative, Architect or as noted to be relocated on the drawings. Removed equipment shall be properly disposed of by this Contractor.

N. The Contractor's Proposal for all work shall be predicated on the performance of the work during regular working hours. When so directed, however, the Contractor shall install work during overtime hours and the additional cost to be charged therefore shall be only the "premium" portion of the wages paid.

O. Unless otherwise specifically noted or specified, include all cutting and patching of existing floors, walls, partitions and other materials in the existing building. The Contractor shall restore these areas to original condition.

P. All material and equipment shall be new unless otherwise noted and shall be in accordance with building standards.

Q. Submission of a Proposal shall be construed as evidence that a careful examination of the portions of the existing building, equipment, etc., which affect this work, and the access to such paces, has been made and that the Contractor is familiar with existing conditions and difficulties that will affect the execution of the work. The Contractor is responsible to indicate any discrepancies between the contract drawings and actual field conditions prior to submittal of bid. Submission of a Proposal will be construed as evidence that such an examination has been made. Later claims shall not be made for labor; equipment or materials required because of difficulties encountered which could have been foreseen during such an examination. The on-site inspection shall verify existing conduit (sizes, clearances, etc) and conditions.

R. Insurance: In accordance with building requirements and shall include a Hold Harmless clause for Owner and Engineer.

S. All work shall be done when and as directed by the Client and in a manner satisfactory to the Building Owner. Work shall be performed so as to cause the least possible inconvenience and disturbance to other building occupants.

T. The final acceptance shall be made after the Contractor has adjusted his equipment, tested the various systems, demonstrated that it fulfills the requirements of the drawings and specifications and has furnished all the required certificates of inspection and approval.

2. SCOPE OF WORK:

A. Scope of Work shall consist of providing labor, materials, equipment, services and fees necessary for complete and safe installation in conformity with the regulations of the State Electrical Code, Local Building Department, National Electrical Safety Code, the requirements of the Local Fire Department, Local Wiring inspector, and all legally constituted codes/authorities having jurisdiction. Where the drawings and/or specification requirements exceed the requirements of applicable codes the requirements specified in the contract documents shall take precedence. Where the drawings and specifications are in conflict, the greater requirement shall take precedence.

B. All drawings, plans, details, specifications and specification addenda are made part of this Contract and shall apply to all work under the Contract unless otherwise amended, modified, supplemented or specified herein.

C. The Contractor shall furnish a written guarantee to replace or repair promptly and assume responsibility for all expenses incurred, for any workmanship and equipment in which defects develop within one year from the date of final certificate for payment and/or from date or actual use of equipment or occupancy of spaces by Owner, included under the various parts of the work, whichever date is earlier. This work shall be done as directed by the Owner. This guarantee shall also provide that where defects occur, the Contractor will assume responsibility for all expenses incurred in repairing and replacing work of other trades affected by defects, repairs or replacements in equipment supplied by the Contractor.

D. The Contractor shall give necessary notice, file drawings and specifications with all departments having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefore. The Contractor shall arrange for inspection and tests of any or all parts of the work if so required by authorities and pay all charges for the same. The Contractor shall pay all costs for, and furnish to the Owner before final billing, all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.

E. Materials and equipment shall be new and comply with the applicable standards of the following authorities, except where the contract documents prescribe more rigorous qualifications, the documents shall govern:

Underwriters' Laboratories, Inc. (UL)
National Electrical Manufacturer's Association (NEMA)
Institute of Electric and Electronic Engineers (IEEE)
American Society for Testing Materials (ASTM)
American National Standards Institute (ANSI)
National Fire Protection Association (NFPA)
Insulated Power Cable Engineers Association (IPCEA)
Occupational Safety and Health Administration (OSHA)
American with Disabilities Act (ADA)
National Electric Code (NEC)
Facility Guidelines Institute (FGI)
State of Maine Building Code
International Building Code (IBC)

3. SHOP DRAWINGS

A. Prior to the installation of any work and procurement of equipment, Contractor shall provide complete sets of coordinated shop drawings of all new and existing equipment, indicating capacity, dimensions and sequence of operation for written approval by the Architect and Engineer.

B. Indicate on each shop drawings submitted:
1) Project name and location
2) Name of Architect and Engineer
3) Item identification
4) Approval stamp of prime contractor

C. Submissions:
1) Submissions 11 in. x 17 in. or smaller: If the submission is a catalog cut, then the Contractor shall submit one original and two copies. Otherwise, he shall submit three copies. The Architect will forward the original and one copy (two copies when no original is received) to the Engineer. All catalog cuts shall be complete.
2) Submissions larger than 11 in. x 17 in.: Submit two prints and one paper sepia to the Architect. The Architect will forward one print and the paper sepia to the Engineer.

D. Submit shop drawings for the following:
1) Switches
2) Fuses
3) Circuit breakers
4) Raceways
5) Wire and cable
6) Wall switches, dimmers and occupancy sensors
7) Receptacles
8) Contactors and momentary contact switches
9) Surface metal raceway
10) Lighting fixtures and exit signs
11) Fire alarm devices and wiring diagram
12) Lighting control system
13) Electrified furniture system
14) Nurse call system
15) Test Procedures and Reports.

4. AS-BUILT DRAWINGS AND EQUIPMENT OPERATIONAL INSTRUCTIONS

A. Upon completion and acceptance of work, Contractor shall furnish written instructions and equipment manuals and demonstrate to the Owner the proper operation and maintenance of all equipment and apparatus furnished under this contract.

B. These instructions shall be typed on 8-1/2 in. x 11 in. paper and bound in three ring binders with clear acetate covers. Contractor shall give three copies of the instructions to the Owner and one copy to the Engineer.

C. The instruction booklet shall bear the name, address and telephone number of the project, Architect and Engineer.

D. Reproducible "As-Built" drawings shall be provided indicating the as installed conditions of the work. "As-Built" drawings shall be provided to the Architect after completion of the installation. "As-Built" drawings shall be in AutoCAD format (Release 2002 or later).

E. Written instructions, equipment manuals, and "As-Built" drawings (in AutoCAD format) shall be given to the owner on a CD when requested.

5. GENERAL PROVISIONS FOR ELECTRICAL WORK:

A. Specifications are of simplified form and include incomplete sentences. Words or phrases such as "the Contractor shall," "shall be," "furnish," "provide," "a," "the," and "all" have been omitted for brevity.

B. Definitions:
1) "Provide": To supply, install and connect up complete and ready for safe and regular operation the particular work referred to unless specifically otherwise noted.
2) "Install": To erect, mount and connect complete with related accessories.
3) "Furnish" or "Supply: To purchase, procure, acquire and deliver complete with related accessories.
4) "Work": Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.
5) "Wiring": Raceway, fittings, wire, boxes and related items.
6) "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
7) "Exposed": Not installed underground or "concealed" as defined above.
8) "Similar" or "Equal": Equal in materials, weight, size, design and efficiency of specified product.

C. Temporary light and power: Provide temporary light and power systems at earliest possible date within the construction areas for the requirements of all trades as herein described. Extend systems to new construction as soon as physically possible. Maintain system during working hours of all trades. Cost of energy will be paid for by Owner. Provide all required maintenance, including lamps and sockets.

D. Quality assurance
1) Quality and gauge of materials: New, best of their respective kinds, free from defects and listed by Underwriters Laboratories, Inc., or other nationally approved testing agency and bearing their label. Materials and equipment of similar application shall be of same manufacturer, except as noted.
2) Current characteristics:
a) Distribution: 277/480 volt and 120#208 volt, 3 phase, 4 wire, 60 hertz with grounded neutral.
3) Heights of outlets: Contractor shall be responsible for coordinating and confirming all mounting heights with Architect and Architectural drawings.
a) From finished floor to centerline of outlets for:
- Receptacles and telephones: 1 ft-6 in.
- Wall switches: 4 ft-0 in.
- Wall fixtures: 7 ft-0 in.
- Motor controllers: 5 ft-0 in.
- Clocks: 7 ft 6 in.
- Strobe lights and speaker/strobe: 6 ft-8 in. or 6 in. below ceiling (whichever is lower)
- Gongs and horns: 7 ft-6 in.
- Fire alarm pull stations: 4 ft-0 in.
b) Exceptions: At junction of different wall finish materials, on molding or break in wall surface, in violation of code, or as noted or directed.

E. Product delivery, storage and handling
1) Moving of equipment: Where necessary, ship in carted sections of size to permit passing through available spaces.
2) Accessibility: For operation, maintenance and repair. Minor deviations shall be permitted. Changes of magnitude or involving extra cost are not permissible without review. Group concealed electrical equipment requiring access with equipment freely accessible through access doors.

F. Materials
1) Nameplates: Provide black lamicoid sheet with 3/4 in. white lettering, fastened with epoxy cement for each disconnect switch, circuit breaker, panel, cabinet, transformer, enclosure, motor controller and the like. Nameplates shall describe the name and number of each component.
2) Cable tags: Tag each conductor passing through splice or pullbox with a white linen tag, indicating point of origin and termination of the circuit.
3) Inserts and supports:
a) Inserts: steel, slotted type, factory painted.
- Single rod: similar to Grinnell Fig. 281.
- Multi-rod: similar to Fee and Mason Series 9000 with end caps and closure strips.
- Clip form nails flush with inserts.
- Maximum loading 75 percent of rating.
b) Supports from building construction: Inserts, beam clamps, steel fishplates (in concrete fill only), cantilever brackets or other means. Submit for review.
c) Grouped lines and services: Trapeze hangers of bolted angles or channels.
d) Where building construction is inadequate: Provide additional framing. Submit for review.

G. Paint shall be the best grade for its purpose. Deliver in original sealed containers and apply in accordance with manufacturer's instructions. Colors shall be as selected by Architect or Engineer. Utilize galvanized iron primer on panel and pull boxes, after fabrication. Utilize hot dipped galvanized or dipped in zinc based primer for: outlet boxes, junction boxes, conduit hangers, rods, inserts and supports. Zinc based primer with finish to match surroundings shall be used for marred surfaces of steel equipment and raceways. A field-applied zinc based prime coat shall be utilized for steel or ironwork.

H. Brush and clean work prior to concealing, painting and acceptance. Painted exposed work soiled or damaged; clean and repair to match adjoining work before final acceptance. Remove debris from inside and outside of material and equipment.

I. Final locations and mounting orientations of all switches, receptacles and light fixtures shall be verified with Architect.

J. Provide access doors when concealed electrical equipment requires access. All access door locations shall be reviewed by Architect prior to installation.

6. DEMOLITION

A. "Selective Demolition": Is hereby defined to include but is not necessarily limited to the removal of the following existing materials, items and equipment.
1) Refer to electrical demolition plan and related notes for extent of demolition.
2) Refer to existing drawings and site conditions for all removal of work necessary for completion of new work as shown. Each bidder shall carefully examine the premises and documents during the bidding period and ascertain the extent of removal of existing work. If additional work is noted by the Contractor, call it to the attention of the Architect prior to submitting bid. By submitting a bid, the Contractor will have deemed to have made such examination, to accept such conditions, and to have made allowances in preparing his bid.
3) Items of salvage shall be carefully removed without damage; nails and other fasteners removed that are not integral to their construction; and stored and protected at locations directed by the Owner. Identify and tag all salvage materials regarding location in existing building and relationship of parts.
4) All demolished and/or removed materials not required by Owner shall become the property of the Contractor and shall be removed from the premises, and shall be properly disposed of in a legal manner, off-site.
5) Care must be taken not to disturb existing wiring, which is not effected by demolition. Restore all circuits and equipment disrupted or disturbed by the removal of only parts of existing systems. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work. Alarm and emergency systems shall not be interrupted.
6) Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing facilities. Temporary shutdowns when required are to be made only with written consent of Owner at times not to interfere with normal operation and no additional charge.
7) Connect new work to existing in a neat and approved manner. Restore existing work disturbed while installing new work to acceptable condition as determined by building Owner.
8) All raceways to be abandoned shall be reworked as defined within the demolition notes. Where it is impractical to remove raceway back to source, disconnect wiring at load (equipment) and at line side, cut and cap, flush to surface. Remove conductors from existing raceways to be rewired. Clean raceway as required prior to rewiring.
9) All required work for tie-in to the existing equipment shall be accomplished after hours, the exact day and time shall be directed by Owner, and at no additional charge.

7. CUTTING AND PATCHING

A. The Contractor shall be responsible for all cutting and patching of the existing and new construction work, which may be required for the proper installation of the electrical work. All patching shall be of the same materials, workmanship, and finish, and shall accurately match all surrounding work.

B. Core boring of concrete floors and/or walls if required, shall be provided by the Electrical Contractor.

8. COORDINATION

A. The Contractor shall verify locations of all equipment with architectural drawings. In centering outlets and locating boxes and outlets, allow for overhead pipes, ducts, and mechanical equipment, variations in fire proofing and plastering, window and door trim, paneling, hung ceilings, and the like, and correct any inaccuracy resulting from failure to do so without expenses to the Owner.

9. EQUIPMENT FURNISHED BY OTHERS

A. The Contractor shall furnish and install wiring for equipment furnished by others, as shown on drawings. Coordinate with all other trades or details for installation. The term "wiring" as used here-in, includes, but is not limited to, furnishing and installing conduit, wire, junction boxes, disconnects and making connections. Contractor shall check architectural, mechanical, and plumbing. Drawings and specifications for equipment to be installed by others. Contractor shall be responsible for proper wiring and necessary electrical adjustments to equipment to conform to specified requirements of the equipment.

10. LOW-VOLTAGE DISTRIBUTION EQUIPMENT:

A. Provide complete equipment including: Switches, fuses, circuit breakers, panels and transformers, etc.

B. All equipment shall conform to NEMA, ANSI and IEEE standards

C. Disconnect switches shall be fused or nonfused as noted. Voltage shall be as required. Switches shall be heavy duty, except as noted, and horsepower rated for motor loads.
1) Toggle type switches shall be nonfused, load break, utilized with a maximum ratings of 20 amp at 600 volts and 30 amp at 240 volts. Two-pole switches shall be similar to Leviton MS 302. Three-pole switches shall be similar to Leviton MS 303.
2) Knife-blade type switches shall be load break, quick-make-quick-break with arc quenchers, UL Class R up to 600 amp. Switches shall be similar to General Electric QMR. All switch enclosures shall be dead front, NEMA Type 1, except as noted.

D. Fuses:
1) Circuits 0 to 600 amperes shall be protected by fuses similar to current limiting BUSSMAN LOW-PEAK Dual-Element Time-Delay LPN-RK SP UL class RK1 or class J in restricted space only, and be listed by UL with an interrupting rating of 200,000 amperes RMS symmetrical.
2) Motor Circuits - All individual motor circuits with full load ampere ratings (FLA) of 480 amperes or less shall be protected by fuses similar to current limiting BUSSMANN LOW-PEAK Dual-Element Time-Delay LPN-RK SP 250V (UL Class RK1 or Class J in restricted space only), and be listed by UL with an interrupting rating of 200,000 amperes RMS symmetrical.
3) All fuses shall be provided by same manufacturer.
4) Provide 1 spare matching fuse for each set of 3 and a minimum of 3 spare per size and type.

E. Circuit breakers: Molded case breakers shall be thermal-magnetic, quick-make-quick-break, bolt-on type, manually operated with insulated trip-free handle. Multi-pole type breakers shall contain internal trip bar. Terminals shall be suitable for copper or aluminum cable. Provide interchangeable trip for 225A frame and above. Furnish auxiliary devices where required for shunt tripping, open and close motor operator and alarm indication. Enclosures shall be dead front, NEMA Type 1, except as noted. Frames AIC (Fully rated, series rating not permitted) rating shall meet the available fault and equipment at the point of installation.
1) The base rails for each transformer is to be seated upon a neopreme pad. Neopreme pad is to isolate the transformer from the structure. Neopreme pad shall be "Super W" as manufactured by Mason Industries.
2) Dry type transformers shall comply with NEMA ST-20 and meet the minimum efficiencies based on rating as published in NEMA standard TP-1.

F. Contactors for lighting control shall be similar to ASCO model no. 917 with required accessories and mounted in a NEMA 1 enclosure. Contactors for panelboards shall be similar to ASCO model no. 920, matching bus size, with required accessories and mounted in a NEMA 1 enclosure or internal to panel as required.

G. Provide multi-cable lugs where required. Double lugging shall not be permitted.

H. Mounting height shall be a maximum of 6 ft-6 in. from floor to top switch unit.

I. Update directories on existing panelboards where circuiting is changed.

J. Tests: Open and close load break switching devices under load.

11. RACEWAYS:

A. Provide raceways complete with boxes, fittings and accessories. Conduit or tubing sizes referred to in specifications and on drawings are nominal diameters. Minimum diameter shall be 3/4 in. Raceways shall run concealed, except as noted.

B. Materials
1) Raceways:
a) Rigid steel conduit: full-weight pipe, galvanized, threaded, conforming to UL Standard No.6 as manufactured by Republic Steel, Allied Tube or equal.
b) Electrical Metallic Tubing (EMT): thin wall pipe, galvanized, threadless, conforming to UL Standard 797 as manufactured by Republic Steel, Allied Tube or equal.
c) Flexible Metal Conduit: Flexible metal conduit shall be single strip, continuous, flexible, interlocked double wrapped steel, galvanized inside and outside, forming smooth wiring channel. Flexible metal conduit shall be as manufactured by Pyle-National, American Flexible Conduit or equal.
d) Liquidtight Flexible Metal Conduit: shall be similar to flexible metal conduit, but with extruded moisture and oil-proof/sunlight resistant outer jacket of polyvinyl chloride plastic, with a flexible metal core and be as manufactured by Liquidtite, Anaconda Sealtite or equal.
e) Wireways: Wireways shall be of the totally enclosed type constructed of code gague galvanized steel, minimum No.16 gague, with ground continuity and hinged cover. Provide all fittings, tees, elbows, wire retainers, closure plates, hangers and component parts for a complete installation. Wireways shall be manufactured by Hoffman or equal.
f) Cable tray shall be of the aluminum ladder type. Cable tray shall be a complete continuous system with all fittings supports and accessories. Cable tray shall be as manufactured by Thomas & Betts, B-Line Systems or equal.
g) Surface Metal Raceway: Size as noted. Base 0.04 inch, cover 0.25 inch, Material shall be steel. Finish shall be baked enamel. Covers shall be screw-on.
2) Fittings and accessories:
a) Rigid steel: Rigid steel and intermediate metal conduit fittings, couplings, bushings, locknuts and connectors shall be threaded and galvanized or cadmium plated and shall be as manufactured by O/Z Gedney, Thomas & Betts or equal. Zinc die cast not permitted.
b) Electrical Metallic Tubing: shall be galvanized steel compression type with insulated throat and shall be as manufactured by O/Z Gedney, Thomas & Betts or equal. Galvanized rigid steel elbows, 2 in. or larger.
c) Flexible metal conduit: shall be steel or malleable iron zinc plated with center stop & wedge type with insulated throat as manufactured by O/Z Gedney, Thomas & Betts or equal.
d) Bushings: Metallic insulated type.
e) Liquidtight Flexible Metal Conduit: shall be malleable iron zinc plated suitable for grounding with sealing ring and insulated throat as manufactured by O/Z Gedney, Thomas & Betts or equal.
f) Surface metal, raceway, fittings, couplings, supports and boxes shall be manufactured by Wiremold.
g) Metal clad type MC, armored cable, and fire alarm cable are to use 2-screw malleable iron, zinc plated connectors. Connectors to be provided with insulated throat and be manufactured by Raco, O/Z Gedney or equal.
h) MI cable terminations and slices are to be as manufactured by the cable manufacturer. All splices are to be 2-hour fire rated.
3) Boxes:
a) Concealed Interior Outlet boxes: Except as otherwise required by construction, devices or wiring, boxes shall be stamped steel, 4 in. square or octagon for fixtures. Boxes above ceiling shall be 1-1/2 in. deep. Boxes in ceiling or slab shall be 3 in. deep. Boxes in wall for fixtures shall be 2-3/4 in. deep. Boxes in wall for receptacles and switches shall be 1-1/2 in. deep. Furnish with raised covers and fixture studs where required. Without fixture or device: furnish blank cover. Offset back-to-back outlets with minimum 6 in. separation. Devices shall be manufactured by Raco or equal.
b) Interior exposed or surface mounted outlet and junction boxes shall be of cast metal with Threaded Hubs, Killark, O/Z Gedney or Crouse Hinds Condulet Type. Covers shall be cast metal.
c) Junction and pull boxes: Galvanized sheet steel with screw-on covers, except as noted. Furnish with insulated supports for cables. Locations shall be as noted or required and accessible. Provide barriers in new and renovated boxes between 120/208 volt and 277/480 volt wiring. Devices shall be manufactured by Hoffman or equal.
4) Provide raceway support utilizing ceiling trapeze, straphangers, or wall brackets. Provide U-bolts at each floor level of riser raceways and connected to acceptable supports. Provide riser clamps at each floor level of riser raceways resting on slab. Spacing of supports shall be a minimum of 10 ft on center for metallic raceway and as required for nonmetallic raceway. Spacing shall be 5 ft on center for wireways and per code and as noted for others. Mount supports to structure masonry with toggle bolts on hollow masonry, expansion shields or inserts in concrete and brick, machine screws on metal, beam clamps on framework, wood screws on wood, and pan through straps in metal deck. Nails, rawl plugs or wood plugs shall not be permitted. Where required by structure, furnish through bolts and fishplates.
5) Exposed raceways shall be run parallel with or at right angles to walls. Provide clearance with water, steam or other piping (minimum 3 in. separation from steam and hot water pipes, except 1 in. from pipe cover at crossings and 18 in. for parallel runs). For hung ceiling outlets, run in hung ceiling and connect to ceiling support channels. In masonry and poured concrete, run vertically only.
6) Maintain grounding continuity of interrupted metallic raceways with ground conductor, and in flexible conduit for feeders and motor terminal connections.
7) Empty raceways over 10 ft long: Provide fish or pull wire, galvanized or nylon rope.
8) Raceway and Cable Installation: Rigid steel conduit shall be permitted for feeders and branch circuits. Paint male threads of field-threaded conduit with graphite-base pipe compound and butt conduit ends. Touch up marred surfaces and field-cut threads, CRC-cold galvanized.
a. Raceways installed exposed in mechanical and unfinished spaces - rigid steel conduit.
b. Raceways installed exposed in finished areas - surface metal raceway
c. Raceways installed in wet or damp areas - rigid steel conduit.
d. Flexible taps from junction boxes above hung ceilings to recessed fluorescent lighting fixtures shall be in flexible metal conduit. Provide minimum 4 ft and maximum 6 ft lengths. For final connection to motor terminal box, transformer and other vibrating equipment: provide with polyvinyl sheathing and ground conductor. Minimum length: 18 in. with slack. Connect ground conductor to enclosure or raceway at each end.
e. Branch circuit wiring installed concealed in ceilings, furred or stud walls -emt or health care cable type HCF-90. (All critical and life safety circuits shall be installed installed in conduit)
f. Feeders in dry locations- Rigid steel or EMT.
g. Fire alarm system is to be in a flexible conduit system. Type of conduit system to be as required by locations. Cable installed concealed in ceiling in walls is to be type- MC fire alarm cable.
h. Two-hour rated feeders - Mineral Insulated Cable
9) Cut conduit ends square. Ream smooth. Paint male threads of field threaded raceways with graphite base pipe compound. Draw up tight with raceway coupling.
10) Expansion fittings shall be installed at right angles with clip joint centered in expansion joint. Provide a length of run in accordance manufacturer's recommendations. Preset fittings shall allow for temperature variation. For expansion joint crossings, cross at right angles and anchor ends. For raceway not in slab, provide flexible conduit with external bonding jumper strip. In slab, provide 0.Z. Type "AX" or Appleton type "XJ" or "XJF" with ground continuity.

C. Erect wall and switch outlets in advance of furring and fireproofing. Outlet boxes shall be set square and true with building finish. Secure to building structure by adjustable strap iron or grout in with masonry. Verify outlet locations in finished spaces with architectural drawings of interior details and finishes. Provide barriers between switches connected to different phases for voltages exceeding 150 volts to ground.

D. Panel, junction and pull boxes shall be located clear of other trades. Conceal junction and pull boxes in finished spaces. Where necessary, reroute raceways or make other arrangements for concealment. Boxes shall be accessible. Provide access doors as required for accessibility. Support boxes from building structure, independent of conduit. Provide floor-to-ceiling channels for mounting on drywall and lightweight construction. Outlet boxes for fixtures recessed in hung ceilings shall be accessible through opening created by removal of fixture. Secure to black iron support. Motor terminal boxes: coordinate with motor branch circuit conduit and wiring; add box volume where required.

E. Fire sealants: Provide for raceways and wire passing through floor slots, sleeves or openings in fire-partitions.

F. Perform continuity tests of resistance of feeder conduits from service to point of final distribution using 1 conductor return. Maximum resistance shall be 25 ohms.

12. WIRE AND CABLE:

A. Provide wire and cable complete with accessories. Size reference shall be AWG except as noted.

B. Conductors shall be copper, ASTM standard solid (No. 10 and smaller) or stranded (No. 8 and larger). General use cabling shall be No. 12 minimum. At 120 volts and over 100 ft circuit length, provide No. 10 minimum. At 265 volts and over 200 ft circuit length, provide No. 10 minimum.

C. Control and alarm cabling, except as noted, shall be No. 14 minimum. At 120 volts and over 200 ft circuit length, provide No.12 minimum.

D. Other voltages and phases: adjust cable sizing as required to maintain code acceptable voltage drop. Increase raceway sizes for larger wire as required.

E. Insulation shall be rubber and thermoplastic meeting ASTM and ICEA standards. Type THHN/THWN shall be utilized for feeders and branch circuits except as noted. SFF-2 shall be used for branch circuits located in wiring channels of continuous fluorescent fixtures and in ambient temperatures over 90 Deg. C rated for 600V.

F. Health care facilities cable or "hospital grade" AC cable is to be type HFC-90 with a galvanized steel armor jacket with a #16 AWG internal bonding wire. Wire/Armor combination plus insulated green ground conductor to provide two grounding means. Conductors are to be solid copper in sizes #12 AWG through #8 AWG and stranded for sizes #6 AWG though #1 AWG. Interior conductors are to be wrapped with a moisture and fungi resistant paper. HFC-90 cable shall be manufactured by ACF or approved equal.

G. Fire alarm cable is to be type MC cable with a galvanized steel red armored jacket. Conductors are to be solid copper in sizes #18 AWG and #16 AWG with two to eight conductors per cable. Twisted shield pairs are to be sizes #18 AWG and #16 AWG per cable. Insulation is to be type TFN rated for 105 degrees C for a power limited fire protective signaling cable applications. Provide an insulated ground conductor. Cable to be rated for 600V. Fire alarm cable to be as manufactured by AFC or equal.

H. Mineral insulated cable shall be a factory assembly of one or more copper conductors corresponding to standard AWG sizes. Conductors are to be contained within highly compacted magnesium oxide insulation and enclosed within a seamless, liquid-and-gas tight continuous copper sheath. Cable to be 2 hour fire rated and be as manufactured by Pyrotenax or equal.

I. Color coding shall be as follows:
1) 120/208 volt system:
Black for A phase
Red for B phase
Blue for C phase
2) 277/480 volt system:
Brown for A phase
Orange for B phase
Yellow for C phase
3) Neutral wire shall utilize white outer covering throughout. Equipment ground wire shall utilize green outer covering throughout.
4) Where color-coded cable is not available, certify in writing and request permission to overlap conductors with 6 in. of color taping in accessible locations.

J. Provide flameproof linen or fiber tags in accessible locations. For feeders indicate feeder number, size, phase and points of origin and terminations. For control and alarm wiring, indicate type (control or alarm), size of wire, and points of origin and terminations. Similar to Stranco Products, Inc.

K. Terminations, splices and taps under 600 volts: Copper conductors No. 10 and smaller shall utilize compression-type of twist-on spring-loaded connectors and clear nylon-insulated covering. Copper conductors No. 8 and larger shall utilize mechanical bolted pressure or hydraulic compression type using manufacturer's recommended tooling. Cable lugs and connectors shall utilize compression type of same metal as conductor. Provide to match cable, with marking indicating size and type. Copper lug connections to bus bars: use antiseize compound on tang.

L. Not more than 3 lighting or convenience outlet circuits shall be installed in one conduit unless otherwise indicated. If more than three circuits, derate wire current carrying capacity and maintain code requirements on conduit fill. Neutral conductor shall be counted as a current carrying conductor. Submit to engineer for review prior to installation.

M. Pull no thermoplastic wires at temperatures lower than 32 deg F. Provide separate raceways for conductors of normal and emergency, 120/208 and 277/480 volt systems, except 480 volt motor branch circuit wiring and related 120 volt control wiring. Thermoplastic wires hall not be installed in computer area raised floors.

N. Leave wires with sufficient slack to permit making final connections.

O. Perform continuity and insulation tests. Megger test 100 percent of feeders, 10 percent of branch circuits and motor branch circuits over 25 hp. Perform tests prior to connecting equipment and in presence of authorized representatives. Submit written report of results. Correct or replace cable testing below manufacturer's standards.

13. GROUNDING

A. An equipment grounding conductor commonly described as a "green wire" shall be provided for all branch circuits protected by overcurrent devices except for lighting branch circuits. Green wire ground shall also be provided for flexible conduit and motor circuits. Metallic raceway continuity shall be maintained with a bare No. 6 wire. Where isolated grounding branch circuits are used, provide a separate and distinctly marked green ground wire. Each Grounding conductor shall serve a maximum of three circuits/poles.

B. Service and equipment:
1) For separately derived services or service switches, ground the neutral conductor through disconnecting link and ground terminal to water service ground clamp and building steel or driven ground rods in exterior installations.
2) Ground the center tap of Y-connected transformers through secondary neutral and ground bus to water service ground clamp or building steel.
3) Ground clamps shall be bronze, solderless type with bronze screws, suitable for receiving noted conductors. Mount ground clamp on water service at street side of main service valve. Provide jumper to by-pass water meter.

C. Run insulated ground conductors in rigid steel conduit or EMT with conductor connected to conduit, through ground fitting at each end.

D. Ground noncurrent carrying metal parts of distribution panels, switchboards, transformer enclosures, raceways, busway enclosures, controller enclosures, motor frames and other electrical equipment.

E. Miscellaneous:
1) Ground the following:
a) Telephone system.
b) Fire alarm system.
c) Emergency distribution system.

14. POWER WIRING

A. Provide all power wiring to all motors and equipment furnished under all contracts on the project. Include extensions from controllers to motors and motor connections. Mount and wire all contactors and power devices furnished under all contracts.

15. CONTROL WIRING

A. Provide all control wiring for motors and equipment furnished under all contracts and as specifically shown on the drawings, except as noted for mechanical/plumbing equipment. Include mounting and wiring of all control devices furnished with equipment.

B. Control wiring less than 120 volts for motors, alarms for equipment furnished under mechanical/plumbing will be provided under mechanical/plumbing specifications.

16. DEVICES:

A. Provide complete material and accessories as noted by Leviton, Hubbell, or equal.

B. Local wall switches shall be specification grade, totally enclosed, toggle, quiet type, rated 20 amp, 120/277 volt, AC. All switches shall be ganged with multi device plates, in areas where dimmers are specified with wall switches; all switches shall match dimmer series and shall be ganged together. Switches shall have screw type terminals and shall be of the white phenolic compound finish, unless otherwise directed by the Architect (coordinate with Architect prior to bid). Toggle switches shall be manufactured as follows:

HUBBELL
1) 20A, 120/277V Single Pole, Hubbell No. HBL 1221I
2) 20A, 120/277V Double Pole, Hubbell No. HBL 1222I
3) 20A, 120/277V Three Way, Hubbell No. HBL 1223I
4) 20A, 120/277V Four Way, Hubbell No. HBL 1224I
5) DIMMER SWITCHES: LUTRON DIVA/MAESTRO SERIES

C. Receptacles shall be minimum hospital grade type duplex convenience 125 volts, 2 pole, 3 wire, U ground slot. Grounded, except as noted. Meeting NEMA standards, publication WD-6. Receptacle finish shall be of the white phenolic compound type unless otherwise directed by the Architect (coodinate with Architect prior to bid). Receptacle shall be manufactured as follows:

PASS & SEYMOUR HOSPITAL GRADE
1) 20A, 120V Standard Duplex Normal Power, Pass & Seymour No. 8300
2) 20A, 120V Standard Duplex Critical Power, Pass & Seymour No. TR8300PIRED
3) 20A, 120V Ground Fault, Pass & Seymour No. 2095HG

D. Device plates: Coordinate with Architect for type. For receptacles other than 120 volt, inscribed voltage available.
1) Reinforced thermoplastic by same manufacturer of devices.
2) All emergency receptacles shall be hospital grade & red in color.
3) All device plates shall be have an approved label (Dymo or equal) with its panelboard of origin and circuit designation. Label shall be located on device plate and inside receptacle box.

E. Colors: Coordinate colors with Architect.

F. Mounting orientation of receptacles (horizontal or vertical): Coordinate with Architect.

17. LIGHTING FIXTURES:

A. Provide Lighting Fixtures, lamps and components as per lighting fixture schedule. Fixtures shall be completely factory assembled, wired and equipped with all necessary sockets, ballasts, supporting hardware, plaster rings, backboxes, conduit, etc. as required for a complete and satisfactory assembly. Listed catalog numbers do not necessarily denote required mounting equipment or accessories.

B. Fixtures shall be completely wired and constructed to comply with all Local Codes and Underwriters Laboratories Standards for electrical lighting fixtures and the State and Local Energy codes.

C. All fixtures shall be independently mounted from black iron or building structure by a minimum of (2) independent mounting chains as required and not from ceiling grid. Electrical contractor shall be responsible for all coordination of ceiling construction types with lighting fixtures. Fixtures shall be provided for operation with proper voltage characteristics. Refer to plans for information.

D. Refer to Architectural plans for exact locations and quantities of lighting fixtures.

E. Fluorescent lighting fixtures shall comply with IES standards RP-1 and RP-24 and NEMA Standard Publication LE-1. Industrial fixtures shall comply with RLM standards Institute and shall bear the RLM label.

F. Furnish all fluorescent, incandescent, HID and tungsten halogen lamps as indicated on lighting fixture schedule and as required for each fixture. All fluorescent lamps shall be T8, SPX35 RS (Min. CRI 80+) unless otherwise noted. All HID lamps shall be color corrected. Lamps shall be supplied by Philips, General Electric, Osram/Sylvania.

G. Ballasts shall be RTC Gold Label, indicating approved integral ballast protection. High ballast factor (90% or greater), Type `E' (Ballast efficiency factor) with internally protected capacitors shall be utilized. Fluorescent ballast shall be quiet operating ETL and CMB certified electronic ballasts with THD<10% as manufactured by Universal, Advance, EBT or Valmont with a min. 3 year warranty against any defects in workmanship and/or material and shall include payment of all labor charges for replacement of any ballast. Ballasts for each fixture within a fixture type shall be identical. Wherever dimmers are shown on plans, fixtures shall be provided with compatible dimming ballast equal to Lutron "Hi-Lume" matching local or central dimming system.

H. Emergency battery shall be: capable of operating (2) lamps. For T8 lamp, battery shall be Bondine #B50 for compact fluorescent lamps - 4 pin battery shall be Bodine #B94C.

I. Refer to architectural documents for Lighting Fixture Specifications.

J. Continuous row fixtures shall have lamps staggered.

18. TELEPHONE/DATA CONDUIT SYSTEM:

A. Provide complete system of: empty conduit, pull boxes, outlets, sleeves and fish wires.

B. Equipment and installation shall conform to requirements of Telephone Company and telecommucation specifications.
1) Outlets shall be:
a) Wall: 4 in. square with reducer ring. Cover plate provided integral with outlet device. Blank off where no device is installed.
b) Floor: in-floor cast iron with low-tension fitting or as specified for poke thru floor assemblies.

C. Provide fishwires, in raceways over 10 ft long and at all drops to outlets.

D. Provide riser pull boxes at a minimum of 50 feet intervals.

E. Conduit shall be 3/4 in. minimum. Furnish empty conduit from outlet to nearest accessible hung ceiling or as noted. Terminate open end with insulated bushing.

19. FIRE ALARM SYSTEM

A. The building is served by a base building fire alarm system. (Honeywell) The system will remain and be expanded to accommodate the renovations to the building. During the construction phase the existing system shall be protected from damage.

B. Work Included:
1) Work under this section includes the installation of components to form a complete and operative fire alarm system, including removal of the existing fire alarm system devices that are not to be retained.
2) Work shall include, but not limited to, the following:
a) Installation of new Fire Alarm System components and associated equipment
b) Disconnection, removal and disposal of existing fire alarm equipment and wiring
c) Testing
3) Furnish and install Fire Alarm System components to work in conjunction with the existing base building fire alarm system as described herein and as shown on the plans; to be wired, connected, and left in first-class operating condition. The system shall include manual station (fire alarm boxes), automatic fire detectors, audio/visual devices, strobes, beacon, door holders, electric door strikes, all wiring, conduit, connections to devices, connections to sprinkler flow and tamper switches, zone modules, SNAC panels, outlet boxes, junction boxes and all other necessary material for a complete operating system. The new fire alarm system components will be as manufactured by the base building system manufacturer.
4) The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings and as herein specified.
5) The complete installation is to conform to the applicable sections of NFPA-72 and Local Code Requirements
6) The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.
7) The electrical contractor is to coordinate the installation, final connections and testing with the building manager/owners fire alarm system contractor/service company. All costs associated with the building manager/owners contractors as it relates to this project will be paid by this contractor as part of his base bid.

20. ELECTRICAL TESTING

A. Provide all necessary meters, instruments, temporary wiring and labor to test and adjust all equipment and wiring installed and/or connected under this contract, including electrical equipment furnished by others, to determine proper polarity, phasing, freedom from grounds and shorts and operation of equipment. All measuring instruments must be properly calibrated.

B. Whenever the authorities having jurisdiction require that any work be tested or approved, Contractor shall provide proper facilities for access for inspection.

C. Check all lighting fixtures and receptacles for proper operation.

D. Motors:
1) Make the following tests on the motors before starting up:
a) Check motor nameplate for horsepower, speed, phase and voltage.
2) Make the following tests on all motors during or immediately after start up:
a) Check shaft rotation: Check bearing temperature: Check motor for smooth operation.
b) Take a current reading of full load using a clamp on ammeter. If ammeter reading is over the rated full load, current, determine the reason for the discrepancy, and take the necessary corrective action.
c) Following established procedures equipment shall be energized after certifications by the Contractor that the installation's satisfactory. All motors and equipment shall be tested for proper operation.

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ELECTRICAL SPECIFICATIONS

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