SECTION 26 00 00 - ELECTRICAL

The following is the Electrical outline specifications, which defines the scope of work of the Electrical system.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 CODES, ORDINANCES, AND PERMITS

A. Codes and Ordinances:

1. All material and work provided shall be in accordance with the following codes and standards as most recently amended.
   - Commonwealth of Massachusetts Building Code
   - State Department of Public Safety
   - NFPA 101 "Life Safety Code"
   - NFPA Standards
   - Standards of the Underwriters Laboratories (UL)
   - Occupational Safety and Health Act (OSHA)
   - Americans with Disabilities Act (ADA)
   - Energy Conservation Code
   - Town of Cohasset

Where contract documents indicate more stringent requirements than codes, the contract documents shall take precedence.

Permits: Be responsible for filing documents and securing of inspection and approvals. Pay all local connection & permit fees. Utility Company backcharges related to permanent service will be paid directly by the Town. Costs related to temporary service, refer to Section 015000.
PART 2 - PRODUCTS

2.1 RACEWAYS AND FITTINGS

A. RACEWAYS - GENERAL:

1. No raceway shall be used smaller than 3/4” diameter and shall have no more than four (4) 90 deg. bends in any one run, and where necessary, pull boxes shall be provided. Only rigid metal conduit or intermediate metal conduit is allowed for in-slab work. Cable systems, if allowed to be used by other sections of this specification, shall not be used exposed or in slabs, whether listed by "UL" for such use or not.

   a. Rigid metal conduit, may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in penthouse for drops down to equipment from elevations above eight feet and also where raceway may be subject to mechanical damage.

   b. Electrical Metallic Tubing (EMT), may be used in masonry block walls, stud partitions, above furred ceilings, where exposed but not subject to mechanical damage, and shall be used for fire alarm work.

   c. Surface metal raceways shall be used where raceways cannot be run concealed.

   d. Flexible metal conduit shall be used for final connections to recessed lighting fixtures from above ceiling junction boxes and for final flexible connections to motors and other rotating or vibrating equipment. Liquid tight flexible metal conduit shall be used for the above connections which are located in moist locations. All flexible connections shall include an insulated grounding conductor.

   e. Rigid non-metallic conduit may be used at the contractor’s option for underground electric and telephone services outside the foundation wall and shall be polyvinyl chloride (PVC) schedule 40, 90oC. If option of rigid non-metallic conduit is exercised, underground runs outside the foundation wall shall be concrete encased at electrical contractor’s expense.

   f. PVC Schedule 40 may also be used for below slab circuits within building confines and site lighting branch circuits. Below slab rigid non-metallic conduits do not require concrete encasement. Rigid non-metallic conduits shall not be used for exterior feeders, in slabs, nor for elbows which penetrate slabs. Raceways and fittings shall be produced by same manufacturer.

   g. Acceptable manufacturers:

      1) Pittsburgh Standard Conduit Company
      2) Republic Steel and Tube
      3) Youngstown Sheet and Tube Company
      4) Carlon
      5) Or equal

B. Outlets, Pull and Junction Boxes:

1. Outlets:

   a. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations or surface mounted shall be of the cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps not allowed in new construction. Thru the wall boxes are not permitted.

      1) Acceptable manufacturers:

         a) Appleton
b. Pull and Junction Boxes: Where indicated on plans, and where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish, and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be as required by Code.

1) Acceptable Manufacturers:

a) Brasch
b) Hoffman
c) Keystone
d) Lee Products Co.
e) McKinstry Inc.
f) Eldon Inc.
g) Or Equal

2.2 CONDUCTORS

A. All conductors shall be a minimum size of #12 AWG except for control wiring and fire alarm wiring where #14 AWG may be used. For all exit sign circuits, normal/emergency and/or emergency only circuits, exterior lighting circuits, and also where distance from panelboard to first outlet exceeds 80' for 120 volts, #10 AWG shall be minimum size wire allowed. All feeder and branch circuit conductor shall be color coded as follows:

1. 208Y/120V Phase A Black
2. 208Y/120V Phase B Red
3. 208Y/120V Phase C Blue
4. Grounded Conductor
   a. 120/208 White

5. Equipment Ground
   a. 120/208 Green

B. All conductors not installed in accordance with color scheme shall be replaced. All conductors larger than #6 AWG must be identified with colored tape.

C. Connections throughout the entire job shall be made with solderless type devices.
1. For #10 AWG and smaller: spring type.
2. For #8 AWG and larger: circumferential compression type.
3. Acceptable manufacturers:
   a. 3M "Scotchlock"
b. IDEAL "Wingnut"
c. BURNDY
d. MAC
e. Or Equal

4. Any splices made up in ground mounted pull boxes shall be resin cast waterproof type or waterproof pressure type, as manufactured by King Technology, St. Louis, MO.
D. Conductors shall be copper, soft drawn, and annealed of 98% conductivity. Conductors larger than #10 AWG shall be stranded; #10 AWG and smaller shall be solid. Conductors shall be insulated for 600 volts and be of following types:
   1. All conductors shall have heat/moisture resistant thermoplastic insulation type THHN/THWN (75 deg. C) except as follows:
      a. In sizes #1 AWG and larger: Crosslinked polyethylene insulation type XHHW (75 deg. C - 90 deg. C) may be used.
      b. Fire alarm system conductors shall be #14 AWG, type THHN, solid. Color coding of fire alarm conductors shall be in accordance with fire codes.
      c. Fixture whips #16AWG type "SF".

E. Mineral-Insulated Metal-Sheathed Fire-Resistive Cables (Type MI) - Cables shall consist of a factory assembly of one or more solid copper conductors insulated with highly-compressed magnesium oxide and enclosed in a seamless, liquid-and-gas-tight continuous copper sheath. Cables shall be rated for 600 volts and less. Cables shall comply with Article 330 of the National Electrical Code. Cables shall be classified by Underwriters Laboratories, Inc. as having a 2-hour fire resistive rating. Cable terminations shall be made with UL listed mineral-insulated cable fittings. Approved Manufacturer - Pyrotenax USA, Inc., or equal.

F. Type MC cable may be used for concealed branch circuits and fire alarm in hollow spaces where allowed by code if installed and terminated as specified under Execution Section. Armor to be galvanized steel, and shall be UL listed for 2 hour thru-wall fire penetration.

G. Acceptable manufacturers:
   1. AFC Cable Systems
   2. American Wire & Cable
   3. Cerro
   4. Cornish
   5. Crescent
   6. General Cable
   7. Okonite
   8. Or Equal

2.3 ELECTRICAL POWER EQUIPMENT

A. Motors: Each motor shall have a disconnect switch and starter provided under this section. Starters which are a part of "factory assembled" control panel will be provided under section supplying equipment to be controlled but connected under this section.

   1. Provide motor terminal boxes for each motor not furnished with same.

B. Disconnect Switches:
   1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in "OFF" position. Three pole toggle switches are not acceptable as substitute for disconnect switches.
   2. Acceptable Manufacturers:
      a. General Electric
      b. Westinghouse
      c. Square D/Groupe Schneider
      d. Siemens
      e. Allen Bradley
      f. Or Equal
C. Fuses:
   1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other contractors will be complete with fuses, unless noted otherwise on electrical drawings.
   2. Acceptable Manufacturers:
      a. Bussmann, Division of McGraw
      b. Gould/Shawmut
      c. GEC-ALSTHOM
      d. Or Equal

2.4 ELECTRICAL SYSTEM CONTROLS AND INSTRUMENTS
   A. Provide a complete power system consisting of branch circuits, motor disconnect switches, pushbutton stations, motor starters, and other devices to connect up and leave in operating condition each piece of electrically operated equipment provided either under this section or other Divisions.
   B. All control wiring not indicated in the electrical specifications or not shown on electrical drawings will be provided by Temperature Control Subcontractor.

2.5 MAIN BUILDING SWITCHBOARD
   A. Main building switchboard shall be constructed in accordance with UL 891 and ANSI standards and of the required number of vertical sections bolted together to form one metal enclosed rigid structure. The front shall be accessible. Buses shall be copper.
   B. Switchboard shall be arranged for operation as follows:
      1. Voltage - 120Y/208 volts
      2. Frequency - 60 cycles
      3. Service - 3 phase, 4 wire, ampere capacity as indicated on drawings.
      4. Neutral - full capacity
      5. Available short circuit current at line terminals - 65,000 RMS amperes symmetrical.
      6. Integrated equipment rating - 65,000 AIC
      7. Copper ground bus, full length
      8. UL service entrance label

2.6 PANELBOARDS
   A. Panelboards shall be dead-front, door in door safety type equipped with single or multi-pole circuit breakers suitable for 120/208 volt, 3 phase, 4 wire operation.
   B. Buses shall be copper. Panelboards shall have a circuit directory card mounted in a frame with plastic cover on inside of door. Panelboards to have a copper ground bus with terminals for each circuit. Panelboards serving isolated ground receptacles shall have a separate ground bus for terminations of the isolated grounds. The isolated ground bus shall be mounted to the panel tub via non-conducting means with a separate grounding conductor run to the normal panel ground bus.
   C. Panelboards and distribution panels shall be of same manufacturer as switchboard.
2.7 SURGE PROTECTIVE DEVICES
   A. Furnish and install surge protective devices with ratings of 120,000 amperes on the secondary side of the main service overcurrent device and panelboards feeding computer equipment.

2.8 FLOOR OUTLETS (FLUSH TYPE)
   A. All flush floor outlets shall be Wiremold RFB series. The RFP4 series shall be used generally.
   B. Whenever floor outlets for different services are indicated in the same location, they shall be ganged together.
   C. Covers shall be brass series FPCT, FPBT and FPFFT Manufactured of die cast aluminum. Flush floor outlets located in carpeted areas shall be provided with 6CT, 6CTC, and 6CFFTC carpet plates of the number of gangs required.

2.9 WIRING DEVICES
   A. Receptacles: Receptacles shall be flush mounted. All standard 20 ampere devices to be of same manufacturer.
      1. Acceptable Manufacturers:
         a. Twenty (20) ampere duplex grounding type NEMA 5-20R, Arrow Hart 5739SI,
         b. Thirty (30) ampere, 250 volt NEMA 10-30R complete with plate, Arrow Hart 9344
   B. Switches: 20 ampere,
      1. Arrow Hart 1991 series,
   C. Composition material of wiring devices to be nylon with white finish.
      1. Provide gaskets on all wiring device plates where devices are on walls separating conditioned and non-conditioned spaces.
   E. Blank coverplates shall be steel, paintable.
   F. Dimmer Controls:
      1. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, magnetic low voltage, electronic low voltage). Manufacturer shall provide file card upon request. Universal dimmers are not acceptable.

2.10 LIGHTING FIXTURES
   A. Provide lighting fixtures complete with lamps, ballasts, and other devices as required for a first class installation. Furnish Ceiling Subcontractor with instructions concerning openings necessary, and provide frames for NEMA standard ceiling types or special mounting frames, as may be required. Fixtures shall be supported independently of hung ceiling construction.
B. LED Assemblies
   1. LED luminaires shall conform to UL 1598 and to UL 8250 – Safety Standard for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products.
   2. Products shall be lead and mercury free.
   3. Photometric characteristics shall be established using IESNA LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurement of Solid-State Lighting Products.
   4. Color characteristics of LED luminaires shall be as follows in accordance with ANSI C78.377 – Specifications for the Chromaticity of Solid State Lighting Products.
   5. LED and driver cooling system shall be passive and shall resist the buildup of debris.
   6. LED luminaire output after 50,000 hours of operation shall be not less than 70 percent of the initial lumen output when determined in accordance with IESNA LM-80-08 – IESNA approved Method for Measuring Lumen Maintenance of LED Lighting Sources.
   7. LED source package electrical characteristics:
      a. Supply voltage: 120 V, 208 V, 240 V, 277 V, or 480 V as indicated on the Drawings. Provide step-down transformers if required to match driver input voltage rating.
      b. Total harmonic distortion (current): Not more than 10 percent
      c. Power factor: Not less than 90 percent
      d. RF interference: Meet FCC 47 CFR Part 15/18
      e. Transient protection: IEEE C62.41 Class A.
   8. All LED Assemblies shall be provided by Osram, Phillips, GE, or equal.

C. Provide universal arrows on all exit signs and punch out directions as shown on floor plans.

D. Pendant mounted fixtures shall be suspended by means of air craft cable with aligner and canopy in finished areas or threaded rods in non-public areas. Length of suspension method to be as required to mount fixtures at the elevations called for or as otherwise shown on drawings or architectural elevations.

E. Fixture types shall be as scheduled.

F. Exterior - General
   1. Furnish exterior luminaires that comply with requirements specified in this Section and in the luminaire schedule on the Drawings.
   2. Luminaire photometric characteristics shall be based on IESNA approved methods for photometric measurements performed by a recognized photometric laboratory.
   3. Luminaire housing shall be primarily metal.
      a. Metal parts shall be free from burrs and sharp corners and edges.
      b. Sheet metal components shall be fabricated from corrosion-resistant aluminum, formed and supported to prevent sagging and warping.
      c. Exposed fasteners shall be stainless steel.
   4. Doors and frames shall be smooth operating and free from light leakage under operating conditions.
      a. Relamping shall be possible without the use of special tools.
      b. Doors, frames, lenses and diffusers shall be designed to prevent accidental falling during relamping and when secured in the operating position.
      c. Door shall be removable for cleaning or replacing lens.
   5. Luminaires shall have minimum reflecting surface reflectance as follows unless scheduled otherwise:
      a. White surfaces: 85 percent
      b. Specular surfaces: 83 percent
      c. Diffusing specular surfaces: 75 percent
6. Provide lenses, diffusers, covers and globes as scheduled on the Drawings fabricated from materials that are UV stabilized to be resistant to yellowing and other changes due to aging or exposure to heat and ultraviolet radiation.

7. Doors shall have resilient gaskets that are heat-resistant and aging-resistant to seal and cushion lens and refractor.

2.11 AUTOMATED LIGHTING CONTROL SYSTEM

A. Manufacturers

2. Acceptable alternate manufacturers:
   a. Encelium Energy Management System by OSRAM Sylvania or equal.

B. System Description

1. Operation: Input signal from digital signal sources switch or dim DALI devices associated with LED drivers, fluorescent lighting fixtures and other LCS end devices.
   a. Each device and relay is connected to a digital data bus.
   b. Each DALI device and relay has a digital address and be operated by a digital signal.
   c. Each device or relay can be assigned to any or all of 16 available groups connected to a single data bus.
   d. Each LED driver may have as many as 16 preset lighting levels or scenes. Scenes can be programmed to LED drivers and may be applied to groups.
   e. Each fluorescent ballast may have as many as 16 preset lighting levels or scenes. Scenes can be programmed to fluorescent ballasts and may be applied to groups.

2. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.
4. Comply with protocol described in IEC 60929, Annexes E and G, for DALI lighting control devices, wiring and computer hardware and software.
5. Comply with UL 916.
6. Comply with UL 924.

2.12 DUAL TECHNOLOGY CEILING OCCUPANCY SENSORS

A. Dual technology occupancy sensors shall be capable of detecting occupants within the coverage area designated via detection of a doppler shift in the transmitted ultrasonic sound wave and a change in the infrared heat present. Major motion and minor motion shall cause the controlled load to switch to the "ON" mode.

B. The dual technology passive infrared sensor shall use a multi-level 100 segment Fresnel lens and four pyroelectric detectors to insure adequate PIR coverage of the intended area.

C. Dual technology sensors shall have on override to "ON" bypass logic key in the event of sensor failure.

D. Sensors are to be ceiling mounted using a back-mounting plate and standard electrical outlet boxes.

E. Dual technology sensors shall cover up to 2000 sq. ft. for walking motion, with a field of view of 360 degrees.
F. Dual technology sensors shall be compatible with electronic ballasts, compact fluorescent, and inductive loads.

2.13 ACCESS PANELS

A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.

B. Access panels shall be prime painted and equipped with screwdriver operated cam locks.

C. Acceptable manufacturers:

   1. Inland Steel Products Company – Milcor
   2. Miami Carey
   3. Walsh-Hannon-Gladwin, Inc. - Way Locator
   4. Or Equal
   5. Specific types:
      a. Acoustical Tile Ceiling "Milcor Type AT"
      b. Plastered Surfaces "Milcor Type K"
      c. Masonry Construction "Milcor Type M"
      d. Drywall Construction "Milcor Type DW"

2.14 SLEEVES, INSERTS, AND OPENINGS

A. Sleeves: Provide sleeves of proper sizes for all openings required in concrete floors and walls. Sleeves passing through floors shall be set with top of sleeve 1" above finished floor. Core drilling will also be acceptable if in accordance with any structural standards. Any unsleeved openings shall be waterproofed.

2.15 GROUNDING SYSTEM

A. All equipment and systems shall be grounded. Refer especially to NEC Section 250 Requiring Connections to Building Steel, Foundation, Water Service, and Interior Piping. Provide transformer pad grounding to be in accordance with utility company standards.

2.16 ELECTRIC SERVICE

A. Coordinate and cooperate with Utility Co., with respect to providing service and metering. See allowances section for backcharges by utility company with respect to permanent service.

B. Provide all primary system raceways, elbows, pull wires and all pad grounding. Utility company will provide pad mounted transformer and primary conductors including making up of all terminations and connections.

C. Provide secondary service complete including all conductors, raceways and connectors.

D. Metering: All usage will be on one secondary meter. Utility Company will furnish current transformers and potential transformers to be installed in transformer.

2.17 TELEPHONE/DATA SYSTEMS

A. Telephone system instruments and interconnecting wiring will be provided by the ITS Contractor. Data system outlets and interconnecting wiring will be provided by the ITS Contractor.
B. For each telephone outlet or data outlet indicated on the drawings, provide a 4” square flush outlet box. In insulated partitions, provide a 1” racewaystubup terminating with bushing to above nearest accessible hung ceiling.

2.18 STANDBY ELECTRICAL SYSTEM

A. Provide one 125KW, 150 KVA at .8 PF standby power rated natural gas generator set mounted in perfect alignment on an all welded, fabricated steel sub-base which shall allow for attachment of all necessary engine and generator accessories.

1. Acceptable Manufacturers:
   a. Kohler
   b. Caterpillar
   c. Onan
   d. Generac
   e. Or Equal

B. Generator: 125 KW, 150 KVA, 120/208 volt, 3 phase, 4 wire, 60 Hz, 1800 RPM revolving field type main generator with brushless exciter.

1. Voltage regulation +/-1%.

C. Generator Control Panel:

1. To completely control operation of engine generator set. Panel to have automatic start control. AC volt meter, AC ammeter, pointer type frequency meter, volt meter, ammeter and selector switch.

D. Automatic Transfer Switch:

1. Provide automatic transfer switches for operation on 120/208 volts, 3 phase, 4 wire operation. Unit to be housed in a NEMA 1 enclosure. Transfer switches shall be rated for minimum 42,000 amps.
   a. Entire switch shall be listed under UL 1008.
   b. Acceptable Manufacturers:
   c. Russ Electric RMTD (4 Pole)
   d. ASCO (with overlapping neutral contacts)
   e. Onan
   f. Kohler
   g. Or Equal

E. Remote Annunciator Panel: A flush mounted panel shall include a visual signal that battery charger is functioning properly and both audible and visual signals. Annunciator shall meet NFPA 110 Standards.

F. Generator shall be housed in a weatherproof sound attenuated aluminum enclosure.

2.19 FIRE ALARM AND DETECTION SYSTEM

A. Work Included:

1. Furnish and install a 24 VDC closed circuit non-code, continuous ringing, supervised, addressable fire alarm system in accordance with the following specifications, to be wired, connected and left in first class operating condition. All equipment shall be listed by Underwriters Laboratories or approved by Factory Mutual.
2. General Requirements  
   a. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible (Voice Evac) and visual alarm devices, and all accessories required to provide a complete operating fire alarm system in accordance with code and local fire department.  
   b. The system shall be ADA compliant and installed in accordance with NFPA 72.

2.20 LADDER TRAY  
   A. Provide 12” wide aluminum ladder tray with 6” rung spacing with 4” side rail. Ladder tray shall be as manufactured by B-Line. “Ladder Type”. Provide all hangers required.

2.21 UNINTERRUPTIBLE POWER SUPPLY  
   A. General: Provide a three phase, on-line, solid state uninterruptible power system hereafter referred to as the UPS. The system consists of a solid state inverter, rectifier/battery charger, a static switch, an internal maintenance bypass switch, an internally assembled battery cabinet and synchronizing circuitry as described herein.

   B. UPS Requirements and Performance Characteristics:

      1. Ratings – 20 kVA/16 kW  
         a. Input Requirements: Voltage: 208, 3 phase, 4 wire plus ground ± 15%

      2. Battery back-up of 7 minutes at 100% load.  
         a. Output Characteristics:  
            1) Voltage:208Y/120, 3 phase, 4 wire plus ground. Output voltage adjustable ± 3%.

2.22 LIGHTNING PROTECTION SYSTEM  
   A. General:  

      1. Provide all labor, material, equipment, and services required for the complete lightning protection system in accordance with NFPA 780, UL96A and applicable contract drawings for the Building. System shall receive UL Master Label.

   B. Standards of Quality:  

      1. All materials shall be the product of a manufacturer regularly engaged in the production of lightning protection equipment.

      2. All material shall be manufactured by Heary Bros. Lightning Protection Co, Thompson Lightning Protection, Harger, or East Coast Lightning Equipment.

   C. Master Label:  

      1. Submit factory certified tests.
      2. Submit guarantee for installation and range of lightning protection.
PART 3 - EXECUTION

3.1 TESTING REQUIREMENTS

A. The Electrical Contractor shall provide testing of the following systems with the Owner and Owner’s representative present:

1. Lighting and power panels for correct phase balance.
2. Emergency generator.
3. Lighting control system (interior and exterior).
4. Fire alarm system.
5. Security systems.

B. Testing reports shall be submitted to the Engineer for review and approval before providing to the Owner.

3.2 OPERATION MANUALS AND MAINTENANCE MANUALS

A. When the project is completed, the Electrical Contractor shall provide operation and maintenance manuals to the Owner.

3.3 RECORD DRAWINGS AND CONTROL DOCUMENTS

A. When the project is completed, an as-built set of drawings, showing all lighting and power requirements from contract and addendum items will be provided to the Owner.

END OF SECTION