SECTION 26.00.00
ELECTRICAL

PART 1 – GENERAL

1.01 GENERAL

A. The Conditions of the Contract and other sections of Division 1, General Requirements, apply to work of this Section.

B. The Work to be done under this section is shown on the Drawings E-1, E-2, E-3, E-4 & E-5.

1.02 WORK TO BE PERFORMED

A. The scope of work under this Section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, services and incidentals necessary to complete all of the Work in accordance with the Contract Documents which are intended to describe and provide for a finished piece of Work, and are to be cooperative; what is called for by either shall be complete in every detail, notwithstanding whether or not every item necessarily involved is particularly mentioned.

B. Electrical Work shall generally consist of, but not be limited to:

1. Obtain all permits, inspections , approvals and pay all fees;
2. Selective demolition of items as noted or shown;
3. Provide all wire and cable, connectors and connections;
4. Provide all raceways, fittings and supports;
5. Provide all device, pull, outlet and junction boxes;
6. Provide all wiring devices and plates;
7. Provide all safety disconnect switches as shown;
8. Provide all fire detection and alarm equipment, devices and ancillary devices as required;
9. Testing, training, commissioning and demonstration of all systems;
10. Record Drawings;
11. Operation and Maintenance Instruction and Manuals;
12. Warranties.

C. All permit and inspection fees for the work of this section shall be paid for by this Contractor.

D. Be prepared for, and accommodate work-arounds, given the likelihood that this Contractor will not be able to access some portions of the building at some times. It is expected that this Contractor will then work in other areas of the Project. Required work-arounds shall not be the basis of any claim for additional compensation.

E. Restore to match surrounding surfaces any area disturbed or exposed by the Work of this contract.

F. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with

work of others and provide a complete and fully functional installation. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation. Remove all debris caused by the Contractors' work.

G. Drawings are diagrammatic and indicate general arrangement of systems and work included in Contract. It is not intended to specify or to show every offset, fitting or component; however, Contract Documents require components and materials whether or not indicated or specified as necessary to make the installation complete and operational.

H. Wiring shall be routed as required to minimize cutting and patching required. Devices shall be located to comply with code required locations, and to avoid field obstructions, and to comply generally with locations as shown on the drawings. The relocation of devices and related work within 10 feet of location shown on plans shall be included in the contract price.

I. As work progresses and for duration of Contract, maintain complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately, including work installed as a modification or addition to the original design. Indicate actual circuiting, light fixture locations, device outlet locations, switch assignments, loadcenter schedule, etc.

1.03 RELATED WORK SPECIFIED UNDER OTHER SECTIONS

A. The following items of work are specified and included under other sections of the specifications:

1. Section 23.00.00 Heating, Ventilating and Air Conditioning

B. Painting of electrical conduits, pull boxes, hangers, panelboard doors and trim, and all other electrical equipment, to match the surrounding finish as directed by the Architect, shall be done by the Painting Subcontractor.

C. All electric motors shall be furnished and set in place by the trade requiring same and shall be wired by this Contractor.

D. All control devices including starters, thermostats, pneumatic-electric switches, electric-pneumatic switches, aquastats and alternators required for the automatic temperature control system shall be furnished and installed under the Heating, Ventilating and Air Conditioning Section of the Specifications unless otherwise indicated on the electrical drawings.

E. All automatic temperature control wiring and raceways, including wiring all control devices shall be provided under the Heating, Ventilating and Air Conditioning Section of the Specifications unless otherwise indicated on the electrical drawings.

F. All temporary power shall be provided by the General Contractor.

G. All removal and disposal of demolished electrical items shall be provided by the General Contractor.

H. All cutting and patching required for the electrical work shall be provided by the General Contractor.

1.04 SUBMITTALS

A. Submit shop drawings and manufacturer's product data in accordance with the provisions of the General Conditions. Submit quantity of copies as requested.

B. List of material and equipment requiring shop drawings shall include, but is not limited to:

1. Wire and Cable
2. Wire and Cable Connectors and Devices
3. Raceways and Fittings
4. Boxes
5. Wiring Devices and Device Plates
6. Circuit Breakers
7. Disconnect Switches
8. Fire Alarm System Devices and Equipment

C. Submittals shall be indexed from list above. Add additional items to end of list. Check, stamp and mark with project name shop drawings and product data before submitting for approval. Specifically indicate on shop drawing transmittal form or by separate letter any deviations from Contract Documents because of standard shop practice or other reason. Cross out, but do not obliterate, material not intended for inclusion in the Work. Clearly indicate material to be included in the Work.

D. Submit for approval all materials incorporated in the Work. Installation of material which is not approved shall be at the risk of this Contractor, and the Owner may order that it be removed and/or replaced.

E. Submit samples of any material or equipment requested, prior to approval.

F. The Engineer will review one initial submittal, and one re-submittal of any item. If review, of re-submittals beyond the first re-submittal are required; this Contractor shall bear the Engineer's cost to review the re-submittal. If materials which have previously been approved or approved-as-noted are re-submitted, this Contractor shall bear the Engineer's cost to review the re-submittal.

1.05 CODES, ORDINANCES AND PERMITS

A. All Work shall be done in strict accordance with the Codes, rules and regulations governing electrical work in the City of Newton, and the Commonwealth of Massachusetts, and the Massachusetts Electrical Code. If there is any conflict between plans or specifications and such rules and regulations, the rules and regulations shall take precedence.

B. The publications and/or standards listed below form a part of this specification. The publications are referenced in text by the basic designation only.

1. National Fire Protection Association (NFPA) - USA:
   a. No. 70 National Electrical Code (NEC)
   b. No. 72 National Fire Alarm and Signaling Code
   c. No. 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations
2. Commonwealth of Massachusetts

a. 527 CMR 12.00 Massachusetts Electrical Code

b. 780 CMR Massachusetts State Building Code, 9th Edition and it's reference standards

c. 521 CMR Massachusetts Regulations of the Architectural Access Board

C. Perform work strictly as required by rules, regulations, standards, codes, ordinances, and laws of local, state, and federal government, and other authorities that have lawful jurisdiction.

D. Give notices, file plans, obtain permits and licenses, pay all fees and obtain all necessary approvals from authorities that have jurisdiction. Coordinate with General Contractor for submission of, and/or prepare and submit, an NFPA 241 plan as required by the AHJ. Deliver all certificates of inspection to the Architect. No work shall be covered before examination and approval by the Authority Having Jurisdiction. Replace any imperfect or condemned work with materials conforming to the requirements, and satisfactory to the Architect, without extra cost to the Owner. This Contractor is responsible to obtain all permits and pay all fees.

E. Where the Engineer is to witness testing or perform inspections of work, provide not less than seven (7) calendar days notice to the Engineer of such inspections or testing. At or before request for completion inspection, provide completed as-built plans for review by the Engineer at the final inspection.

F. Where the local Authority Having Jurisdiction (AHJ) requires work which is not included in the Contract, and where such work will result in an added cost to the Owner, this Contractor shall obtain such requirement from the AHJ in writing. Such requirements shall be supported by applicable code, ordinance or law citation(s), or other justification, to the full satisfaction of the Owner.

1.06 INSPECTION OF SITE

A. Prior to submitting a bid, the bidder is advised to with prior arrangement with the Owner, visit the site (See Advertisement for site date) and shall at that time, inspect all existing conditions to ascertain the exact scope and nature of the work that is required under this Contract, how it relates to existing work to remain and all job conditions and restrictions.

B. Bidders are advised to visit the site and inform themselves as to conditions under which this work will be performed, prior to submitting prices. Failure to do so will, in no way relieve the successful bidder from the responsibility of furnishing any materials or performing any work in accordance with the true intent of the Drawings and Specifications.

C. No claim for extra compensation will be recognized if difficulties are encountered which an examination of the site conditions, Drawings and Specifications prior to executing the Contract would have revealed.

1.07 STORAGE AND REMOVAL OF MATERIALS

A. Provide suitable containers on-site for storage of materials, or store material off-site. Type and location of containers shall be subject to the approval of the Engineer.

B. The General Contractor shall provide suitable containers for all demolition and waste materials generated by this work.

1.08 CHANGES IN THE WORK

A. Any addition, deletion or change in the work which affects the contract sum will be addressed via a change order. This Contractor may be noticed to proceed with the work while the change order paperwork is being processed via a bulletin, construction change directive, or other document.

B. In addition to any requirements listed in other sections of the contract, any proposals shall be fully supported by documentation of costs, including material quantities and unit costs, labor units, labor rates and any mark-ups in accordance with the contract. Any sub-contractor proposals shall be similarly detailed. Material unit costs shall be based on the proposer's actual costs, which shall be documented by vendor quotes, invoices or other upon request. Material prices from estimating or pricing guides will not be accepted. Material prices which are in excess of the retail costs of materials in the area will not be accepted.

C. Any change order proposal shall also state the impact, if any, on the contract duration. If no such statement is made, the contract duration will remain unchanged.

D. The proposer shall bear the costs associated with reviewing, documenting and processing any change orders which are the result of a failure to properly carry out the work, or other proposals which are 1) not requested by the Owner, Architect or Engineer, or 2) are not the result of differing conditions.

E. Where the work is under construction control, any change to the work deviating from the approved construction documents must be submitted to and approved by the engineer in advance via a request for information (RFI). The reason(s) for the change must be clearly stated, such as field interference, AHJ request, convenience, etc. Unapproved changes will prevent the issuance of a Final Construction Control Document, acceptance of the work, and payment for unapproved work. The Engineer's costs for addressing RFIs as a result of proposed changes which are for the convenience of the Contractor shall be paid for by the Contractor. Regardless of the reason, approved changes shall be marked on the as-built drawings by the Contractor.

1.09 SAFETY

A. The General Contractor and this Contractor shall be jointly responsible for all safety on the Project. This shall include safety to the workers, Tenants, the Engineer and Owner and their respective employees. The General Contractor shall develop and implement all safety programs required by mandated and industry standard regulations.

B. Comply completely with permitting and safeguarding requirements of all excavation, as required by 520 CMR 14.00, Excavation and Trench Safety.

PART 2 – PRODUCTS

2.01 GENERAL

A. Products furnished shall be designed and approved for the intended use, shall meet all requirements of the Massachusetts Electrical Code (MEC), and local codes, shall be manufactured in accordance with the standard indicated, and shall meet the requirements specified in the Contract Documents. Materials and equipment shall be listed by a nationally recognized testing laboratory.

B. All material incorporated in the Work shall be new and unused. Samples of any material or item shall be furnished upon request of the Engineer, prior to approval.

C. All products shall be rated for and approved for use in the application shown, regardless of any notations on the plans. Equipment located outdoors or in wet locations shall be weatherproof, and/or enclosed in suitably rated enclosures. All equipment shall be rated for the current, voltage and phases at which they are applied.

D. All workmanship shall be of the highest quality, as determined by the Engineer. This Contractor will be required to repair or replace all Work which is not of the highest quality and workmanship.

E. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

F. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular classification of material. For example, all wire of one manufacturer, all switches of one manufacturer, etc.

G. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of performance, quality, type and style.

H. This Contractor shall be responsible for ordering and furnishing the correct quantity of material required. Routing and equipment arrangements shown on the drawings are approximate only and are not warranted to be accurate.

I. Devices and equipment shall not require batteries to operate, unless expressly specified.

2.02 WIRE AND CABLE

A. General

1. Minimum wire size shall be No.14 AWG.
2. All conductors shall be annealed copper, 98% conductivity, Class B stranding, except No.10 AWG and smaller diameter may be solid.
3. Aluminum conductors are not allowed.
4. Minimum sizes shall be No. 12 AWG for power and lighting and No. 14 AWG for control.
5. Conductors shall be identified (colored) as required by the MEC.
6. Wire and cable in underground ducts shall be approved for use in wet locations.
7. Wire and cable shall be manufactured by General Cable Co., American Wire, Okonite, or approved equal.

B. NEC Type THWN/THHN: UL 83

1. Conductors for power, lighting, grounding and control; above grade; No. 14 AWG through No. 8 AWG; shall be NEC type THWN/THHN.

C. NEC Type MC: UL 1569, with full size grounding conductor, and steel or aluminum interlocked armor sheath.

1. Metal-Clad cable shall have full size green grounding conductors.
2. Metal-Clad cable shall be used in concealed locations only. Concealed locations include above ceilings and within dry wall partitions.
3. Metal-Clad cable shall be used in dry locations only.

4. Metal-Clad cable shall be used in all areas of assembly and immediately adjacent areas.

D. Type NM-B Cable shall not be used.

2.03 WIRE AND CABLE CONNECTORS AND DEVICES

A. Wire and Cable Connectors and Devices: UL 486.

B. Ground conductors of # 14, 12 and 10 AWG shall be made up using only green wire nuts with grounding pigtail provisions.

2.04 RACEWAYS

A. Surface Raceways: UL 5. Including a system of interlocking, two piece metal raceways, fittings and outlet boxes designed for surface mounting, as manufactured by Wiremold, Hubbell, MonoSystems, T&B or approved equal. Color as selected by architect. Use surface raceway only where explicitly shown or concealed wiring methods or alternate routing of raceway/wiring is not possible, and only with the express permission of the Engineer.

B. Rigid Galvanized Steel (RGS): UL 6. Fittings – threaded.

C. Electrical Metallic Tubing (EMT): UL 797. Fittings – compression one inch and below, set screw over one inch. Pre-painted raceways are not acceptable.

D. Rigid Polyvinyl Chloride Conduit (PVC): NEMA TC 2. Fittings shall be manufactured by conduit manufacturer.

E. Flexible Metallic Conduit (FMC): UL 1.

F. Liquid-tight Flexible Metallic Conduit (LFMC): UL 360. Use for connections at exterior mounted equipment, or other location exposed to weather or wet conditions.

G. Fittings for metallic raceway shall be steel. Connectors for EMT, FMC, LFMC shall have insulated throat.

H. Steel supports or racks shall be galvanized steel channel and fittings. Supports shall be manufactured by Unistrut, Kindorf, Husky Products Company, or approved equal. Steel support rods or support bolts for conduits shall be 1/8" diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than 1/4" in diameter.

I. All required fittings, offsets and bends required shall be provided to route the conduits from source to destination, whether these are shown on the plans or not. Contractor shall/may arrange conduits as required to avoid obstructions, and account for field conditions. Provide all supports as required by the National Electrical Code.

J. Wireways shall be painted steel trough with screw mounted covers fabricated from a minimum of 14 gauge steel with ANSI grey polyester coating over phosphatized surfaces, inside and outside. Wireways shall be sized as required. Wireways shall be furnished without knockouts.

2.05 BOXES

A. Outlet Boxes: UL listed, NEMA OS 1, with marked volume. Size boxes in accordance with volume requirements of MEC.

B. Outlet boxes shall be specifically designed for the construction encountered, with suitable supports and attachments.

1. Outlet boxes shall be metallic, in gangs and configurations to suit the application, with suitable wire/cable clamps as required. Outlet boxes shall be flush mounted in all finished areas. Ceiling outlet boxes shall be listed and rated for support of light fixtures up to 50 pounds.

2. Surface mounted outlet boxes shall be specifically designed for the construction encountered, with suitable supports and attachments. Outlet boxes shall be metallic, in gangs and configurations to suit the application. Outlet boxes may be surface mounted in unfinished areas.

C. Pull boxes shall be code gauge sheet steel, painted, with screw covers. In wet, exterior or basement areas, provide galvanized sheet steel boxes, with gasketed cover. Where dimensions are shown, these are based on no splices. Increase dimensions as required if splices are provided in pull boxes

D. Existing device outlet boxes may be reused only where 1) boxes are securely mounted, 2) boxes meet volume requirements of the MEC, 3) the box is in usable, good overall condition and 4) the box can be used with the wiring method employed. Otherwise, new devices shown at the location of an existing device to be removed shall be provided with a new outlet box suitable for the device.

E. Where existing device outlet boxes are re-used or connected to, provide box extensions suitable for the installed area, to comply with MEC 314.16. Also provide all adapters, rings, etc, for mounting new devices on existing outlet boxes as required. In finished spaces, rings, extensions and adapters shall be finish appearance type approved by the Architect.

F. Junction boxes shall be of size and type to accommodate (1) structural conditions, (2) size and number of raceways, conductors or cables entering, splices, and (3) devices or fixtures for which required.

G. Special care shall be taken to set all boxes correctly square and true with the building finish. Junction boxes and accessories shall be as manufactured by Steel City, Appleton, Raco, or approved equal.

2.06 WIRING DEVICES

A. Receptacles:

1. Specification grade NEMA 5-20R 20A for 20 ampere protected branch circuits, NEMA 5-15R for 15 ampere protected circuits, 125V, side-wired, self-grounding.

2. Receptacles shall be ivory colored, with matching device plate.

3. Ground Fault Circuit Interrupter (GFCI, GFI) duplex, 20 amp, 120 volt, specification grade, 5 mA sensitivity/trip, Class A, with pilot light. GFCI receptacles shall include self-test feature, and comply with UL 943 edition in effect at time of permitting. Where non-GFI receptacles are mounted in common view with GFI receptacles, provide “designer” type receptacle to match appearance of GFI receptacle.

4. Receptacles located in exterior, damp or wet locations shall be listed as weather resistant.

5. Receptacles located in exterior locations shall be GFI type.

6. Receptacles located in unfinished basements or crawl spaces shall be GFI type.

7. Receptacles serving equipment shall be GFI type.

B. Device Plates:

1. Device plates in finished areas shall be brushed stainless steel, in other areas pressed steel, one piece, single or multi-gang type selected to match the device or combination of devices. So-called “goof” plates are not allowed.
2. Weatherproof receptacle plates/covers shall be metallic, pad-lockable rated ‘weatherproof while in use’.

C. Locations of all receptacles and switches to be reviewed prior to rough-in. Coordinate light switch locations with doors as installed, and install switches on latch side of door. Adjust locations as required, without cost. Provide three way switching for lighting at rooms with multiple entries, and at top and bottom of all stairs. Layout and locations of all switching must be confirmed with Architect and Owner prior to rough-in.

D. Wiring devices shall be manufactured by Pass & Seymour/Legrand, Hubbell or Leviton.

2.07 CIRCUIT BREAKERS

A. Circuit breakers shall be compatible with and listed for use in the existing panelboard, and shall be as manufactured by the manufacturer of the new or existing panelboard.

B. Circuit breakers shall be quick-make, quick-break molded case type in amperes and poles to suit. Coordinate with all trades, and adjust circuit breaker ampere ratings and poles as required to suit installed equipment. Where serving lighting circuits, provide switch duty (SWD) rated circuit breakers. Where serving heating, air conditioning or refrigeration loads, provide HACR rated circuit breakers.

C. Circuit breakers shall be toggle type, manually operated, trip free with simultaneous opening/closing of all common poles. Trip units shall be thermal-magnetic type. Prior to material release, verify all circuit breaker rating and poles and adjust as required and coordinate with all powered equipment to be served as installed or approved, and adjust to suit.

2.08 DISCONNECT SWITCHES

A. Disconnect switches shall be NEMA Heavy Duty Type HD, three pole disconnects with ampere rating as required by equipment served.

B. Disconnect switches located indoors shall be furnished in NEMA 1 general purpose enclosures, and NEMA 3R for outdoor areas or in wet locations. Enclosures shall be of code gauge (UL 98) sheet steel (NEMA 1) or code gauge phosphate treatment with gray baked enamel finish.

C. Disconnects shall be padlockable in the off position, and include a cover interlock to prevent opening while the disconnect is in the ‘ON’ position. Interlock shall have a defeat feature.

D. Disconnects shall be horsepower rated for 600 volts AC. Where required or shown switches shall be fused type with dual element fuses, rated as indicated on the plans, or as required by equipment manufacturer.

E. Switch blades shall be fully visible in the OFF position with the door open. All current-carrying parts shall be copper and plated through electrolytic processes to resist corrosion and promote cool operation. The handle and mechanism shall be an integral part of the box, not the cover.

F. Manual starter shall be a toggle type switch with overload protection, poles as shown, designed for use on motor circuit. Provide enclosure suitable for area installed.

G. Disconnect switches shall be manufactured by Square D, General Electric or Eaton.

2.09 EXISTING DISTRIBUTION EQUIPMENT

A. Where connections are made in existing panelboards or other distribution equipment, the panel index shall be revised to indicate the new loads served. All existing panelboards that do not have a circuit directory card mounted in a frame with noncombustible plastic cover shall have one installed on the inside of the door. All directory cards shall be properly filled in, using a typewriter, and indicate areas and devices served by each unit. Where spares or spaces are provided, mark these designations in pencil by hand.

B. New circuit breakers, disconnects, starters, etc. added to existing equipment shall be the same frame size and interrupting capacity as existing panelboards and circuit breakers. New circuit breakers installed in existing panelboards shall be listed as fully compatible with the panelboard.

2.10 FIRE ALARM SYSTEM

A. The existing FACP located on the first floor floor in the entry vestibule is an EST RMDP-1N addressable FACP. New devices shall be UL listed compatible with the existing FACP.

B. Pre-inspection: Prior to ANY work on the existing fire detection and alarm systems, this Contractor shall perform a 100% test/inspection of the existing system. This test shall document the condition of the existing system. The test shall be witnessed by the Owner's representative, and a complete pre-inspection report prepared and submitted within 24 hours of the pre-inspection. Any defective devices or other system anomalies shall be brought to the attention of the Owner's representative at that time, and noted on the pre-inspection test report. This Contractor shall be responsible for the proper operation throughout the construction period for all devices which are operational at the time of the pre-inspection.

C. Provide all wiring, peripheral devices and programming, as required to connect new devices to existing notification appliance circuits (NAC), initiating device circuits (IDC), signal line circuits (SLC) and to shut down the equipment associated with the devices.

D. Smoke Detector, photoelectric.

1. Where noted, provide duct housing, detector and sampling tubes. Provide watertight version when located exterior to the building. Provide Remote LED alarm indicators and key operated test stations shall be provided for each detector duct type detector.

    a. Where duct detectors monitor and/or shutdown equipment which is remote from the detector (such as roof mounted equipment), the detector shall be labeled with the identifier of equipment which is monitored and/or shutdown (i.e. "RTU-6"). This identifier shall also be used at the system annunciator.

    b. Also provide 6" red reflective adhesive identifier labels at the monitored and/or shutdown equipment, which are visible from the roof access point.

PART 3 – EXECUTION

3.01 MATERIALS AND WORKMANSHIP

A. Work shall be executed in workmanlike manner and shall present neat, rectilinear and mechanical appearance when completed. Maintain maximum headroom at all times. Do not run raceway exposed unless shown exposed on drawings. Material and equipment shall be new and installed according to manufacturer's recommended best practice so that completed installation shall operate safely and efficiently.

B. This Contractor shall review installation details of all electrical equipment in public areas with the Architect and cooperate fully with the Architect in this regard. Any work installed which is not reviewed with and approved by the Architect is subject to re-work at no increase in contract price.

C. All workmanship shall be of the highest quality, as determined by the Engineer. This Contractor will be required to repair or replace all Work which is not of the highest quality and workmanship.

D. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

E. Conductor fasteners shall be tightened with a torque tool in good condition to factory specifications. At time of inspection, torque tool(s) shall be available to demonstrate proper torque.

3.02 DEMOLITION

A. Demolish the existing systems to allow installation of the new systems. No components, items or materials are to be re-used, unless specifically noted herein. All demolition material shall become the property of the General Contractor, for his lawful disposal, except any material which the Owner may salvage. Equipment to be turned over to the Owner as salvaged shall be moved to on-site storage as directed by the Owner.

3.03 CONTINUITY OF SERVICES

A. Do not interrupt existing services without Owner's and Architect's approvals.

3.04 TESTING, INSPECTION AND CLEANING

A. Test wiring and connections for continuity and grounds before fixtures are connected; demonstrate insulation resistance by megger test as required. Insulation resistance between conductors and grounds for secondary distributions systems shall meet NEC requirements.

B. Verify and correct as necessary: voltages, tap settings, trip settings and phasing on equipment from secondary distribution system to points of use. Test secondary voltages at panelboards, and at other locations on distribution systems as necessary. Test secondary voltages under no-load and full-load conditions.

C. Provide necessary testing equipment and testing.

D. Failure or defects in workmanship or materials revealed by tests or inspection shall be corrected promptly and retested until satisfactory results are achieved. Replace defective material.

E. Final Inspection

1. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

F. Clean panels and other equipment. Panelboard interiors shall be cleaned and vacuumed. Equipment with damage to painted finish shall be repaired to Architect's satisfaction.

G. After completion of project, clean the exterior surface of equipment included in this section.

3.05 WARRANTY

A. Materials provided under this section shall be warranted against defects in materials and workmanship by this Contractor for not less than one (1) year from the date of substantial completion.

B. This Contractor shall respond to the site to address any warranty contact from the Owner within 48 hours. If the defective item can be repaired, it shall be repaired within 48 hours. Repairs shall be to the full satisfaction of the Owner, and repairs which render an item in a condition less than new will not be accepted. If the item cannot be repaired within 48 hours, it shall be replaced within 48 hours. If the item cannot be repaired or replaced within 48 hours, the contractor shall provide such temporary work as directed by the Owner to address the issue until such time as the issue is permanently addressed. If the issue appears to be across all same or similar products, the contractor shall be prepared to address (repair or replace) the remaining items.

3.06 ACCESS AND ACCESS PANELS

A. Provide proper access to material or equipment that require access, inspection, replacement, repair or service. If proper access cannot be provided, confer with Engineer as to best method of approach to minimize effects of reduced access.

3.07 FIRE BLOCKING AND STOPPING

A. Provide all materials and labor to penetrate or remove and re-install existing fire blocking, or re-route wiring to avoid fire blocking.

B. Provide fire stopping for all electrical conduits which enter or pass through fire rated walls or floors. Materials and methods of fire stopping shall be approved by UL. Fire seal fittings shall be used around cable, in sleeves, or in core drilled holes passing through fire rated walls and floors. Fire stopping shall be T&B Fire-Seal, O.Z. Gedney, Minnesota Mining and Manufacturing Company or approved equal.

3.08 WIRING METHODS

A. Install wire and cable in approved raceways as specified and as approved by authorities that have jurisdiction.

B. Surface metal raceways shall not be used unless explicitly specified and shown on Drawings, or approved in advance by the Engineer. Do not use surface raceways on floor. Surface raceways shall be secured to the mounting surface using concealed means. Use only fittings provided by the manufacturer of the raceway system provided. Use of surface metal raceways, where approved, in lieu of cutting, fishing wiring, patching and painting, shall not be the basis of any claim for additional compensation.

C. Wiring methods shall be as follows:

1. Interior, finished, dry locations, concealed – EMT or Type MC Cable.
2. Interior, finished, dry locations, exposed – None (conceal wiring methods).
3. Interior, mechanical, electrical or other utility spaces, exposed – EMT or RGS.
4. Interior, wet locations – RGS.
5. Exterior, rising through or above grade – RGS.

D. Only the best possible workmanship for type MC cable installation shall be accepted. Type MC cable which is not properly supported, neatly installed, or bundled shall be removed and replaced at no additional cost. The acceptability of Type MC cable installation shall be solely the determination of the Engineer.

E. Provide flexible conduits for connections to electrical equipment and to appliances and equipment that are subject to movement, vibration or misalignment; where equipment connections dictate; and where noise transmission must be eliminated or reduced.

F. All conductors shall be installed in raceways, or fished in, or run in attic spaces, as required by the NEC. Wiring shall be concealed in finished spaces.

G. All wiring in finished spaces shall be run concealed, except where surface metal raceway systems are specifically noted on the plans or otherwise approved. Provide chases, soffets and boxouts, finished to match surrounding areas, as required.

H. Splices shall be made only at device outlet boxes. Addition or re-use of boxes in finished areas solely for the purpose of splicing will not be accepted.

I. All device outlet boxes shall be set flush to the final finish surface. All openings in the surface finish around the box shall be filled in accordance with the MEC. Where device outlet boxes are located in an area with existing device outlet boxes, match mounting heights, but not less than 18” above finish floor. Mount all boxes true and plumb. Patch and paint as needed.

J. All conductors shall be neatly arranged and bundled, without excess cable at any point, but with reasonable slack to allow installation and removal of the device.

3.09 GROUNDING

A. Bond and ground equipment and systems connected under this Section in accordance with standards of MEC and other applicable regulations. Provide approved means for terminating and connecting grounding conductors, such as lugs, crimp-on terminals, green ground screws, grounding wirenuts, etc.

B. Conduit system shall be electrically continuous throughout. Equipment frames, enclosures, boxes, etc. shall be grounded by use of green colored equipment ground conductor sized as per Table 250.122 of MEC. Raceway ground alone will not be accepted.

C. Green bonding jumper shall be installed in flexible conduits.

3.10 MOTORS AND CONNECTIONS

A. Motors will be provided under other Sections.

B. Check electrical connections and sizing of motor circuit protection and prevent damage to motors and equipment from incorrect direction of rotation.

C. Review existing conditions prior to disassembly/disconnection for verification of size, speed, and operation of existing motors.

D. Consult drawings and specifications and shop drawings for verifications of size, speed, and operation of motors furnished under other Sections.

E. Final connection to appliances and motors shall be made with flexible conduit (at least 16" long) with green ground wire installed.

F. Motors, control panels and variable frequency drives (VFDs) will be furnished under other Sections. Equipment disconnects shall be provided in or on unit, mounted, with load conductors to equipment. Make all line connections at the mounted disconnects. Provide all line and load conductors and conduits, and make all line and load terminations at VFDs. Provide 120 volt single phase branch circuits at control panels.

G. Obtain necessary control wiring and interlocking diagrams from equipment suppliers for installation under this Section and connect equipment circuits for proper sequence of operation. Refer to sequence of operations provided under other Sections, and circuit equipment via control devices such as thermostats, relays, aquastats, contactors, etc.

3.11 WIRING DEVICES

A. Mount all wiring devices plumb in device outlet boxes. Center devices on boxes, and set true within the device plate. Set device plates so all edges contact surface, and conceal box edge.

B. Side wire devices only. Back wiring will not be accepted.

C. Provide neutral conductor to each switch location in accordance with MEC.

D. Locate kitchen counter small appliance branch circuit receptacle outlets spaced as required by the MEC and where applicable (in accessible, barrier-free, etc. areas) 521 CMR. Locate all other receptacles in accordance with MEC and where applicable 521 CMR spacing and location requirements.

E. In addition to any locations depicted on the plans, provide GFCI protection for all 125- and 250-volt receptacles located in the following locations, unless excepted by the Code:

1. At mechanical equipment
2. Damp and wet locations.
3. Rooftops.

3.12 CIRCUIT BREAKERS

A. Install circuit breakers in panelboards. Mark panel schedule accordingly. Panel markings shall be printed by typewriter, printer or other suitable means. Handwriting will not be acceptable. Utilized circuits shall be marked in ink. Spare or spaces shall be so marked in pencil, and may be marked by hand. No circuit shall be described in a manner that depends on transient conditions of occupancy.

3.13 FIRE ALARM

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. Permitting

1. It is recognized that various jurisdictions may have varying requirements for issuance of permits for work related to fire protection systems. Be responsible for determining the local authority(ies) having jurisdiction, what their requirements are, and providing all documents required for permitting. The Engineer will provide the contract document plans, specifications, and where requested by the AHJ, a fire protection construction documents narrative.

2. Coordinate with General Contractor for submission of, and/or prepare and submit, an NFPA 241 plan as required by the AHJ.

C. Comply completely with 780 CMR 33, Safeguards During Construction. Comply with NFPA 241 as listed in 780 CMR 35.

D. Wiring Methods

1. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. All junction boxes shall be spray painted red and labeled “Fire Alarm”, exposed conduit shall be EMT with minimum 2” wide red band maximum spacing every 5’, no less than one 2” per conduit between devices. Pre-painted raceways are not acceptable. System smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

2. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760.

3. Conduit shall be 3/4 inch (19.1mm) minimum.

4. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and signaling line circuits, and 14 AWG for notification device circuits.

5. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR). Where located in ducts, provide suitably approved cable.

6. All field wiring shall be completely supervised.

E. Test: Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

   a. Check installation, supervision, and operation of smoke detectors.

END OF SECTION 26.00.00