SECTION 16050

GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: The Contract Documents, as defined in the General Conditions, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
   1. The Contract Documents attached hereto represent portions of the Project, which have been identified by the Owner for the purpose of dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.
   2. The limits of each separate portion are determined by and are the responsibility of the Contractor who will provide direction, coordination, and resolution of disputes between separate Contractors, Subcontractors and trades in order to integrate the separate parts into the total construction of the Project.
   3. These extents, limits, and determinations are not the responsibility of the Architect/Engineer of Record.

B. Drawings are schematic and diagrammatic. Use judgment and care to install all electrical work in a practical manner to function properly and fit the building construction and finishes. Electrical conductors, conduit, components, etc., not shown or specified which are required of any device or system to produce a complete and operative system are a requirement of this specification.

C. Cooperate with other subcontractors/installers/suppliers in laying out work so that the Electrical Phase of the work will properly fit the building construction and finishes. Wall thickness, space requirements, etc., other than that shown on the Drawings, required to facilitate the electrical construction are to be directed to the Architect's and Owner's attention prior to commencing any work so that proper action may be taken to remedy this.

D. Exact location of outlets are determined from dimension on Drawings, manufacturer's shop drawings, or as may be determined on the job. Do not scale Drawings for exact location of any outlet. Verify all mounting heights by project conditions prior to rough-in.

E. Owner reserves the right to change the location of any outlet, device, or system improperly installed to fit equipment and/or finish and to change the exact location of any outlet, switch, device, etc., up to 10 feet (10') prior to rough-in with no additional cost.

F. Provide the proper number of conductors and conduits or cables to produce an operative system as specified herein.

G. No two ungrounded conductors will be connected to the same circuit breaker/fused switch in any panel. No splicing of branch circuit conductors in any panels, safety switches, or non-automatic circuit breakers in separate enclosures is allowed.

H. All materials are new. Conform to the latest requirements of Underwriter's Laboratories, National Electrical Code, National, State or local agency having jurisdiction, and National Fire Protection (NFPA) Codes.

I. Install, test, and connect all materials, devices, equipment, wiring systems, etc., in strict compliance with industry standards, manufacturer's recommendations, and as specified herein.

J. Install all materials, equipment, devices, etc., in a neat and workmanlike manner.

K. Protect from damage all apparatus and equipment furnished on this project. Equipment and materials shall be handled, stored, and protected in accordance with the manufacturer's recommendations. Store

electrical conduit to provide protection from the weather and accidental damage. Store plastic conduit on even supports and in locations not subject to direct sun rays or excessive heat. Seal, store, and handle cables carefully to avoid damage to the outer covering of insulation and damage from moisture and weather. Repair, repaint, and/or replace any piece of equipment or material marred or damaged to the complete satisfaction of Owner.

L. Any new piece of equipment, switch, device, etc., shown mounted on and/or adjacent to any equipment which if installed, would impair the proper operation of that existing equipment, will be removed and relocated by the Contractor with no cost to Owner as required in order that equipment will function properly.

M. Preperation, handling, and installation shall be in accordance with the manufacturer's written instructions and data. Coordinate work and other suppliers in furnishing and placing of work. Review shop drawings of other trades to confirm measurements as necessary to properly perform work.

1.2 DISCREPANCIES

A. Should the Contractor find discrepancies or omissions in the Contract Documents, or be in doubt as to the intent, he shall immediately obtain clarification from the Architect/Owner before proceeding with work or purchasing.

B. It is the Contractor's responsibility to review the Drawings and Specifications prior to submitting his bid, for compliance with the local regulations of the inspection agency, fire inspection agency and the local electric and telephone utilities.

1.3 RECORD DRAWINGS

A. Furnish to the Owner at job acceptance and completion one (1) set of drawings, showing an accurate location of the work actually installed related to the original Drawings. Include all approved and installed Change Orders, field condition changes, and other variations from the original Drawings and Specifications. Drawings shall be the record drawing sets that are updated on a daily basis and kept at the project site until the project has been completed.

1.4 POSTED OPERATING INSTRUCTIONS

A. Operating instructions approved by Owner shall be provided for each system and each principal piece of equipment for the use of operation and maintenance personnel. Operating instructions shall include such instructions as start-up, proper adjustment, operating, lubrication, shut-down, safety-precautions, procedure in the event of equipment failure, and any other necessary items of instruction as recommended by the manufacturer of the unit.

B. A copy of the one-line diagram with revisions shall be stored near the main distribution panel.

1.5 INSPECTIONS

A. The complete job shall, during actual construction, and for the warranty provision period, have the following performed.
   1. Upon written notice, furnish labor and tools to assist and be directed by Owner for a reasonable amount of time to make such tests and observations as are requested by the Architect and Owner pertaining to the safety and operation of any device or system installed.
   2. Inspection by any Federal, State, or local authority having jurisdiction of the project.

1.6 CODES, PERMITS, AND FEES

A. References to codes, standards, and specifications of technical societies, trade organizations, and governmental agencies shall mean latest editions.

B. This electrical installation shall comply with:
   1. Local authorities.

2. National Electrical Code (NEC).
3. The regulations of the servicing Electrical Utility Company.
4. Americans with Disabilities Act Guidelines (ADA).
5. International Building Code (IBC).
6. National Fire Protection Association (NFPA).

C. The Contractor shall obtain and shall pay for all applications and permits required by the local authorities.

D. Where, in any specific case, different sections of any of the aforementioned codes and regulations or Drawings and Specifications each specify different materials, methods of construction, or other requirements, the most restrictive shall govern. In the case of any conflict between a general provision and a special provision, the special provision shall govern.

E. Contractors proposing to undertake work under this division shall review the Drawings and Specifications subsequent to the approval for permit by the local authorities, noting any and all comments, changes or additions to the work herein described, and immediately notify the Owner for proper coordination with his work and that of other divisions. The same shall apply for any similar circumstance arising during construction, prior to the completion of work.

1.7 GUARANTEE

A. Guarantee work performed and all equipment installed under this contract shall be free from defects in workmanship and materials for a period of one year from date of final written acceptance by Owner, unless a longer guarantee is specified in the various sections..

B. Defects shall be corrected arising during this period at the contractor's own expense, upon written notice of Owner.

C. Guarantee all lamps as follows:
1. All fluorescent and high intensity discharge (H.I.D.) lamp burn-outs occurring during the first one hundred-eighty (180) days after final acceptance. Replacements for these burn-outs shall be furnished and installed upon written notice from Owner.

1.8 MANUFACTURER'S RECOMMENDATIONS

A. Manufacturer's recommendations for installation shall be followed for the installation of all equipment.

1.9 DELIVERY, STORAGE, HANDLING AND SCHEDULING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Protect stored equipment and materials from damage.

C. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.10 REMOVAL OF SALVAGE MATERIAL AND DEBRIS

A. All trash, salvage material, etc. shall be removed from the site at all times during construction on a regular basis.

1.11 TRENCHING AND BACKFILLING

A. Comply with OSHA Standards for all trenching.

1.12 CUTTING, PATCHING, FINISHING, AND PAINTING

A. Paint all exposed conduit, piping, wireways, boxes, cabinets, etc., where exposed in any space other than listed herein. Conduit, piping, etc., in mechanical rooms and electrical rooms shall be painted to match to the satisfaction of the Owner.

B. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair the structural value. Coordinate any cutting required.

1.13 CORROSION PROTECTION

A. All joints, connections, etc., exposed to climatic conditions to be completely watertight

1.14 SITE VISIT AND FAMILIARIZATION

A. Contractors proposing to undertake work shall:
1. Visit the site of the work, and fully familiarize themselves of all conditions that affect the work or cost thereof.
2. Examine the Drawings and specifications as related to the site conditions.
3. Acquaint themselves with all utility companies from whom services shall be supplied; verify locations of utility service points, demarcations and interfaces and determine exact requirements.

B. Consideration will not be granted for any alleged misunderstanding of the amount of work to be performed.

1.15 COORDINATION OF UTILITIES

A. It is the responsibility of the Contractor to coordinate all utilities location both overhead and underground and verify their locations with the various utilities prior to commencing any work. Special connection requirements shall be included.

1.16 MOTORS AND MOTOR CONTROLS FOR MECHANICAL EQUIPMENT

A. The interconnecting power wiring and conduit, control wiring and conduit, magnetic and manual motor starters, push-button stations, and 120 volt and above electrical power circuits shall be furnished and installed under Division 16.

1.17 SUBMITTALS

A. Provide submittal data bound in 8-1/2” x 11” folder with specification section referenced. Submittals shall consist of catalog datasheets containing physical dimension data and electrical characteristics complete enough to comfirm operational compliance. Where a fire alarm system is required refer to the fire alarm specification for specific submittal requirements. Submittals are required for:

1. Panelboards, switchboards.
2. Starters and drives (if applicable).
3. Lighting fixtures and lamps.
4. Generators (if applicable).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials, equipment, and devices shall meet the requirements of UL where UL standards are established for those items, and the requirements of NFPA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment locations shall be as close as practical to locations shown on the Drawings and subject to such revisions as may be found necessary or desirable at the time the work is installed. Verify all dimensions by field measurements.
   1. Minor relocations may be made where required, provided that such work is coordinated with all other work and that there will be no impairment of system operation as a result.
   2. Major relocation shall not be made without prior approval

B. All penetrations by electrical raceways or equipment through roofs, ceilings, walls or floors shall be sealed and made permanently water tight. Penetrations in fire rated assemblies and designated smoke barriers shall be sealed with UL listed fire retardant material.

C. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with the National Electrical Code.

D. The National Electrical Contractors Association publication Standard of Installation shall be used as a reference as to the minimum quality of workmanship required.

E. Surface mounted equipment, devices, and raceway is only allowed in mechanical equipment areas.

F. After work is complete clean light fixtures, panelboards, switchboards, and electrical equipment to remove dust, dirt, grease, or other marks and leave work n clean condition.

3.2 COORDINATION

A. Interferences and clearances shall be coordinated and corrected with other Trades before proceeding with the work.

B. The electrical work shall be coordinated with the work of the other trades. Obtain appropriate information of equipment prior to connection. Coordinate connection requirements, locations, etc.; some equipment may require multiple connections.

C. Coordinate the cutting and patching with other Trades of the building components to accommodate the installation.

D. Lay out the work on the premises and make proper provision for the work of other trades. The exact location of each item shall be determined by reference to the Drawings, by measurements on the site and in cooperation with other contractors. Accurately locate all openings required.

E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

F. Electrical equipment and devices shall be installed to operate without objectionable noise and vibration being transmitted to occupied portions of the building or to any part of the building structure. Provide absorption pads, shear pads, and spring isolators as required or recommended by manufacturer of equipment.

G. Install equipment and materials to provide required maintenance and code working clearance for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

3.3 EQUIPMENT IDENTIFICATION

A. Provide nameplates for the following as a minimum requirement:
   1. Switchboards, starters, disconnects, panelboards.
   2. Individual Breakers, Disconnect Switches and Motor Starters, Contactors and Relays.

3. National Electrical Code Requirement: Other equipment and installations required to be identified or provided with warning or caution signs shall be so treated in a manner to comply with the National Electrical Code (NFPA 70) requirements and as contained herein.

B. Provide complete warranty information for each item. Include date of beginning of warranty or bond, duration of warranty or bond, and names, addresses, telephone numbers and procedures for filing a claim to obtain warranty services.

3.4 PAINTING OF EQUIPMENT

A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA.

B. Field Applied: Paint electrical equipment as required to match finish or to meet safety criteria. Touch-up paint of all equipment shall be required where equipment has become damaged as a result of handling, rusting, etc. Paint shall match completely the existing finish.

3.5 TESTING

A. Perform tests as specified to prove installation is in accordance with contract requirements. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications. Typed records of all the following tests shall be included in maintenance instructions. Tests, in addition to specific system test described elsewhere, shall include:

1. Circuit Continuity: Test feeder and branch circuits for continuity. Test neutrals for improper grounds.

2. Equipment Operations: Test motors for correct operation and rotation.

3. Circuit Numbering Verification: Select on a random basis, various circuit breakers in the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.

4. Product Failure: Products which fail during the tests or are ruled unsatisfactory by the Architect shall be replaced, repaired or corrected as prescribed by the Architect at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

5. Miscellaneous: Include test results in the maintenance manual. Cost, if any, for all tests shall be paid by the Contractor.

6. Fire Alarm and Interlock Systems: Product malfunction symptoms in operating systems to test alarm and interlock systems. Each fire alarm signal initiating device, including all smoke detectors, shall be activated to verify proper zone annunciation and alarm signal interlocks. Activation of ionization type smoke detectors, both ceiling and duct type, shall be accomplished by means of a smoke emitting device per manufacturer's recommendations. Photoelectric type shall be tested by interrupting light beam. Correct operation of alarm circuit annunciation in the fire alarm zone annunciation panel shall be verified. [Refer to Fire Alarm Section for additional testing.]

7. Insulation Resistance: Perform 1000-volt D.C. tests for one minute on all equipment (i.e. panelboards, switchboards, distribution panels, motors) rated 300 volts and higher for feeder and branch circuit conductors, including the neutral. Repair or replace circuits showing less than 10 megohms resistance to ground.

8. Emergency Lighting and Exit Light: Contractor shall test in field after installation each emergency light and exit light. Test results shall be documented in type written report to the owner or witnessed by the owner.

END OF SECTION

SECTION 16110

RACEWAY SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduits, cable trays, ducts, boxes, etc.

B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
   3. ANSI C80.5 - Rigid Aluminum Conduit.

B. National Electrical Contractors Association (NECA):
   1. NECA "Standard of Installation."

C. National Electrical Manufacturers Association (NEMA):
   1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   2. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   3. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   4. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

D. National Fire Protection Association (NFPA):
   1. ANSI/NFPA 70 - National Electrical Code.

E. Design Requirements
   1. ANSI/NFPA 70 (N.E.C.), unless noted otherwise on the Drawings.
   2. Furnish products listed and classified by Underwriters Laboratories, Inc.

1.3 PROJECT CONDITIONS

Routing shown on drawings is diagrammatic only, determine exact routing and lengths required.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Minimum size conduit as follows:
   1. 1/2" for power and branch circuit wiring, unless noted otherwise on the Drawings.
   2. 3/4" for telephone and data, unless noted otherwise.
   3. 3/4" for all below grade/in-slab conduit.

B. Install in accordance with the following schedule
   1. In all concrete: Galvanized rigid steel (GRC) or Schedule 40 PVC as noted. Coat metallic conduit with polyvinyl polyethylene or asphalt application.
   2. Above suspended ceilings: electrical metallic tubing (EMT).
   3. In metal stud walls: electrical metallic tubing (EMT).
   4. In exposed locations indoors: Galvanized rigid steel (GRC), intermediate grade rigid steel (IMC), electrical metallic tubing (EMT). Exceptions noted on the Drawings or where prohibited by codes.
   5. Conduit in earth (no encasement): Galvanized rigid steel (GRC) or Schedule 40 PVC as noted. Coat metallic conduit with polyvinyl polyethylene or hot asphalt application.
   6. In classified areas: GRC with seals as required.
   7. MC cable may be used only where all of the following conditions are met:
      a. final connections to fixtures and equipment
      b. restricted to 5 feet maximum length
      c. areas concealed from public view
      d. areas where EMT would be acceptable.

2.2 FITTINGS

A. Use insulated throat connector fittings listed for the raceway on which they are used.

2.3 CONDUIT STRAPS AND HANGERS

A. Two (2) hole push on stamped steel straps. Use on surface areas such as concrete, masonry, wide flange beams, columns and wood.

B. Where conduits are grouped together, use trapeze hangers consisting of all thread rods sized as required 1/2" x 1-7/8" (12 gauge) with single bolt channel pipe straps and rolled strut.

2.4 EXPANSION AND SEAL-OFF FITTINGS

A. Expansion fittings in conduits where shown on the Drawings or where required to pass through expansion joints embedded in concrete.

B. Seals at all freezer/cooler penetrations.

C. Seals at all classified areas.

2.5 CONDUIT

A. Rigid Galvanized Steel Conduit (GRC): ANSI C801. UL6.
B. Intermediate Metal Conduit (IMC): UL1242.
C. Flexible Metal Conduit: Interlocked steel and aluminum construction.
D. Nonmetallic Conduit NEMA TC 2: Schedule 40 PVC.
E. Liquidtight Flexible Metal Conduit: Interlocked steel and aluminum construction with PVC jacket.
F. Electrical Metallic Tubing (EMT): ANSI C80.3.

2.6 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported.
   2. Receptacle and Switch Boxes – sized for the appropriate number of conductors.

B. Cast Boxes: NEMA FB 1, Type FD. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.7 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install all raceway in accordance with manufacturer's instructions.

B. Size all raceway in accordance with NEC.

C. Group related conduits; support using conduit rack. Construct rack using approved steel channel.

D. Do not support conduit with wire or perforated pipe straps in any type structure. Remove wire used for temporary supports. Steel tie wire may be used to anchor conduit down to reinforcing rods in concrete encasement only. Do not attach conduit to ceiling support wires.

E. Arrange conduit to maintain headroom and present neat appearance. . Route all conduit whether exposed or concealed parallel and perpendicular to walls, ceilings, building structures, etc. Maintain adequate clearance between conduit and piping. Cut conduit square; de-burr cut ends and ream. Bring conduit to shoulder of fittings; fasten securely

F. Use conduit hubs or locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

G. Use conduit bodies to make sharp changes in direction. Telephone and computer system conduit bends shall not exceed three (3) 90 degree turns prior to installing pull box. Comply with NFPA 70 on all bends. Make conduit bends only with bending tools.

H. Avoid moisture traps; provide junction box at low points in conduit system.

I. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

J. Provide suitable nylon pull string in each conduit except sleeves and nipples.

K. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

L. Ground and bond conduit.

M. Install knockout closures in unused box openings.

N. Support boxes independently of conduit.

O. Cap all upturned conduits during construction rough-in to prevent moisture or debris from entering. Swab to remove any and all moisture.

P. Support conduits as required by NFPA 70 (N.E.C.)

Q. Install conduit to preserve fire resistance rating of partitions and other elements with appropriately rated Firestopping materials. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation. Complete installation of all raceway prior to painting of area. Any raceway installed after painted must be painted to match with the same paint to the satisfaction of the owner. All cable and wiring installed must be concealed in raceway or in cable tray so as not to be visible in public areas. Any cable or wire found visible in public spaces at final inspection shall be concealed to the satisfaction of the Owner.

END OF SECTION

SECTION 16120

WIRES AND CABLES

PART 1 GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Wire and cable.
   2. Wiring connectors and connections.
   3. Telecommunications wire

B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):
   1. ANSI/NFPA 70 - National Electrical Code.

B. Regulatory requirements
   1. Conform to requirements of ANSI/NFPA 70.

1.3 PROJECT CONDITIONS

A. Routing shown on Drawings is diagrammatic only. Determine exact routing and lengths required.

B. Determine required separation between cable and other work.

C. Determine cable routing to avoid interference with other work.

PART 2 PRODUCTS

2.1 WIRE AND CABLE

A. Description: Single conductor insulated wire.
B. Conductor: Copper.
C. Insulation Voltage Rating: 600 Volts.
D. Insulation: ANSI/NFPA 70, Type THHN/THWN. (Feeders may be XHHW.)
E. Insulation Temperature Rating 90 degrees C.
F. UL Listed. Minimum size #12 for power circuits and #14 for control circuits unless noted otherwise.

2.2 TELECOMMUNICATION WIRE

A. Voice: Category 3, UTP, 4 pair, jacketed.
B. Data: Category 5, UTP, 4 pair, jacketed.

PART 3 EXECUTION

3.1 GROUPING OF CONDUCTORS

A. Maximum three hots, three neutral, and three ground may be contained in one raceway without derating. This does not imply a neutral is required for each hot.

B. Mixing of conductors from different voltage classes is prohibited.

3.2 INSTALLATION

A. Swab raceway before installing wire.

B. Install products in accordance with manufacturers instructions.

C. Use stranded conductors for control circuits and final connections to all vibration equipment.

D. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.

E. Install a properly sized grounding conductor in all raceways containing power circuits.

F. Pull all conductors into raceway at same time.

G. Protect cable from damage.

H. Clean conductor surfaces before installing lugs and connectors.

I. Make splices, taps, and terminations to carry full ampacity of conductors.

J. Use only compression connectors for copper conductor splices and taps, #6 AWG and larger.

K. Use solderless pressure compression connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller 90 degrees C rated.

L. Inspect wire and cable for physical damage and proper connection.

M. Verify continuity of each branch circuit conductor.

N. Comply with the following color code or as required by local authority:

<u>208Y/120 Volt System</u>
Phase A - Black
Phase B - Red
Phase C - Blue.
Neutral - White.
Equipment Ground - Green.

O. Electrical Tests:
1. Perform insulation resistance test on each feeder and branch circuit conductor with respect to ground and adjacent conductors. Applied potential: 1000 volts dc for 1 minute.
2. Perform continuity test to insure proper cable connection.
3. Minimum insulation resistance values: two megohms.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall switches.
   2. Receptacles.
   3. Device plates and box covers.
   4. Photocells.

B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. National Electrical Contractors Association (NECA):
   1. NECA - Standard of Installation.

B. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

C. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories, Inc. (UL):

E. Regulatory Requirements:
   1. Conform to requirements of NFPA 70, Underwriters Laboratories.
   2. Provide Products listed and classified by Underwriters Laboratories, Inc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hubbell, GE, Leviton, Pass and Seymor, Tork, Intermatic

2.2 MATERIALS

A. Color: Ivory or as required by Architect. All devices commercial grade.

B. Receptacles shall be 3 wire, grounding type, side and backwired, 20A, 125V (in dwelling units 15A is acceptable). Ground-fault receptacles shall have feed-through. All receptacles for circuits other than 125V shall be standard NEMA configuration.

C. Switches shall be 20A, 120-277V, snap type. Switches used for mechanical equipment shall have pilot lights.

D. Cover plates shall be stainless steel. Weatherproof where exposed to elements. Where equipment in a weatherproof area is to be continuously engaged the weatherproof covers shall allow closure with the plug installed.

E. Space occupancy Sensors: Wattstopper W Series Ultrasonic ceiling mount line voltage occupancy sensor or equal for lighting control parallel to switches in all classrooms and multiple user restrooms. Wattstopper Model W-1000A or better for all classrooms.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions prior to beginning work.

B. Verify that outlet boxes are installed at proper height.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install devices plumb and level. Gang switches where practical.

C. Coordinate ceiling mounted occupancy sensor location for optimal performance with other ceiling mounted appliances. Connect to allow local manual switch override.

D. Install switches with OFF position down.

E. Install receptacles with grounding pole on bottom.

F. Interface with other work:
1. Coordinate locations of outlet boxes to obtain appropriate mounting heights. Work to relocate boxes will be performed at no cost to the owner where boxes were not coordinated prior to rough-in.
2. Install wall switch 48 inches center line above finished floor.
3. Install convenience receptacle 16 inches center line above finished floor unless noted.

G. Clean exposed surfaces to remove splatters and restore finish.

H. Operate/test that all devices are energized and work properly.

I. Clean all devices.

END OF SECTION

SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Service entrance switchboard and associated items of equipment, panelboards, and transformers.

B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. Work under this Section shall comply with the following:
   1. Latest edition of the National Electrical Code (NFPA-70), and interim amendments in effect. Comply with local and state, utility regulations and laws.

1.3 SYSTEM DESCRIPTION

A. Electrical System Voltages: As indicated on drawings.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Items of electrical distribution system, including switchboards, panelboards, safety switches, etc. manufactured by one of the following, unless otherwise indicated on Drawings.
   1. General Electric.
   2. Square D.
   3. Siemens
   4. Eaton

B. Equipment will bear name and trademark of manufacturer as listed above.

2.3 PANELBOARDS

A. Panelboards: Install as scheduled on Drawings, including voltage, amperage, bus bracing, and interrupting ratings.
   1. Main lugs only (MLO), main circuit breaker (MCB), or main fusible switch (MFS) panelboard and branch devices as indicated on Schedule. NEMA PB1, Tin plated aluminum or copper.
   2. Branch Circuit Protective Devices: Bolted type thermal magnetic center-trip circuit breakers for alternating current, each with single-handle common trip. Tandem or half-sized circuit breakers or load center type construction not permitted. Circuit breaker Amp Interrupting Capacity (AIC) no less than values indicated on Drawings.
   3. Cabinets: Zinc-coated sheet steel with knock-outs, UL listed and labeled. Trims and doors to have manufacturer's standard color. Trims to be fitted with hinged doors having combined lock and latch. Locks will be keyed alike and furnished with two keys for each panelboard.
   4. Directory Holder: Provide typewritten circuit directory identifying load(s) on each circuit under clear plastic cover.

2.5 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.

2.9 FUSES

A. Manufacturers: Bussman, Gould-Shawmet

B. Description: Dual element, current limiting, time delay, 250 or 600 volt as required, UL 198E, Class RK 1.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's recommendations, power company requirements, and as indicated on Drawings.

B. Install service in accordance with utility company's requirements, necessary to provide complete electric service as indicated on Drawings.

C. Required items include, but are not limited to, trenching and backfilling, primary and secondary conduits, service conductors (including primary conductors where required), C.T. cabinet, bussed enclosure, other associated metering hardware, and grounding system per local utility or codes.

D. Perform Work in strict compliance with local utility's requirements, with any applicable local codes and latest edition of NFPA 70.

E. Install panelboards in accordance with NEMA PB 1.1. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor. Top breaker maximum height not to exceed 6’-8".

F. Provide filler plates for unused spaces in panelboards.

G. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. The branch circuit directory shall clearly indicate load served.

H. Tighten accessible bus connections and mechanical fasteners after placing switchboard. Tighten bolted bus connections in accordance with manufacturer's instructions.

I. Adjust circuit breaker trip and time delay settings as required.

J. Install disconnect switches and fuses where indicated on drawings or where required by equipment and NFPA 70.

K. Provide permanent label on inside door of each switch indicating UL fuse class and size for replacement.

L. Install enclosed controllers where indicated, and in accordance with manufacturer's instructions.

M. Height: 5 ft to operating handle.

N. Provide engraved plastic nameplates on all panelboards indicating name; and on all disconnects, starters, etc. indicating load name.

END OF SECTION

SECTION 16510

LUMINAIRES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luminaires and accessories.
   2. Emergency lighting units.
   3. Exit signs.
   4. Ballasts.
   5. Lamps.
   6. Luminaire accessories.

B. Related Documents: Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.
   2. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.
   3. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code.
   2. NFPA 101 - Life Safety Code.

1.3 SUBMITTALS

A. Provide factory cutsheets including photometric data for fixtures. All cutsheets shall be labeled with fixture designation.

B. Provide factory cutsheet including energy performance for ballasts.

C. Provide factory cutsheet for all lamps.

PART 2 PRODUCTS

2.1 LUMINAIRES

A. Fixtures are scheduled based on one manufacturer. Equivalent products by Acuity Brands, Holophane, Cooper, and Philips Companies are acceptable.

2.2 BALLASTS

A. Manufacturers:
   1. Motorola.
   2. Advance.
   3. General Electric.

B. Ballasts shall include a three year warrantee.

C. Ballast shall provide Independent Lamp Operation for Instant Start ballast allowing remaining lamp(s) to maintain full light output when one or more lamps fail.

D. Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.

E. Ballast shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency). GOPA ballasts shall operate from an input source of 347V.

F. Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz and 52 kHz to avoid interference with infrared devices, eliminate visible flicker and avoid Article Surveillance System, such as anti-theft devices.

G. Ballast shall have a Power Factor greater than 0.98 for primary lamp.

H. Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.77 for Low Watt, 0.87 for Normal Light Output, and 1.18 for High Light for Instant Start ballasts or 0.71 for Low Watt and 0.88 for Normal Light Output for Programmed Start ballasts.

I. Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less.

J. Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.

K. Ballast shall have a Class A sound rating for all 4-foot lamps and smaller.

L. Ballast shall have a minimum starting temperature of -29C (-20F) on Instant Start ballasts.

M. Ballast shall not contain any Polychlorinated Biphenyl (PCB).

N. Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.

O. Ballast shall comply with ANSI C62.41 Category A for Transient protection.

P. Ballast shall comply with ANSI C82.11 where applicable.

Q. All ballasts for tube lamp fluorescent fixtures shall have integral disconnect means.

2.3 LAMPS

A. Lamp Manufacturers:
   1. General Electric.
   2. Sylvania.
   3. Phillips

2.4 BATTERIES

A. Exit lights shall have 90 minute battery back-ups with test buttons. Other fixtures serving as emergency lights shall be provided with 90 minute battery back-ups. Fixtures shall be powered by the battery when normal power is off.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires and exit luminaire signs using pendants supported from swivel hangers or in accordance with details shown on drawings. Provide pendant length required to suspend luminaire at indicated height.

B. Install surface mounted luminaires and exit luminaire signs plumb and adjust to align with building lines and with each other. Secure to prevent movement. Mount exit signs to flush box.

C. Install in accordance with manufacturer's requirements to obtain a complete operational lighting system.

D. Install exit luminaire signs at height required by local authority.

E. Aim and adjust luminaires as directed by owner and local authority.

F. Position exit luminaire sign directional arrows as required by local authority.

G. Clean photometric control surfaces.

H. Clean finishes and touch up damage.

I. Relamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

SECTION 16720

FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. NFPA 72, National Fire Alarm Code; NFPA 70 National Electrical Code; Local building code; Local authority.

1.2 SUMMARY

A. System includes a manual fire alarm system serving multiple buildings. System shall meet NFPA 70, NFPA 72 and local authority requirements. System shall be a manual system with pull stations located at all exists, smoke detectors at all fire alarm panels (master and auxiliary), door hold-opens, and notification appliances in all restrooms, corridors, classrooms, and offices.

B. The system shall upon completion of entire project be one master project with a master fire alarm panel in the northeast building offices and an auxiliary panels in each building. Each individual building devices shall be wired to a local auxiliary panel which provides power and control. All auxiliary panels shall communicate to the master panel as one common system. The system shall allow each individual building to be added to the master system as work progresses with the master system on line and active.

C. The master panel shall be installed prior to any other work. Due to phasing of construction coordinate installation of auxiliary panel wiring connections to master panel. After completion, replace any interconnect cabling routing underground or over roofs, with cabling routed through corridor ceilings.

1.3 SUBMITTALS

A. Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility with all others systems interfacing with the fire alarm system. Identify on the drawings, conductor sizes and types. Provide each device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device.

B. The contractor shall include the following information in the equipment submittal:
   1. Power calculations.
      a. Supervisory and alarm power requirements for all equipment
      b. Justification showing power requirements and battery capacity calculations of the system power supplies.
      c. Voltage drop calculations for wiring runs in worst cast conditions.
   2. Data shall be submitted on the following:
      a. FACP including all fire detection.
      b. Power supplies, batteries, and battery chargers.
      c. Equipment enclosures with module layouts showing space allocation.
      d. Intelligent addressable manual pull stations, heat detectors, smoke detectors, alarm monitoring modules, and supervised control modules.
      e. System audible and visual signals.
      f. Software and firmware as required providing a complete functioning system.
      g. Internal wiring.
      h. System programming instruction manual. menu-drive programming software and proposed system program.
      i. System installation, operation and maintenance manual including all modules.

3. Data describing more than one type of item shall be clearly marked to indicate the type provided for a given application. The reviewing authority will assume that all options not crossed out in submittal material will be furnished for the project. All submittal material shall be complete. Partial submittal will not be accepted. Submit copies of UL listing or FM approval data showing compatibility of the proposed device or appliance and the panel being provided.

1.4 QUALITY ASSURANCE

A. The complete installation shall conform to the applicable sections of NFPA-72, Local code Requirements and National Electrical Code.

B. Each and all items of the Fire Alarm System shall be listed by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

C. Installer: Qualified with at least 5 years of successful installation experience on projects with fire alarm and detection system installation work similar to that required for project.

D. Provide a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. Include a control panel, manual pull stations, automatic fire detectors, horns, flashing lights, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system. No special tools, modems, or and off-board programmer shall be required to program the system so as to facilitate ease of expansion, building parameter changes or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

E. All panels and peripheral devices shall display the manufacturer's name on each component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer or devices and equipment with a minimum of 10 years experience and meeting all UL listing/labeling requirements. Installer shall have a minimum of 5 years experience on equivalent projects with proposal manufacturers items. Documents verifying requirements are met shall be provided if requested.

2.2 SYSTEM OPERATION

A. The automatic fire detection and alarm system shall consist of main control panel, analog/addressable detection devices, manual stations, audial/visual devices wired in accordance with the drawings and shall function as specified herein.

B. The system shall be capable of monitoring a future fire protection sprinkler system.

C. The control panel shall provide power, annunciation, supervision and control for the fire detection and alarm system. The control panel shall be modular in construction, and contain equipment meeting the requirements of this specification as necessary. The system shall be designed such that alarm indications override trouble conditions.

D. The system shall function as follows when any manual station or automatic detection device operates:
1. General alarm audible and visual devices shall sound until acknowledged and silenced at panel.
2. Device address and location message shall display at panel. Once alarm is acknowledged, this same readout shall latch on. A subsequent alarm received from another devce after silencing shall flash the subsequent device alarm on the control panel. Control panel to be capable of storing 800 historical events.
3. Automatically notify fire department or central station.

4. Light an indicating lamp on the device initiating the alarm.
5. Shut down applicable air conditioning units.
6. An audible alarm tone shall occur within the control panel until silenced.
7. Any zone activated alarm shall send a signal (dry contacts only) to energy management system, where applicable.
8. The activation of any alarm device will release all smoke dampers, where applicable.
9. Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system. When the switch is in the “off-normal” position (bypass), a trouble condition will appear at the control panel.

2.3 SYSTEM SUPERVISION

A. The system shall have independently supervised initiation circuits so that fault in any one zone shall not affect any other zone. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

B. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicate at the control panel. A “power on” LED shall be displayed continuously while incoming power is present.

C. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audible and visually indicated at the control panel.

2.4 POWER REQUIREMENTS

A. The control panel shall receive 120 VAC power via a dedicated circuit.

B. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode of a period of twenty-four (24) hours with five (5) minutes of alarm indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

C. All circuits requiring system-operating power shall be 24VDC and shall be individually fused at the control panel.

2.5 MATERIALS AND EQUIPMENT

A. Control Panel:
1. The control panel shall provide power, annunciation and control for the detection and alarm system. The control panel shall be recessed modular in construction, and contain all modules necessary to operate according with the section. The system shall be capable of reading and displaying at the control panel, the sensitivity of remote analog/addressable detection devices. Individual analog/addressable detection device alarm threshold shall be adjustable from the control panel. The detection system shall remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode. Analog/addressable detection devices shall be in alarm at any time up to the total number connected to the system.
2. The control panel shall be capable of supporting non-addressable as well as analog/addressable detection devices.
3. The panel annunciator shall be a 32 character alphanumeric display, which shall provide an optional user definable message associated with each detection device or zone.
4. Dynamic supervision of system electronic, wiring, detection devices and software shall be provided by control system. Failure of system hardware or wiring shall be indicated by type and location on the alphanumeric annunciator. The system shall provide fail-safe operation, i.e. incoming alarms shall automatically override all other modes of operation, and the panel shall automatically return to normal operating mode from any operator initiated mode.
5. Ground fault detection shall be provided for all initiating and audible circuits. Lamp test capability shall be provided to test all visual panel indicators and associated software. The control panel

shall be equipped with a silence before reset feature, designed to prevent accidental system reset during an alarm condition.

6. The system alarm lamp shall flash upon receipt of any alarm condition. Acknowledgement of the alarm by operation of the silence switch shall silence the audible alarm and cause the alarm lamp to light steadily. Receipt of subsequent alarms shall cause the audible devices to resound and the alarm lamp to flash.
7. The system trouble lamp shall flash and an integral trouble buzzer shall sound upon the occurrence of any trouble condition. Acknowledgement of trouble condition by operation of the silence switch shall silence the audible alarm and cause the trouble lamp to light steadily. Receipt of subsequent trouble shall cause the trouble buzzer to resound and the trouble lamp to flash.
8. The service mode shall permit the arming and disarming of individual detection or output devices as well as manually operating output devices. The panel shall automatically return to normal mode in the event that the panel remains unattended in the service mode.
9. The panel shall be capable of receiving and processing alarm even when in the service mode.
10. The control shall operate from a three wire 120 VAC supply, or when so configured 120 VAC and internal AC and DC shall be separately fused within the control. Light emitting diodes (LEDs) shall be included to indicate (green) system power, (yellow) trouble, and (red) alarm; trouble and alarm shall also be annunciated on an alpha-numeric display which will give device number and location plus diagnosis of trouble. Momentary contact switches shall provide for Locate, Next Alarm, Next Trouble, Acknowledge/Silence and Reset. An audible device shall sound within the control cabinet for alarm or trouble. Alarm shall override any trouble condition.
11. The control power supply shall be capable of powering up to 240 addressable early warning detectors and at least four (4) audible signal circuits. All system expansion modules shall interconnect through a card edge connecter and shall require no inter-module wiring.
12. Each device on an addressable initiating circuit shall be checked continuously to include the following: sensitivity, responses, opens, shorts, ground faults, functionally and status.
13. The control shall report the failure of a device's transmitting component(s), open or shorted, on an addressable initiating circuit. The device shall be recognized and identified by location within the circuit to the specific device, and all others devices on the circuit shall continue to function properly.
14. A programmable signal module shall provide leased line or city tie an output circuit for operation of DC audible devices.

B. Ceiling Mounted Smoke Detectors, at Fire alarm main panel, each auxiliary panel, and on both sides of doors on hold-opens.

C. The manual pull station shall be listed by Underwriters Laboratories, Inc. The manual pull station shall be non-coded, double action and shall operate on any addressable detection circuit. The addressable manual fire station shall be individually annunciated on the control panel.

D. The audio/visual units shall have a candela rating and dB rating as required by NFPA 72, flashing strobes with low current draw. Strobes are vertical wall mounted with clear lens window and lettering reading "FIRE" vertically. Cover plate finish shall be textured red enamel. Strobes shall flash in synchronization. Contractor to install recessed junction box in finished areas. Visual appliances shall have selectable strobe settings of 15, 30, 75, 95, 110, and 115 cd. Combination Audio/Visual units to be used in all locations where both audio and visual notification is required.

E. Door hold-opens, 24VDC powered from fire alarm system, electro-magnetic, mount at top of doors. Provide area smoke detector on ceiling on both sides of all doors on hold-opens.

F. Fire alarm cabling to be as required by Fire Alarm Manufacturer, listed for use, and with red jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendation. All wiring shall be installed in strict compliance with all the provisions of NEC. Upon completion, certify in writing to owner. Installation also to comply with all "Americans with Disabilities Act" (ADA) regulations for Audible and Visual Alarm devices. Any areas found to be deficient of audible and/or visual alarm devices are to have additional devices added so as to comply, with no additional cost to the Owner.

B. All fire alarm cabling to be installed in conduit or rated for open installation. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.

C. Installation of equipment and devices that pertain to other work in Contract shall be closely coordinated with all trades.

D. Clean all of the fire alarm equipment after completion of installation.

E. Provide connection to all duct smoke detectors, door hold-opens, and smoke dampers as applicable.

F. All splices shall be made using solderless connectors or compression type terminal strips. All connectors shall be installed in conformance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. Testing – General:
1. Furnish all test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.
2. All intelligent analog devices shall be tested and logged for correct address and sensitivity using test equipment specifically designed for that purpose.
3. After installation, wiring, and check-out of all Fire Alarm devices; areas that are determined to be deficient to have additional Fire Alarm Audial/visual devices added to the total system, at no additional cost to the Owner.
4. The completed Fire Alarm System shall be fully tested in accordance with NFPA-72 by the Contractor in the presence of the Owner's representative and the Local Fire Marshall.

B. Acceptance Testing:
1. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared in accordance with NFPA 72, and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

3.3 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include, but not be limited of, the following:
1. System record drawings and wiring details including one set of reproducible masters.
2. System operation, installation and maintenance manuals.
3. Written documentation all logic modules as programmed for system operation.
4. Documentation of systems voltage, current and resistance reading taken during the installation and testing.
5. If required by local jurisdiction, contractor shall provide documents certifying that the final installation is in conformance with the design documents, NFPA 72 and all codes applicable to the installation.

3.4 WARRANTY/SERVICES

A. The contractor shall warrant the entire system against mechanical and electrical defects for a period describe in the contract general terms. This period shall begin upon completed certification and test of the system.

B. The fire alarm system subcontractor or manufacturer shall offer the owner's consideration at the time system submittal a priced inspection, maintenance, testing and repair contract in full compliance with the NFPA 72.
   1. The services offered under this contract shall be performed at no charge during the first year after system acceptance and owner shall have the option of renewing for single or multiple years up to five years at the price quoted upon completion of the warranty period.
   2. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

C. Furnish training as follows for to system user:
   1. Conduct walking tour of project and briefly describe function, operation and maintenance of each component.
   2. Training in the receipt, handling and acknowledgement of alarms.
   3. Training in the system operation including manual control of output functions from the system control panel.
   4. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.

END OF SECTION