DIVISION 16

ELECTRICAL

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The General Conditions, any supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this section as fully as if herein.

PART 1 – GENERAL

1.1 Scope of Work:

A. Note: - This work is subject to applicable mechanical sections where there is specified equipment with electrical connections. All work in other parts of Division 16 shall meet requirements of this section.

B. This work includes all labor, materials, equipment and services for a complete electrical system. Included in this contract, but not limited to, is the following:

1. Coordination of connections and providing conduits for all work required for the complete installation of electrical.

2. Electrical equipment and building grounding systems.

3. Furnish and install electrical connections complete to all equipment.

4. Coordinate connection of mechanical and heating and cooling equipment with furnishing trade. Furnish and install motor starters and disconnects as required by National Electrical Code. Do all power wiring from panel to disconnect to starter and to motor or equipment. Wire all line voltage controls carrying motor or equipment power. Interconnecting low voltage or control wiring shall be done under section specifying the equipment.

5. Support systems for electrical work.

6. Cutting and patching for installation of work specified under Division 16.

7. Test of electrical systems.

8. Demolition of electrical, see demolition drawings for notes.

9. Facility communication system and all interconnecting wiring and conduits.

10. Fire alarm system. Provide a manual toggle switch located at the main entrance which shall shut down all HVAC systems.

C. Under this section provide electric services for all fixtures, appliances and items of equipment requiring same and shown on any contract drawings, specified under this division, mechanical division or any other division or specifications,

or specified to be furnished by Owner.

D. Electrical contractor is strongly urged to examine the premises and observe the existing conditions under which site work will be done and all other circumstances which will affect work before submitting bid. The submittal of a bid will indicate that the contractor has made a site visit and has full knowledge of the existing conditions and any problems which may occur in the completion and performance of the work.

1.2 Local Conditions:

A. Examine the premises and observe the conditions under which work will be done and all other circumstances which will affect the work before submitting bid. The submittal of a bid will indicate that the Contractor has full knowledge of the problems involved in the performance of the work.

B. Verify, in the field, scale dimensions on plans.

C. Contractor shall note that portions of the existing building will remain operational during construction.

D. Check architectural, structural, mechanical, and electrical plans to avert possible installation conflicts.

E. Prior to installation of materials and equipment, discrepancies between plans and actual field conditions or between plans and specifications shall promptly be brought to the attention of the Architect/Engineer for a decision.

1.3 Applicable Codes and Standards:

A. Unless stated otherwise in the GENERAL CONDITIONS, the currently adopted codes by the enforcing authorities shall govern.

1. NFPA Codes.

2. IBC Building Code.

3. Local codes.

4. Requirements of the Fire Marshal.

5. ADA.

6. Maryland Building Code for the Handicapped.

7. ANSI A117.l - 2004.

1.4 Listed Equipment:

A. All electrical equipment and cables shall be labeled or listed by a nationally recognized listing or testing agency. The equipment shall be installed only in applications for which it is listed and as per the listing requirements. Should this specification inadvertently indicate a manufacturer whose equipment is not listed or labeled, the contractor shall notify the Engineer for direction. Under no instance shall the non-listed equipment be installed.

1.5 Energy Star Compliance:

A. All light fixtures used on this project shall be in compliance with the State of Maryland "Energy Star" program.

1.6 Submittals:

A. All submittals shall include sufficient data to make a thorough evaluation of features, construction and performance. Submittals shall be bound in booklet form with a cover sheet indicating each item and respective manufacturer's catalog number.

B. Materials, equipment and fixtures shall completely satisfy specification requirements and be suitable for their intended use. Items or equipment submitted shall include all accessories and options recommended by the manufacturer for satisfactory, reliable and safe operation in its designated location.

C. Where model number or name of one manufacturer is followed in specifications by one or more other manufacturer's names, design has been based on first product named and shall be considered to be the specified product or manufacturer, named alternates may require minor deviations. Contractor shall indicate deviations in submittals/shop drawings.

D. Under base bid, furnish equipment and material specified or named alternates. Products submitted shall be equal in quality to products of the specified manufacturer and shall include the standard features of the specified product and also optional features or necessary changes specified herein. Submittal of alternates shall include all changes in building systems, piping, wiring, supports or accessories required for satisfactory and intended operation. Engineer shall be final judge of equivalence.

E. Substitute equipment submitted shall include a price change or advantage to Owner, if accepted, at time of submission. Product and performance requirements of substitute items shall be the same as named alternates.

F. Contractor shall insure that material and equipment delivered to job site is suitable for the intended application and indicated connections. Review of shop drawings shall not include review of specified quantities.

G. Review of and noted comments on Contractor's submitted shop drawings do not

constitute a change order or a waiver of contract requirements. In the event of conflict between submittals or shop drawings and contract documents, the latter shall govern. If waiver of particular requirement is requested by Contractor a formal written request shall be made to Owner as per General Conditions.

H. When directed, Contractor shall provide samples of material or equipment, as directed.

I. Equipment shall be shipped or fabricated in sections in suitable size for entering building and all necessary arrangements for their installation shall be made by Contractor.

J. Shop drawings and submittals shall bear the General Contractor's review and approval stamp prior to submission to the Architect.

K. Submittals shall be bound in booklet form, include a summary cover page listing manufacturer and model number and shall indicate if the submitted item is a substitute. Furnish a minimum of six (6) copies of all submittals or as required by the Architect. At least one submission shall be a manufacturer's original product and data sheet, the remaining may be photocopies. Three (3) copies of all shop drawings and material cuts are required for equipment brochure at contract completion.

L. Within 30 days after award of contract, submit a complete list of materials to be used on project specifying manufacturer, grade, trade name, and catalog number. Materials list shall be complete. Partial list not acceptable.

M. Submit copies of shop drawings for all electrical equipment custom-made for this contract. Drawings shall be revised as directed and resubmitted.

N. Manufacturer's drawings, sketches, and instructions shall supplement but not supersede contract drawings and specifications.

O. Submittals shall show:

1. Physical size and arrangement of equipment.

2. Wiring diagrams for all equipment showing all circuit devices, conductor sizes, color coding, type, etc.

3. Elementary control diagrams in straight line form for motor control equipment showing all control devices connected in the system.

4. Specifications for all components.

1.7 Cutting and Patching:

A. Refer to the General Conditions for cutting and patching. Patch all existing walls

which were cut for installation of electrical equipment and wiring. Patch all openings where existing electrical devices are removed.

B. Neither cutting of structural members, nor the drilling of holes through beams or structural steel shall be done without the specific permission of the Architect or Engineer.

1.8 Fire Seals:

A. Provide fire rated seals for all penetrations through fire rated floors or walls. Fire seals shall be provided in a manner to maintain the integrity of the fire wall. Where conduits penetrate floor which do not extend more than 5' from the wall, provide an "expanding" type grout around conduit. Provide UL listed fire sealant inside conduit, Dow Corning silicon foam or approved equal. PVC conduit shall have a UL listed expanding fire barrier. See Section 16110 for additional requirements.

B. Junction Boxes - Provide putty wraps on all junction boxes in fire rated walls.

1.9 Materials and Accessories:

A. Materials shall be new and listed by the Underwriters Laboratories, Inc., or locally approved national testing agency as conforming to standards in every case where such a standard has been established for the particular materials in question.

B. Contractor shall field verify fit of equipment in available space prior to rough-in. Any discrepancies shall be brought to the attention of the Architect/Engineer.

C. Equipment shall be packaged in their original containers and be limited to products regularly produced and recommended for service ratings in accordance with manufacturers' catalogs, engineering data or other comprehensive literature made available to the public, and in effect at the time of contract award and shall be turned over to the Owner free of all defects.

D. All equipment or materials for any one system shall be furnished by the same manufacturer. Such items as lamps, conduit fittings, wire, electrical switchgear, wiring devices, switchgear, etc., shall be the same throughout the project.

E. Materials installed on exterior of buildings shall be weather tight and of such design as intended for this purpose. Ferrous exterior materials, galvanized.

F. Equipment shall be installed in strict accordance with manufacturer's instructions for type, capacity and suitability of each piece of equipment used. Use weatherproof equipment where required. Install equipment in accordance with manufacturer's recommendations and meet conditions for manufacturer's standard warranty.

G. Contractor shall effectively protect his work, materials, or equipment which are liable to injury during construction period. Openings into any part of conduit system as well as associated fixtures, equipment, both before and after being set in place must be securely covered or otherwise protected to prevent obstruction of conduit or injury due to carelessness or maliciously dropped tools or material, grit, dirt, or any foreign matter. Contractor is responsible for all damage so done until his work is installed and accepted. Conduit ends shall be covered with capped bushings.

H. Furnish reinforced concrete housekeeping pads for all free-standing electrical distribution equipment, where designated on drawings.

I. Provide all accessories, equipment and connections required for complete installation, ready for continuous use by Owner.

1.10 Inspection and Regulations:

A. Do not allow or cause any of this work to be covered up or enclosed until it has been inspected, tested and approved by the authorities having jurisdiction over the work. Should any of this Contractor's work be enclosed or covered before such an inspection and test, he shall, at his own expense, uncover the work and after it has been inspected, tested and approved make all repairs with such material as may be necessary to restore all of his work and that of the other contractors to its original condition.

B. Work shall meet requirements of Owner, National Electrical Code, local regulations, and rules of the Utility Company. Equipment and materials shall bear label of approval of National Board of Fire Underwriters and be U. L. listed for their particular application.

C. Work shall meet requirements of the owner's insurer.

1.11 Tests:

A. Give timely notice of intention to test or cover up work to permit observation. Contractor shall test all wiring for continuity and grounds before connecting any equipment or outlets. Contractor shall test entire system in accordance with current procedures stated in Acceptance Testing Specifications published by the InterNational Electric Testing Association, Inc.(NETA). All equipment necessary to conduct such test shall be furnished at the Contractor's expense.

1.12 Work by Others:

A. Following work is by others or is specified under other Divisions of this specification:

1. All automatic temperature control system wiring and equipment shall be furnished and installed under Division 15, unless specifically noted

otherwise.

1.13 Cooperation with Other Trades:

A. Confer with all other trades whose work might affect installation and arrange work in proper relation to that of others and with architectural finishes.

B. Where interferences occur, Contractor shall, before installing work involved, consult with Architect and other trades to reach agreement as to exact location and level of work.

C. Contractor is responsible for arrangement of work, equipment and maintenance of proper clearances for installation. Should work installed require modification to avoid interference, such changes shall be made without additional cost.

D. If work is dependent for its proper execution on contiguous work not specified in this Division. The Contractor shall examine such work and report in writing any defects therein or conditions rendering it unsuitable. Beginning of work without making of such a report shall constitute an acceptance of such work, and any subsequent defects in his work consequent shall be of his responsibility.

1.14 Field Measurements:

A. Visit the site before submitting bid and check location of existing utilities, conditions, verify dimensions and locations shown on the plans and overall costs and work herein described or shown.

B. Take measurements necessary for this work and be responsible for their accuracy. Necessary pull boxes and junction boxes as required to accomplish distribution shall be provided.

1.15 Structural Difficulties:

A. Should structural difficulties prevent performing work, necessary deviations, as determined by Architect, shall be performed.

1.16 Access Panel:

A. Provide access doors or panels for concealed portions of the work requiring accessibility for operation and maintenance. Minimum door size is 12” x 12”. Door to be same fire rating as system in which they are installed. See architectural specifications for finish and manufacturer.

1.17 Drawings and Specifications:

A. Drawings shall be considered schematic in nature and shall represent a completed product. Contractor is responsible for installation of equipment and methods of achieving a satisfactory and intended installation. Locations of devices are

intended to show a general arrangement and intended function. Door swings and architectural features shall be checked for final condition. Coordinate with all contract documents, Owner provided furniture or equipment drawings, structural, architectural, and mechanical plans and specifications. Coordinate with other trades.

B. Where a conflict exists between drawings and specifications, the Architect/Engineer shall be contacted to determine the intent. In all circumstances, the final contract document interpretation shall provide compliance with all codes.

C. Wiring devices shall be located uniformly with respect to building structure and other work. Locations shall be coordinated. Should there be any interference between electrical wiring and other trades, Contractor shall notify Architect so that proper location may be decided upon.

1.18 Permits:

A. All permits, licenses or incidental fees not otherwise identified under provisions of General Conditions of this contract specification shall be borne by this Contractor. This shall include electrical and fire alarm permits.

1.19 Operations and Maintenance Manuals:

A. Furnish 3 sets of Operation Manuals in loose leaf binders. The manuals shall include:

1. Descriptive brochures on all equipment.

2. Maintenance instructions.

3. Operation Instructions.

4. Parts list for all equipment.

5. Certificates for equipment as required.

6. Service phone number of installing company.

7. Table of Content.

8. Wiring Diagrams.

1.20 "As Built" Drawings:

A. A separate set of white background Electrical prints marked in red ink "As Built" shall be kept in good condition at the job site during progress of construction. Mark to indicate changes as they occur in the field installation of equipment.

B. Show location of equipment, conduits, etc.

C. At all times, these Drawings shall be up-to-date and available at the site for verification. Before final payment is approved, the Drawings shall be made correct and delivered to the Architect. The correct circuit breaker numbers shall be used on the "As-Builts".

D. At the completion of the job, the contractor shall obtain the AutoCAD drawing files from the Engineer at cost and update file from the "as-built" drawings. The updated AutoCAD files and plotted drawings shall also be delivered to the Architect.

1.21 "AutoCAD Files :

A. The contractor may obtain the AutoCAD drawing files from the Engineer at a cost of $50 to assist in the preparation of shop drawings and/or as-built drawings for this job. No materials or information from the AutoCAD files shall be duplicated or used for any other project.

1.22 Guarantee:

A. Unless otherwise specified, guarantee unconditionally for a guarantee period as set forth in General Conditions all materials, workmanship and installation. During this period, adjust, repair or replace at no cost to Owner any item of equipment or workmanship found to be defective.

1. Contractor shall be responsible for and pay for damages caused by or resulting from defects in workmanship.

(END OF SECTION)

PART 1 - GENERAL

1.1 Scope of Work:

A. Requirements of this section apply to all other parts of Division 16.

PART 2 - PRODUCT

2.1 Raceways and fittings, minimum size 3/4 inch, except for controls, which may be ½ inch. A separate insulated grounding conductor shall be provided in all conduits and raceways.

A. EMT - Electrical Metallic tubing: Triangle PWC, Republic, or Porter, galvanized steel, enameled inside finish, UL-797, WW-C-563.

B. IMC - Intermediate Metal Conduit: Triangle PWC, Republic or Poreter, galvanized mild steel, enameled inside finish, UL-1242.

C. Galvanized rigid steel conduit: Triangle PWC, Republic or Porter, hot dipped galvanized steel, UL-6, WW-C-582D.

D. Flexible metallic conduit: Triangle PWC, Republic, or Porter, Greenfield, electro-galvanized steel, WW-C-566B, UL-1.

E. Non-metallic conduit: Olin, Triangle, Porter, Carlon, Schedule 40 or Schedule 80 polyvinyl chloride (PVC) conduit.

F. Liquid-tight flexible conduit: Sealtite, American Brass type U.A.

G. Surface Metal Raceway: Wiremold or equal.

2.2 Conduit Fittings:

A. Compression fittings, Steel: Midwest, O-Z Gedney, Steel City.

B. Set screw fittings, steel: Midwest, O-Z Gedney, Steel City.

C. Plastic insulating bushings: T & B, O-Z, Gedney, Scotch, Steel City, Raco, Appleton, Efcor, Union.

D. Metallic bushings: T & B, Gedney, Steel City, Raco, Appleton, Efcor. Use metallic bushings where bushing is exposed.

E. Flexible liquid resistant conduit fittings: Sealtite or equal.

F. Expansion Joints:

1. Conduits, rigidly secured to building construction on opposite sides of a building expansion joint, shall be provided with expansion and deflection couplings. The couplings shall be installed in accordance with the manufacturer's recommendations.

2. Expansion and deflection couplings shall also be installed where shown on the drawings.

3. The expansion/deflection couplings shall be by O-Z/Gedney or equal.

2.3 Ground System Devices and Equipment:

A. Cable connections accessible: Brundy, Hy-press type.

B. Ground bushings: O.Z. Type BL.

C. Pipe connectors: O.Z. Type ABG.

D. Enclosure connector: O.Z. Type QG or KG.

E. Feed through lug: Brundy type Q2B.

2.4 Boxes:

A. Outlet, junction, switch, or manufactured pull boxes shall be one piece stamped galvanized steel, machine screw fasteners with ground bond screw, UL listed.

B. Conduit fittings shall be steel. Conduit fittings shall be by Appleton or approved equal.

C. Cast boxes, types FS and/or FD shall be of malleable iron or aluminum. Cast boxes of Feraloy ("gray metal") shall not be acceptable. Cast boxes shall be Appleton or approved equal.

D. Group surface mounted device boxes shall be in a multi-gang cast box. The size shall be governed by the intended use.

E. Exposed boxes less than eight feet above floor or on accessible finished surfaces shall not have removed and unused knockouts. Boxes with exposed knock-outs will not be accepted. Use cover plates which do not protrude beyond the box and without sharp edges. Box mounting hardware shall be concealed within the box. Boxes shall be fastened to studs where spacing permits.

F. Exterior wall surfaces or otherwise exposed to weather shall be cast FD boxes with threaded hubs and neoprene gaskets. U.L. Listed.

G. Surface interior boxes: all interior outlet boxes, except those in unfinished spaces,

shall be surface Wiremold boxes, ivory in color. U.L. Listed.

H. Stamped outlet boxes: one piece galvanized steel. Boxes shall not be smaller than 4" octagon or square and shall have machine screw fasteners and bond screws. U.L. Listed. Outlet boxes shall be Steel City, Raco, Bowers or Appleton.

I. Pull boxes: construct of code gauge galvanized sheet steel with screw cover. UL Listed.

2.5 Surface metal raceway: Wiremold Type 700, V-3000, V-4000, V-6000 or Plugmold 2000, 2100, 2200, field painted to match surroundings. Use manufacturer's recommended accessories for entire installation of raceway and devices. Devices and covers shall be secured with spreaders or yokes. Where plugmold is specified, provide receptacles 12" on center.

2.6 Poke thru Devices:

A. Poke thru devices shall be fire rated for 2 hour minimum and have a partition to allow separate power and communication lines at each service fittings.

B. Service fittings shall be floor-surface mounted with a duplex receptacle on one side and a dual cable telephone cover on the other side. Provide steel city PT-200 with PT-301 service fittings or approved equal.

2.7 Power Poles:

A. Power poles shall be 3” square, steel housing separate telecommunications and power compartment. Each pole shall have duplex receptacles, power connections and plate for voice/data. Power poles shall be fastened at the floor with a factory furnished baseplate, ceiling trim flange, and pole top junction box. Provide Wiremold 3 DTP series with accessories required for complete and functioning installation. Length shall be between 10’-5” and 15’-5” as required by ceiling height.

2.8 Conductors:

A. General:

1. Unless specifically indicated otherwise, all wiring shall be 98 percent conductivity copper conductors. Minimum wire size shall be #12 AWG. All wire AWG #8 or larger shall be stranded. Insulation shall be dual rated THWN/THHN. Manufacturers shall be Triangle, Phelps Dodge, or Royal.

2. Where aluminum wire is specified for feeders, wire shall be compact stranded Stabiloy, by Alcon Cable Corp. Insulation shall be XHHW 90 degrees C. All terminations shall be tool applied compression connectors,

as specified below, for all wire ends including circuit breaker, disconnects, and terminal block connections. At contractors option he may use copper conductors with equivalent capacity.

B. Wire Within Buildings:

1. Single conductor wires: 600 volt, dual rated THWN/THHN, within metallic raceways. Two wire drops to light fixtures may be flexible metallic conduit in lengths not over 6 feet, as permitted by code.

2. Cable Assemblies -600 Volt:

a. Type MC cable shall be temperature rated as required by location and installation. Cable shall have a continuous insulated ground wire and be bonded to device and box screw. Provide proper color coding for system voltage.

b. Provide Healthcare type HCF cables with 2 ground paths in all patient care areas as per NEC 517. This shall include all patient care areas which includes exam rooms and treatment rooms in medical and dental offices.

c. Type MC-IG cable with two insulated ground wires shall be provided for all isolated ground circuits.

C. Exterior Wiring:

1. Underground: In conduit: dual rated THWN/THHN.

2. Above grade: In conduit: Type dual rated THWN/THHN.

3. Aluminum wiring shall not be used.

D. Wire Connectors:

1. Copper wire: For connections of one or more #10 AWG or smaller, solderless twist-on connectors shall be used. The connectors shall have an outer insulating shell manufactured from nylon (polyamide) material and shall be formed with "S"-shaped fins to improve the twisting action. The spring insert shall be a helical elongated coil formed from square spring steel to cause the spring to have "live action" and reduce the turning friction. The connectors shall be rated flame and heat retardant for up to 105 degrees C maximum and be Underwriter's Listed under UL 486. Connectors shall be Buchanan "B"-Caps or approved equal by Pass & Seymour, Ideal, Hyco. Conductors #8 AWG and larger shall be terminated, spliced or tapped wherever practicable with T & B "Color Keyed" Series 54000, tool applied compression connectors or approved equal.

2. Aluminum wire: Where aluminum connectors are spliced, tapped or terminated, including connections to panelboards, circuit breakers and equipment, connectors shall be tool applied Burndy Types AYP, AYPO, YA-A Series 54000 compression connectors, or approved equal, with wire barrels factory pre-filled with an oxide inhibiting compound. Terminating pigtails shall be T & B or MAC with insulating sleeves or approved equal.

   a. Terminations: Belleville type compression washers shall be used when ambient temperature exceeds 30 degrees. C, T & B Series 60800 or approved equal.

   b. Compression tools: All compression connectors shall be made with manufacturer's recommended tool incorporating a ratchet release type mechanism to insure complete compression, typically Burndy Y-39 Hypress or approved equal.

E. Wire Fastening Products:

1. Provide wire fastening products when wiring is specified or required to be secured.

2. Wire fastening products shall include but not be limited to the following types of components: natural nylon cable ties, black (UV-resistant) cable ties, cable tie mounts, adhesive cable tie mounting pads, adhesive press clips, molded nylon clamps, molded polypropylene clamps, flat nylon clamps and adhesive-mount adjustable clamps.

3. The contractor shall provide all accessories required for a complete and satisfactory installation.

4. Wire fastening products shall be by Brady or approved equal.

F. Wire Pulling Lubricants:

1. Use pulling lubricants on all raceway wiring. Pulling lubricants shall be of a greaseless compound, non-corrosive, non-conductive, non-combustible, non-toxic, for use with PVC, steel, aluminum or copper raceways and safe for use on all UL-listed wire insulation. The pulling lubricant shall be "Quick-Slip" by Buchanan or approved equal by Ideal.

G. Electrical Supporting Devices:

1. Materials secured to the structure by: inserts cast in concrete, expansion anchors in concrete block, machine screws or bolts on metal surfaces. Bolts and screws used on interior shall be black steel or galvanized; on exterior, brass or bronze. Cartridge driven studs used only where

specifically noted or permitted by the Architect. Hangers shall be as follows:

a. Steel channel: Kindorf, Unistrut, Globe Strut, Strut by `B-Line'.

b. Channel fittings: Kindorf, Unistrut, Globe Strut, fittings by 'B-Line'.

c. Conduit hangers: Clevis type by Unistrut, Kindorf, Grinnell.

d. Wall anchors: Expansion bolt, toggle bolt, or other approved structural anchor. Plastic anchors, wood or fiber plugs shall not be used.

2. All electrical materials and conduits larger than 2" shall be secured to joists shall be fastened to the top member of the joist.

PART 3 - EXECUTION

3.1 Preparation:

A. Check door swings and clearances with equipment, cabinets, appliances and coordinate with all contract drawings prior to performing work.

3.2 Installation:

A. Switches and receptacles shall be installed in locations shown on contract drawings. Contractor shall study general building plans in relation to space surrounding each device in order that intended work may accommodate all other specified work. Boxes shall be installed in a rigid and satisfactory manner. Support all boxes independent of raceways. Adjacent wall mounted wiring devices, room thermostats or other equipment shall be coordinated and so located either at the same elevation or in line, one above the other. Install conduit, outlets and equipment to clear beams or obstructions. Do not cut into or reduce the size of any load-carrying member without the approval of the Architect. Permission of resident Architect shall be obtained before cutting any existing structural concrete walls or floors. Check drawings and work of others to prevent interference. Deviations of work to avoid obstructions as determined by the Architect shall be done without additional cost.

B. Wiring and conduit shall be kept at least 6 inches from parallel runs of heated pipes or ducts. Exposed runs of conduit or tubing shall have supports spaced not more than 6 feet apart and shall be installed with runs parallel or perpendicular to walls, structural members or intersections or vertical planes and ceilings, with right angle turns consisting of cast metal fittings and symmetrical bends.

C. Exposed wiring and conduit shall be installed in a neat and workmanlike manner with runs plumb and parallel to walls. Bends and offsets shall be avoided where

possible, but where necessary shall be made with an approved hickey or conduit bending machine. Conduit or tubing which has been crushed or deformed in any way or has begun to rust shall not be installed. Use expansion bolts to secure equipment, conduit or devices. Wood or dowel plugs are not acceptable. Conduits or tubing shall be supported on approved types of galvanized wall brackets, ceiling trapeze or pipe straps, secured by means of expansion bolts in concrete or brick. Nails shall not be used as a means of fastening surface boxes or conduits. Conduit or tubing shall be installed in such a manner as to insure against trouble from collection of trapped condensation and all runs on conduit shall be arranged as to be devoid of traps wherever possible.

D. Raceways and cable shall meet requirements of the National Electrical Code and local codes.

E. General branch circuit wiring shall be concealed in walls and above ceilings. Do not run branch circuit wiring below slab except where indicated by dashed lines or for floor devices.

F. Except noted or specified otherwise, wiring shall be installed as follows:

1. Indoors in finished areas, conceal in walls or above ceilings: EMT or MC cable.

2. Indoors, exposed in existing finished areas with drywall or plaster walls and ceilings: Cut and patch to install MC cable or EMT.

3. Indoors, exposed in existing finished areas with masonary walls: Fish flexible steel conduit in walls where possible. If not possible use Wiremold 700, 2000, 2100, 2200, V-3000, V-4000, V-6000.

4. Indoors, exposed in newly finished areas: Not acceptable, conceal wiring.

5. Indoors exposed in unfinished areas: EMT. (No exposed MC cable will be accepted).

6. Outdoors, exposed: threaded, painted IMC.

7. Outdoors underground: PVC schedule 40 (3/4" min), unless noted otherwise.

8. Liquid-tight flexible metal conduit shall be used for connections to motors and other electrical equipment subject to movement, vibration, mis-alignment, cramped quarters or noise transmission.

G. Clamps shall be malleable iron. Multiple runs shall be supported on metal channel with conduit clamps. Trapezes shall be metal channel with conduit clamps.

H. Check door swings and clearances with equipment, cabinets, appliances and coordinate with all contract drawings prior to performing work

I. Conceal all raceways and wiring in finished areas. Finished areas shall be defined as those areas having finished or painted walls. All wiring in mechanical and electrical rooms may be exposed and shall be in EMT. No exposed MC cable will be accepted.

J. Penetrations through concrete walls, floors and footings., both interior and exterior shall be sleeved and caulked with grout or plastic compound to provide watertight seal.

K. Seal conduits exposed to weather or subject to low temperatures to prevent air infiltration.

L. Penetrations through roof shall be flashed with galvanized sheet metal roof jack. Jack shall fit tightly at top of cone and the skirt shall extend not less than 6" beyond the base of the cone. Seal opening between conduit and top of cone with caulking compound. Exposed conduit on roof: IMC. All work on roof shall comply with roof warranty and roofing specifications.

M. Handling and installation: Bends shall be kept in accordance with minimum recommended by manufacturer. Cables shall be paralleled on reels and be pulled directly into raceway from the coil or reels on which they are received. Cable shall not be laid on the ground.

N. Use pulling lubricants on all raceway wiring. Wire and cable installed only after raceways are free of obstructions and clean. All wire color coded. Wiring shall be tagged with Brady "Quick" labels at all pull boxes, junction boxes and panelboards. Wiring in panelboards and terminal cabinets shall be neatly trained and served.

O. Where new wiring is indicated at existing walls, conceal as much as possible. Cut and patch existing drywall and plaster walls to conceal wiring. Where wiring is run along block or concrete walls, use Wiremold only if wall cannot be "fished" with MC cable or flexible steel conduit.

P. Fire seals shall be used to maintain the integrity of fire rated walls, floors, partitions, or ceilings.

Q. Conductors at vertical raceways shall be supported. One support shall be provided at the top of the vertical raceway, refer to NEC 300-19 for spacing criteria.

R. Only motor and panel feeders may be fed from below or in slab conduit, unless the branch circuit wiring is indicated by a dashed line on the drawing. No branch circuit wiring will be accepted below slab when indicated in walls and above

ceilings.

3.3 Demolition:

A. Remove all light fixtures, wiring devices, telephone outlets, and indicated items noted on the demolition plans.

B. Where removal of a wiring device or light fixture will disconnect power to downstream electrical items, contractor shall provide required junction boxes, conduit, and wiring to keep "existing to remain" items fully operable.

C. The owner shall have first claim on any removed materials. If the owner does not want demolished materials, the contractor shall dispose of the materials appropriately.

D. All Hazardous electrical materials such as PCB ballasts and fluorescent lamps shall be disposed of in an EPA approved manor.

3.4 Guarantee:

A. Unless otherwise specified, guarantee unconditionally for a guarantee period as set forth in the General Conditions all materials, equipment, workmanship and installation. During this period, adjust, repair or replace at no cost to Owner any item of equipment or workmanship found to be defective.

(END OF SECTION)

The General Conditions, any supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this section as fully as if herein.

PART 1 - GENERAL

1.1 Scope of Work:

A. Work included:

1. Electrical distribution system.

B. Work included elsewhere: See Section 15010 - General Provisions (Mechanical), Section 16010 - General Provisions (Electrical).

C. Unit Pricing: As part of bid, provide unit pricing for additional receptacles and local light switches, complete.

1.2 Submittals:

A. Submit cuts on all items of electrical equipment. Include panelboards, switches, wiring, receptacles, motor starters, disconnects, wiring devices, cover plates, distribution equipment and over current devices.

PART 2 - PRODUCTS

2.1 Equipment:

A. Disconnect Switches: Disconnect switches 30 amp through 400 amp shall be heavy duty type, Fusible, with solid neutral and shall fuse all ungrounded conductors. Unless otherwise specified, fuses at service entrance shall have 100,000 amp interrupting capacity, UL approved. Switches shall be rated as shown on contract drawings and shall be quick-make, quick-break with positive pressure fuse clips, externally operated cover, and interlocked handle with provision for padlocking in open or closed position. Enclosures shall be NEMA 1 except NEMA 3R where located outdoors or where accessible to the general public. Furnish additional locks where required. Switches shall be Square D or approved equal by ITE or Cutler Hammer.

B. Fuses:

1. All fuses shall be UL listed Class R, Class J and/or Class L (time delay). All fuse contact surfaces shall be electroplated, and fuse shall be so selected as to provide a fully selective coordinated system. Spare fuses shall be in a spare fuse cabinet and shall be as follows:

a. Provide 10% of each rating (minimum of 3 per rating).

b. Service Entrance, Feeder Circuits, Motors, Motor Controllers, Transformers and inductive circuit fuses (600 ampere & smaller):

(1) Rated 1/10 amp to 600 amp, 250 volt AC, shall be UL listed Class RK1 or RK5 as required, current limiting with 200,000 ampere RMS interrupting rating. Fuse body shall be constructed of high temperature, dimensionally stable, long-life non-hygroscopic material.

c. Where short circuit current does not exceed 10,000 ampere RMS and for protection of individual equipment units fuses shall be rated 1 amp to 600 amp, 250 volt AC, shall be UL listed Class K-5 with 10,000 ampere interrupting rating.

2. Fuses shall be by Bussman or approved equal by Littlefuse, Reliance.

C. Wire Troughs: Removable covers, end closing plates, mounting brackets, NEMA 1 for indoors, NEMA 3R raintight for outdoors, grey enamel. Wire troughs shall be Square D or equal by General Electric, Hoffman, Keystone.

D. Circuit Breaker Panelboards:

1. Commercial grade, plug-on circuit breaker type with locking covers and with typed directories inside the covers. All components shall be UL listed and where applicable labeled suitable for service entrance. Panelboards shall be Square D `I-LINE' series or equal by Cutler Hammer or ITE. If substitute non-plugin panel(s) are provided, the panel(s) shall be factory equipped with circuit breaker mounting kits for mounting of 14 circuit breakers. The owner shall not be required to purchase any accessories or mounting kits to install a breaker at a later date.

2. Provide panelboard mounted transient voltage surge suppression (TVSS) on the service panel and additional locations where indicated on the drawings and panel schedules. The TVSS shall comply with UL 1449 Third Edition. Provide Innovative Technologies protector services with the following specification. (PTE, or PTX for GFI application.)

a. ANSI/IEEE C62.41 locations category A, B, C.
b. Peak surge current 160 KA/phase.
c. 20 year free replacement warranty.
d. Audible alarm, surge counter, and phase loss monitor.

The surge suppressor shall b e mounted straight out from the circuit breaker so that the lead wiring feeding the unit does not exceed 12 inches. Equals must meet or exceed specifications for let-thru and energy

withstand and warranty.

3. Ampere ratings and "total spaces" numbers on panel schedules are given as minimum requirements. A panelboard will not be construed as meeting the specifications unless both these minimum requirements are met or exceeded.

2.2 Circuit Breakers:

A. Thermal-magnetic type, tripping free of handle and employing deion principle of arc. Handles shall assume three distinctive positions; `OFF', `ON' and `TRIPPED'.

B. Circuit breaker used for HACR or hid lighting loads shall be UL Listed for their intended purpose.

C. All circuit breakers for elevators, shall have 120 volt shunt trip mechanisms.

D. All lugs and breakers shall be rated at 75^{o}C minimum.

E. All new breakers being installed in existing panels shall be compatible with existing panel. Provide all required mounting hardware.

2.3 Motor Snap Switches:

A. Motor snap switches shall be provided with toggle lock-off handle guard.

B. Flush mount where wall mounted in finished areas.

C. Motor snap switches shall be Arrow-Hart 6808-GD (10) or 7810-GD (30).

2.4 Wiring Methods:

A. In general, branch circuits shall be No. 12 AWG (minimum) THHN copper. Control wiring and signal circuits may be No. 14 AWG THWN/THHN.

B. Wiring shall be concealed within walls, ceilings and floors.

C. Electric room wiring raceways may be installed exposed. Exposed wiring shall be installed in a neat and workmanlike manner with runs plumb and parallel to walls.

D. All wiring shall be supported in accordance with provisions of National Electrical Code and local code requirements and shall utilize approved fasteners and clamps. Conduits secured to walls shall be fastened to wall studs where spacing permits. In all cases, conduits and clamps shall be rigidly secured and free of obtrusions

which may cause injuries.

E. Wiring shall be color coded to distinguish between services of different voltages. Use distinctive color for switched conductor wherever possible. Color coding to be as follows:

F.

Voltage	Neutral	Phase A	Phase B	Phase C	Ground
120/208 Wye	White	Black	Red	Blue	Green
277/480 Wye	Gray	Brown	Orange	Yellow	Green

G. All No. 12 and No. 10 branch circuit conductors shall have solid color compound or solid color coating. All neutral sizes shall have solid color compound or solid color coating.

H. No. 8 AWG and larger phase conductors shall have either:

1. Solid color compound or solid color coating.

2. Stripes, bands or hash marks of colors specified above.

3. Colored, pressure-sensitive plastic tape. Tape shall be applied in half overlapping turns for a minimum of three inches for all terminal points, and in all junction boxes, pull boxes, troughs, manholes, and handholes. Tape shall be 3/4-inch wide with colors as specified above. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply. Tag all wires at terminal equipment, outlets, terminal cabinets pull and junction boxes, and control center, with Brady "Quick" label tags.

4. Circuit number and panel identification shall be painted on the back of all device plates, on all receptacles and wall switches.

2.5 Wiring Devices:

A. Switches shall be extra hard use, commercial premium specification grade and comply with Federal Specification W-S 896B and be rated 20 amperes and voltage as dictated by the system and shall not require derating for lamp loads. They shall be approved for control of motors up to 80 percent of the switch rating and shall be quiet AC type. Use single pole, double pole, three way and/or four way as shown connected. The color shall be ivory, white, or brown to suit wall finishes and shall be P&S, Leviton, Arrow-Hart, Hubbell, or General Electric.

B. General use Receptacles - Receptacles shall be extra hard use, commercial premium specification grade, two pole, three wire, straight blade type and shall comply with Federal Specifications W-C 596G with a rating of 20 amperes. The color shall be ivory, white, or brown to suit wall finishes and shall be P&S,

Leviton, Arrow-Hart, Hubbell, or General Electric.

C. Ground Fault Interrupter devices shall be duplex receptacle type and shall comply with Federal Specifications WC-596G and Underwriters Laboratories Inc. standard 943, Class A. They shall be no more than one and one eighth inch deep with standard terminal screw connections and rated at 20 amperes. The color shall be ivory, white, or brown to suit wall finishes and shall be P&S, Leviton, Arrow-Hart, Hubbell, or General Electric.

D. Device plates: Indoors: .040 inch, brushed type 302 stainless steel.

E. Device plates Weatherproof for outdoor and wet locations: Receptacle covers shall be cast aluminum and comply with 2002 NEC and shall provide " protection while in use". Provide Intermatic #WP1010MC, WP1010MCH for single gang applications, or approved equal. Weatherproof Switch plates shall also be cast aluminum, UL listed for wet locations.

2.6 Connections to Mechanical Equipment:

A. Note carefully all other sections of this specification (in particular Division 15) describing electrical equipment to be furnished in order to fully understand all equipment wiring and motor starting requirements.

B. An enclosed disconnect switch and motor starter shall be furnished and installed for each motor installed unless specifically indicated as furnished under other sections of specifications.

C. All thermostats shall be furnished and installed under Division 15.

D. Furnish and install all power wiring for motors complete from panelboard thru motor starters to motor terminations.

2.7 Motor Starters and Controls:

A. Install items in accordance with manufacturer's instructions.

B. Coordinate with the heating, ventilation, air conditioning, ATC and plumbing Contractors and their associated drawings and specifications for the requirements for interlocks, contacts, pilot lights, and Hand-Off-Automatic switches which shall be provided by the Electrical Contractor for all starters provided under this section of the specification.

C. Provide and install all starters, pushbuttons, etc., also install any motor starters or miscellaneous line voltage control devices which are furnished under other divisions of this specification.

D. In finished areas, mount motor starters flush and install suitable coverplates.

E. Install heaters or adjust solid state trip as applicable with full load current of motors provided.

F. Set overload devices to suit motors provided.

G. All controllers operated by remote devices shall have maximum control voltage of 120 volts. Line voltage starting shall be permitted up to 15 horsepower for 208 and 240 three phase motors and up to 30 horse power for 480 volt three phase motors. Motor controllers above this rating shall be of Wye-Delta, closed transition, part winding or auto transformer in order to limit starting current to acceptable levels.

H. All motors shall be connected with minimum 3 foot length of sealtite flex conduit at motor connection box.

PART 3 - EXECUTION:

3.1 Installation:

A. Switches and receptacles shall be installed in locations shown on contract drawings. Contractor shall study general building plans in relation to space surrounding each device in order that intended work may accommodate all other specified work. Boxes shall be installed in a rigid and satisfactory manner. Support all boxes independent of raceways. Adjacent wall mounted wiring devices, room thermostats or other equipment shall be coordinated and so located either at the same elevation or in line, one above the other. Install conduit, outlets and equipment to clear beams or obstructions. Do not cut into or reduce the size of any load-carrying member without the approval of the Engineer. Permission of resident Architect shall be obtained before cutting any existing structural concrete walls or floors. Check drawings and work of others to prevent interference. Deviations of work to avoid obstructions shall be done without additional cost.

B. Ground all equipment in accordance with the National Electrical Code requirements and with local ordinances and utility company requirement.

C. Mount top of panelboards 6 feet 2 inches above floor unless otherwise noted. Secure to studs or erect supporting frames.

D. Where panelboards are recessed, conceal raceways connected to them. Furnish bulkheads and wall framing where semi-recessed mounting is required.

E. Mounting heights, unless otherwise specified:

1. Receptacles - 18 inches.

2. Where receptacles are mounted at counters, they shall be 8 inches above

counter height and shall clear any splash board provided with counter.

3. Wall switches - 48 inches.

4. Where applicable, mounting heights shall conform to Handicap Code for Barrier Free Installations.

F. All wiring devices shall be wired using the screw terminals. Push connections are not acceptable.

G. Wiring shall be run in heavy wall conduit where installed below vapor barrier.

H. Support pull boxes and junction boxes in ceiling from structure and not from raceways or ceiling suspension systems.

I. Use locknuts and insulating bushings at all rigid conduit ends at junction boxes, pull boxes, panel, starters, disconnects, and other boxes.

J. Protect conduit openings and do not pull wire until work which could damage wire has been completed near ends of conduit. All empty raceways shall be furnished with nylon rope.

K. Bend conduits with hickey or bender, where bends are necessary. Do not bend in vise or use a pipe tee for bending.

L. When cutting conduit, square ends, thread, ream and clean.

M. Use Sealtite conduit and fittings in damp places for pumps, motor connections, in mechanical equipment rooms or out of doors for flexible connections.

N. Use gasketed covers and threaded raceway hubs for exterior raceway connections. Use vandal-resistant hardware where accessible to public.

O. Label all safety switches, disconnects, panelboards, motor starters, motor service switches and other equipment with engraved laminated plastic tags, screw attached, not smaller than 3/8 inch high, indicating function served. Letters shall not be smaller than 1/4 inch high and shall be black on white background. Submit proposed designations and sample for approval. Panelboard nameplates shall also indicate the panel and circuit it is fed from as well as Voltage/phase, feeder circuit breaker ampacity and date.

P. No more than three phase conductors shall be installed in a conduit without derating the conductors as per NEC. All sizes given on the plans are for 3 max current carrying conductors.

3.2 Guarantee:

A. Unless otherwise specified, guarantee unconditionally for a guarantee period as set forth in General Conditions all materials, equipment, workmanship and installation. During this period, adjust, repair or replace at no cost to Owner any item of equipment or workmanship found to be defective.

(END OF SECTION)

The General Conditions, any supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this section as fully as if herein.

PART 1 - GENERAL

1.1 Scope of Work:

A. Work includes furnishing, storing, installing and connecting all fixtures, complete for continuous satisfactory operation. Included is furnishing poles and bases, lamps, mounting brackets, stems, escutcheons, frames, plaster rings, and trim required to match surrounding surface.

1.2 Submittals:

A. Refer to Section 16010, GENERAL PROVISIONS, in particular regarding submission on alternate products and form of submittals.

B. Contractor shall verify ceiling types and coordinate trim and mounting hardware prior to submission of fixtures to insure proper compatibility of fixture type with ceiling system. Should a conflict be found, the contractor shall contact the Architect/Engineer for clarification.

C. Manufacturer's model and catalog numbers, change frequently and may not necessarily include all features or options as specified herein or required for complete installation. In particular, catalog number may only indicate type and series of required fixture. When specified types, finishes, features, options or accessories conflict with given model number, the written description shall govern. Contractor shall bear final responsibility for insuring that fixtures delivered to jobsite completely conform will all specifications and features as specified herein and are approved for installation in intended location. Voltage shall be as indicated on drawings.

D. Substitute light fixtures shall be submitted with photometrics. All outdoor fixtures shall be submitted with a footcandle chart indicating footcandle levels at the mounting height the fixture is to be installed. Light levels shall be given to at least 4 mounting heights in all directions as applicable.

E. Submit cuts of all fixtures furnished, samples when requested, lamped for display.

F. Under base bid furnish fixtures and equipment specified or named equals (Note: named equals shall not be considered the specified equipment). Where no named equal is given and only "or approved equal" is noted, Contractor may at his option use alternates of his selection, however, such alternate MUST conform to the specified fixture's or item's construction performance and catalog features and shall have a similar aesthetic appearance. Failure to conform will result in rejection of item.

G. When a named equal is submitted in place of the one specified, it will only be considered if equivalent in quality, construction performance, similar features and aesthetic impact. Fixtures will not be evaluated unless complete photometric data is submitted along with photograph cuts. Alternate fixtures will not be evaluated unless complete photometric data including ITL or ETL Test Report, Isolux diagrams, fixture efficiency, candela chart and point-by-point comparison calculations are submitted. One submittal shall be composed of original catalog sheets complete with photometric data, remaining others may be photo-copies of the original.

H. Submittals shall be in a covered brochure form and include a cover page indicating specified type, manufacturer's catalog numbers, and fixture description. Where multiple types are indicated on sheets, the proposed item shall be clearly identified.

I. Substitute fixtures when named alternates are specified will not be considered unless they are named on an addendum as an equal that is issued 7 days prior to the bid date.

J. Final choice and review of finishes and colors shall be made by Architect at time of submission at no charge in contract price.

PART 2 - PRODUCTS

2.1 General Equipment:

A. Fluorescent ballasts: Type P automatic thermal resetting, multivolt (100 - 300 volt input) CBM approve, "A" sound rated, high power factor, electronic solid state, 10% THD. In low ambient temperature areas, provide low temperature ballasts (O Deg F) and where otherwise required by high ambient conditions, high ambient, heat sink ballasts shall be used. Ballasts shall be General Electric, Advance, Universal.

B. Fluorescent lamps: 48 inch, F32-T8, 41k, by low Mercury type, General Electric, ALTO or equal by Phillips, Sylvania.

C. Lighting fixtures shall bear label of Underwriters' Laboratories, Inc. and shall be suitable for intended location. Fixtures shall be labeled indicating suitability for damp or wet locations where required.

D. Each fixture shall be supplied with necessary straps, supports or hangers, or other miscellaneous materials and devices to install them in a satisfactory manner to conform to architectural treatment and finishes in area in which they are to be installed. Consult all Mechanical, Architectural and Structural plans and related contract documents to be familiar with all necessary details for proper fixture placement. Failure to do so will not relieve Contractor of responsibility of furnishing all necessary material, complete to perform function intended for

indicated lighting system.

E. Exit sign color shall be as required by local code. Furnish single or double faced with directional arrows as required by installation and field visual conditions.

2.2 Lighting Fixtures:

A. All fixtures furnished shall be standard manufacturer's cataloged and stocked fixtures. Specially fabricated fixtures, unless so specified, will not be accepted. Replacement parts and lenses shall be readily available from manufacturer. Fixture voltages shall be as shown to be connected on drawings.

B. Lighting fixture schedule: (Refer to drawings.)

2.3 Occupancy Senor Controls:

A. Power Packs.

1. Provide power packs for all low voltage motion detectors.

2. Input voltage to be 120 or 277 to match light fixture.

3. Secondary voltage of 24 VDC.

4. Secondary output of 150 mA, 114 mA with relay connected.

5. Low voltage leads are rated for 300 volts.

6. UL-rated 94V-0 plastic enclosure.

7. UL 2043 plenum rated.

8. Dimensions: 1.6” x 2.7” x 1.6” (41mm x 70mm x 41mm) with a ½ inch snap-in nipple.

9. UL and CUL listed; five year warranty.

B. Passive Infrared Sensors.

1. Provide at locations shown on the drawings.

2. 24 VDC/VAC.

3. Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode.

4. Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity.

5. Multi-level, 360^0 Fresnel lens for superior occupancy detection.

6. CI-300 contains isolated relay with N/O and N/C outputs; rated for 1 Amp at 30 VDC/VAC.

7. Built-in light level sensor (CI-300) – works from 10 to 300 footcandles (107.6 to 3,229.2 lux).

8. Mounting options: ceiling tile; 4 square junction box with double gang mudring.

9. Units per power pack: CI-300 up to 5 (B), up to 7 (BZ); CI-305 up to 12 (B), up to 16 (BZ).

10. Dimensions: 4.5" diameter x 1.02: deep (114.3mm x 25.9mm).

11. UL and CUl listed; five year warranty.

C. Ultra Sonic Ceiling Sensor.

1. Provide at locations shown on the drawings.

2. Solid state, crystal-controlled (25 kHz $\pm$ 0.005%).

3. Temperature and humidity-resistant 25 kHz receivers, W-500A contains 1 receiver, other models contain 2 receivers.

4. Time delay adjustable from 15 seconds to 15 minutes.

5. Mounts to ceiling tile or 4 square junction box.

6. Units per power pack: up to 7 (B); up to 9 (BZ).

7. Dimensions: 4.5" x 4.5" x 1.25" (115mm x 115mm x 32mm) W x L x D.

8. UL listed; five year warranty.

D. Dual Technology Sensors.

1. Provide at locations shown on the drawings.

2. 24 VDC/VAC.

3. Ultrasonic frequency of 40 kHz.

4. Time delays: SmartSet (automatic), fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode.

5. Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity (for PIR sensitivity); ultrasonic sensitivity is variable with trimpot.

6. Built-in light level sensor (DT-300) – works for 10 to 300 footcandles (107.6 to 3,229.2 lux).

7. Low voltage, momentary switch input for manual ON or OFF operation.

8. DT-300 contains an isolated relay with N/O and N/C outputs; rated for 1 Amp @ 30 VDC/VAC.

9. Multi-level, 360^0 Fresnel lens for superior occupancy detection.

10. Mounting options: ceiling tile; 4 square junction box with double gang mudring.

11. Units per power pack: DT-300: up to 2 (B), up to 3 (BZ); DT-305: up to 3 (B), up to 4 (BZ).

12. Dimensions: 4.50" diameter x 1.02" deep (114.3mm x 25.9mm).

13. UL and CUL listed; five year warranty.

PART 3 - EXECUTION

3.1 Installation:

A. Support fluorescent fixtures from structure above and screw fasten to grid. Do not support from acoustical tiles. Provide rigid hangers or framing to support units. Install grid clips for troffers. Provide additional hangers to achieve one support at each troffer corner.

B. Install plaster rings or frames where fixtures are recessed in plaster ceilings. Install matching trim for fixtures in other types of ceilings.

C. Coordinate fixture locations with ceiling framing and equipment locations. Align all continuous row fixtures in uniform rows. Furnish metal channels to achieve alignment, if required. All fixtures shall be supported securely with approved hangers. Such hangers shall be set in perfect alignment and elevation.

D. The contractor shall provide the required unistrut, chains, hangers, all thread, etc. to hang light fixtures in areas without suspended ceilings.

E. Where light fixtures are to be mounted on existing drywall or plaster ceilings in finished areas which are not to have suspended ceilings installed, all exposed raceways and device boxes shall be Wiremold.

F. Outlet mounted fixtures shall be mounted directly to mounting ears of outlet box or to fixture studs as required by selected fixture. Furnish structural supports for heavy fixtures.

G. All splices shall be carefully placed in outlet boxes or wiring gutters with no crowding in a neat and orderly manner.

H. Light fixtures shall not be used as raceways. Furnish boxes at each fixture where multi-circuit homeruns are used.

I. Upon completion of above work and prior to final acceptance of building, each fixture shall be equipped with proper number of new lamps of specified size, all in good operating condition. Replace any lamp or ballast which appears to be defective or noisy or of the wrong color, in opinion of Architect. Fixtures shall be clean at time of acceptance.

3.2 Guarantee:

A. Unless otherwise specified, guarantee unconditionally for guarantee period as set forth in General Conditions, all material, equipment, workmanship and installation. During this period, adjust, repair or replace at no cost to Owner any item of equipment or workmanship found to be defective.

B. Lamps shall be guaranteed for 90 days after final acceptance.

(END OF SECTION)

The general conditions, any supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this section as fully as if repeated herein.

PART 1 - GENERAL

1.1 Scope of Work:

A. Work Included:

1. Fire alarm system as specified and as required by Code.

2. Connection to sprinkler tamper and sprinkler flow switches. Flow and tamper switches shall be furnished under section specifying sprinkler system.

3. Provide duct smoke detectors and HVAC unit control. Duct smoke detectors shall be furnished and installed by this section.

4. Elevator recall controls.

5. Testing of the fire alarm system shall be preformed in front of the owners and the Local Fire Marshal's representatives.

6. Complete demolition of existing fire alarm system.

B. Related work elsewhere: Section 15500 - Fire Protection System, Section 15900 - Automatic Temperature Controls.

1.2 Codes and Standards:

A. NFPA Standards 101, 72A, 90 latest editions.

B. National Electrical Code, latest edition.

C. Local building code.

D. Requirements of local Fire Department.

E. NFPA Standard 90A, latest edition.

1.3 Qualifications:

A. All major items shall be products of one United States manufacturer regularly engaged in production of such equipment, who has maintained in this area a maintenance and service organization for a period of two years where skilled, factory trained men are available on a 24 hour basis.

1.4 Certification:

A. The contractor shall provide the services and equipment of an alarm service company listed by Underwriters Laboratories Inc., in its Directory as being capable of furnishing the signaling systems specified herein and who is authorized to, and shall, issue a certificate to the equipment described herein as its representation that such equipment and all connected wiring and devices which form the specified system together with installation and maintenance service are in compliance with the requirements established by Underwriters Laboratories Inc.

1.5 Submittals:

A. Complete fire alarm system and detection system, wiring diagrams, color coding, all system components.

B. General Submittal Requirements.

1. Number of copies: six to general contractor, Three to local fire marshal.

2. Provide floor plan blue print drawings with each set of submittals.

3. A submittal shall consist of equipment cuts, drawings, wiring diagrams, risers, sequence of operations, battery calculations.

C. Drawings.

1. Project name and address (include all addresses if more than one bldg).

2. Project owner’s name and address including zip code (tenant for tenant work; building owner for shell work).

3. Building construction permit number, if available.

4. Contractor name, address, telephone number, and contact person.

5. Symbol and abbreviation key.

6. Minimum scale for floor plans is 1/16" per ft.

7. Occupancy of all rooms and areas.

8. Location of all partitions.

9. Rating of any firm walls, partitions, doors, and associated detection.

10. Smoke partitions, doors, duct penetrations, and associated detection.

11. Graphic annunciator detail.

D. Equipment.

1. Include catalog cuts for all equipment to be used.

2. For system additions, submit existing equipment catalog cuts for coordination and to check compatibility.

3. Annotate all catalog cuts to show exact model(s) to be used.

4. Include system devices provided by others such as duct detectors and door holders.

E. Wiring Diagram.

1. This must be a point-to-point diagram showing all terminal connections at devices and panel(s).

2. Typical circuits or devices may be shown once.

F. Sequence of Operations.

1. For all initiating devices, show all system outputs such as audible & visual devices, annunciation, door & damper closure, AHU shutdown, door unlocking, smoke control system activation, sprinkler system activation, etc.

G. Battery Calculations.

1. Show all devices and current draw.

2. Provide the required alarm and supervision time.

H. Send the submittals to the State Fire Marshal's office for review no later than 30 days after award of the contract. Make corrections as required by the Fire Marshal’s office and resubmit until the submittal has been approved. The contractor shall include all cost associated with producing one resubmittal as part of the contract.

PART 2 - PRODUCTS

2.1 Fire Alarm System:

A. General:

1. Provide a complete and integrated fire alarm system, including an addressable multiplexed main control panel, addressable manual fire alarm stations, duct smoke detectors, smoke detectors, sprinkler flow and valve tamper switch connections, graphic annunciator; digital communicator and

all required outlets and wiring.

2. Make connections to all water flow and valve tamper switches, duct smoke detectors, alarms and initiating devices, and related systems furnished under other contracts. Location and quantity of flow and tamper switch connections will vary as per approved sprinkler system layout. Contractor shall be responsible for connections to all switches furnished under sprinkler contract. Flow switches shall be installed under Division 15. Wiring shall be under this division.

3. Operation of any detector, manual station or water flow device shall sound a continuous alarm on all audible alarms and flash all visual alarms. All alarms shall continue until manually reset. Operation of tamper devices or a failure in supervised wiring shall continuously sound trouble alarm. Receipt of an alarm from an initiating device shall have priority and shall not be inhibited in trouble mode.

4. System as specified herein shall be addressable Simplex 4010, Edwards Notifier, Silent Knight, Fire Lite. Equals shall be compatible and UL listed to service the existing fire alarm system components.

5. Wiring shall generally be in accordance with sections of this division except that minimum wire size for detector or contact device circuits shall be no. 22 AWG THHN and No. 12 AWG THHN for signal circuits. All wiring shall be in EMT or red Fire Alarm MC Cable and shall comply with the requirements of 16100.

6. Locations for all ceiling mounted equipment shall be coordinated with lights, air outlets and other ceiling fixtures, and shall be acceptable to the Architect.

7. System shall be installed in accordance with manufacturer's recommendations, by or under direct supervision of an authorized factory trained representative. Manufacturer shall provide complete wiring diagrams for the entire system and it shall be submitted for approval. All tests and adjustments shall be made by manufacturer's representative.

8. Make provisions for telephone company connection. Provide 3/4 inch EMT conduit to telephone service terminal equip., connect to dedicated line, & test.

9. Install required digital communicator interconnect wiring for proper operation.

10. All equipment shall be listed by Underwriters' Laboratories, Inc., for service in accordance with NFPA Standards 72, latest editions, and all components shall be approved by the local fire inspection approving agency.

11. Installation of system shall comply in all respects to NFPA Standard 72, and NFPA Standard 90A, "Air Conditioning and Ventilating Systems".

12. Smoke detectors specified hereafter shall have been listed in accordance with Underwriters' Laboratories UL-268, standard for commercial detectors and shall have approval from the State Fire Marshal's Office. Detectors which do not meet this standard shall not be considered as complying with intent of this specification.

13. All strobe circuits shall be loaded no more than 75% of capacity.

2.2 System Operation:

A. Actuation of any fire alarm station, smoke or thermal detector shall:

1. Automatically operate fire alarms in building in which item was activated, and initiate digital communicator.

2. Initiate flashing fire strobes.

3. Activate annunciators on fire alarm panel and remote annunciators indicating zone and building in which station, detector or flow switch was activated.

4. Activate elevator capture circuit, and denergize the elevator battery lowering system.

5. Activate a set of auxiliary dry contacts (DPDT).

6. Denergize all sound and public address systems.

B. Actuation of any a sprinkler water flow device shall:

1. Automatically operate fire alarms in building in which item was activated, and initiate digital communicator.

2. Initiate flashing fire strobes.

3. Release all magnetic door holders.

4. Activate annunciators on fire alarm panel and remote annunciators indicating zone and building in which station, detector or flow switch was activated.

5. Activate elevator capture circuit, and denergize the elevator battery lowering system.

6. Activate a set of auxiliary dry contacts (DPDT).

7. Denergize all sound and public address systems.

8. Activate the outside waterflow alarm at the siamese connection.

C. Actuation of any tamper device shall sound a trouble alarm at control panel. It shall not sound building alarm.

D. Activation of an elevator lobby or shaft smoke detector shall:

1. Sound building fire alarm system.

2. Return elevator to primary level of discharge and open door.

3. Light appropriate annunciator light and fire zone.

4. Disconnect elevator battery back-up. Provide required contactors.

E. Activation of a machine room smoke detector shall:

1. Sound building fire alarm system.

2. Return elevator to primary level of discharge and open door.

3. Light appropriate annunciator light and fire zone.

4. Flash light in the elevator cab.

5. Disconnect elevator battery back-up. Provide required contactors.

F. Activation of an elevator shaft or machine room (135 degrees F fixed) heat detector shall:

1. Sound building fire alarm system.

2. Shunt trip all power to the elevator and elevator machine room.

3. Activate appropriate annunciator light and fire alarm zone.

4. Disconnect elevator battery back-up. Provide required contactors.

G. Activation of the smoke detector in the elevator lobby of the primary level of discharge shall:

1. Sound building fire alarm system.

2. Return elevator to secondary level of discharge.

3. Activate annunciator.

4. Disconnect elevator battery back-up. Provide required contactors.

H. Activation of a HVAC duct detector or manual HVAC shut-down switch shall:

1. Shut down the HVAC unit by the use of supervised relays, and all associated compressors.

2. Activate a supervisory trouble.

3. Indicate HVAC unit in alarm on the fire alarm control panel and annunciator.

I. Activation of the fire pump controller alarm (fire pump running, fire pump loss of power, fire pump phase reversal) or emergency generator alarm shall:

1. Activate the digital communicator

2. Activate a supervisory trouble.

2.3 Equipment:

A. Main control panel shall provide power and necessary components for operation of supervised alarm initiating circuits, supervised tamper circuits and supervised alarm signal circuits utilizing 24 volt DC devices.

B. Construction shall be modular with solid state, microprocessor based electronics. Visual indicates shall be high contrast, LED type. Type control panel shall contain the following features:

1. 127 zone addressable interface.

2. Eight 2 amp alarm indicating appliance circuits (provide supplemental power supplies as required).

3. Two form C alarm contacts.

4. Two form C trouble contacts.

5. Earth ground supervisory circuit.

6. Automatic battery charger and batteries.

7. Surge suppressor on each line feeding from remote buildings.

8. Sixteen programmable contacts for control of HVAC units.

2.4 Operation:

A. Primary power for system shall be from a 3 wire, 120 volt AC supply.

B. Operation:

1. The addressable controller continuously interrogates each addressable device on the communicator channel for status condition such as: normal, off-normal, alarm, or trouble. Sophisticated poll and response communication techniques ensure supervision integrity and allow for "T-tapping" of the circuit. Using a twisted, shielded pair of #18AWG wire, a maximum of 10,000 feet of wire.

C. Alarm signal circuits shall consist of a 2 wire circuit terminating in an end-of-line device. Circuit shall be fused. A yellow LED indicating lamp (one for each circuit) shall illuminate on face of control panel should a break occur or an alarm line be shorted when system is in normal condition.

D. End-of-line devices shall be located in a separate, covered, recessed box at end of each circuit and shall have red engraved plastic tags indicating zone designation, screw attached to cover. Cover shall be brushed, 302 stainless steel.

2.5 Annunciators:

A. Provide one Alphanumeric Annunciator located as directed by the fire marshal. The Annunciator shall be flush mounted with a 40 digit display, with reset, test, trouble tone and trouble silence.

B. Provide one Graphic Annunciator as detailed on the drawings. Provide a UL listed compatible to the system furnished. WSA or equal

2.6 Standby Battery:

A. Provide an integral gelled electrolyte, lead-acid battery in each control cabinet to power the entire fire alarm system, including detectors, audible and visual alarms, annunciators and manual devices. Batteries shall have sufficient capacity to operate 24 hours in standby mode and 10 minutes in full alarm mode. Furnish integral automatic chargers to fully re-charge the batteries within 24 hours of power restoration, after a full discharge. Size batteries at 125% of calculated requirement. System shall be U.L. listed for intended purpose.

2.7 Automatic Devices: (Individually Addressable)

A. General: All detectors shall permit changing detector type (ionization, photoelectric, or thermal) without necessitating base, zone or control panel rewiring.

B. Smoke detectors shall be a plug in unit containing photoelectric detection chambers. It shall operate from a 24 volt or less DC power source, and shall contain an alarm indicator LED to signal actuation of detector. It shall also be possible to connect a remote relay to detector.

C. Thermal detectors shall be fixed temperature in mechanical equipment rooms or where rapid temperature variations can occur. Temperature ratings shall be as recommended by manufacturer.

2.8 Strobe Power Supplies:

A. The power supply shall be a standalone power supply intended for powering fire alarm notification appliances via its own Notification Appliance Circuit(s) (NAC). The unit shall be UL 864 Listed for power limited operation of outputs and comply with NFPA 70 (NEC), article 760. The power supply shall support a full 8A of notification power even if the battery is in a degraded mode and only AC power is connected.

B. The power supply shall be activated by a standard Notification Appliance Circuit (NAC) from any Fire Alarm Control Panel (FACP) or a "Dry Contact" opening. The units shall be 8 ampere, 24 VDC, regulated and filtered, supervised remote power supply/charger. It shall operate over the voltage range of 8 to 33 VDC or FWR. The primary application of the unit shall be able to expand fire alarm system capabilities for additional NAC circuits to support ADA requirements and to provide auxiliary power to support system accessories or functions. The power supply shall provide four Class "B", two Class "A" or two Class "B" and one Class "A" NAC circuit(s). Eight Class "B" or four Class "A" circuits shall be available with an optional PS-EXP module. The PS-8 unit shall supply up to 240 mA of auxiliary power that is available during both non-alarm and alarm or auxiliary power to not less than 2.5A at 24 VCD during non-alarm. The power supply shall be capable of charging batteries of up to 33 ampere hours per NFPA 72 at maximum rate of 0.750 Amps per hour.

C. Input activation options shall be from not les than two NAC circuits or Dry Contact closures. These inputs shall have the capability of being directed to any combination of the four NAC circuit outputs. Each NAC circuit output shall be rated at 3 amperes for Class "B" applications or 3 amperes each for Class "A". The outputs shall be programmable to generate a steady or Temporal (Code 3) output and or a synchronized strobe or horn output. The power supply shall provide independent loop supervision for either Class "A" or Class "B" FACP NAC circuits and shall have the capability to "steer" all alarm or trouble conditions to either incoming NAC circuit. The units shall have common trouble terminals. The power supply shall be powered from a 120 VAC source with a current consumption of xx amperes max. the unit shall incorporate short circuit protection with auto reset. The power supply shall incorporate a built in battery charger for lead acid or gel type batteries with automatic switchover to battery back up in the event of AC power failure. The charger shall incorporate fused protection for the batteries and have the ability to report low battery and/or no battery conditions(s). Standby current for battery back up shall be 0.129 Amps max. The power supply shall have the ability to latch trouble LED's so the circuit in trouble can be identified. The cabinet dimensions shall be 17" H x 15" W x 5.5"D.

2.9 Alarm Devices:

A. Audible/visual signal devices shall be 24VDC, flush mounted combination horn/strobe light assemblies. Strobe light shall be a Xenon flash tube, 15, 30, 60 or 110 candela with Lexan lens and red lettering. Where wall depth permits, unit shall be flush mounted. Lamp and horn shall be polarized for supervision. Horn shall be rated at 95 db measured at 10 feet. Unit shall be framed in a **white** front panel with word "FIRE" in red lettering. Units shall be wall or ceiling mounted as noted on the drawings.

B. Visual devices shall be similar to A/V devices except that no horn shall be provided.

2.10 Manual Fire Alarm Stations: (Addressable)

A. Manual fire alarm stations shall be double action, of non-code type, and shall consist of a molded housing fitted with a pull-down lever and a push-in tab first to provide access to pull-down lever which when operated locks in position after releasing a spring loaded contact switch to effect actuation of alarm circuit. Body of manual station shall be hinged to a backplate assembly to which it is locked with a screw. Resetting the station after operation shall require opening station momentarily and then locking body to backplate. Provision shall be made for surface or semi-flush mounting to conduit boxes.

2.11 Digital Communicator:

A. Provide a dual line, 8 zone digital communicator with battery back-up. Unit shall be activated by fire alarm panel and shall signal an UL listed central station. Provide line seizure module and connect to telephone system. Systems shall separately signal fire alarm and system trouble. Integral or separate digital communicators are acceptable.

B. Include a 1 year service contract to monitor this system as part of the bid.

2.12 Addressable Interface Point:

A. Provide addressable interface modules to monitor all dry contacts such as kitchen hood extinguishing system, sprinkler, tamper, and flow switches.

B. Provide a minimum of three to monitor fire pump controllers for “phase reversal, loss of power, and pump running”.

C. Provide a minimum of three to monitor emergency generators for “generator not in auto, generator failure, and generator running”.

2.13 Addressable Duct Detectors:

A. Duct smoke detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle. The detectors shall be designed to ignore invisible airborne particles or smoke densities that are below

the factory set alarm point. No radioactive materials shall be used. Detector construction shall be of the split type, that is, mounting base with twist-lock detecting head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm LED visible through a transparent front cover. Detectors shall obtain their operating power from the supervised current in the fire alarm loop. Installation must comply with NFPA-90A.

B. A manual control switch shall be provided at the annunciator at the main entrance for control of all HVAC fans. The switch shall have hand-off-auto positions. The contractor shall provide a plycarbonate shield over the switch which shall sound a local audible alarm. Activation shall also activate a supervisory alarm on the fire alarm system.

2.14 Programmable relays:

A. Programmable relays shall be provided for control of elevator recall, HVAC unit shutdown, starting of smoke control fans, etc. Relays shall have contact ratings of 15 amp 120 volts. Provide supplemental relays as required if the relay from the fire alarm manufacturer does not meet these specifications. A minimum of five relays rated at shall be provided for the elevator recall. One relay shall be required for shutdown of each HVAC unit, either by smoke detector activation or by the manual shut-down control at the front door.

B. Provide relays for sprinkler waterflow alarms, kitchen equipment shunt trip and control of exhaust and makeup fans.

2.15 Sprinkler Alarm A/V Device:

A. Audible devices shall be a horn and strobe for operation on a 24 volt system. Wiring class shall permit installation within system conduit. The unit shall be fully enclosed, of modular design and shall be U.L. listed for indicated installations and use. Color shall be factory finish red. Rating shall be 87 decibels at 10 feet. Provide Potter SASH-24.

2.16 Spare Parts:

A. Provide the following spare parts:

1. 2 – Smoke Detectors

2. 2 – Heat Detectors

3. 1 – Duct Smoke Detector

4. 2 – Programmable Control Relays

5. 2 – Manual Pull stations with “Stopper” Covers.

6. 2 – Horn/Strobes, Adjustable

7. 2 – Strobes, Adjustable

PART 3 - EXECUTION

3.1 Installation:

A. Provide audible and visual devices as shown, located as per local codes.

B. Connect all water flow alarms, pressure switches and tamper switches. Use zone area modules to address each item.

C. Connect audible and visual devices so all will sound and flash continuously until silenced when any alarm device is activated.

D. Conceal all wiring in finished areas above ceiling where possible. Fire alarm Junction boxes shall be red and identified.

E. Submit wiring diagram indicating color coding and wire sizes prior to installation. Furnish final wiring diagram after completion of system to Owner.

F. Provide interlock wiring for HVAC units.

G. Provide connections to all required air system fans to shut them down upon activation of a duct mounted smoke detector of HVAC shutdown switch. Provide connections to the starter control circuit for motors with starters. Provide 1 HP motor rated relays for all 120 volt motors or motors without magnetic starers. Provide required interlock wiring to shut down all associated air conditioning compressors, heat pumps, electric duct heaters, and outside air intakes.

H. The contractor shall meet with the fire Marshall and owner to coordinate programming of the addressable devices. Use actual room numbers and field descriptions agreed upon by all parties. Do not use construction blueprint room numbers.

I. Where the contractor opts to have remote strobe power supplies, he shall be responsible to provide all requited 120 volt power to the remote location. Use a dedicated circuit of dedicated fire alarm circuit with capacity.

J. All wiring methods shall be in EMT or Red fire alarm MC cable and be installed in compliance with 16100 and as specified herein. (No MC cable shall be installed exposed).

K. The contractor shall not **rough-in** or **order fire alarm equipment** until the fire alarm drawings are **approved** by the Fire Marshall.

L. The contractor shall obtain the services of an elevator installer to coordinate connection of elevator recall relays.

3.2 Inspection, Test, Adjustment, and Report:

A. Contractor shall furnish all necessary equipment and appliances for testing complete system during process of work and after completion of installation, including a meager test of all wiring. Tests generally shall demonstrate following to satisfaction of Owner:

1. That all circuits are continuous and free from short circuits.

2. That all circuits are free from unspecified grounds.

3. That resistance to ground of all non-grounded circuits is not less than 1 megohm.

4. That all circuits are properly connected in accordance with applicable wiring diagrams. Test of detector circuits shall be performed with all ionization, photoelectric and thermal type detectors removed from their bases.

B. In addition to general tests listed above and prior to acceptance of project by Owner, an authorized factory trained representative shall inspect, test and adjust complete fire detection and alarm system. Inspection, tests and adjustments shall be made in presence of Contractor and Owner's representative and shall include following:

1. Visual inspection of all equipment.

2. Verification of fire and trouble alarm signals at all receiving locations and circuits, including audible and visual alarms, remote annunciators, etc. Owner's personnel may by required for this verification.

3. Test of sensitivity of each ionization and photoelectric detector by means of test set.

4. Examination of location of each detector to determine if effectiveness of a detector may be or has been reduced or if field conditions indicate requirements for relocation or addition of detectors.

C. All detector adjustments and tests shall be performed as follows:

1. With detector in its exact operation location, not at a convenient test place.

2. Under maximum air flow conditions, after air balancing has been performed, with supply air systems constant and no undergoing balancing or other alterations, and with air conditioning refrigeration and heating

systems operating properly.

3. On clean detectors.

D. Any defects detected during general tests and complete system test shall be repaired as quickly as possible, and tests reconducted.

E. A fire and smoke detection system inspection and test report shall be completed and endorsed by a factory representative and placed on file with Owner. Report is mandatory; it shall include all test dates, detector locations, serial numbers and sensitivities. It shall contain a summary of all maintenance performed, all recommendations for relocation or addition of detectors, and final action regarding these recommendations, and shall contain a system certification.

3.3 Guarantee:

A. Guarantee unconditionally as specified in the General Conditions, following acceptance by Owner, the complete Fire Alarm System. During this period, adjust, repair or replace, at no cost to Owner, any item of equipment, material or workmanship found to be defective.

(END OF SECTION)

The general conditions, any supplementary General Conditions and Division 1, General Requirements, are hereby made a part of this section as fully as if repeated herein.

PART 1 - GENERAL:

1.1 Scope of Work:

A. Provide a card access system.

B. Card readers.

C. Door strikes.

D. All required data and control wiring.

1.2 Related Work:

A. All devices, combinations of devices and equipment shall be constructed and installed in conformity with this specification, shall be approved for the purpose for which they are installed by all authorities having jurisdiction and shall be listed by U.L.

1.3 Testing:

A. Before final acceptance, test entire system in the presence of the Owner. Certify that the system is in satisfactory and proper operating condition.

B. The system shall operate satisfactorily before final acceptance and payment is made. Include allowances in bid proposal for complete testing and certification by factory engineer.

1.4 Qualifications:

A. The system contractor shall be a factory authorized representative of the equipment being installed and shall have at least 4 years' experience in designing, installing, and maintaining systems of similar nature and design. Guarantee the equipment to be free from all defects, including batteries, relays, and lamps for a period of one year from date of installation. System set up and orientation, shall be conducted only by, or under the direct supervision of a factory authorized engineer, thoroughly trained and experienced with the particular type of equipment being installed. All equipment shall be U.L. listed.

PART 2 - SYSTEM OPERATION AND PRODUCTS

2.1 Control Panel:

A. The system shall be a micro-processor based unit controller with a fully distributed database; all access decisions shall be made by the individual processor (controller). The controllers shall be of modular design which will allow for present access requirements and the capability to expand without replacement of previously installed equipment.

B. One controller shall be designated a "Primary" with all system programming and system logging to be associated with it.

C. All other controllers (up to a maximum of 99) shall be designated "Secondaries" and shall communicate with the "Primary" via an RS-422 network configuration. The secondary controller shall transmit all transaction messages to the primary for logging purposes.

D. Each controller shall be capable of supporting at least two card readers and be expandable in increments of two card readers up to a maximum of eight per controller. This is to be accomplished with the addition of dual port interface modules.

E. Each controller shall have built-in battery back-up of programmed access information and shall be for a period of not less than ninety days.

F. Each controller shall be powered by a 12VDC power source rated at a minimum of 1.2 amperes. This power supply may also have a battery back-up for use of complete system operation in the event of power failure.

G. Strikes or other locking devices shall have a separate battery back-up for continued operation in the event of power failure.

H. All system inputs and outputs shall have built-in surge suppression circuitry on plug in modular circuit boards. This surge protection, designed as an integral component of the system, shall be self-sacrificing in the event of extreme surges or spikes.

I. The system shall be capable of being supported by an optional report generator package. This will allow for various reports to be printed or displayed from a personal computer attached to the system.

J. The system shall have the ability to display system user names associates with access activity. This shall be an optional component of the controller and shall not require software support. This feature shall not decrease the maximum number of card holders allowable on the system.

2.2 System Features:

A. The system shall be capable of but not limited to the following requirements:

B. Maximum user capability: Up to 3,000 individual users may be given access

cards, tokens or codes and have their access and egress controlled and recorded. This shall be expandable by the addition of a memory expansion module and shall require no other additional hardware or software.

C. Access levels: One of up to 32 user defined access levels shall be assignable to each access system user. An access level shall be defined as one or a group of people who are allowed access to the same points at the same days and time periods.

D. Time zones: Up to 32 user defined time zones shall be assignable to each access level. These time zones shall determine the day or days and times that access will be granted or a scheduled event shall occur. Any or all of the time zones shall be combinable for flexibility and versatility of system access privileges and scheduled events.

E. Holidays: Up to 28 user defined holidays shall be assignable on the system.

F. Log buffer: There shall be an 800 event log buffer to record and hold access and alarm information. When used in conjunction with the "Lock System" mode, this shall enable remote site control and reporting of the system.

G. Scheduled events: Any access controlled point shall be capable of scheduled open periods for any length of time to allow for care-free access. Any designated alarm port shall be capable of scheduled on and off periods for any length of time to allow for automatic alarm system control.

H. Remote door unlock: The operator shall have the capability of opening any access point by typing 9n a simple command from the keyboard. This activity shall cause an entry to be logged displaying the door number and time that it was performed.

I. Selective logging by door: The following log messages shall be controllable for each access point:

1. Inhibit duress capability

2. Inhibit ACCESS GRANTED message

3. Inhibit DOOR STILL OPEN message

4. Inhibit DOOR OPEN message

5. Add alert capability to DOOR OPEN message

J. Forced entry alarm: Under software control, an alarm relay shall be energized if a door is open without a card or keypad code. This condition shall be resetable from the keyboard.

K. Password levels: Two passwords shall be used of up to eight characters and are not printed or displayed at any time for security purposes. The two password levels shall provide a method of limiting the system operator's ability to gain access to the system's programming information.

2.3 Card Readers:

A. The card readers shall employ an infrared light source and detection circuit to enable the "reading" of infrared access cards. There shall be no moving parts in the all solid state reader assembly.

B. The card reader shall be of a swipe reader design with two LED indicators - a green and a red. The green solid light shall be interpreted to mean that the system is operational and ready for a card to be swiped. A green flashing light shall be interpreted to mean that access has been granted and the access point is not entry or access can be gained. A red flashing light shall be interpreted to mean that access has been denied and entry or exit will not be possible.

C. Electrical connections from the infrared reader to the access control processor shall e via color coded 6 conductor, 22 AWG shielded cable. No special connectors or coaxial cable shall be required.

D. Tampering with or connecting together the reader wiring shall have no compromising effect on the system's security aspect.

E. Card readers shall be capable of being hard wired up to 2,500 feet from the controller without the use of any type of amplification device.

F. Card readers shall be available in two different models. One model shall be mountable in a U.S. standard single gang electrical box. The second model shall be mountable in standard 1.75 inch or wider door mullions as used on all glass building fronts.

G. Card readers shall be capable of accepting multiple sized infrared access cards or tokens.

H. Card readers shall be of all metal construction and be usable indoors and outdoors without modification.

I. The card reader's operating temperature range shall be -35^{o}C to +67^{o}C non-condensing.

2.4 Infrared Access Cards:

A. The infrared access card shall be constructed of no metallic or magnetic materials and shall be of a passive design for great stability and reliability.

B. Each infrared access card shall contain on of 4 billion unique code numbers and

an additional security check number.

C. No facility codes shall be used in order to enable easier multiple site applications.

D. The card shall be "swiped" through the card reader assembly. Infrared light shall pass through the card's material and be detected on the opposite side of the card. This shall enable the access control processor to interpret the card's encoded information.

E. The infrared card shall be available in the following forms:

1. Standard credit card size

2. IBM data size

3. Custom sizes

2.5 Door Strikes:

A. Door Strikes - Electric door strikes and step down transformers shall be provided at locations as indicated compatible with existing door frames and door hardware. Contractor shall field confirm prior to submission. Provide Cyferlock or equal.

2.6 Submittals:

A. Submit shop drawings, product data, wiring diagrams and manufacturer's literature.

B. Indicate system components, size of components, location and provide full schematic or wiring system showing building and operation details.

C. Submit manufacturer's installation instructions.

D. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

E. Equipment submittals shall include the following:

1. Manufacturer's literature and illustrations.

2. A description of the system operation which includes the method of operation and supervision of each type of circuit operation of manual controls, and sequence operation.

3. Wiring diagrams which show the method of wiring for each type of circuit for each function performed.

4. Each wiring diagram shall indicate:

a. Method of fusing and location of fuses on the circuit.

b. Recommended wiring type and size and methods of ground or shielding (if used).

c. Terminal identification at control panels and remote devices.

F. Submission of shop drawings without the wiring and connection diagrams shall be cause for rejection of the submission.

PART 3 - EXECUTION

3.1 Installation:

A. Install wiring in conduit concealed in walls and ceilings.

B. Test completed system in presence of Owner's representative, architect, consulting engineer, general contractor, and manufacturer's technical representative. Upon completion of a successful test of system, the electrical contractor shall so certify in writing to Owner, architect and general contractor.

C. Warrant the system, including equipment and wiring free from inherent electrical and mechanical defects for a period of one year form date of Owner's acceptance of the system.

D. Equipment manufacturer shall provide a gratis testing and inspection contract during the warranty period, with option for paid extension at expiration of the gratis period.

3.2 Guarantee:

A. Upon completion of the system installation and before final inspection, thoroughly check the alarm system. Certify in a letter to the Architect that each detector, all devices, and the complete system has been checked and is as specified, that all items have been labeled, that as built wiring diagrams have been prepared and the Owner's representatives have been instructed in the alarm system.

(END OF SECTION)