

SECTION 28 72 10

LIFE SAFETY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, and coordinated system.
- B. The fire alarm system shall comply with requirements of the NFPA Standard 72 for Protected Premises Signaling Systems and all local codes and regulations. The system shall be electrically supervised and monitor the integrity of all conductors. The manufacturer shall confirm all codes have been met and all necessary devices provided prior to submitting price.
- C. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto the Signaling Line Circuits.
- D. The system shall be an active/interrogative type system where each transponder is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel/node indicating that the transponder and its associated initiating device and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display, as specified hereinafter for the particular input.
- E. The system shall be arranged such that not less than 20 percent additional transponders may be inserted into any network communication loop.
- F. The FACP and peripheral devices shall be manufactured by **Notifier, Edwards, or Siemens.**
- G. The installing company shall employ **NICET (minimum Level II Fire Alarm Technology)** technicians on site. To guide the final checkout and to ensure the systems integrity, the submitting company shall employ **NICET Level IV** minimum managers and engineers. Proof of NICET level training shall be included as part of submittal package and kept on site with personnel.

- H. The installing company shall be **UL** listed for fire alarm installations. **UL** certificate shall accompany submittal package. The certification listing category shall be UUUJ and shall be indicated in the project submittal.
- I. The Contractor shall make arrangements and pay all fees in connection with the testing of the Life Safety System. All system devices shall be tested for their correct operation, except non-restorable type heat detectors which shall be sample tested. All tests carried out shall meet the requirements of the local authority having jurisdiction.
- J. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - 1. Factory Mutual Systems
 - 2. Underwriters Laboratories

1.2 SCOPE

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance
 - 1. Each SLC loop shall be wired NFPA 72 Class B, Survivability Level 1.
 - 2. Initiation Device Circuits (IDC) shall be wired NFPA Class B, Survivability Level 1 as part of an addressable device connected by the SLC circuit.
 - 3. Notification Appliance Circuits (NAC) shall be wired NFPA Class B, Survivability Level 1 as part of an addressable device connected by the SLC circuit or a panel circuit.
 - 4. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone, which ever is greater.
 - 5. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

C. Basic System Functional Operation

1. As part of the fire alarm; when a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
 - a. FACP will sound and display the alarm condition showing the device address, location, zone information, time/date, and device type.
 - b. The remote annunciator will sound and display the same information as shown on the FACP display unit.
 - c. Via system programming, the horn/bell outputs for all zones will activate and sound in temporal 3-3 pattern in synchronized fashion until silenced from FACP panel.
 - d. All strobes on floors with activated horn/bell outputs shall flash in a synchronized pattern per floor until silenced from the FACP panel.
 - e. Automatic functions including, but not limited to: elevator(s) recall, smoke evacuation, smoke door release and supply/return fan shutdown shall be activated via system programming as directed by codes and/or drawings.
 - f. Release all magnetically held smoke doors.
 - g. Provide signals to the mechanical controls including smoke dampers to shut down or reroute air-handling systems to prevent the recirculation of smoke.
 - h. Provide a DACT (Digital Alarm Communicator Transmitter) and a signal via DACT for connection to a central station or local municipal fire department (connection and leased line, if required, shall be provided by building owner).
 - i. Initiate a preprogrammed timing sequence.
 - j. Additionally, actuation of a lobby elevator smoke detector shall cause immediate non-stop return of all automatic elevators served by that lobby to the primary discharge level; except that,

when the alarm has been initiated on the primary discharge level, the elevators, shall be returned to the designated alternate discharge level per the requirements of ANSI ASME A17.1.

- k. Additionally, actuation of any elevator equipment room or shaft smoke detector shall cause immediate non-stop return of all automatic elevators served by that equipment room or shaft, to the primary discharge level per the requirements of ANSI ASME A17.1. Provide all required signals from FACP to elevator controls for smoke detector in elevator machine room per the requirements of ANSI ASME A17.1
- l. Additionally, actuation of any smoke detector located in the air handling units and/or equipment rooms shall activate signals to the mechanical controls indicating the floor of occurrence.
- m. It shall be possible to silence the alarm signals by operating the signal silence switch. However, the activation of another zone shall repeat the entire alarm process, thus causing the signals to resound.
- n. Silencing the alarm shall cause all speakers to silence. Firelights will continue to flash.
- o. Fire pump (if applicable) normal power availability, fire pump phase reversal and fire pump run status shall be monitored. Loss of normal power, phase reversal shall annunciate as supervisory alarms and pump running shall annunciate as an alarm.
- p. Provide a signal to activate the elevator shunt trip breaker upon activation of the heat detector(s) in the elevator shaft or elevator machine rooms.

2. General Operation

- a. Power failures, opens, grounds or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced, however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

1.3 SUBMITTALS

A. General

1. Copies of all submittals shall be submitted to the Architect/Engineer for review prior to acceptance of system.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
3. The authority having jurisdiction shall be notified prior to installation of equipment and wiring. Complete information regarding the system including specifications, wiring diagrams, battery and power supply calculations, floor plans and graphics shall be submitted for approval.
4. If submittals, upon review by the Owner and/or the Owners Representative, are found not to conform with the performance, type and quality of products as well as all other requirements of these specifications; the Contractor shall be required to resubmit. The Contractor shall be responsible for the Owner's extra expenses for subsequent review(s) of rejected submittals. Such extra fees shall be deducted from payments by the Owner to the Contractor. Approval of the submittals by the Owner shall, in no case, relieve the Contractor of the responsibility to meet the requirements of this specification.

B. Shop Drawings

1. Drawings shall include the following minimum requirements for submittal:
 - a. Point-to-point wiring/conduit layout for all devices on 1/8" scale plans.
 - b. Device placement showing all addresses and device ID.
 - c. All panel and equipment terminations.
 - d. All circuit voltage drop and current calculations spread sheets.
 - e. All battery calculation spreadsheets.
 - f. Legend reflecting device description, manufacturer, model number, and back-box requirement.

- g. Wiring legend reflecting wire function, type, and recommended manufacturer's part number.
- h. Full sequence of operations.
- i. Power supply and amplifier calculations.

- 2. Specification data sheets on each individual system component.

C. Data Sheets

- 1. Submit simultaneously with the shop drawings, complete manufacturer's technical data sheets showing product description, listings, and specs.
- 2. Copies of **NICET II** and **IV** certifications.
- 3. Copy of company **UL** listing certificate.

1.4 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall comply with the latest standards.

- 1. National Fire Protection Association (NFPA), 2000 Edition - USA:

- No. 13 Sprinkler Systems
- No. 13A Halon 1301 Extinguishing Systems
- No. 17 Dry Chemical Extinguishing Systems
- No. 17A Wet Chemical Extinguishing Systems
- Clean Agent Extinguishing Systems
- No. 70 National Electrical Code
- Specifically Article 760
- No. 72 National Fire Alarm Code
- No. 101 Life Safety Code

- 2. International Building Code
- 3. American National Standard A17.1-1980
- 4. Underwriter's Laboratories Fire Resistance Directory

5. Local and State Building Codes
6. ADA Public Law 101-336
7. All requirements of the Authority Having Jurisdiction (AHJ)

1.5 APPROVALS

- A. The system shall have proper listing, approval and labeling from the following nationally recognized agencies:

FM	Factory Mutual Systems
UL	Underwriters Laboratories

1.6 SYSTEM FEATURES

- A. The system shall include the following features as a minimum:
1. During an alarm condition, the LCD annunciator shall display the activated alarm until acknowledged. This shall allow determination of where the last alarm has taken place.
 2. Ground fault detection in wiring on either plus or minus side.
 3. Separate alarm and trouble shall be displayed on the LCD annunciator.
 4. Resound feature.
 5. Dead Front" design control panel with all LED alarm trouble and power on indicators and all switches located behind a locked tempered glass door.
 6. Solid state construction.
 7. All alarm initiating circuit wiring, signal circuit wiring, speaker circuit wiring shall be supervised.
 8. Automatic transfer to standby batteries upon power failure.
 9. Lightning and surge protection.

PART 2 - PRODUCTS

2.1 CONDUIT AND WIRE

- A. All fire alarm wiring shall be installed in conduit. Conduit shall be installed as required by specification Section 26 10 00.
- B. Wiring shall be in accordance with local, state and National codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system.
- C. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes from the 120 volt normal power source or from a generator powered source if available.
- E. All junction boxes and conduit utilized for fire alarm system cabling shall be painted red.
- F. All circuit breakers serving the fire alarm system shall include red marking and a listed locking mechanism per NFPA 72.

2.2 MAIN FIRE ALARM CONTROL PANEL:

- A. The FACP shall be completely microprocessor based.
- B. System Capacity and General Operation:
 - 1. Configure size of panel to operate number of SLC circuits in a fashion so that each circuit handles no greater than 70% load of capacity or a maximum of 5 floors per circuit.
 - 2. The fire alarm control panel shall include a full-featured operator interface and backlit 80-character Liquid Crystal Display (LCD).
 - 3. The system shall be fully field programmable from the display panel. Panels requiring the use of external keyboards for programming and changes are not acceptable.
 - 4. The FACP shall provide the **minimum** following features:
 - a. Drift compensation to extend detector accuracy over life.

- b. Detector sensitivity test, per NFPA 72, Chapter 7.
 - c. Maintenance alert, to warn of excessive smoke detector dirt or dust accumulation.
 - d. Multiple sensitivity levels for alarm, selected by detector.
 - e. System status reports to display and printer. Provide printer.
 - f. Alarm verification, with verification counters.
 - g. Cross zoning with the capability of counting two detectors in alarm.
 - h. Walk test.
 - i. UL-1076 security monitor points.
 - j. Control-by-time with holiday schedules.
 - k. Day/night automatic adjustment of detector sensitivity.
 - l. Device blink control for sleeping areas.
 - m. Releasing capability.
 - n. Pre-Alarm.
 - o. Selectable sensitivity levels, three minimum.
 - p. History Storage, with a minimum of 400 events.
 - q. Point Enable/Disable.
 - r. Point Read (status and level of obscuration).
 - s. Output point for connection to any building EMS.
- C. Signaling Line Circuits (SLC)

1. Each SLC interface shall provide power to communicate with 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control).
2. Each SLC circuit shall not exceed 70%, load capacity or cover more than 5 floors.

D. Serial Interface

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
 - a. One serial port shall support a serial printer.
 - b. One serial port shall support a CRT/NRT device.
 - c. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.

E. Field Charging Power Supply (**FCPS**): The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries. Provide batteries to support 60-hour standby with ten minutes of alarm indication at the end of this period. Battery charger shall be capable of recharging all batteries to seventy percent capacity in twelve hours.
2. The Field Charging Power Supply shall have four outputs (Survivability Level 1) and shall be available for connection to the Notification devices.
3. Provide 20-watt spare capacity in each electrical room on each floor for tenant audible circuits. Locate in a junction box clearly labeled "tenant fire alarm audible circuits".
4. Provide 1ea. Field Charging Power Supply (DC) per floor to allow for tenant build-out expansion of NAC devices. At no time shall there

exceed 70% load capacity of any FCPS on any of the common levels.
Provide power capacity as follows:

<u>Floor Size</u>	<u>Capacity</u>
<25,000 gross sq. ft.	6 amps DC
25,001 to 35,000 gross sq. ft.	10 amps DC
35,001 gross sq. ft. and greater	consult engineer

5. Locate audible (where required) and visual power supplies adjacent to one another and in a location within each room approved by the engineer.
6. Provide battery capacity and amplifier capacity in the main fire control panel for addition of tenant devices described above.

- F. Provide and install ceiling mounted smoke detector within 5 horizontal feet of FACP.

2.3 SYSTEM COMPONENTS

A. Horns/Bells

1. All Horns/Bells shall be installed as shown on drawings and in accordance with NFPA 72 and local codes.
2. Horns in corridors and all public spaces shall produce a nominal sound output of 15 dBA above average ambient noise levels with a minimum sound output of 15 dBA.
3. Horns shall be UL-464 listed for fire evacuation and operate on 12 or 24 voltage in a temporal 3-3 pattern.
4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
5. Speakers shall be bone white in color.
6. Provide a unit cost to add 2 speakers per 25,000 sq.ft. This unit cost shall be applied to additional speakers that may be required at the request of the Fire Marshal during field inspections.

B. Strobe Lights

1. All strobe lights shall meet the requirements of the ADA, UL Standard 1971.
2. Strobe intensity and flash rate shall meet the requirements of UL 1971, ADA and NFPA 72.
3. Combination horn/strobe devices shall meet all above requirements as well as horn/bell requirements listed herein.
4. Strobe unit shall mount to a four inch square electrical outlet box. The strobe light shall have a white lens with red "FIRE" imprinted on it. When the unit is combination speaker/strobe, the speaker portion shall comply with the requirements stated in A. above.
5. All strobes shall have selectable output intensities from 15 to 110 cd. The intensity selected shall meet NFPA 72 requirements for the layout shown on the drawings.
6. Strobe spacing shall be as follows:
 - a. Strobes shall be spaced a maximum of 100' apart in corridors and within 15' of the end of every corridor to comply with the requirements of NFPA 72.
 - b. Strobes in open areas shall be provided to comply with NFPA 72.
 - c. Provide strobes in public spaces such as restrooms, kitchens, breakrooms, cafeterias, conference rooms, training rooms and any other space where six or more people are likely to gather.
7. Provide a unit cost to add 5 strobes including required signal circuits per 25,000 sq.ft. This unit cost shall be applied to additional strobes that may be required at the request of the fire marshal during field inspections.

C. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be dual-action, non-coded, non-break glass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. Units shall be master keyed with control equipment.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side. This shall be achieved with the pull lever remaining at a right angle to the station body until reset.
4. The station body shall be constructed so that chips and scratches will not expose metal.
5. Manual fire alarm stations shall be located as required by NFPA 101 and the International Building Code.

D. Smoke Dampers

1. Smoke dampers shall be provided by Division 23.
2. Provide a smoke detector at each smoke damper location to meet the requirements of NFPA 72. Confirm quantities and locations of smoke detectors required for smoke dampers with Division 23. Provide 120 volt power as required for operation of smoke dampers.

E. LCD Alphanumeric Display Remote Annunciator

1. The alphanumeric display annunciator shall be a supervised, backlit LCD display containing a minimum of eighty, (80) characters for alarm annunciation in clear English text. Annunciator shall be located as shown on the drawings or at the location selected by the local fire department.
2. The LCD annunciator shall display all alarm, supervisory, and trouble conditions from the FACP via the serial card.

2.4 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

E. Addressable Devices - General

1. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel signaling line circuits.
2. Addressable photoelectric smoke and thermal detectors shall provide alarm and power/polling LEDs. LED(s) shall flash under normal conditions and LED(s) shall be placed into steady illumination by the control panel, indicating an alarm condition.
3. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system.
4. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, **not the detector**, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
5. All field wiring is to be terminated on the detector base, **not on the sensor head**. Addressing of detectors shall be via integral decade switches built into sensor. Devices requiring separate addressing means will not be accepted.
6. Any additional equipment required to program devices are not acceptable.

F. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. Provide photoelectric smoke detector heads with bases as required. Detectors shall be of the solid state photoelectric type utilizing a stable LED light source and a silicone photo diode as the receiving element to form a highly accurate means of smoke detection. Internal detector circuits shall be shielded against electrical interference and resistant to transients, noise and, RF interference. Detector shall be low profile, the complete unit including base shall not exceed 1.875 inches in depth.

Detector shall have a dual purpose red LED that flashes continuously to show that the device is operating and, that comes on steady to show that the device is in alarm.

3. Nominal detector sensitivity shall be 1.4% per foot obscuration with a range of 1% to 1.84%. Regardless of sensitivity settings, the detector's stability shall be unaffected by high air velocity. No radioactive materials shall be used.
4. Provide smoke detectors in elevator lobbies, at stairwell doors, in telephone rooms, electrical rooms, mechanical rooms, elevator pits, the top of the elevator shaft, adjacent to the fire alarm control panel, fire pump room, computer rooms as defined by NFPA 90, chiller plants, pump rooms, UPS rooms and elevator machine rooms.

C. Linear Beam Smoke Detector

1. Each beam shall be comprised of a solid state infrared (IR) transmitter, photodiode receiver and microprocessor based control module. Should IR output be attenuated below the desired alarm obscuration level as a result of smoke interference an alarm will be annunciated. Total obscuration of the beam is annunciated as a beam blockage trouble signal. All wiring from the control module to the transmitter and receiver heads is supervised.
2. The projected beam smoke detector system shall have an operating range of 10M. (33 ft.) to 100M. (330 ft.) and be listed for spacing the beam 30 ft. from a wall and 60 ft. on center. The transmitter and receiver optical elements shall be adjustable +/- 90 degrees horizontally and +/- 30 degrees vertically. The sensitivity shall be field selectable from 7% to 50% obscuration.

D. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

G. Duct Smoke Detectors

1. Duct smoke detectors shall be addressable type with visual alarm and power indicators. Provide remote LED/test stations where duct detectors are mounted in non-visible areas such as above ceiling.
2. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes where required. Provide smoke detectors in each return air path of any mechanical equipment that moves air in excess of 2000 CFM to meet the requirements of NFPA 72 and 90A. Provide smoke detectors in each supply and return air path of any mechanical equipment that moves air in excess of 15,000 CFM to meet the requirements of NFPA 72 and 90A. Confirm quantities of smoke detectors required for mechanical equipment with Division 23. Room detectors may be used to accomplish smoke detection in the supply/return air paths if the application permits.
3. Each duct detector shall be installed along with addressable control module as needed for fan shutdown and/or smoke control. Detectors zoned with other devices shall be capable of operating its control module even if all other devices on their circuit have gone into alarm.
4. Duct detectors shall be provided by this division, installed by the mechanical contractor and electrically connected to the fire alarm system by the electrical contractor.

E. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device such as flow, tamper, release systems, etc.) to one of the fire alarm control panel SLCs.
3. The IDC zone shall be suitable for Survivability Level 1 operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include an LED.

5. Monitor module shall be provided for all sprinkler flow and tamper switches. Switches are furnished and installed by others and electrically connected to the fire alarm system by the electrical contractor. Verify quantities and locations and coordinate installation of devices required with fire protection shop drawings. Provide connections to devices per fire protection shop drawings.

F. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay. Each relay shall have a red LED mounted on its cover to indicate if that relay has been activated.
2. The control module NAC may be wired for Class (A/B) Survivability Level 1 with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

G. Door Holders

1. Provide door holders for wall mounting and for floor mounting. Door holders shall operate on 24 volt dc power and each holder shall not draw more than 70 milliamps of power.
2. Coordinate quantities of door holders required with architect's door schedule.

2.5 BATTERIES

- A. The batteries shall be sealed, 12 volt nominal (two required).
- B. The battery shall have sufficient capacity to power the fire alarm system for the time required in NFPA 72. This time shall be based on the type of system installed. At the end of this period the system shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes upon a normal AC power failure.

2.6 ELEVATOR VISUAL SIGNAL (NC & FLA)

- A. Provide 1/8" diameter minimum red LED mounted in a single gang polished stainless steel coverplate. Engrave nameplate "DO NOT USE ELEVATOR" with 1/8" high black filled letters. Coordinate installation of this device with the architect prior to rough-in to assure this component is integrated into the architecture of all elevator lobbies.
- B. Provide gasketed coverplate for elevator lobbies in parking decks and similar damp locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all equipment, wiring, conduit and outlet boxes required for the erection of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. Color code shall be used throughout.

3.2 TEST

- A. The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the system.

3.3 FINAL INSPECTION

- A. Upon completion of the installation, the electrical contractor shall provide to the architect, with a copy to the manufacturer's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the manufacturer.

3.4 INSTRUCTION

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components shall be provided and shall include one session for a period of 8 hours. Additional time that may be required for end-user training will be at added cost to owner.

3.5 GUARANTEE

- A. All equipment and wiring shall be guaranteed against defects in materials and workmanship for a two year period from the start up and beneficial use of the system. Warranty service for the equipment shall be provided by the manufacturer's factory trained representative during normal working hours, Monday through Friday excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost to the owner.

3.6 INSPECTIONS

- A. Upon satisfactory completion of the system test, the manufacturer's representative shall present for the owner's consideration, a proposal to provide semi-annual inspection and tests of the system.

END OF SECTION