

Technical Specification  
for  
Linear Heat Detection Systems

Client Facility

owned by

Client Name  
Client Address  
Client City, Client Code  
Country

Prepared By

Your Name  
Your Company  
Your City,

Monday, October 16, 2000

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## SECTION 1

### 1. General Requirements

- 1.1. The Contractor shall furnish all labor, equipment, and materials, and perform all operations in conjunction with the installation of the Linear Heat Detection System for Client Name at the Client Facility facility at Client Address, Client City, Country, as indicated and described in this Specification.
- 1.2. At the time of bid, all exceptions taken to these Specifications, all variances from these Specifications, and all substitutions of operating capabilities or equipment called for in these Specifications shall be listed in writing and forwarded to the Owner's Designated Representative. Any such exceptions, variances, or substitutions which were not listed at the time of bid and are identified in the submittal shall be grounds for immediate disapproval without comment.
- 1.3. Any equipment proposed as equal to that specified herein shall conform to the standards herein, and the Manufacturer must supply proof of having produced similar equipment, now giving satisfactory service. In addition, the Contractor must obtain the Owner's or Owner's Designated Representative's approval in writing ten (10) working days prior to bidding equipment other than specified. The Manufacturer's name, model numbers, and three (3) copies of working drawings and engineering data sheets shall be submitted for approval. Included in the submittal shall be a written statement, indicating compliance with the features, functions, and performance of the specified equipment.

### 2. Quality Assurance

- 2.1. Each component of the Fire Alarm System shall be Factory Mutual Approved and/or Listed as a product of a single fire alarm system Manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "FM" and/or "UL" labels.
- 2.2. The equipment furnished under this Specification shall be provided by a fire alarm system supplier who has been providing this type of equipment for the past five years. The system supplier shall have a service organization capable of providing a service technician at Client Address, Client City, , within 24 hours of a request for on- site service.
- 2.3. All control equipment shall have transient protection devices designed to comply with UL864 requirements.
- 2.4. All materials and equipment shall be new and unused.

- 2.5. All equipment supplied shall be first quality, and the Manufacturer's best type and latest model. Obsolete equipment shall not be used.

### **3. Scope**

- 3.1. General - The work covered by this Specification will include the following work to be performed by the Contractor at Client Address in Client City, Country.
  - 3.1.1. Complete installation of a Linear Heat Detection Fire Alarm System on Client Facility at the Client Name.
  - 3.1.2. Testing of the complete Linear Heat Detection Fire Alarm System for alarm, trouble, and supervisory functions upon completion of the installation.
  - 3.1.3. Coordinating and conducting the demonstration test.
  - 3.1.4. Coordinating and conducting fire department acceptance test.
- 3.2. The Contractor shall furnish, install, test, and place into full operating condition a complete, 24 VDC closed-circuit, electrically supervised, Linear Heat and Fire Detection System, as specified herein, and indicated on the drawings. The system shall include, but not be limited to, all control and communication equipment, power supplies, signal initiating devices, audible and visible notification appliances, activation of Other, connection to the municipal fire alarm circuit, conduit, wire, fittings, and all other accessories required to provide a complete and operable control system.
- 3.3. The work described hereinafter, and as indicated on the drawings and associated documents, shall consist of all labor, materials, services, software, programming, and testing required to provide a complete and operating system.
- 3.4. All devices shall be installed and wired in accordance with the Manufacturer's instructions. The plans and associated documents provided with this Specification are presented for estimation purposes only; it is the responsibility of the Contractor to visit the site, acquaint themselves with existing conditions, and determine the required quantities of devices and specific optimum locations.

### **4. Qualifications of Bidders**

- 4.1. All Contractors connected with the captioned project shall provide proof of competence of both their company and the individual foreman assigned to this project. They shall demonstrate, in a manner acceptable to the Owner and the

Owner's Designated Representative, proficiency in installing fire detection, alarm, and control systems for at least five years.

- 4.2. The Contractor shall have been in the business of installing linear heat detection, alarm, and control systems for at least two years and shall provide documentation indicating recent projects of similar size where the Contractor was responsible for providing the complete installation of fire detection, alarm, and control systems.
- 4.3. Acceptable Manufacturers of the electronic fire detection, alarm, and control equipment are: The Protectowire Company, Inc., Hanover, Massachusetts 02339, USA, 781-826-3878.
- 4.4. Distributors of acceptable Manufacturer's equipment shall provide documentation indicating that they are authorized by the Manufacturer to distribute and service the equipment, and that the Manufacturer has stated that they have satisfactorily completed all training courses offered by the Manufacturer in relation to the equipment provided.
- 4.5. The Manufacturer or its authorized distributor shall confirm that, within reasonable distance of the job site, there is an established agency which stocks a full complement of parts and offers service during normal working hours on all equipment to be furnished and that the agency will supply parts without delay and at reasonable cost.
- 4.6. The Manufacturer or its authorized distributor shall confirm that it has the capability to provide on-site emergency service within twenty-four (24) hours of notification of the requirement for such service.

## 5. Codes and Standards

- 5.1. All equipment, devices, cables, etc., shall be Listed by Underwriters Laboratories and/or Approved by Factory Mutual for use in Fire Protective Signaling Systems under the following standards as applicable:
  - 5.1.1. UL 864 Control Units for Fire Protective Signaling Systems.
  - 5.1.2. UL 268 Smoke Detectors for Fire Protective Signaling Systems.
  - 5.1.3. UL 268A Smoke Detectors for Duct Applications.
  - 5.1.4. UL 521 Heat Detectors for Fire Protective Signaling Systems.
  - 5.1.5. UL 228 Door Closers-Holders for Fire Protective Signaling Systems.
  - 5.1.6. UL 464 Audible Signaling Applications.

- 5.1.7. UL 1638 Visual Signaling Appliances.
- 5.1.8. UL 38 Manually Actuated Signaling Boxes.
- 5.1.9. UL 346 Waterflow Indicators for Fire Protective Signaling Systems.
- 5.1.10. UL 1481 Power supplies for Fire Protective Signaling Systems.
- 5.2. All other equipment shall be Listed by Underwriter's Laboratories and/or Approved by Factory Mutual.
- 5.3. The system shall comply with all state and local codes with no exception.
- 5.4. The installation shall be made in accordance with the applicable provisions of the latest published edition of the following:
  - 5.4.1. National Fire Protection Association Standard 101, Life Safety Code.
  - 5.4.2. National Fire Protection Association Standard 70, National Electrical Code.
    - 5.4.2.1. Article 210, Branch Circuits.
    - 5.4.2.2. Article 760, Fire Protective Signaling Systems.
    - 5.4.2.3. Article 500, Hazardous Areas.
  - 5.4.3. National Fire Protection Association Standard 72, National Fire Alarm Code.
  - 5.4.4. National Fire Protection Association Standards, as appropriate for the hazard.
  - 5.4.5. Factory Mutual Loss Prevention Data Sheets, as appropriate for the hazard.
  - 5.4.6. Factory Mutual Loss Prevention Data Sheet 5-40 Protective Signaling Systems.
  - 5.4.7. Factory Mutual Loss Prevention Data Sheet 5-43 Auxiliary Protective Signaling Systems.
  - 5.4.8. The equipment Manufacturers' guidelines.

- 5.5. The system shall be tested in accordance with the latest edition of the following:
  - 5.5.1. National Fire Protection Association Standard 72, Chapter 7, National Fire Alarm Code.
  - 5.5.2. The equipment Manufacturer's guidelines.
- 5.6. The final system shall receive an Underwriters Laboratories Field Certification from an alarm service company authorized to issue Underwriters Laboratories certificates.

## **6. Related Documents**

- 6.1. Drawings and related documents supplied with this Specification shall be used by the Contractor as a guideline for the requirement for, and location of, the system components. It shall be the responsibility of the Contractor to visit the site, acquaint themselves with existing conditions, and determine the required quantities of devices and specific options on locations.
- 6.2. The requirements of building permits and authorities to proceed shall become a part of this Specification. The building permits and authorities to proceed shall be obtained by the Contractor, where applicable.
- 6.3. Prior to commencement and after completion of work, the Contractor shall provide written notification to the authorities having jurisdiction.
- 6.4. The Contractor shall notify the Owner and the Owner's Designated Representative, in writing, when the system is ready for the demonstration test. The system shall be considered ready for the demonstration test only after all preliminary tests have been made by the Contractor and the Manufacturer's technical representative, and all deficiencies have been found and corrected. In addition, two (2) copies of a report, prepared by the Contractor and the Manufacturer's technical representative and signed by them, attesting that the system is in completely satisfactory and operable condition, must be submitted to the Owner's Designated Representative before the Owner will agree to the scheduling of the demonstration test.
- 6.5. The Contractor shall notify the Owner, the Owner's Designated Representative, and the fire department, in writing, when the system is ready for the fire department Acceptance Test. The system shall be considered ready for the fire department Acceptance Test only after the successful completion of the demonstration test and successful operation throughout the burn-in period.

## 7. Order of Precedence

- 7.1. Should conflicts arise out of discrepancies between documents referenced in this Specification, the more stringent requirement shall apply; however, should a level of stringency be undeterminable, the discrepancies shall be resolved as follows:
  - 7.1.1. State and local codes shall take precedence over all documents.
  - 7.1.2. The National Fire Protection Association Standards shall take precedence over this Specification.
  - 7.1.3. Applicable insurance underwriter's standards shall take precedence over this Specification.
  - 7.1.4. This Specification shall take precedence over the drawings.

## 8. Submittals

- 8.1. The Contractor shall submit to the Owner and the Owner's Designated Representative sufficient information to describe their qualifications, the work efforts to be performed, and the materials to be provided. The Contractor shall certify that he/she has reviewed the documentation to verify: dimensions; quantities; installation and fabrication techniques, procedures, and sequences; and good workmanship and safety precautions; and that they are in conformance with this Specification.
- 8.2. These reviews are not the responsibility of the Owner, nor the Owner's Designated Representative. The Owner and the Owner's Designated Representative will only review these documents for the limited purposes of checking for general compliance with the information provided in the contract documents and general conformance with the design concept of this part of the project; not to determine accuracy or completeness of other details, such as dimensions and quantities. The Owner and the Owner's Designated Representative will not approve means, methods, or procedures of construction or installation, nor will they review for safety precautions. Accuracy and process are the responsibility of the Contractor.
- 8.3. Two sets of submittals are required. One set shall be submitted with the bid, and the other set shall be submitted prior to performing work.
- 8.4. As a minimum, each Contractor shall include the following submittals with their bids.

- 8.4.1. Supplier's qualifications, indicating years in business, service capabilities and policies, warranty definitions, spare parts support, and a list of similar installations.
- 8.4.2. Contractor's qualifications, indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.
- 8.4.3. The name of all Subcontractors and their qualifications, indicating years in business and prior experience with installations that include the type of equipment that is supplied.
- 8.4.4. All pertinent information regarding the reliability and operation of the equipment to be supplied.
- 8.4.5. Delivery dates of the equipment to be supplied.
- 8.4.6. Manufacturer's original catalog data and descriptive information for all major components of the system.
- 8.4.7. The Owner or the Owner's Designated Representative, at their sole choice and discretion, may request a demonstration of the proposed equipment.
- 8.4.8. Equipment other than specified will be considered for approval. It shall be the Contractor's obligation to submit data and information to allow the Owner's Designated Representative time to consider the equality of the substituted items to that specified. It is the Contractor's responsibility to meet the entire intent of the specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Owner and the Owner's Designated Representative. Accepted submittals on substitute equipment shall only allow the Contractor to proceed with proposing a substituted item and shall not be considered equal until such time as the Owner and the Owner's Designated Representative have completely accepted the substitute item. The Contractor shall provide the following in writing to the Owner's Designated Representative ten (10) days before the bid closing date:
  - 8.4.8.1. A complete riser diagram of the proposed to be substituted fire alarm system.
  - 8.4.8.2. All pertinent information regarding the reliability and operation of the equipment proposed to be substituted.
  - 8.4.8.3. Manufacturer's original catalog data and descriptive information for all components of the system proposed to be substituted.

- 8.5. The award of the contract will be based on the pre-award submittals. Once the contract is awarded, no changes for equipment, suppliers, or subcontractors will be accepted.
- 8.5.1. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or subcontractors accepted. All costs, including those for removal, relocation, or replacement of a substituted item, shall be at the risk of the Contractor.
- 8.5.2. Upon written request from the Contractor, the Owner and the Owner's Designated Representative may authorize changes, but at their sole choice and discretion.
- 8.5.2.1. It is the Contractor's responsibility to meet the entire intent of the Specification. If any attempt is made to substitute another product or brand for that product and brand of equipment specified, it shall be the Contractor's obligation to submit the above data and information to allow the specifying Engineer time to consider the equality of the substituted items to that specified.
- 8.5.2.2. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Engineer, and Owner's Designated Representative. Approved submittals on substitute equipment shall only allow the Contractor to proceed with installing a substituted item and shall not be considered equal until such time as the Engineer, and the Owner's Designated Representative have completely accepted the substitute item. All costs, including those for removal, relocation, or replacement of a substituted item, shall be at the risk of the Contractor.
- 8.6. As a minimum, the awarded Contractor shall submit two (2) copies of the following prior to performing any work:
- 8.6.1. A schedule indicating the installation sequence, the time frame, and details on how the fire alarm control panel activation and switch-over will occur. This schedule shall ensure that system down-time is kept to a minimum. Projected dates of delivery of the equipment to be supplied, installation completion, demonstration test and final test/acceptance dates shall be included.
- 8.6.2. Shop drawings which shall include original Manufacturer's specification and installation instruction sheets. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets. If any equipment and/or devices required in the system are not so marked, the Owner's Designated Representative shall

mark the sheet, and this equipment and/or devices shall be made part of the system and shall be provided.

- 8.6.3. A riser diagram of the complete fire alarm control system.
  - 8.6.4. A complete point-to-point fire alarm control equipment installation diagram; typical wiring diagrams are not acceptable.
  - 8.6.5. A complete list of electrical current requirements during normal, supervisory, trouble, and alarm conditions for each component of the system.
  - 8.6.6. Battery standby calculations showing total standby power and length of service required to meet the specified system requirements.
  - 8.6.7. Battery calculations showing total alarm power required to meet the specified system requirements.
  - 8.6.8. Sufficient information so that the exact function is known of each installed device.
- 8.7. The Contractor shall not order any equipment, nor perform any installations, prior to completion of review of the submittals by the Owner and the Owner's Designated Representative and receipt of a written authority to proceed to the next milestone from the Owner.

## 9. SECTION 2

### 10. System Function

#### 10.1. General

10.1.1. The system shall provide new control equipment which is UL Listed and/or FM Approved for compatibility with all devices to be used on the system, and will provide contacts to interface to the system transmitting an alarm to the fire department or central receiving station, alert building occupants, supervise each system for conditions which would impair proper system operation, annunciate such abnormal conditions, and control related equipment, as indicated on contract documents.

10.1.2. The system shall be designed such that alarm indications override trouble conditions.

#### 10.2. Alarm Condition

10.2.1. The system operation shall be such that the alarm operation of any alarm initiating circuit shall not prevent the subsequent alarm operation of any other initiating circuit

10.2.2. The system alarm operation subsequent to the alarm activation of any initiation device shall automatically perform the functions contained in this section.

##### 10.2.2.1. Provide Fire Alarm Control Panel Indication

10.2.2.1.1. Alarm conditions shall be immediately displayed on the control panel by a general alarm LED. The General Alarm LED shall illuminate on the control panel until the alarm has been acknowledged. A subsequent alarm received AFTER acknowledgement shall illuminate the general alarm LED.

10.2.2.1.2. Zone alarm conditions shall be immediately displayed on the control panel. Once the alarm has been acknowledged, the zone alarm LED shall remain lit. A subsequent alarm received from another zone after acknowledgement shall illuminate the respective zone alarm LED on the control panel, and the panel display shall show both the new and old alarm information.

10.2.2.1.3. If the audible alarm signals are silenced for any reason, they shall automatically resound if another alarm zone is tripped.

10.2.2.1.4. When the alarm signals are silenced by pressing the Acknowledge pushbutton on the control module, the visual lamps shall continue to flash until the alarm is cleared and the control panel reset.

#### 10.2.2.2. Activate Notification Appliances

10.2.2.2.1. Operate audible notification appliances in all areas.

10.2.2.2.2. Operate visual notification appliances in all areas.

10.2.2.2.3. Any subsequent alarm shall reactivate the audible and visual signals.

10.2.2.2.4. All alarm signals shall be automatically "locked in" at the control panel until the operated device is returned to its normal condition and the control panel is manually reset.

#### 10.2.2.3. Auxiliary Functions

10.2.2.3.1. All auxiliary functions shall be connected to, and operated by, the control panel.

10.2.2.3.2. Upon the initiation of an alarm condition, the system shall shut down the process.

10.2.2.3.3. Upon the initiation of an alarm condition, the system shall notify the fire department.

### 10.3. Trouble Conditions

10.3.1. Failure of normal power, opens on the initiation circuits, opens or shorts on the notification appliance circuits, disarrangements in field system wiring, or system ground faults shall activate a trouble circuit.

10.3.2. When a trouble condition is detected, the following functions shall immediately occur:

10.3.2.1. An amber "SYSTEM TROUBLE" LED shall flash and the system audible signal shall intermittently sound when any trouble is detected in the system.

10.3.2.2. A trouble signal shall be acknowledged by actuating an "ACKNOWLEDGE" switch. This shall silence the panel trouble buzzer.

10.3.2.3. During an "alarm" condition, all "trouble" signals shall be inhibited.

10.3.3. Unacknowledged alarm messages shall have priority over trouble messages, and if such an alarm occurs during a non-related trouble sequence, the alarm condition shall have display priority.

#### 10.4. System Supervision

10.4.1. All wiring extending from the fire alarm system control panel enclosure to system components shall be supervised for opens, shorts and/or grounds.

10.4.2. The occurrence of any fault shall activate the system trouble circuitry, but shall not interfere with the proper operation of any circuit that does not have a fault condition.

10.4.3. Incoming line power shall be supervised so that any power failure shall be audibly and visually indicated at the control panel.

10.4.4. Batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel.

10.4.5. The activation of any standpipe, sprinkler or fire pump valve tamper switch, or post indicator valve shall activate a steady audible trouble signal and illuminate the supervisory LED at the control panel.

10.4.6. Fire pump system conditions shall be individually monitored. Monitoring points shall include the following:

10.4.6.1. Fire Pump Running

10.4.6.2. Fire Pump Power Failure

10.4.6.3. Fire Pump Gate Valves monitored.

10.4.7. The common trouble contact for the emergency generator shall be supervised and produce a supervisory condition when activated.

#### 10.5. System Reset

10.5.1. Means to reset the system to return the control unit to its normal state after all alarm condition have been remedied shall be provided.

10.5.2. Should an alarm condition continue to exist, the system shall return to the alarm state. The zone alarm LED shall remain on.

## 11.Fire Alarm Control Panel

- 11.1. The fire alarm control panel shall be produced by the same Manufacturer that manufactures the Linear Heat Detection Cable, and they shall be UL Listed and/or FM Approved as compatible.
- 11.2. The fire alarm control panel shall provide all power, supervision, and control for the Linear Heat Detection System. It shall be a fully supervised, non-coded fire alarm panel.
- 11.3. The fire alarm control panel shall be capable of monitoring and activating multiple initiation circuits. It shall be of a modular design and construction with individual modules utilized to monitor each circuit.
- 11.4. Initiation Circuits
  - 11.4.1. Initiation circuits shall be provided by plug-in modules designed to meet the special requirements of that circuit.
  - 11.4.2. Each initiation circuit shall be capable of independently monitoring and controlling various initiating devices, either individually or in combination. As a minimum, capability shall be provided to monitor: linear heat detectors, manual stations, smoke detectors, thermal detectors, ultraviolet detectors, and other N.O. non-resistive contact initiating devices.
  - 11.4.3. Each initiation circuit shall provide independent visual indicators that illuminate for alarm and trouble conditions that occur in the circuit. Alarm indications shall be provided by a red indicator and trouble indications shall be provided by a yellow indicator.
  - 11.4.4. Each initiation circuit shall be capable of monitoring up to 3500 feet of Linear Heat Detection Cable.
  - 11.4.5. The initiation circuits shall have the capability to be field selected as either Class A or Class B.
  - 11.4.6. Each initiation circuit shall have the capability to perform a mechanical circuit alarm test, or collectively, by means of a "system test" button, silence alarms activated, and panel reset after an alarm condition has cleared. These functions shall be provided by appropriately labeled switches. Note: Panels activating extinguishing agent release to have test switch removed and a means for electrically disconnecting solenoids for servicing shall be provided.
- 11.5. Alarm Point Locator

- 11.5.1. The fire alarm control panel shall have a means to locate and display the distance to the point of heat actuation or of a short circuit condition anywhere along the linear heat detection cable.
- 11.5.2. The display shall be by a digital meter that shall indicate the distance in feet or meters.
- 11.5.3. The system shall be capable of automatically scanning and monitoring all Linear Heat Detection zones while in standby mode in the system. The time to scan all zones shall not exceed ten seconds. When an alarm condition occurs the system shall lock in on the alarmed Linear Heat Detection zone and activate the display indicating the distance. Upon time expiration of approximately 3 to 6 seconds, the scanner shall continue to monitor all remaining Linear Heat Detection zones.
- 11.5.4. The system shall have a means to override the automatic scanning and allow manual scanning to read each zone.

#### 11.6. Alarm Indicating Circuits

- 11.6.1. The control panel shall contain a minimum of two Class B notification appliance circuits to provide for general alarm signaling.
- 11.6.2. The control panel shall be capable of providing notification signals. These selective notification appliance circuits shall achieve activation by either a single initiating circuit or group of initiating circuits.
- 11.6.3. The power for operating all notification appliances shall come from integral power supplies within the control panel.

#### 11.7. Relays

- 11.7.1. The control panel shall contain all necessary relays required to perform the auxiliary and alarm functions required of the system.
- 11.7.2. Each relay shall have contacts rated for the purpose intended.

#### 11.8. System Power

- 11.8.1. The Control Panel shall operate from a dedicated primary power source of 120 or 240 VAC, 50-60 Hz. Power shall be provided by a three-wire circuit that shall be protected by an input line fuse or internal circuit breakers.
- 11.8.2. The control panel shall have sufficient power to accommodate all input devices in alarm at the same time and, while under this condition, operate

all alarm indicating devices, extinguishing agent control valves, and output relays and functions.

11.8.3. The control panel shall contain batteries and an integral battery charger to provide continuous power in the event of primary power failure.

11.8.3.1. The battery standby power shall be capable of providing 24 hours of continuous standby power for the system; for systems employing extinguishing agent release, 90 hours shall be provided.

11.8.3.2. The integral battery charger shall be a dual rate battery charger, capable of providing a trickle charge rate and a high charge rate. The trickle charge rate shall be capable of continuously maintaining the charge level of the batteries. The high rate charge shall be capable of fully recharging the batteries within 48 hours after they have discharged.

11.8.3.3. The battery charger shall be capable of charging Gel Cell, Nickel Cadmium, and Lead Acid-type batteries.

11.8.3.4. Battery charging indicating meters shall be provided inside the control panel to monitor and provide separate indications of the charging current draw and battery standby voltage. One indication shall continuously display the level of charging current draw. The separate indicator provided to indicate the battery standby voltage shall be a continuous or momentary type; continuous type shall be activated by depressing a switch.

11.8.3.5. Loss of power for the system shall automatically and immediately cause transfer of the system to battery power and cause all audible trouble signals to sound. Transfer from AC to battery power shall occur instantaneously when the AC voltage drops below 85 % of normal level. Upon return of power, the system shall automatically transfer to normal condition, and the batteries shall automatically recharge.

## 11.9. Wire Terminals

11.9.1. Field wiring terminal strips shall be capable of accommodating wire sizes up to #12 AWG.

## 11.10. Enclosure

11.10.1. The enclosure shall be designed to contain and functionally accommodate all input and output circuits, and the power supply. Batteries utilized in

the system may be placed in the main enclosure or an auxiliary battery box provided by the Manufacturer for the purpose of housing batteries.

11.10.2. The enclosure shall consist of a back box and a windowed door, fabricated of heavy gauge steel. The enclosure shall be a NEMA 1 rated enclosure.

11.10.3. The enclosure door shall be mounted on slip hinges that permit door removal for service. A key lock shall be provided on the door to secure access to the fire alarm panel.

11.10.4. The enclosure color shall be red.

## 12. System Field Devices

### 12.1. General

12.1.1. Initiating devices shall be connected to the initiating circuit by Class B circuits.

12.1.2. Notification appliances shall be connected to the control panel by Class A (NFPA-72 Style Z) circuits.

### 12.2. Single Temperature Linear Heat Detection Cable

12.2.1. The Linear Heat Detection Cable shall be a fixed temperature sensing element comprised of two electrical current carrying wires separated by a heat sensitive insulation material.

12.2.2. The detection cable shall detect the specified temperature anywhere along the detector length, regardless of the source of the heat. Averaging, analog-integrating, or thermistor-type detection cables, and rate compensated, or rate-of-rise detection devices, are not acceptable.

12.2.3. Detectors that depend on open flame, density of smoke, or rate of temperature increase are not acceptable.

12.2.4. The detection cable shall be constructed by spiral wrapping the two conductors with a protective mylar tape and then wrapping them in protective outer coverings of cotton braid, PVC, or weather resistant Nylon as required for the intended environment. The detection cable shall be capable of withstanding severe seasonal temperature variations and structural vibrations.

12.2.4.1. The temperature rating of the detection cable shall be clearly printed on the cable jacket.

- 12.2.5. When the detection cable will be required to span distances in excess of the manufacturer's standard mounting guidelines, it shall be constructed with an integral messenger wire. The messenger wire shall consist of a high tensile strength corrosion-resistant steel wire which shall be wrapped around the detection cable at a minimum rate of one turn per linear foot of cable length.
- 12.2.6. The initiating circuits shall be capable of intrinsically safe service and approved for Class I, II, or III, Div. 1, 2, or 3, and applicable groups A, B, C, D, E, F, & G.
- 12.2.7. The detector shall withstand gamma radiation at the rate of  $3.6 \times 10^5$  Rad/hour without insulation breakdown.
- 12.2.8. The detection cable shall be available in several temperature settings to allow for different ambient space temperature ranges and alarm points.
- 12.2.9. The detection cable temperature ranges shall be selected for the expected maximum ambient temperature and the alarm activation temperature suitable for the application in accordance with the Manufacturer's guidelines.
- 12.2.10. Detection cables of different temperature ratings shall have the ability to be easily spliced together in series without affecting the adjacent detector alarm point.
- 12.3. Weatherproof Manual Pull Stations
- 12.3.1. The weatherproof manual pull stations shall be provided by the same Manufacturer that supplies the Linear Heat Detection Cable and control panel and shall be UL Listed and/or FM Approved as compatible with the panel.
- 12.3.2. The weatherproof manual pull station shall be of the non-coded, single action type.
- 12.3.3. The manual station shall be of weatherproof construction and shall be designed for surface mounting.
- 12.3.4. The weatherproof manual pull station shall require a key to reset the station.

## 13. Installation - General

- 13.1. The Contractor shall provide and install all required equipment and accessories necessary for the proper operation of the system.
- 13.2. All work shall be performed in accordance with the best and most modern practices of the trade. The final installation shall present a neat appearance.
- 13.3. The entire system shall be installed in a workmanlike manner, in accordance with the standard instructions and recommendations of the Manufacturer, and in accordance with the approved Manufacturer's wiring diagrams, unless deviations are specifically permitted by the Owner's Designated Representative.
- 13.4. Where new penetrations of floor slabs, fire walls, or fire divisions are made, they shall be fire-stopped in accordance with all local codes.
- 13.5. The entire wiring system for the new and/or modified existing fire detection and alarm system shall be in full accordance with the current edition of NFPA 70, National Electrical Code.
- 13.6. The system shall be installed under the supervision of a qualified, trained Manufacturer's representative.
  - 13.6.1. The Manufacturer's technical representative's name and qualifications shall be submitted to the Owner's Designated Representative in writing. Once approved, the representative shall not be changed without at least two week's written notice to the Owner's Designated Representative and approval by the Owners' Designated Representative.
  - 13.6.2. The Manufacturer's technical representative shall be on site during the entire installation of the new system. The technical representative is expected to be on site with the Contractor during the entire time of final connections and testing of the control equipment and system.
  - 13.6.3. The supervisory work of the qualified, trained, Manufacturer's technical representative shall include, but not necessarily be limited to: checking all the system wiring connections; advising the Contractor regarding technical details of the installation; and the adjustment and testing of all components of the system in order to ensure a complete and satisfactorily operable system.
  - 13.6.4. The technical representative shall monitor all wiring changes and assist the Contractor to ensure a smooth transition to the system.
  - 13.6.5. The cost of the technical representative shall be paid by the Contractor and included in the bid price.

- 13.7. The Manufacturer's technical representative shall also be required to instruct designated property and management personnel in the general operation of the system and to provide the designated personnel an overview of the system functions when the system is in normal, supervisory mode, alarm mode, and trouble mode.

## **14. Installation - Specific Custom Application**

- 14.1. The Contractor shall follow and comply with the Manufacturer's installation instructions for the installation of all equipment
- 14.2. The Linear Heat Detection Cable shall be located in accordance with the appropriate standards and Manufacturer's guidelines. The Linear Heat Detection Cable shall not be recessed in any way into any mounting surface.
- 14.3. When mounted on ceilings the following shall be observed:
  - 14.3.1. The Linear Heat Detection Cable shall be located on the ceiling or side wall not more than 20 inches from the ceiling
  - 14.3.2. Except in the case of solid open joist construction, the Linear Heat Detection Cable shall be mounted on the bottom of the joists. In the case of beam construction where beams are less than 12 inches in depth and less than 8 feet on center, the Linear Heat Detection Cable may be installed at the bottom of the beam.
- 14.4. As a minimum, the Linear Heat Detection Cable shall be formed in accordance with the following:
  - 14.4.1. The cable shall be installed by hand; mechanical devices shall not be applied to the cable.
  - 14.4.2. All bending and fitting shall be performed with installer's fingers. Pliers or other hand tools shall not be used to form the cable.
  - 14.4.3. The minimum bend radius shall be two and one-half (2 1/2) inches; bends shall be freely formed, consistent with the nature of the cable.
- 14.5. As a minimum, the Linear Heat Detection Cable shall be fastened and supported to maintain tautness in accordance with the following:
  - 14.5.1. Only fastening and support devices approved by the Manufacturer shall be used to support or connect the cable.

- 14.5.2. Only stapling machines or tackers approved by the Manufacturer shall be used to fasten the cable.
- 14.5.3. Only mounting clips approved by the Manufacturer shall be used to attach the cable.
- 14.5.4. Fastening and supporting devices, including staples, straps, and mounting clips, shall not be placed at intervals greater than ten (10) feet.
- 14.5.5. When messenger wire is used to support the Linear Heat Detection Cable, turnbuckles and eyebolts shall be employed at each end of the wire. The messenger wire turnbuckles and eyebolts shall be mounted to fixed points. The Linear Heat Detection Cable shall be unwrapped from the messenger wire far enough to form a loop in the messenger wire. The loop shall be clamped with a U-Bolt and the loop slipped over the turnbuckle and the turnbuckle adjusted such that the messenger wire has only a little sag. The messenger wire supports shall not exceed 250 feet in length. Messenger cables shall be supported at a minimum of every 50 feet using a standoff with a grommet. Support the Linear Heat Detection Cable at each end of the run with a double looped cable strap, when mounting to sprinkler branch lines.
- 14.6. The Linear Heat Detection Cable shall be installed in a manner to protect it from physical damage. In areas where it may be subject to physical damage, the Contractor shall install mechanical protection for the cable. As a minimum, the cable shall be protected in accordance with the following:
  - 14.6.1. In areas subject to abrasion and/or pinching, the cable shall be mechanically and electrically insulated, as recommended by the Manufacturer.
  - 14.6.2. When the cable passes through a wall, beam, or joist, the hole shall be large enough to allow the cable to be freely drawn through the opening. The cable shall be protected when passing through masonry walls with conduit, tape, or PVC sleeving.
  - 14.6.3. A bushing shall be installed at the open end of metal conduit through which the cable enters or exits.
  - 14.6.4. In areas where the Linear Heat Detection Cable is subject to abuse, it shall be installed in perforated stainless steel conduit in accordance with the Manufacturer's guidelines.
  - 14.6.5. When the cable is installed lower than seven (7) feet from the floor, or when the area to be protected is less than seven (7) feet in the air and

unprotected by a structure, the Contractor shall install physical protection in accordance with the Manufacturer's guidelines.

- 14.7. As a minimum, the Linear Heat Detection Cable shall be connected in accordance with the following:
  - 14.7.1. The length of the Linear Heat Detection circuits shall not exceed the limits prescribed by the Manufacturer, unless otherwise expressly stipulated in writing and approved by the Manufacturer.
  - 14.7.2. Detection circuit wire other than Linear Heat Detection Cable provided by the Manufacturer shall not be employed for any part of any linear heat and fire detection circuit, other than field cables from the Fire Alarm Control Panel to the start or end of the detection circuit.
  - 14.7.3. All linear heat and fire detection zones shall be terminated in the control panel or in an EOL enclosure supplied by the Manufacturer.
  - 14.7.4. All Linear Heat Detection Cable and fire protection circuits shall be wired in a series loop configuration. Circuits with T taps or Y branches shall not be acceptable.
  - 14.7.5. Except where special fittings are used, all connections to terminals shall be made by means of soft copper leads (PFL) furnished by the Manufacturer.
  - 14.7.6. All splices made in the Linear Heat Detection Cable shall be made only by utilizing splicing connectors furnished by the Manufacturer.

## 15.Wiring

- 15.1. All new wiring shall comply with this section.
- 15.2. The Contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets, and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the Manufacturer, approved by the local fire department, and shall be installed in conduit throughout.
- 15.3. As a minimum, the entire wiring system for the new and/or modified existing fire detection and alarm system shall be in full accordance with the current NFPA 70, National Electrical Code. Local and/or state codes may require that the conductors for the fire detection and alarm system, and the means and methods of their installation, be more stringent than those of the National Electrical Code and NFPA. The more stringent code shall apply for the purposes of this project.

- 15.4. The system control unit shall be arranged to receive power from a dedicated three-wire, 15 amp, 120 or 240 VAC supply and shall be obtained from the "Essential Building Power" panel.
  - 15.4.1. The fire alarm control panel shall have a marking on the inside, which shall indicate the electric panel board and circuit breakers, protecting the feeders to the control panel.
- 15.5. All low voltage operations for all fire alarm system devices shall be provided from the control unit.
- 15.6. All new wiring for the initiating devices, notification appliances, shall be single, solid copper conductor, rated 600 V with cross-linked polyethylene or FTTFE fluoropolymer insulation and shall comply with the appropriate sections of the National Electrical Code. The insulation shall be UL Listed as flame retardant and moisture proof.
- 15.7. All system wiring size shall be as determined suitable by the Manufacturer and in compliance with the current carrying capacities as set forth by the National Electrical Code, yet they shall not be any smaller than as specified herein. The following minimum sizes of conductors shall be used for all new wiring:
  - 15.7.1. Power Supply Conductors: No. 12 AWG.
  - 15.7.2. Linear Detection Cable Connecting Conductors: No. 14 AWG.
  - 15.7.3. Automatic Detector and Manual Pull Station Conductors: No. 18 AWG.
  - 15.7.4. Remote Annunciators: No. 18 AWG.
  - 15.7.5. Remote Pilot Lamp Units: No. 18 AWG.
  - 15.7.6. Notification Appliance Units: No. 14 AWG.
- 15.8. Each circuit shall utilize wire of a color different and distinguishable from other circuits. Color coding shall be approved by the Owner's Designated Representative. Colors shall be continuous throughout each entire circuit.
- 15.9. Raceways containing conductors identified as "Fire Protective Alarm System" conductors shall not contain any other conductors, and no AC carrying conductors will be allowed in the same raceway with the DC fire alarm detection and signaling conductors.
- 15.10. Conduits shall enter panels from the sides or bottom; no conduits shall enter the top of a panel.

- 15.11. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings. Wherever practical, exposed raceways shall be run on the ceiling as close as possible to a wall or as high as possible on a wall. Where exposed raceways must cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib. No spanning from beam to beam or rib to rib will be permitted. The use of a conduit body on one side of a beam or rib will be permitted provided it will be readily accessible.
- 15.12. All raceways, flexible raceways, mounting boxes, junction boxes, and panels shall be securely fastened to ensure positive grounding throughout the entire system.
- 15.13. Where new penetrations of floor slabs or fire walls are made, they shall be fire-stopped in accordance with all local codes.
- 15.14. End-of-line resistors shall be furnished as required and shall be mounted as directed by the Manufacturer.
- 15.14.1. End-of-line resistors shall comply with the system Manufacturer's recommendations.
- 15.14.2. The field location of the End-of-line resistors shall be labeled so that the devices may be easily located, and that location shall be noted on the point-to-point drawings.
- 15.15. All wiring within the control panel shall be neatly served in the panel gutters, where applicable, and shall be secured by means of Thomas & Betts "Ty-Raps" or by other approved means.
- 15.16. All wiring shall be tested for stray voltage, short circuits, and ground faults prior to connection to the control panel and any devices.
- 15.17. Splicing of wiring connections, use of common wire nuts, or more than two wires on one terminal screw is prohibited.

## **16.SECTION 3**

### **17.Scheduling**

17.1. Prior to beginning work, the Contractor shall provide a schedule to the Owner and the Owner's Designated Representative indicating the installation sequence and project time frame.

17.1.1. The schedule shall indicate the installation sequence, the time frame, and details on how the fire alarm control panel activation and switch-over will occur. This schedule shall ensure that system down-time is kept to a minimum. Projected dates of delivery of the equipment to be supplied, installation completion, demonstration test and final test/acceptance dates shall be included.

17.1.2. The Contractor shall provide weekly updates to the Owner and the Owner's Designated Representative.

### **18.Delivery, Storage, and Handling**

18.1. The Contractor shall assure that no equipment is delivered directly from the Manufacturer to the project site.

18.2. All equipment shall be delivered to the Manufacturer's representative prior to delivery to the project site. The Manufacturer's representative shall open all containers and inspect all products for conformance and integrity prior to delivery to the project site. The Manufacturer's representative shall repack acceptable products in their original shipping containers and deliver them to the project site in a timely manner consistent with the schedule of the project.

18.3. The Contractor shall arrange for secure storage of the materials at the project site. All materials shall be stored in a manner that will protect them from removal and damage prior to their installation.

### **19.Clean-up**

19.1. Progressively during the course of installation and following completion of the installation, the Contractor shall remove all trash, debris, and surplus materials occasioned by this project, such that the environment presents a safe, neat, and orderly condition conducts to other activities at all times.

19.2. At the completion of work, each day, the Contractor shall assure that the work area is left in an orderly manner so as not to interfere with other activities occurring in the area.

## 20.As-Built Drawings

- 20.1. The Contractor shall deliver a complete set of reproducible, as-built drawings and four (4) copies of the drawings to the Owner or the Owner's Designated Representative upon completion of the installation of the system, and a minimum of one week prior to the demonstration test.
- 20.2. A copy of the as-built drawings shall be submitted to the fire department prior to the fire department's Acceptance Test.
- 20.3. The Contractor shall show the following information on these as-built drawings:
  - 20.3.1. The exact locations and installation details of the installed equipment and zone of each device.
  - 20.3.2. The exact location of all existing initiating devices and notification appliances.
  - 20.3.3. The installed wiring and color coding and wire tag notifications for the exact locations of all installed equipment.
  - 20.3.4. Locations of each end-of-line resistor and end-of-line device.
  - 20.3.5. Specific point-to-point interconnections between all equipment and internal wiring of the equipment. Typical point-to-point wiring diagrams are not acceptable.
  - 20.3.6. Layout of the annunciator panel and designations of each indicator.
  - 20.3.7. All modifications to the facilities.

## 21.Training Requirements

- 21.1. Prior to final acceptance of the fire alarm system, the Contractor and supplier shall provide operation training to each shift of the Owner's personnel. Each training session shall be conducted during shifts or at another time acceptable to the Owner. Each session shall include an overview of the system and the devices connected to it, emergency procedures (including alarm, trouble and supervisory condition procedures), control panel operation, and safety requirements. Each session shall include a complete demonstration of the system. Dates and times of each training period shall be coordinated through the Owner, not less than two weeks prior to the training session.

## 22. Operating Instructions

- 22.1. The Contractor shall provide Operating and User Instruction Manuals a minimum of one week prior to the demonstration test of the system. Four (4) complete sets of operating and instruction manuals shall be delivered to the Owner upon completion, and one (1) to the fire department prior to final acceptance.
- 22.2. User operating instructions shall be provided, prominently displayed on the cabinet front or on a separate plastic laminated sheet located next to the control unit.

## 23. Testing Instructions

- 23.1. Prior to final acceptance, the Contractor shall deliver to the Owner complete, simple, comprehensive, step-by-step testing instructions providing recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment, and a complete troubleshooting manual explaining what might be wrong if a certain malfunction occurs and explaining how to test the primary internal parts of each piece of equipment.

## 24. Maintenance Instructions

- 24.1. Prior to final acceptance, the Contractor shall provide four (4) complete sets of maintenance instruction manuals to the Owner.
- 24.2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
  - 24.2.1. All aspects of the system operation and maintenance shall be detailed, including a written description of the specific system design (a typical description will not be accepted), system logic diagrams, electrical wiring diagrams of all circuits, drawings illustrating equipment locations, and technical data sheets describing each piece of equipment used in the system.
  - 24.2.2. Instructions on replacing any components of the system, including internal parts.
  - 24.2.3. Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.
  - 24.2.4. A complete list of all equipment and components with information as to the address and phone number of both the Manufacturer and local supplier of each item.

## 25. Demonstration Test

- 25.1. The Contractor shall be responsible for coordinating and conducting the demonstration test.
- 25.2. Upon completion of the installation of the fire alarm system, the Contractor shall provide a minimum of one week's notice to the Owner and the Owner's Designated Representative that the fire alarm system has been satisfactorily tested by the Contractor, and the Manufacturer's representative and is ready for the demonstration test.
- 25.3. At the time of notification, the Contractor shall submit "As-Built" drawings and a "Test Plan" which shall describe how the system will be tested.
  - 25.3.1. The test plan shall include a step-by-step description of all tests to be performed and shall indicate type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements of this specification have been met.
  - 25.3.2. The demonstration test shall not be conducted until the "Test Plan" is approved.
- 25.4. All tests shall be conducted in the presence of the Owner and the Owner's Designated Representative.
- 25.5. The Contractor shall provide all the necessary personnel and equipment required to conduct the test.
- 25.6. The demonstration test shall be conducted between the hours of 7:00 p.m. and 7:00 a.m.
- 25.7. At the demonstration test, the Manufacturer's technical representative shall deliver to the Owner's Designated Representative an Inspection and Test Report, which shall be completed in conjunction with the demonstration test and shall indicate the following:
  - 25.7.1. Project information, including name, address, and city.
  - 25.7.2. The Contractor's name, address, city, and telephone number.
  - 25.7.3. The control panel configuration, serial number, extent of battery backup, locations of remote annunciators, a description of remote functions, and type of fire department connection.
  - 25.7.4. The total quantity of alarm signal units, pull stations, and each type of detector.

- 25.7.5. The quantity of alarm signal units, pull stations, and each type of detector in each zone. In addition, the connection position of each device shall be indicated, and, further, indicate the test result of each device and any subsequent action taken.
- 25.7.6. Pertinent comments regarding the installation, operation, testing, inspecting, or other aspects of the system.
- 25.7.7. The Manufacturer's technical representative shall print his/her name and affiliation and sign and date the document.
- 25.8. The tests shall demonstrate that the entire control system functions as intended. All circuits and devices shall be tested, including equipment shutdown, alarm signaling devices, and auxiliary functions. In addition, supervision of each circuit shall be tested.
- 25.9. As a minimum, the Contractor shall perform the following:
- 25.9.1. Operate every fire alarm device to ensure proper operation, correct annunciation at each remote annunciator and at the control panel, and proper operation of auxiliary functions. Where applying heat would damage any detector, they may be manually operated.
- 25.9.2. The initiating circuits and the notification circuits shall be opened in at least two locations per zone to check for the presence of correct supervisory circuitry.
- 25.9.3. One-half of all tests shall be performed on battery standby power.
- 25.10. Upon satisfactory completion of the demonstration test, the Contractor shall leave the system operating for a minimum of one week prior to the fire department's Acceptance Test.
- 25.11. If unsatisfactory results occur during or after the demonstration test, the Contractor shall be responsible for any and all additional charges incurred by the Owner with respect to corrective action including, but not limited to, test monitoring and engineering services during the time it takes to obtain final acceptance by the Owner.

## **26.Fire Department Acceptance Test**

- 26.1. Before the installation shall be considered completed and acceptable by the awarding authority, the fire department acceptance test shall be performed. This test shall be coordinated and performed by the Contractor's job foreman, in the presence of a representative of the Manufacturer, the Owner, the

Owner's Designated Representative, and a representative of the fire department.

- 26.2. The system shall be considered ready for the fire department acceptance test only after successful completion of the demonstration test, and a minimum of one week of satisfactory operation of the system after the successful completion of the demonstration test.
- 26.3. In order to assure attendance of the fire department, the fire department must be provided reasonable notification of the test date by the Contractor at least forty-eight (48) hours prior to the final test.
- 26.4. The Contractor shall provide all the necessary personnel and equipment required to conduct the test.
- 26.5. At a minimum, the Contractor shall perform the following:
  - 26.5.1. Operate every fire alarm device to ensure proper operation of the system, including correct annunciation at each remote annunciator and at the control panel, and proper operation of auxiliary functions. Where applying heat would destroy any detector, they may be manually operated.
  - 26.5.2. The initiating circuits and the notification circuits shall be opened in at least two locations per zone to check for the presence of correct supervisory circuitry.
  - 26.5.3. One-half of all tests shall be performed on battery standby power.
- 26.6. Upon satisfactory completion of the tests, the Contractor shall leave the fire alarm system in proper working order and without additional expense to the Owner, shall replace any defective materials or equipment provided by him/her under this Contract.
- 26.7. When the testing has been completed to the satisfaction of the Contractor's job foreman, the representative of the Manufacturer, and the Owner's Designated Representative, a notarized letter co-signed by each attesting to the satisfactory completions of said testing shall be forwarded to the Owner and the fire department.

## **27.Spare Parts**

- 27.1. The Contractor shall furnish spare parts in quantities equivalent to 10 percent of the installed quantities of initiating devices and notification appliances.
- 27.2. All spare parts shall be neatly and protectively packed into one or more cartons. The quantity, Manufacturer, and model of each unit in the carton

shall be identified on the outside of the carton. In addition, the name, address, and telephone number of the Contractor and of the Manufacturer's local representative, plus the date of delivery, shall be neatly identified on the cover of each carton.

## 28.Warranty

- 28.1. The Contractor shall guarantee all new equipment and new wiring free from defects in workmanship and inherent mechanical and electrical defects for a period of one (1) year from date of the final acceptance. During that period, the Contractor shall replace any defective materials or equipment provided by him/her under the contract without additional expense to the Owner.
- 28.2. The Manufacturer shall warranty against Manufacturer's defects all new system equipment for a period of one (1) year from the date of shipment of the system.
- 28.3. The Contractor shall guarantee all new raceways, new wiring, and connections to existing wiring to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
- 28.4. Upon completion of the installation of the fire alarm and protective systems equipment, the Contractor shall provide to the Owner's Designated Representative a signed written statement, substantially in form as follows:
  - 28.4.1. "The undersigned, having been engaged as the Contractor on the Linear Heat Detection System installation on the Client Name, Client Facility, Client Address, Client City, Country project, confirms that the fire alarm and protective system equipment was installed in accordance with the wiring diagrams, instructions, directions, and technical specifications provided to us by the Manufacturer and Owner's Designated Representative."