

ت	المادة	الوحدة	الكمية	السعر الافرادى فلس دينار	السعر الاجمالي فلس دينار
١.	تقديم و تركيب وفحص تشغيل نظام Analogue Addressable انذار الحريق والسعر يشمل فك مكونات نظام انذار الحريق القائم و تسليمها للوحدة صاحبة العمل و تركيب المكونات الجديدة التالية مع كل ما يلزم لاعادة تشغيل النظام حسب المواصفات المعمدة لهذه الغاية و اعادة الوضع انشائيا كما كان عليه سابقا و تعليمات المهندس المشرف حسب التالي:	عدد	١		
	(أ) لوحة انذار حريق رئيسية (FACP 5 Loops analogue addressable ,Networkable) شاملة البطاريات, الشاحن, الشاشة, البرمجة و قابلة للتوسعة المستقبلية و جميع ما يلزم من قطع و مواد و اعمال لاتجاز العمل كاملا حسب المواصفات الفنية و المخططات و تعليمات المهندس المشرف.				
	(ب) تقديم و تركيب و تشغيل الكواشف و الاجراس التالية و شبكتها مع لوحات التحكم بالنظام و كما يلي:				
١.	ADDRESSABLE MANUAL CALL POINT	عدد	٣٠		
٢.	ADDRESSABLE OPTICAL TYPE PHOTO	عدد	275		
٣.	ADDRESSABLE OPTICAL TYPE PHOTO WITH ISOLATER	عدد	35		
٤.	ADDRESSABLE RATE OF RISE&FIXED TEMP	عدد	٢٠		
٥.	ADDRESSABLE MONITOR MODULE	عدد	١٩		
٦.	INDOOR FIRE ALARM HORN WITH STROBE W/ Control Module	عدد	٣٠		
٧.	FIRE ALARM REPEATER PANEL WITH SURFACE BACK BOX	عدد	٢		

				12	عدد	ADDRESSABLE CONTROL MODULE	٨.
				٢٠	عدد	Addressable Duct Sensor W/Tube	٩.
				٣	عدد	OUTDOOR FIRE ALARM HORN With Flasher W/Control module	١٠.
				10	عدد	SHORT ISOLATOR MODULES	١١.
							المجموع:

## الشروط والاحكام

١. الاسعار بالدينار الاردني شامل كافة الرسوم الجمركية واية ضرائب اخرى علما بان مشتريات القوات المسلحة الاردنية خاضعة لنسبة الصفر استنادا لنص المادة (٢٢) من قانون الضريبة العامة على المبيعات.
٢. الاسعار تشمل اعمال البرمجة و التشغيل و اصلاح و معالجة اعطال تاسيسات النظام و أي قطوعات اينما وجدت و تركيب القطع الجديدة.
٣. يشمل السعر استخدام التمديدات القائمة و الكوابل الموجودة و التأكد من صلاحيتها لتشغيل النظام.
٤. على المقاول الكشف على الموقع قبل تقديم عرض السعر وبالتنسيق مع شعبة صيانة المستشفيات العسكرية على هاتف رقم (٠٧٨١٧٩٨١٨٤)
٥. التسليم في مدينة الحسين الطبية مركز الاميرة ايمان بنت عبد الله للابحاث و العلوم المخبرية.
٦. مدة التسليم خلال (٩٠) يوم من تاريخ التبليغ بأمر المباشرة.
٧. المواد حسب موافقة المهندس المشرف.

## FIRE DETECTION AND ALARM

### PART 1 – GENERAL

#### 1.1 GENERAL

- A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, fire alarm analogue addressable control panels, repeater panels, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, graphic annunciator panel, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc. But system shall:
- a. Send signal to Card Access/Air Lock system to unlock door in case of fire
  - b. Send signal to Elevator (In case of Fire, elevator will home at ground floor and open the door)
  - c. Shut off gas system in case of fire
  - d. Etc.
- a. Fire alarm systems shall:
1. Comply with requirements of the most recent regulation issued by Civil Defense Department, , UL Listed and NFPA codes.
  2. The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by certified Installer by manufacturer.
  3. The certified installer shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Supervision Engineer
  4. Installers shall have a minimum of 5 years' experience installing fire alarm systems in similar Scale/complexity project.
- b. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control panel.
- c. The main fire alarm control unit shall automatically transmit alarm signals to a Civil Defense Department and Client using a digital alarm communicator transmitter (Auto-dialer).

## 1.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. **General:** The fire detection with & alarm communication systems shall comprise of main fire alarm control panel, optical smoke/heat sensor, heat sensor, optical smoke/heat sensor with integral sounder units, manual call points, electronic sounders, repeat panels, interface units, auto-dialer for communication with civil defense department, control & monitor modules units for integration with AC/Lifts/Dampers. All loop cabling and any other components and accessories deemed necessary for a safe, reliable and satisfactory system shall conform to the relevant and applicable requirements and recommendations of NFPA 72, corresponding UL standards and the equipment manufacturer.
- B. **Control of System:** By the FACP (fire detection & alarm control panel)
- C. **System Supervision:** Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- D. **Priority of Signals:** Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- E. **Noninterference:** A signal on one zone shall not prevent the receipt of signals from other zones.
- F. **System Reset:** All zones are manually reset-able from the FACP after initiating devices are restored to normal.
- G. **Flexibility:** The system shall be fully programmed to accommodate fire alarm zones as indicated on the drawings and schematics. The system shall be configured to allow on site modifications with the minimum of disruption using the PC based software and built-in features to facilitate future changes or alterations to the buildings.
- H. **Transmission to Remote Alarm Receiving Stations:** Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter.
- I. **System Alarm Capability during Circuit Fault Conditions:** System wiring and circuit arrangement prevent alarm capability reduction when an open circuit, ground or wire-to-wire short occurs, or an open circuit and a ground occur at the same time in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- J. **Loss of primary power at the FACP initiates a trouble signal at the FACP and the remote annunciators.** An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- K. **The system shall be of safe soft or hard addressable type i.e. all the devices on the loops of the FACP shall be:**
  - 1. If the devices are inserted or removed all the existing devices shall keep the same address.
- L. **The panel shall allocate the address in strict sequential order when the loop is powered up to speed up commissioning and ensure that it is impossible for two devices to have the same address.**
- M. **All devices shall be assigned up to 32 character alphanumeric label. In case of fire, fault or warning, the label of device sensing threshold shall appear on visual display unit of the panel.**
- N. **Fire Detection and Alarm Systems, which rely on hard or soft addressing techniques, can be acceptable.**

- O. Basic Alarm Performance Requirements: Unless otherwise indicated by the project's security department or local regulations, operation of an automatic alarm operation of one detector:
1. Notification-appliance operation.
  2. Identification at the FACP and graphics monitor of the zone originating the alarm. With a graphical display of the zone.
  3. Identification at the FACP of the device originating the alarm.
  4. Recording of the event in the system memory.
  5. Delayed transmission of an audible (sounders, bells) & visual (strobes) alarm in that zone if the alarm has not been acknowledged as cleared at the fire alarm panel, within a programmable time delay in accordance with local codes.
- P. Basic Alarm Performance Requirements: Unless otherwise indicated by the project's security department or local regulations, operation of one manual station, automatic alarm operation of two detectors, un-cleared or unacknowledged alarm of one detector, or operation of a manual agent release station initiates the following:
1. Notification-appliance operation.
  2. Identification at the FACP of the zone originating the alarm.
  3. Transmission of an alarm signal to the remote alarm receiving stations.
  4. Unlocking of electric door locks (if any).
  5. Release of fire and smoke doors held open by magnetic door holders.
  6. Transmission of an audible (sounders, bells) & visual (strobes) alarm in all zones.
  7. Actuating the operating status of fans and other air-handling equipment serving the zone where the alarm was initiated (refer to emergency sequence of operation).
  8. Actuating the position of smoke dampers in air ducts of system serving the zone where the alarm was initiated (refer to emergency sequence of operation).
  9. Recording of the event in the system memory.
  10. Recording of the event by a separate computer which shall print the event log. (provide serial or Ethernet interface with software).
  11. Activate auto dialer to notify fire brigade.
- Q. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

- R. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status, reading and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- S. Removal of an alarm-initiating device or a notification appliance initiates the following:
  - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
  - 2. Transmission of trouble signal to remote alarm receiving stations.
- T. Printout of Events: On receipt of the signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printout of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- U. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.
- V. Topology: All system components and devices shall be connected to two-wire loop circuits (as shown in the typical schematics).

### 1.3 SCOPE

- A. A fully addressable fire alarm system shall be designed and installed in accordance with the specifications and drawings and in accordance with Civil Defense requirements, NFPA 72 and this specification.
- B. Basic Performance:
  - 1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
  - 2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
  - 3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
  - 4. Initiating device circuits (IDC) shall be Class Bin accordance with NFPA 72.
  - 5. Signaling line circuits (SLC) within buildings shall be Class A Style 7 in accordance with NFPA 72.
  - 6. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
  - 7. Notification appliance circuits (NAC) shall be wired Class B in accordance with NFPA 72.

#### 1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who is an authorized representative of the FACP manufacturer, ISO 9001 certified for both installation and maintenance of units required for this Project.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance. UL listing for NFPA compliant products is a requirement for the project.
- C. **Source Limitations:** Obtain fire alarm system components through one source from a single manufacturer. Equipment must be UL listed to NFPA requirements
- D. **Mixing UL listed equipment and BS / EN certified products shall not be allowed.**
- E. **Compliance with Local Requirements:** Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- F. **Comply with NFPA 72 for installation requirements and NFPA 72 & UL for equipment.**

#### 1.5 RELATED WORK

- A. Section 26 05 00 Common work results for electrical
- B. Section 26 05 00 Common work results for electrical-
- C. Section 28 05 13 - Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below)
- D. Section 26 05 26-Grounding and Bonding for Electrical.
- E. Section 26 05 33 -Raceway and Boxes for Electrical Systems
- F. Section 26 08 00 Commissioning of Electrical Systems

#### 1.6 SUBMITTALS

- A. Compliance statement for specification (point by point)
- B. **Product Data:** For each type of product indicated.
- 1. **Riser diagrams:** Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and entire project wide basis.
- 2. **Detailed wiring diagrams:** Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
- 3. **Battery:** Sizing calculations.
- 4. **Device Address List:** Coordinate with final system programming.
- 5. **System Operation Description:** Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs, Manufacturer's standard descriptions for generic systems are not acceptable.



6. Monitored input/output points schedule & sequence of operation ( cause and effect diagram)
7. All documents required by Civil Defense, in the format required by this party.
8. Size and arrangement of structural elements.
9. Size and location of duct smoke detector, including air-sampling elements.
10. Size and location of bells/flasher & manual call points.
11. Operating Instructions: For mounting at the FACP.
12. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
13. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
14. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
15. Comply with NFPA 72
16. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 1. Comply with NFPA 72
17. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals," make an identical submission to authorities having jurisdiction (Civil Defense). Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Supervision Engineer for review.
18. Certificate of Completion: Comply with NFPA 72 and all applicable local codes (especially Civil Defense and Local codes & regulation)

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, and device wiring diagrams, dimensions, and information for ordering replacement parts.
  - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
  - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
  - c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
  - d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length

limitations.

- e. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include all devices as shown on the riser diagram. Include information indicating who will provide emergency service and perform post contract maintenance.
  - f. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
  - g. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the Client and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
  - h. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
  - i. A printout for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver 2 copies of the final updated maintenance and operating manual to the supervision Engineer.
- a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
  - b. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
  - c. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
  - d. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

### **1.7 Warranty**

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of two years from the date of acceptance of the entire installation by the Project Engineer.

## 1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.
- B. National Fire Protection Association (NFPA):
  - NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition
  - NFPA 14..... Standard for the Installation of Standpipes and Hose Systems, 2010 edition
  - NFPA 20..... Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition
  - NFPA 70.....National Electrical Code (NEC), 2010 edition
  - NFPA 72.....National Fire Alarm Code, 2010 edition
  - NFPA 90A.....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition
  - NFPA 101.....Life Safety Code, 2009 edition
- C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory
- D. American National Standards Institute (ANSI):
  - S3.41.....Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

## **PART 2 PRODUCTS**

### **2.1 EQUIPMENT AND MATERIALS, GENERAL**

- A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

### **2.2 CONDUIT, BOXES, AND WIRE**

- A. Conduit shall be in accordance with Section 26 05 33 and as follows:
1. All new conduits shall be installed in accordance with Local regulation and CDD' requirements.
  2. Conduit fill shall not exceed 40 percent of interior cross-sectional area.
  3. All new conduits shall be (25 mm) minimum.
- B. Wire:
1. Wiring shall be in accordance with Section 26 05 21, and as recommended for connection of fire alarm panels by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 1.5mm<sup>2</sup> for initiating device circuits and 2.5mm<sup>2</sup> for notification device circuits.
  2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically accepted by the fire alarm equipment manufacturer in writing.
  3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.
  4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.
- C. Terminal Boxes, Junction Boxes, and Cabinets:
1. Shall be galvanized steel in accordance with section 26 05 33.
  2. All boxes shall be sized and installed in accordance with NFPA 70.

3. Covers shall be repainted red, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of (20 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 2.5 mm<sup>2</sup> for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the Supervision Engineer.

## 2.3 FIRE ALARM CONTROL UNIT

### A. General:

1. Each building/building expansion shall be provided with a fire alarm control panel as shown on the drawings and shall operate as a supervised zoned fire alarm system.
2. Each power source shall be supervised from the other source for loss of power.
3. All circuits shall be monitored for integrity.
4. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
5. Transmit digital alarm information to the main fire alarm control unit.

### B. Enclosure:

1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

C. Operator terminal at main control unit:

1. Operator terminal shall consist of the central processing unit, display screen,
2. Display screen shall have a minimum 7-inch color touch screen.
3. Fire panel should minimum 2500 analog/addressable input/output points and ability to add cards to extend loops.

The SLC shall be minimum 250 address.

4. The panel history shall support storage not less than 2,000 events.
5. The panel should have 5 Loops expandable to 7 Loops
6. The Panel Should be Net workable not Standalone

D. PowerSupply:

The Power Supply /Batteries/Charger, shall provide the means of automatically supplying 24 V DC operating and emergency power to the system. The power supply shall be capable of powering Notification appliance circuits shown on drawings with 20% spare capacity. The power supply shall be a minimum of 80% efficient, fully regulated, power limited 24 V DC to operate listed signaling devices. The power supply shall provide diagnostic LED's to notify the operator upon AC power and/or the control panel battery detection, system ground fault detection when connected to the control unit and shall be capable of charging from 5 AH to 50 AH batteries. Upon AC power failure the power supply shall automatically transfer the system to battery backup and battery shall be heavy duty higher performance with sufficient capacity to maintain the system for 24 hours followed by an alarm condition for 30 minutes.

Features

- A. High Efficiency Design
- B. Completely Power Limited.
- C. 100% Fully Regulated Power Supply
- D. Primary Power (AC) Monitor.
- E. Automatic Battery Charger Circuit.
- F. Triple - 3 Amp Output with Electronic Current Limiting min.
- G. Fault Detection Circuit.
- H. Battery Monitor Circuit; Hi/Lo Voltage and Open.
- I. 50 AH Battery Charging Capacity.
- J. Sealed lead-acid
- K. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries
- L. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
- M. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.
- N. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification

appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.

- O. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.
- P. Trouble signals:
1. Arrange the trouble signals for automatic reset (non-latching).
  2. System trouble switch off and on lamps shall be visible through the control unit door.
- Q. Function Switches: Provide the following switches in addition to any other switches required for the system:
1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
  2. Alarm off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
  3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
  4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
  5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
  6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
- R. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit
- S. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.
- T. The system should provide reports on detector cleanliness level and remaining lifespan.



## 2.4 ANNUNCIATION

1. Annunciator, Alphanumeric Type (System):
2. Shall be a supervised, LCD display shall be 2x40 annunciation in clear English text.
3. Message shall identify building number, floor, zone, etc. on the first line and device description and status (pull station, smoke detector, and water flow alarm or trouble condition) on the second line.
4. The initial alarm received shall be indicated as such.
5. A selector switch shall be provided for viewing subsequent alarm messages.
6. The display shall be UL listed for fire alarm application.
7. Annunciators shall display information for all buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the Supervision Engineer.

## 2.5 ALARM NOTIFICATION APPLIANCES

### A. Bells:

1. Shall be electric, single –stroke or vibrating, heavy-duty, under-drome, solenoid type.
2. Unless otherwise shown on the drawings, shall be 6 inches (150 mm) diameter and have a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
3. Mount on removable adapter plates on outlet boxes.
4. Bells located outdoors shall be weatherproof type with metal housing and protective grille.

### B. Strobes:

1. Visible/only multi candela: strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific visible/only appliance.).
2. Back plate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.

### C. Horn With Strobe

Audible/visible multi candela: audible/visible (A/V) notification appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The strobe shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. The horn shall have a minimum sound pressure level of 83 or 89 dBA @ 24vdc. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The audible/visible enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The appliance shall be capable of two-wire synchronization with one of the following options:

- i. Synchronized Strobe with Horn on steady.
- ii. Synchronized Strobe with Temporal Code Pattern on Horn.
- iii. Synchronized Strobe with March Time cadence on Horn.
- iv. Synchronized Strobe firing to NAC sync signal with Horn silenced.
- v. Accessories: the contractor shall furnish the necessary accessories.

**Each Notification circuit shall have a minimum of 20 percent spare capacity.**

## 2.6 ALARM INITIATING DEVICES

### A. Manual Pull Station:

1. Shall be non-break glass, address reporting type.
2. Provide addressable manual pull station as shown, the double action manual station shall be push and pull type switch. The manual station, should be made of red lexan, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. The manual station shall mount to a standard single gang switch box or an optional red surface mount box..

### B. Smoke Detectors:

1. Smoke detectors shall be photoelectric type and UL listed including 7th Edition Listed Optical Detectors, for use with the fire alarm control unit being furnished. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
2. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
3. All spot type and duct type detectors installed shall be of the photoelectric type.
4. The sensors shall have Minimum 3 selectable sensitivity levels programmed and monitored from the FACP. at control panel.
5. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

### C. Heat Detectors:

1. The Intelligent Analog Thermal/Heat Sensor shall connect with fire resistance 2 wires to the control panel. The sensor shall be easy to install into the base.
2. The sensor shall incorporate a built in type identification so the system can identify the type of sensor.
3. The sensor shall be continually monitored to measure any change in their sensitivity, because of the environment (dirt, temperature, humidity, etc.).
4. The sensor shall use dual solid state to monitor rate of heat rise in accordance to NFPA 72 Temperature Classification for Ordinary Temperature Rating Range (57- 68C) and for Intermediate Temperature Rating Range (88°C) and provide a fast response to rapid increases in temperature. The sensor on command from the control panel shall send data to the panel representing the analogue value of the ambient temperature.

## 2.7 SUPERVISORY DEVICES

### A. Duct Smoke Detectors:

Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.

## 2.8 ADDRESS REPORTING INTERFACE DEVICE

- A. Shall have unique addresses that reports directly to the building fire alarm panel.
- B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
- C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
- D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
- E. Shall be mounted in weatherproof housings if mounted exterior to a building.

## 2.9 UTILITY LOCKS AND KEYS:

- A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.
- B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.
- C. All keys shall be delivered to the Supervision Engineer and Client.

## 2.10 SPARE AND REPLACEMENT PARTS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
  - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
  - 3. Optical Smoke Detectors, Heat Detectors, combined optical smoke and rate of rise detector (with or without built-in sounder) and Flame Detectors: Quantity equal to 5 percent of amount of each type installed, but not less than one unit of each type.
  - 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed (including bases with built-in sounder), but not less than one unit of each type.
  - 5. Speakers and horns: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
  - 6. Keys and Tools: One extra set for access to locked and tamper proofed components.
- B. Spare and replacement parts shall be in original packaging and submitted to the Supervision Engineer.

## 2.11 INSTRUCTION CHART:

- A. Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a back plate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the Supervision Engineer before being poste

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION:**

- A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit.
- B. All conduits, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas.(If needed)
- C. All new and reused exposed conduits shall be painted, PAINTING to match surrounding finished areas and red in unfinished areas.
- D. . Where devices are installed on existing shallow backboxes, extension rings of the same material, color and texture of the new fire alarm devices shall be used. Mounting surfaces shall be cut and patched, Restoration, and be re-painted as necessary to match existing installation.
- E. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the Supervision Engineer.
- F. Strobes shall be flush wall mounted with the bottom of the unit located (2,000 mm) above the floor or (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum (900 mm) clearance from side obstructions.
- G. Manual pull stations shall be installed not less than (1,050 mm) or more than (1,200 mm) from finished floor to bottom of device and within (1,500 mm) of a stairway or an exit door.

#### **3.2 TYPICAL OPERATION.**

- A. Activation of any manual pull station, water flow or pressure switch, heat detector, gaseous suppression system, or smoke detector shall cause the following operations to occur:
  - 1. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Buildings.
  - 2. Release only the magnetic door holders on the floor from which alarm was initiated after the alert signal.
  - 3. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
- B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.
- C. Smoke detectors in the primary elevator lobbies of Buildings shall, in addition to the above functions, return all elevators in the bank to the ground floor.
- D. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.
- E. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.
- F. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

#### **3.3 TESTS**

- A. Provide the service competent, factory-trained engineer and authorized by the manufacturer of the fire

alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Supervision Engineer and Civil Defense Department Officer.

- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the Supervision Engineer and Civil Defense Department Officer. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meet all contract requirements. After the system has passed the initial test and been approved by the Engineer, the contractor may request a final inspection.
1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
  3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
  4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
  5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

#### **3.4 FINAL INSPECTION AND ACCEPTANCE**

- A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
- B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a Supervision Engineer and Civil Defense department Officer.

### 3.5 INSTRUCTION

- A. The manufacturer's authorized representative shall provide instruction and training to the Client as follows:
1. Six 1-hour sessions to engineering staff, and central attendant personnel for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
  2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
  3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.
- B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a troubleshooting guide of the entire system for submittal to the Client. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose-leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.
- C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

### 3.6 ON-SITE ASSISTANCE

- A. **Occupancy Adjustments:** When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.