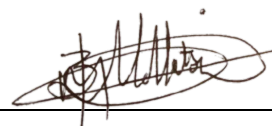



REPORT	
For:	Technical Specification for Design, Supply, Delivery, Installation and Commissioning of Fire Detection system
Project Name:	Clothing Store Refurbishments- Port of Durban
Project Number:	
Author:	Moeketsi Mahlatsi
Owner:	Transnet
Client:	Transnet National Port Authority
Project Sponsor:	Transnet National Port Authority
Project Manager:	Sanelisiwe Shozi
Revision Number:	A
Approved by:	Aslam Haffejee
Release Date:	04-07-2023
Print Date:	04-07-2023
Template Date:	01/05/2012
Document No:	KZNLH-1-14-SP-1001


Distribution	
Name:	Title:
Thokozani Mhlongo	Engineering Manager

DOCUMENTATION DISTRIBUTION, REVISION AND APPROVAL HISTORY

REVISION NUMBER	DATE	DISTRIBUTION/ REVISION	PREPARED BY	REVIEWED BY	APPROVED BY
A	04-07-2023	CLIENT REVIEW	M.M	A.H	A.H

Prepared by:  04-07-2023
 Moeketsi Mahlatsi (Eng. Technologist) Date

Reviewed by:  05/07/2023
 Aslam Haffejee (senior Engineer) Date

Approved by:  05/07/2023
 Aslam Haffejee (Senior Engineer) Date

ADDITIONAL SIGNATORIES:

Accepted by: _____
 (Eng. Manager) Date

Accepted by: _____
 (Senior Project Manager) Date

Transnet SOC Limited

Contract Number:

Description of the *works*: Clothing Store Refurbishments

ADDITIONAL SIGNATORIES (TNPA):

Accepted by:

Date

Accepted by:

Date



Table of Contents

1	GENERAL	6
2	STANDARDS	6
3	SITE CONDITIONS	7
3.1	External Condition	7
3.2	Internal Condition	7
4	SCOPE OF WORKS	7
5	DESIGN	8
5.1	Fire Detection System	8
6	MATERIALS	8
7	ZONING	8
7.1	Fire Zoning	8
8	ACCESS LEVELS	9
9	INSTALLATION METHODS & MATERIALS	9
9.1	Devices	9
9.2	Circuit Wiring	10
9.3	Conduit & Accessories	10
9.4	Wiring Trunking & Cable Trays / Ladders	11
	To be supplied and installed by electrical sub-contractor	11
10	EQUIPMENT REQUIREMENTS	11
10.1	Fire Control Panel (FCP)	11
11.1.1	General	11
11.1.2	Operator Control	11
11.1.3	System Capacity and General Operation	12
11.1.4	Central Microprocessor	13
11.1.5	System Display	14
11.1.6	Signalling Line Circuits (SLC)	14
11.1.7	Communication Interfaces	15
11.1.8	Enclosures	15
11.1.9	Power Supply	15
11.1.10	Auxiliary Field Power Supply – Addressable	16
11.1.11	Specific System Operations	17
10.2	Fire Detection Field Components	19
11.2.1	General	19
11.2.2	Addressable Manual Fire Alarm Box (Manual Call station)	20
11.2.3	Intelligent Photoelectric Smoke Detector	20
11.2.4	Intelligent Thermal Detectors	20
11.2.5	Advanced Multi-Criteria Intelligent Detector	20
11.2.6	Addressable Control Module	20
11.2.7	Addressable Releasing Control Module	20
11.2.8	Addressable Relay Module	21



Transnet SOC Limited

Contract Number:

Description of the works: Clothing Store Refurbishments

11.2.9 Isolator Module	21
11.2.10 Batteries	21
11 TESTING & COMMISSIONING.....	21
12 OPERATING & MAINTENANCE MANUALS	22
13 MAINTENANCE.....	24
14 GUARANTEE	25
15 EXTENDED GUARANTEE	25
16 DOCUMENTATION & TRAINING PROGRAMME	25
16.1 Block Plan	25
16.2 Training Programme	26

1 GENERAL

The additional technical specification in this section shall be read in conjunction with the Works Information.

Should there be any conflict between any parts of this document then sections shall be considered in the following order of priority:

Technical Specification; Works Information; and Drawings.

2 STANDARDS

Full compliance shall be required as stipulated in the following standards.

The Materials and Equipment covered in this specification are to be manufactured and tested in accordance with the following latest revisions of standards:

- BS EN 50136: Alarm systems. Alarm transmission systems and Equipment.
- SANS 10142: Wiring Code
- SANS 10114-1: Interior lighting
- SANS 10400: National Building Regulations
- SANS 10139: Fire Detection & Alarm systems for buildings
- SANS 7629 & 7846: Electric cables specifications
- Occupational Health and Safety Act (Act 85, 1993)
- Local Municipal by-laws and regulations
- Local fire regulations
- Regulations of the Independent Communications Authority of South Africa (ICASA)
- CIBSE Commissioning Code C: Automatic Controls

The design of an automatic fire detection system, the equipment supplied for the system, and the installation of such equipment shall be in accordance with the Standards listed below. The equipment and components shall be deemed to have been tested and approved by a reputable and recognised international test laboratory to prove compliance with at least one or more of these Standards. Copies of test certificates shall be provided by the *contractor* with their tenders:

- EN 54: Components of automatic fire detection systems
- BS 5445: Components of automatic fire detection systems
- BS 5839: Fire detection and alarm systems for buildings

Material for which a SANS specification exists, shall be in accordance with such a specification, and shall bear the SABS mark.

All equipment used shall originate from suppliers which have been certified in accordance with SABS ISO 9001 (ISO 9001) for quality assurance. Copies of certificates of approval shall be provided by the *contractor* with their tenders.

Equipment designed to BS 5446, Fire systems for residential premises, or similar other standards are not acceptable.

3 SITE CONDITIONS

The site of the existing building for Clothing store refurbishment is within the Port of Durban.

The site is subjected to the following prevailing conditions:

3.1 External Condition

Summer ambient	: 40°C Dry Bulb Maximum
Winter ambient	: 16°C Minimum
Humidity	: Average 77%
Altitude	: 0 m at sea level

3.2 Internal Condition

Summer	: 24 °C Dry Bulb – 55% Relative Humidity
Winter	: 22 °C Dry Bulb – 55% Relative Humidity

The building is positioned in a severe coastal environment; therefore, equipment offered shall be suitably corrosion resistant for such conditions.

4 SCOPE OF WORKS

The extent of works covered in this document comprises the detailed design, supply, installation, testing, commissioning and training of a complete Fire Detection System, which comprises of the following:

- Fire Alarm Control panel.
- Optical Smoke and Heat Detector units.
- Manual Call Stations.
- Fire alarm sounders and sirens.
- Fire rated cabling.
- Control System for control of HVAC systems in the fire alarm conditions.
- All accessories and miscellaneous equipment to ensure proper functioning of the systems.
- Supplying of O&M Manuals and training; and
- 12 Month Warrantee Period.

5 DESIGN

Any uncertainty which may exist regarding the specification requirements shall be submitted to the Employer's engineer in writing. The requirements and design standards of the specification shall be adhered to unless otherwise approved by the Authority or its authorised representative in writing.

Small items of equipment forming part of a system are not covered by this specification.

However, it is still required that the total system shall comply with the highest standard of the design and fire protection practice.

5.1 Fire Detection System

The Fire Detection system shall be supplied and installed as per this specification relevant standards.

The system must consist of a main Fire Control Panel (FCP) located within the building that is always manned. Smoke and heat detector units are to be installed throughout the building. Cabling of the system shall be done in dedicated wire ways for the fire system.

The system shall be integrated ("hard-wired") to the following equipment / systems which are to be supplied and installed by other sub-contracting companies. Allowance for all necessary controls and equipment to activate/disable the equipment must be provided for.

- Smoke ventilation system – to enable ventilation of smoke in the event of a fire.
- Fresh Air and Air-Conditioning system – to disable operation of the systems.

6 MATERIALS

All materials used on the contract shall be new and of the very best of their respective types and kinds.

All equipment and parts used in a particular system shall originate from one supplier as far as practicably possible.

7 ZONING

7.1 Fire Zoning

Devices shall be grouped into zones as follows, unless the zones are indicated on the drawings and/or Supplementary Specification:

- A zone shall not have more than 20 field devices.
- Each building floor shall have a minimum of two (2) separate zones.
- The roof area shall be on a separate zone.
- The floor area of a single zone shall not exceed 2000m².
- Every floor of a building larger than 300m² shall be on a separate zone.
- Every area enclosed by fire walls shall be on a separate zone.

- In an analogue addressable system, each zone shall be enclosed by 2-line isolators.

A minimum of 20% spare capacity shall be allowed in the design of the control panels, loops,

zones, etc. The control panel shall have facilities to accommodate a further two detectors

circuits, additional to the required number of zones, without having to replace or add additional

cabinets (extensions) to the control panel, unless specified otherwise.

8 ACCESS LEVELS

The levels of access (modified) applicable to the control panels are as follows.

Level 1: No password or key:	Access by members of the public. In addition, the "silence" function shall be accessible or operational.
Level 2: Password or key:	Access by the person responsible for the system and trained on the system, and for system maintenance.
Level 3: Password or key:	Access by persons trained to reconfigure the system.
Level: Password or key:	Access by persons authorised by the system owner to allocate passwords to levels 2 and 3. a) Access by persons trained and authorised by the manufacturer to repair, or to alter the firmware, thereby changing its basic mode of operation.

9 INSTALLATION METHODS & MATERIALS

9.1 Devices

The base of a detector shall always be mounted in the area which it protects so that the indicator LED can be seen from the doorway which normally provides access to the room. The indicator LED shall face towards the main entrance or lobby or side of main approach in the passage.

Bases shall be provided with dust caps to protect the base against dust and dirt whilst construction work is in progress. This is only applicable to bases that contain electronic components.

Surface mounted units shall be solidly fixed to the wall by means of their back plates.

Manual call point units shall be mounted at 1,4m above finished floor level.

9.2 Circuit Wiring

The following methods are acceptable for the wiring of detector circuits:

- Steel conduit and conduit accessories cast into, or built into, the building structure and wired with insulated conductors of a type which complies with the requirements of this specification.
- Steel conduit and conduit accessories, surface mounted in building structures and wired with insulated conductors of a type approved by the Department.

Wires and cables may also be installed in wiring trunking and armoured cable may also be installed on cable trays, as specified in this specification.

Cables with stranded wires shall be terminated by the crimping on of lugs. No stranded wires without lugs will be accepted.

T-Junctions shall be made only in approved draw boxes at detector outlets.

Separate wiring installations for detector circuits, evacuation communication wiring, audible alarms, electrical lock wiring, card reader wiring, AC and DC power circuits, remote control circuits and monitor wiring, video cables, computer cables, etc., shall all be done in separate conduit- or trunking installations. Detector wiring shall not be installed together with any other wires in wireways.

Detector wiring may share the same draw boxes or expansion joint boxes with other firefighting system wiring or security system wiring, but the boxes shall be subdivided by means of steel plates.

All electrical work and wiring associated with "FIRE DETECTION SYSTEMS" shall be carried out in compliance with the requirements of the "STANDARD SPECIFICATION FOR ELECTRICAL INSTALLATIONS" of the Client.

Cables installed over vertical distances of more than 1,5m, shall be properly supported at intervals of less than 1,5m.

9.3 Conduit & Accessories

The Contractor for the fire detection system shall be responsible for the supply and installation of all conduits, conduit accessories, wiring trunking and cable trays, as may be necessary or required for the system, unless specified otherwise.

Conduit and conduit accessories shall be cast in, or built into, the building structure in new buildings. No surface mounting will be acceptable in new buildings or structures.

Surface mounted conduit and conduit accessory work will be allowed only in existing buildings.

Steel conduit and conduit accessories surface mounted on building structures, steelwork, and woodwork, shall be done neatly and in straight lines and shall be saddled at 1 m centres with spacer saddles.

M4 machine screws shall be used for fixing of spacer saddles onto steelwork. Suitable holes shall be drilled and tapped in the steelwork for this purpose.

Steel conduit and conduit accessories, surface mounted in roof spaces of buildings or structures with pitch roofs, shall follow the roof structural elements.

The quality of materials and the methods of installation of steel conduit and conduit accessories.

shall be carried out in compliance with the requirements of the "STANDARD SPECIFICATION FOR ELECTRICAL INSTALLATIONS" of the Client and SANS 10142.

Conduit installations shall be done in such a way that detector circuit wiring can be done without interruption and without T-joints.

Round draw boxes for detectors shall be mounted hard against the ceiling in the case of false ceilings or ceilings of pitch roof buildings and detector bases shall be mounted against boxes so that no open wiring occurs anywhere in a conduit and wiring system.

No Sprague tubing or PVC conduits shall be used in detector circuit wiring systems. Only flexible conduit which is not of the spiral type may be used in special applications.

9.4 Wiring Trunking & Cable Trays / Ladders

To be supplied and installed by electrical sub-contractor.

10 EQUIPMENT REQUIREMENTS

10.1 Fire Control Panel (FCP).

11.1.1 General

Main FCP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.

11.1.2 Operator Control

a) Acknowledge Switch:

Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

b) Alarm Silence Switch:

Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silence-able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

c) Alarm Activate (Drill) Switch:

The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

d) System Reset Switch:

Activation of the System Reset switch shall cause all electronically latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

e) Lamp Test:

The Lamp Test switch shall activate all local system LEDs, light each segment of the LED and display the panel software revision for service personal.

11.1.3 System Capacity and General Operation

- a) The control panel or each network node shall provide or be capable of 200 intelligent/addressable devices.
- b) The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 5 amps @ 40Vdc.
- c) It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
- d) The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex, Wheelock, Advanced or similar Notification Appliances.
- e) The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual colour coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
- f) The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
- g) The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.
- h) The FCP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
- i) The FCP or each network node shall provide the following features:
 - Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - Detector sensitivity test.
 - Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - Nine sensitivity levels for alarm, selected by detectors. The system shall support sensitive advanced detection laser detectors. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
 - The ability to display or print system reports.

- Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
- Rapid manual station reporting (under 3 seconds) and shall meet requirements for activation of notification circuits within 10 seconds of initiating device activation.
- Periodic detector test, conducted automatically by the software.
- Self-optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its pre-alarm level to just above normal peaks.
- Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
- Walk test, with a check for two detectors set to same address.
- Control-by-time for non-fire operations, with holiday schedules.
- Day/night automatic adjustment of detector sensitivity.
- Device blink control for sleeping areas.

j) Network Communication:

The FCP shall be capable of communicating on a Local Area Network (LAN), firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

11.1.4 Central Microprocessor

- a) The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
- b) The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
- c) The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.
- d) A special program check function shall be provided to detect common operator errors.
- e) An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
- f) For flexibility and to ensure program validity, an optional Windows (TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall

also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

11.1.5 System Display

- a) The system shall support an 80-character display. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
- b) The display shall provide all the controls and indicators used by the system operator:
 - The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
- c) The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
- d) The display shall also provide Light-Emitting Diodes:
 - The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PRE-ALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge, Discharge and Abort.
- e) The display shall provide a QWERTY type of keypad:
 - The 80-character display keypad shall be an easy-to-use QWERTY type of keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
- f) The system shall support the display of battery charging current and voltage on the 80character LCD display.

11.1.6 Signalling Line Circuits (SLC)

- a) Each FACP or FACP network node shall support one SLC. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
- b) CPU shall receive analogue information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analogue information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

11.1.7 Communication Interfaces

TNPA utilizes Wonderware orchestra SCADA system platform for monitoring plant operations such as air conditioning plant, electrical reticulation, and other firefighting system.

The new firefighting system shall seamlessly be integrated into TNPA' existing SCADA system for remote monitoring.

The Consultant shall provide detailed designs and cost estimates for relaying the existing fire detection, sprinkler system to the clothing store for continuous monitoring and quick response notification

11.1.8 Enclosures

The control panel shall be housed in a cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.

The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right- or left-hand hinging.

11.1.9 Power Supply

- a) A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6A of available power for the control panel and peripheral devices.
- b) Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
- c) Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries which allow for 4hrs of uninterrupted power or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
- d) The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - Ground Fault LED
 - AC Power Fail LED
 - NAC on LED (4)
- e) The main power supply shall operate on 240Vac, 50 Hz, and shall provide all necessary power for the FACP.
- f) The main power supply shall provide a battery charger using dual rate charging techniques for fast battery recharge and be capable of charging batteries up to which shall be sized to last 4hrs.
- g) All circuits shall be power-limited, per UL864 requirements.

11.1.10 Auxiliary Field Power Supply – Addressable

- a) The auxiliary addressable power supply is a remote 24Vdc power supply used to power Notification Devices and field devices that require regulated 24Vdc power. The power supply shall also include and charge backup batteries.
- b) The addressable power supply for the fire alarm system shall provide up to a minimum of 6.0 amps of 24Vdc regulated power for Notification Appliance Circuit (NAC) power or 10 amps of 24Vdc general power. The power supply shall have an additional 0.5 amp of 24Vdc auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge backup batteries to last 4hrs.
- c) The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits.
- d) The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized notification devices at the same time.
- e) The addressable power supply shall operate on 240Vac, 50Hz.
- f) The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signalling Line Circuit (SLC) or other multiplexed means. Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24Vdc, 5Vdc and 0Vdc at approximately 3.33kbaud.
- g) The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
- h) The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
- i) The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
- j) The addressable power supply mounts in either the FACP back-box or its own dedicated surface mounted back-box with cover.
- k) Each of the power supply's four output circuits shall be programmed for Notification Appliance Circuit or General Purpose 24Vdc power. Any output circuit shall be able to provide up to 2.5A of 24Vdc power.
- l) The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of an end-of-line resistor. When the power supply's output circuit is selected as General 24Vdc power, the circuit shall be individually supervised when an end-of-line relay is used.

- m) When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
- n) When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
- o) The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
- p) An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

11.1.11 Specific System Operations

- a) Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
- b) Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
- c) Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
- d) Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - Device status
 - Device type
 - Custom device label
 - View analogue detector values
 - Device zone assignments
 - All program parameters
- e) System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
- f) System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.

- g) Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyse the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be enunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- h) Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
- i) Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
- j) The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:
- Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
 - Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
 - All devices tested in walk test shall be recorded in the history buffer.
- k) Water-flow Operation:
- An alarm from a water-flow detection device shall activate the appropriate alarm message on the main panel display turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
- l) Supervisory Operation:
- An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
- m) Signal Silence Operation:
- The FACP shall have the ability to program each output circuit (notification, relay, speaker etc.) to deactivate upon depression of the signal silence switch.
- n) Non-Alarm Input Operation:
- Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

10.2 Fire Detection Field Components

11.2.1 General

- a) Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
- b) Addressable devices, which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
- c) Detectors shall be intelligent (analogue) and addressable and shall connect with two wires to the fire alarm control panel Signalling Line Circuits.
- d) Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
- e) The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
- f) Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.
- g) The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base.
- h) The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- i) Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- j) Detectors will operate in an analogue fashion, where the detector simply measures its designed environment variable and transmits an analogue value to the FACP based on real time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analogue value of each detector.
- k) Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
- l) A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analogue value reaching 100% of the alarm threshold.

- m) Addressable modules shall mount in a 100 mm square, 54 mm deep electrical box. An optional surface mount Lexan enclosure shall be available.

11.2.2 Addressable Manual Fire Alarm Box (Manual Call station)

- a) Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
- b) All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
- c) Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word "FIRE" shall appear on the front of the stations in raised letters, 44 mm or larger.

11.2.3 Intelligent Photoelectric Smoke Detector

The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

11.2.4 Intelligent Thermal Detectors

Thermal detectors shall be intelligent addressable devices rated at 58°C and have a rate-of-rise element rated at 9.4°C per minute. It shall connect via two wires to the fire alarm control panel signalling line circuit.

11.2.5 Advanced Multi-Criteria Intelligent Detector

- a) The intelligent multi criteria detector shall be an addressable device combining two sensing elements in a single sensing device providing the ability to detect two major elements of a fire. The detector design shall allow sensitivity setting between 1% and 4% per 30cm obscuration.
- b) The detector shall include a photoelectric sensing element, thermal sensing element.

11.2.6 Addressable Control Module

- a) Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered polarized audio/visual notification appliances.
- b) The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y.
- c) Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised remote supply.
- d) For multiple circuit control a module shall be available that provides 6 Style B or 3 Style D control circuits.

11.2.7 Addressable Releasing Control Module

- a) An addressable Flash-Scan releasing module shall be available to supervise and control compatible releasing agent solenoids.

- b) The module shall operate on a redundant protocol for added protection.
- c) The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24Vdc solenoids.

11.2.8 Addressable Relay Module

- a) Addressable Relay Modules shall be available for HVAC control and other network building functions. The module shall provide two relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
- b) For multiple relays control a module shall be available that provides 6 programmable relays.

11.2.9 Isolator Module

- a) Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
- b) If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- c) The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- d) The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

11.2.10 Batteries

- a) The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- b) The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- c) If necessary to meet standby requirements, external battery and charger systems may be used.

11 TESTING & COMMISSIONING

The testing of the system shall be done in the presence and to the satisfaction of an authorised representative of the Client and the Project Manager.

Tests shall include simulation of fire conditions in each zone to prove the efficiency of all aspects of the system to the satisfaction of the Client and Project Manager.

All equipment, material, etc., which may be necessary for these tests shall be supplied by the Contractor, including a suitable smoke generator.

The Contractor shall do his own complete commissioning tests before the actual first take-over tests are done. This is to satisfy himself that everything is working and is in accordance with the specification.

12 OPERATING & MAINTENANCE MANUALS

12.1 Operating Instructions

Instruction cards, clearly indicating the procedure to be followed in the event of a "FIRE" alarm, shall be supplied, and framed under Perspex in approved teak or non-ferrous material frames.

The instruction cards shall be in English and at least one other official language to be decided in conjunction with the client. The frame shall be neatly mounted on the walls alongside the control panel and external indicator panels respectively, where they can be clearly read.

In the case of the control panel, the instruction card shall also clearly state the procedure to be followed in the event of a "FAULT" alarm.

Four Sets of Operating and Maintenance Manuals shall be prepared in the form as suggested by BS 5839-1. All O&M Manuals and As-built drawings shall be supplied on USB in both PDF and native format with four sets of hard copies.

- 12.1.1 Plant schematics and wiring diagrams shall be the latest revision and shall be framed behind glass and displayed adjacent to switchboards.
- 12.1.2 The operating and maintenance manuals shall include but not be limited:
 - Descriptive Information

This section shall consist of but not be limited to;

- General description,
 - Design parameters,
 - Building load,
 - Installed capacities,
 - Principal components,
 - Refrigeration piping distribution schematics
 - Air distribution schematics
 - Control schematics
 - Electrical board schematics
- Equipment data

This section shall consist of but not be limited to;



- Equipment designation
- Manufacturer and model
- Manufacture local representative
- Size and rating
- Speed, pressure and temperature limitations
- Operating instructions

This section shall consist of but not be limited to:

- Starting and stopping procedures
- Time switch functions
- Seasonal adjustments
- Sequence under loading and unloading
- Normal operation and tripped conditions
- Logs and records to be kept
- Inspection and maintenance

This section shall consist of but not be limited to;

- Inspection Schedules and Checklist.
- Lubrication Schedules.
- Air Filter Maintenance Schedules.
- Routine Replacements, Adjustments and Calibrating.
- Routine Cleaning, Painting and Protection.
- Inspection and Maintenance Logs and Records to be kept.
- Reference documents

This section shall consist of but not be limited to:

- Tender Specification & Drawing List
- As built Record Drawings
- Test Reports
- Commissioning Reports
- Equipment manufacturer data

This section shall consist of but not be limited to:

- Descriptive literature
 - Catalogue Cuts, Brochures or Shop Drawings

- Dimensioned Drawings
- Materials of Construction
- Parts Designations
- Operating characteristics
 - Performance Tables and Charts
 - Performance Curves
 - Pressure, Temperature, and Speed Limitations
 - Safety Devices
- Operating Instructions
 - Pre-start Checklist
 - Start-up Procedures
 - Inspection during Operation
 - Adjustment and Regulation
 - Testing
 - Detection of Malfunction
 - Precautions
- Inspection instructions procedures
 - Normal and Abnormal Operating Temperature, Pressure and Speed Limits.
 - Schedule and Manner of Operation
 - Detection Signals
- Maintenance instructions procedures
 - Schedule of Routine Maintenance.
 - Procedures.
 - Troubleshooting Chart
- Parts list
- Service contracts

13 MAINTENANCE

- 13.1 Allow for the maintenance of the complete installation for a period of TWELVE (12) MONTHS after 'practical' completion certificate has been issued by the Engineer. Visit the installation once a month on the basis of a proper preventive programme approved by the Engineer.
- 13.2 Report to an official nominated by the Client on arrival and again on leaving their premises on each visit. Such person, who has been nominated by the Client, shall sign a Service Report giving details of corrected temperature and humidity readings taken, etc.

- 13.3 At each service visit, maintenance personnel shall, inter alia, perform the following duties in addition to any other which may be necessary. Make good any defects as required in items of the guarantee given for the plant in terms of the specification.
- 13.4 Attend to any complaints made with respect to the installed plant by the authorized person mentioned in the foregoing. No other person shall have any right to instruct the Selected Subcontractor or make any complaint.
- 13.5 Instruct the Client's maintenance personnel on the attention required to any item requiring more frequent attention during the service visits.
- 13.6 A major service shall be executed in the sixth and twelfth month of the maintenance period shall be to the satisfaction of the *Employer's* Engineer. This major service shall include all annual servicing functions as recommended by the manufacturers of material and equipment supplied and/or installed under this contract

14 GUARANTEE

- 14.1 The contractor shall guarantee the materials, apparatus and workmanship delivered and installed by him. The guarantee shall be valid for a period of twelve months starting on the date when the practical completion certificate is issued. The complete installation shall be guaranteed against defects as a result of patent and latent defects of the apparatus, as well as against faulty materials and workmanship. Fair wear and tear is excluded from the guarantee.
- 14.2 The guarantee shall provide for all parts, spares and appurtenances which become defective during the guarantee period, to be replaced free of charge to the Client. All costs of labour, out-of-town allowances, materials and transportation required to replace such part of a defective installation shall be borne by the Selected Subcontractor and shall be included in his guarantee. The Selected Sub contractor shall cede to the Client the remainder of any equipment guarantee which he has received from his suppliers, and which may extend beyond the period of twelve months mentioned herein.

15 EXTENDED GUARANTEE

- 15.1 Where certain equipment have supplier's standard guarantee clauses of which do not correspond with the required guarantee of twelve (12) months, the Contractor shall allow in the tender price for the extension of guarantees and additional charges thereof, in order to comply with guarantee clause.

16 DOCUMENTATION & TRAINING PROGRAMME

16.1 Block Plan

- An approved block plan, indicating the zones and appropriate zone reference numbers, shall be installed at all control panels.

- The block plan shall be discussed with the Fire Prevention Officer of the Department before manufacturing takes place.
- The block plan shall have a professional appearance. Text shall be in English and at least one other official language to be decided in conjunction with the Department and the User Department. A freehand drawing or badly finished plan will not be acceptable.
- The block plan shall clearly indicate the position of the zone in which a fire has started, when read together with the displays and indications on the control panel.
- Non-fading material shall be used for the artwork. The block plan shall be mounted in a frame behind glass, or shall be covered with a transparent stick-on material, to protect the artwork.
- The block plan shall be mounted in an approved position at the control panel.
- For an addressable system, the addresses of all field devices shall be shown on the block plan.

16.2 Training Programme

The *Contractor* shall allow in their tender prices for a training course, to train on site at least four (4) persons, as nominated by the Client from his own operating personnel. The training shall be adequate for the installation, to ensure that operating staff fully understand the system. During this period, the personnel shall be made fully conversant with the operation of, and daily maintenance required for, each item of equipment of the system. The training, especially on computer equipment and control panels, shall be of such a standard that will enable the client to carry out his own in-house training of other personnel.

The training course shall start only after first take-over inspection of the system.

The training course shall be carried out in English.

The O&M Manual of the contract shall include a full description of the contents of the training course, as referred to in clause above.