

**TECHNICAL SPECIFICATION
FOR FIRE DETECTION**

SPECIFICATION FOR FIRE DETECTION

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APPENDIX -1

1 GENERAL DESCRIPTION AND SCOPE OF WORK

- 1.1** This section covers the requirement of intelligent addressable fire alarm system for the proposed Hotel as per the layout drawing enclosed, specification laid down below and as per description of item given under the schedule of quantities.
- 1.2** The work described in this specification consists of all labour, materials, equipment and services necessary and required to complete, test and commission the fire detection and alarm system. Any material not specifically mentioned in this specification but required for proper performance and operation shall be provided and installed for a complete and operational system, by the contractor at no extra cost.
- 1.3** The contractor shall furnish, and install complete and ready for intended use and operation, an intelligent, addressable fire detection and alarm system including Fire alarm panel(s), initiating devices (manual pull stations, addressable photo & thermal detectors, beam detectors etc.) indicating devices (sounders, bells, visual warning signals, etc.) and supervisory devices, enunciators, wiring apparatus and accessories.
- 1.4** The installation and locations of equipment and devices in the building shall be governed by the code/publication with due regard to actual site conditions, manufacturers' recommendations, ambient factors affecting the equipment and other operations in the vicinity. If any deviation from the specifications is necessary, approval shall be obtained from the Engineer-in-Charge before work is started thereon.
- 1.5** Materials and equipment shall be new, first grade, standard; current models of the manufacturer and shall be suitable for this system. Where two or more pieces of equipment performing the same function are required, they shall be exact duplicates produced by the same manufacturer.
- 1.6** All materials, devices, and equipment shall be compatible with the circuits or systems in which they are utilized.
- 1.7** Provision shall be made for maintaining Fire System Panel(s) through BMS. The panel shall be capable of inter-connected with BMS and shall have open code architecture.

1.8 In addition to SITC of Fire alarm system, the following work shall be deemed to be included within the scope of work to be executed by the bidder as this is being a turnkey job within his quoted cost.

- i) It includes obtaining approvals from Chief Fire Officer and all other statutory authorities for complete scope of work as per relevant rules & regulations etc.
- ii) The Fire Detection and Alarm System of the building shall be integrated with respective to the zoning of PA system so that, in case of fire, the PA system shall automatically come in announcement mode of that zone and play pre-recorded evacuation messages from PA system. For integration of the system if additional module(s) w.r.t. zoning are required shall be measured and paid separately.
- iii) Suitable racks shall be provided for housing amplifiers, pre-amplifiers, CD player control equipments etc.
- iv) Minor Civil repair works, making surface good after work i/c minor items/ petty work etc required for successful commissioning of entire system.
- v) Client will provide Single phase AC Power supply in Fire Alarm Panel room and the contractor shall extend the power from these points for its panel etc.

1.9 Graphical User Interface (GUI) based main network Fire Detection must be capable of graphically representing each facility being monitored with floor plans and icons depicting the actual locations of the various systems; and / or sensors' locations. The GUI software shall be located in control room in one of the Floors and shall monitor all the Floor for Fire Detection, Digital voice evacuation system and 2 way communication panel connected with each other through fibre optics. The software shall provide the facility to Monitor, Control all the Digital voice evacuation system as well as 2 way communication from main control room using voice signals over Fire Network along with the Fire detection signal. The software shall be capable of broadcasting on Voice over IP. (UL 9th Edition Approved and NFPA compliant/BS EN)

- a. Operator work station with PC having Intel Pentium I7 Processor including Serial ports (RS232) and USB ports and following accessories etc. complete with software all as specified.

- b. 4 Gigabytes of RAM memory
- c. 2 TB of hard disk space
- d. DVD ROM
- e. 21” LED colour monitor
- f. Mouse with Mouse Pad
- g. Standard Key Board
- h. Latest Windows Operating System
- i. Compatible Fire Alarm System Control Software
- j. Laser Printer colour A4- 1 No
- k. Software for Automatic Fire Detection and Alarm System
- l. UPS 800 VA or better

2 REQUIREMENTS

- a. This installation shall be made in accordance with the specification, local codes and local fire authorities having jurisdiction over this project.
- b. Fire Detection & Alarm System Installation work shall be carried out in accordance with Indian Standard Code of Practice for Electrical Wiring Installation IS: 732 - 1989, IS: 2274-1963 and IS 2189-2008 with upto date amendment.
- c. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Fire Authority. Proposed Intelligent Addressable Fire Detection & Alarm system in general shall be carried out as per following CPWD Specifications / IS standard with upto date amendment.

d. Reference Standards

All equipment and installation shall be installed in compliance with the following codes and listing:

APPLICABLE CODES, STANDARDS AND APPLICABLE PUBLICATIONS

IS : 2175	:	Heat Sensitive Detectors.
IS : 2189	:	Automatic Fire Detection and Alarm System.
IS : 11360	:	Smoke Detectors.
NFPA 71 & 72	:	Commissioning Tests for Fire Alarm Systems.
BS : 5839	:	Commissioning Tests for Fire Alarm Systems.
BS : 5445, UL&FM/ NFPA :		Fire Detection and Alarm System.
UL864	:	Fire Alarm Panel
UL268	:	Duct Detector

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take precedence over cathe said regulations and standards.

e. Test at Site

- i) All commissioning tests at site will be in line with UL/ EN.
- ii) Following test shall be conducted: -
 - Loop Checking. All wiring shall be tested for continuity, shorts, and grounds before the system is activated. All test equipment, the installing contractor, shall make instruments, tools and labor required to conduct the tests available.
 - Checking of multi criteria detectors, etc. by simulation/functional test by Aerosol Spray or as recommended by the manufacturer.
 - Functional tests for fire alarm panel. The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated.

Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

At the final test and inspection, a factory-trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.

- The Mock trial of the complete Fire Detection and Alarm system.

f. Tests at Manufacturer's Work

- i) Tests certificates will be furnished for approval of all Fire alarm devices and system devices.
- ii) All routine tests as per relevant codes for the Fire Alarm Panel, shall be conducted and results furnished to the Project Manager.

3 SHOP DRAWINGS

On the basis of GFC drawings issued by the department along with soft copy, the Contractor shall submit three (3) sets of Shop drawings contain the following within 30days of issue of GFC drawings for approval of Engineer –In – charge.

- i) Block Diagram showing all detectors and devices area wise, their connectivity to the panel including wire description.
- ii) Point-to-point wiring diagrams showing the points of connection and terminals used for all electrical field connections in each system, all equipment or systems which are supervised and controlled by the fire alarm system. Diagrams shall show all connections from field devices to the control panel initiating modules, output modules, switches, relays and terminals. Diagrams shall show interconnection of all devices, modules, output modules, switches, relays and terminals.
- iii) The Contractor shall submit specific catalogue for each of the item specified in BOQ for approval from Engineer in charge before procurement.

4 POWER SUPPLY

- a. The control panel shall drive from addressable 230 Volts AC/ 24 Volts DC from main power supply. In case of failure of main power supply, the panel shall be automatically switched over to standby power supply i.e. battery. The standby battery as secondary supply shall be such that when charged by associated battery charging equipment it can operate independently for a period of 24 hours for normal working operation and capable of operating the system for 2 hours during an emergency conditions. Batteries shall be of Lead Acid type sealed Maintenance free.
- b. In addition to the batteries, a battery charger suitable for operation on the auxiliary power available in the plant as specified above. The capacity of the charger shall be such that the same can charge the battery (within 8 hrs) while supplying the rated load of the fire detection system. Facilities shall be provided to limit the voltage supplied to fire detection and alarm system to their rated values during the time of charging. The charger shall normally supply the battery trickle charging current and the DC load of the fire detection and alarm system. In case the AC supply on the input side of the charger fails the necessary power for the complete fire detection and alarm system shall be supplied by the battery.
- c. Visible and audible annunciation for troubles or failure in the power supply system like "charger Failure", "Battery Low Voltage", etc. shall be provided.
- d. Battery earth/fault indication/annunciation shall be included in the panel.

5 DESIGN REQUIREMENT

- a. The system shall be provided with multiple loops and distributed as per GFC drawing issued by the department on award of work. All devices shall be connected directly to the loop with 2x1.5 sq. mm fire survival cable. The PA system shall be independent from the fire alarm system however system should be integrated with zoning of PA system. Each Floor shall have one or two loops depending upon number of detectors (sensors).
- b. Addressable Smoke Detectors, Addressable Manual Pull Station, Fault Isolators, Control Modules, Monitor Module, Response Indicators, strobe etc.

- c. The Panel shall have necessary Logic Software and Hardware built into it for time delay starting of strobe. Further, AHUs of each Floor shall be shut off only when any detector on that floor operates an alarm.
- d. The Voice Evacuation PA system shall be integrated with Fire Detection and Alarm System of the building.
- e. In case of fire, the PA system shall automatically come in announcement mode. It shall also be possible to play pre-recorded evacuation messages from PA system in case of fire.
- f. Suitable racks shall be provided for housing control equipments etc.

6 SPECIFICATION

The design, supply and installation testing & commissioning of entire fire alarm system shall conform to BS: 5839 or NFPA 72. All devices including Main Fire Alarm Panel shall be UL/CE listed.

6.1 General Features Common To All Detectors:

- a. Compatibility: - All automatic fire detectors shall be inter changeable without requiring different mounting bases or alterations in the signal panel.
- b. Response Spectrum:- Combustion gas detectors shall respond to both visible and invisible aerosols; size and colour of the aerosols shall not have a decisive influence on the response of the detector.
- c. Sensitivity: - On average 30 mgs of burned material per cu.m. (as measured in a 1 cu.m. chamber) shall release an alarm sensitivity which shall be adjustable according to the use of the space.
- d. Power Consumption:- Each detector shall use the minimum of power, for economic circuits, so that it shall have capacity to connect at least 240 detectors/devices in one loop.
- e. Built-in-response indicator:- Each detector shall incorporate indicator —LED at the detector which shall blink during normal condition and light up on

actuation of the detector to locate the detector which is operated. The detector shall not be affected by the failure of the response indicator lamp.

- f. Maintenance:- All detectors shall be fitted either with plug-in system type connections only, from the maintenance and compatibility point of view.
- g. Construction:- The detector shall be vibration and shock proof. When disassembling for cleaning purposes, its components must not be damaged by static over voltage.
- h. Atmospheric and Thermal Disturbance:- The detector shall so designed as to be practically immune to environmental criteria such as air currents, humidity, temperature fluctuations, pressure and shall not trigger false alarm, due to the above conditions.
- i. Continuous Operation:- An alarm release shall not effect a detector's functioning. After resetting the alarm, the detector shall resume operation without any readjustment.
- j. Adaptability to ambient conditions: - Detectors shall be designed for adaptability to humid locations. No performance deterioration shall be acceptable.
- k. Detector shall have Inbuilt isolation circuit to protect system against wire to wire short circuit/fault.

6.2 Intelligent Addressable Multi Criteria Detector

- a. The detector shall have both optical and thermal sensor and shall be capable of working in combined mode (Optical + Thermal) and heat mode (only Thermal).
- b. The combined modes of operation both the inputs from the optical and thermal sensors are processed using special algorithms before an alarm decision is made. If the presence of smoke is detected above a threshold value for a period of time or if heat sensor temperatures rises above certain fixed temp or rate of rise, then an alarm will be generated. In "heat only" mode only temperature above certain fixed level / rate of rise in temp (i.e. both – fixed & rate of rise) as well will generate an alarm conditions.

- c. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
- d. The multi criteria detector shall be a combination of smoke & heat (fixed & rate of rise, both) and it can be used as a smoke detector, as a heat detector or as a combined smoke/heat detector upon demand and is programmed and set-up specifically for the environmental conditions that it is part of. It should detect smoldering and open fires at an early stage by being able to detect and evaluate the characteristics of fire and smoke (Tyndall or relevant applicable principle) as well as heat (NTC sensor / thermistor principle). The sensitivity of the detector can be adjusted using software, if required as per site conditions.
- e. The multi criteria detector shall activate on receiving smoke particles in the 0.5 to 10 micro meter range or as specified. The detector shall be completely solid state with LED indication.
- f. The detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage (17 to 28 V DC) two wire supply. The sensitivity of the detector shall not vary with change in ambient temperature, humidity, pressure or voltage variation.
- g. Neither its performance shall be affected by air current upto 10 mtr. per second or as per relevant IS Standard/NFPA72.. The detector shall be suitably protected against dust accumulation / ingress and it shall be free from maintenance and functional test at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement. The detector housing shall be damage resistant made of polycarbonate or proprietary self extinguishing material.
- h. The coverage per detector shall be as per BS: 5445 or as listed with UL/EN. This coverage area will reduce depending upon structural configurations or partitions etc. The sensitivity of detector shall be set adjusted by the supplier to suit the site requirement and after that it shall automatically be changed based on ambient condition.

- i. The multi criteria detector shall be intelligent addressable detector with hard addressing or manually-set digital code and be able to give intelligent output to the fire alarm panel regarding its condition.
- j. The Base of the detector shall be interchangeable with other detectors and the construction shall be of polycarbonate or any approved flame retardant material. The enclosure shall at least meet IP 22 protection grade/ as per UL listing.
- k. It shall be able to withstand temperature variations from 0° Centigrade to 50° Centigrade. Relative humidity (non condensing type) upto 95% shall not hamper its performance. The voltage rating shall be from 17V DC to 28V DC, though the voltage may be changed depending upon the working voltages of a proprietary Fire Alarm Panel.
- l. The Detector shall meet the requirements of UL/EN and be approved by UL/EN. It shall be possible to test the detector's working both from the Panel as well as locally by means designed by the bidder.
- m. It shall be possible to mount the detectors in duct casting units for sampling of supply air from the AHUs.

6.3 Addressable Duct Smoke Detector

The smoke detector housing shall accommodate an intelligent photoelectric detector, of that provides continuous intelligent monitoring and alarm verification from the panel. The Duct Casting Units shall be directly installed in the air conditioning ducts (Return air) for detecting any hazardous quantity of products of combustion being carried through the ducts.

The complete unit shall consist of a housing to accommodate Photo Electric Detector with plug - in facility and sampling tubes, one for air inlet and other as the air outlet. The Inlet tube shall extend into and across the duct width (from 0.5 meter to 3.0 meter), the outlet tube shall be of fixed length of 7.5 cm length.

When the AHU blower fan operates, a continuous cross sectional sampling of air from the duct shall flow through the housing containing the Detector. The outlet tube shall return the sampled air into the duct.

The housing shall be mounted outside the duct, the probe tubes shall be inserted through the duct by cutting precision sized holes into the duct and sealed with rubber gaskets.

6.4 Addressable Smoke Detector

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

6.5 Addressable Heat Detector

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

6.6 Addressable Manual Call Point

Manual Push Button shall be of Pull down type units, completely encased in a MS/Polycarbonate housing/ LEXAN, as per Boq with provision for cable or conduit coupling. The Manual Push Button shall have the word prescribed in clear bold letters on facia window "In Case of Fire Pull Down. Its casing shall be of red color:

The Manual Call Box Station shall be fully addressable with its own set code and operated by digitized signals sent from the Panel. The Voltage range shall be from 17 V to 28 V. It shall have protection as per IP 33. The operating temperature range shall be from 0⁰ C to 50⁰ C. Relative Humidity (non condensing) range for performance parameters shall be between 0 to 95%.

6.7 Loop Powered Addressable Hooter Cum Strobe

The wall mounted Strobe shall be loop powered & suitable for indoor and outdoor application with minimum sound level 90 db at 1M distance. Strobe shall be of red colour. In case the Hooters cum Strobe need to have sperate wiring and power supply unit, the vendor shall quote for the item mentioned in the SOQ.

6.8 Modules

6.8.1 Zone Adapter Module

The Zone Adapter module or ZAM shall provide an interface between the intelligent fire alarm system and a two-wire conventional detection zone. The interface module shall supervise the zone of detectors and the connection of the external power supply. The module shall be UL/EN Listed. The module shall draw loop current for its own

operation but shall use an external power supply for powering the conventional two wire detectors. It shall be UL/EN listed.

6.8.2 Monitor Module (For Input To Fire Alarm Panel)

The Input Device shall provide an addressable input for N.O. or N.C. contact devices such as manual water flow switches, pressure switches, etc. The input device shall provide a supervised initiating circuit.

An open-circuit fault shall be annunciate at the Fire Alarm panel (Subsequent alarm shall be reported.) The device shall contain an LED which blinks upon being scanned by the Fire Alarm

panel. Upon determination of an alarm condition, the LED shall be latched on. The operating voltage shall be in the range of 15 to 32 VDC, Maximum current draw 5.0 mA (LED on).

6.8.3 Control Module (For Output From Fire Alarm Panel)

The control module shall provide an addressable output for a separately powered alarm indicating circuit or for a control relay. The control module shall provide a supervised indicating circuit where indicated on the plans. An open circuit fault shall be annunciated at the Fire Alarm panel.

The Output Device shall provide a control relay where indicated on the plans. The relay contacts shall be SPDT rated at two amps 24 V DC. The device module shall contain an LED which blinks upon being scanned by the Fire Alarm panel. Upon activation of the device, the LED shall be latched on.

7 COMMISSIONING AND ACCEPTANCE TESTS

The commissioning and acceptance tests shall be apart from the standard or routine tests prescribed and normally conducted by the manufacturer /Design-Build Contractor and will be irrespective of the fact whether the same are covered by such tests or not. All commissioning tests at site will be in line with NFPA 71 and 72.

Each sounder circuit shall be energized separately and the sound level reading taken to check for conformity with the minimum standards.

Mains failure performance.

Battery disconnection test.

Open circuit of each sounder circuit to be tested.

Short circuit of each sounder circuit to be tested.

The results of the above tests either by fault warning or fire alarm shall be recorded in the logbooks which will be signed both by the Design-Build Contractor and the employer's Representative.

APPENDIX – I

1 CODES AND STANDARDS

Execute and complete the work to recognized industry best standards and in full compliance with specifications. The following and any other relevant International /national codes, standards and recommendations shall apply in addition to the regulatory/ statutory/ approvals requirements to all aspects of the Contract:

A. National Fire Protection Association (NFPA) - USA :

1. No. 70 National Electric Code (NEC)
2. No. 72-2016 National Fire Alarm Code
3. No. 101 Life Safety Code
4. NFPA 70 National Electric Code
5. NFPA-2001 Clean Agent Fire Extinguishing Systems
6. NFPA-75 Standard for the Protection of Information Technology Equipment's
7. NFPA-76 Standard for the Protection of Telecommunication Facilities

B. Underwriters laboratories Inc. (UL) - USA :

1. UL 50 Cabinets and Boxes
2. UL 268 Smoke Detectors for Fire Protective Signaling Systems

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| 3. | UL 864 | 9th edition Control Units for Fire Protective Signaling Systems |
| 4. | UL 268A | Smoke Detectors for Duct Applications |
| 5. | UL 521 | Thermal Detectors for Fire Protective Signaling Systems |
| 6. | UL 228
Systems | Door Closers-Holders for Fire Protective Signaling |
| 7. | UL 464 | Audible Signaling Appliances |
| 8. | UL 38 | Manually Activated Signaling Boxes |
| 9. | UL 346
Systems | Water flow Indicators for Fire Protective Signaling |
| 10. | UL 1481 | Power Supplies for Fire Protective Signaling Systems |
| 11. | UL 1076 | Proprietary Burglar Alarm Units and Systems |
| 12. | UL 1971 | Visual Notification Appliances |

1.1 Standards

- a. National Building code (NBC) – 2016
- b. BIS: 2189- Fire Alarm system
- c. Local Fire Authority Requirements.

1.2 Approvals

All the equipment's shall be tested, approved, and/or listed by:

- a. LPCB (Loss Prevention Certification Board), UK
- b. UL (Underwriters Laboratories Inc.), US
- c. ULC (Underwriters Laboratories Canada), Canada
- d. Factory Mutual Systems (FM) Publications
- e. Factory mutual Approval Guide
- f. National electrical manufacturers association (NEMA)
Enclosures for Industrial Controls and Systems

- g. ANSI A17.1 Safety code for Elevators and Escalators
 - 1. NFPA-75 Standard for the Protection of Information Technology Equipment's
 - 2. NFPA-76 Standard for the Protection of Telecommunication Facilities