SECTION-B

FIRE ALARM & VOICE ANNUNCIATION SYSTEM

1.1 PREAMBLE

A. This section of specification defines the technical requirements for Fire alarm and voice annunciation system as specified in accordance with the requirements of the Contract Documents and codes.

1.2 SUMMARY

A. The scope of work for the FAVA System outlined in this section of the specification includes the systems design verification, supply, installation, testing, commissioning and handing over of the complete Intelligent Fire Alarm and Digital Voice Alarm System (FAVA) by the Contractor.

B. The entire work shall be carried out in a manner consistent with good engineering practice & **system's performance shall not be compromised**. The Contractor shall take into account all site conditions including space allocation for FAVA System while designing the system and selecting the equipment.

C. The Contractor shall be responsible for engaging a qualified, competent and experienced FAVA System staff to perform the system design verification, preparation and submission of system proposal, obtaining approvals from relevant authorities and site supervision for installation, testing and commissioning.

D. The Contractor shall perform the system design verification based on the criteria / data and technical requirements specified in this section / drawings and the local Authorities regulations / requirements.

E. The Contractor shall provide systems which comprises products of manufacturers who have designed, developed and used these products successfully for a period of at least five years.

F. The Contractor shall submit catalogue information, design calculations and samples complete with full technical data and shop drawings for the entire system, test certificates, etc. and any other information required by the Employer's Representative for acceptance prior to commencement of installation.

G. The Contractor shall submit analytical test reports for the Electrical Systems wherever applicable after the commissioning or after the system is put into operation or as required by the Employer's Representative. The result should comply with local authority requirements.

H. The FAVA System must comply with the standard NFPA72 (latest edition), State PWD, NEC 2011, NBC 2005, IPC, Chief Fire Officer (CFO) of Mumbai, Local Municipal Authorities, MOEF guidelines and subject to approval by the Employers Representatives. Tender specifications, drawings, schedules, general and special conditions of the Contract apply to this Section.

Standard Code	**Description**
Fire Alarm & Voice Alarm System	
NBC 2005	National Building Code of India 2005
NEC 2011	National Electrical Code 2011
IE Rules	Indian Electricity Rules 1956
CFO-NOC	NOC from Chief Fire Officer
Unless specifically mentioned otherwise, all the applicable Codes and Standards published by the Bureau of Indian Standards and their subsequent revision/ BS Standards	

shall govern the design, workmanship, quality and properties of materials and method of testing.	
NFPA-72	National Fire Protection Association 72
IS : 2189	Code of practice for Fire Detection and Alarm System
IS 11360	Specification for Smoke Detectors for use in automatic electrical fire alarm system
UL 268	Smoke Detectors for Fire Protective signaling Systems.
UL 268A	Smoke Detectors for Duct Applications.
UL 217	Smoke Detectors Single Station.
UL 521	Heat Detectors for Fire Protective signaling Systems.
UL 228	Door Holders for Fire Protective signaling Systems.
UL 464	Audible signaling Appliances.
UL 632	Electrically-Actuated Transmitters
UL 864/UOJZ, APOU	Control Units for Fire Protective signaling Systems
UL 1638	Visual signaling Appliances.
UL 38	Manually Activated signaling Boxes.
UL 1971	Standard for signaling Devices for the Hearing Impaired
UL 1481	Power Supplies for Fire Protective Signaling Systems.
UL 1711	Amplifiers for Fire Protective signaling Systems.
UL 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
UL 346	Water flow Indicators for Fire Protective signaling Systems.
UL. 50	Cabinets and Boxes
NFPA 92B	Smoke Management Systems in Malls, Atria, Large Areas

NFPA 101	Life Safety Code
NFPA 92A	Smoke Control Systems
NFPA 90A	Air Conditioning Systems
CABLES	
BS 6387	Specifications for performance requirements for cables required to maintain circuit integrity under fire conditions
IS 694	PVC insulated cables for working voltages upto and including 1100V.
IS 10810	Method of test for cables
BS 8519	Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications
BS 7846	Thermosetting insulated, armoured, fire-resistant cables of rated voltage 600/1000 V, having low emission of smoke and corrosive gases when affected by fire.
IEC 60520-1	Appliance couplers for household and similar general purposes – General Requirements
BS 7629-1	Specification for 300/500 V fire resistant screened cables having low emission of smoke and corrosive gases when affected by fire. Multicore and multipair cables
BS EN 50200	Method of test for resistance to fire of unprotected small cables for use in emergency circuits
BS 5839-1, 6, 8 & 9	Fire detection and fire alarm systems for buildings.
BS 5266-1	Emergency lighting. Code of practice for the emergency lighting of premises
CONDUITS	
IS:9537 (Part-II)/ CEE 23 & IEC 60695-2-1:1991	Steel Conduit and Fitting Accessories &PVC Conduit and Fitting Accessories
TRUNKING	

IS 14927, IEC 1084.	Cable Trunking
EARTHING	
IS 3043	Earthing Code of Practice

1.3 SUBMITTAL

A. Technical Data: Submit data for approval including, but not limited to, the following:

- Constructional details, standards to which fire alarm & voice annunciation panel & field devices comply, loop capacities, amplifier capacities, coverage details, cable sizing etc.
- Manufacturer's technical catalogue & Cut sheets.
- Dimensional and electrical characteristics
- Software Calculations with voltage drop study all field devices.
- Acoustic study to indicate complete coverage of the Premises for Voice annunciation as per tender document.

B. Samples of each type of field devices, detectors, speakers, hooters, all type of cables and, if requested by the Engineer, other accessories.

C. Shop and Construction Drawings: Submit Drawings for approval including, but not limited to, the following:

- Exact location of main FA & VAS Panels, detectors, devices, interface panels & all field equipments etc with relevant section details showing coordination between various trades.
- Single line diagram based on design requirement.
- Details of installation for each type of detectors & devices.
- Interface point schedule with other services i.e. HVAC, fire fighting, electrical, security etc. Same shall be signed off by all other subcontractor for Lodha approval.
- Cause & effect matrix as per project requirement.

D. Certificate of Origin: For each lot of cable supplied, provide a certificate of origin issued by manufacturer stating origin, date of manufacture, composition, Standards to which it complies and test certificates. All test certificates are to comply with the test requirements of the relevant standard to which the cable is manufactured, (i.e. type).

E. As-Built (Record) Drawings: At Project close-out, submit Record Drawings of installed electrical ducts, and manholes, in accordance with requirements.

F. Product Certificates: Signed by manufacturers of cables and accessories certifying that the products furnished comply with requirements.

G. Routine tests at factory.

H. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

I. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

J. Product Test Reports: Indicate compliance of FA & VA Panels, field devices, cables and accessories with requirements based on comprehensive testing of current products.

K. Maintenance Data: For FA & VA panels, detectors, devices, cables etc. to be included in the maintenance manuals.

1.4 MANUFACTURERS

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to those noted in Section G.

1.5 TECHNICAL REQUIREMENT

1.5.1 INTELLIGENT ADDRESSABLE FIRE ALARM CONTROL PANEL (FACP)

1.5.1.1 FUNCTIONAL REQUIREMENT

A. Fire-alarm system shall initiate – but not limited to - one or more of the following devices and systems:
   1) Manual Pull Stations.
   2) Heat detectors
   3) Smoke detectors
   4) Multi Sensor Detector
   5) Verified automatic alarm operation of smoke detectors
   6) Automatic sprinkler system water flow
   7) Heat detectors in elevator shaft and pit
   8) Fire-extinguishing system operation
   9) Fire Fighting Standpipe system

B. Fire-alarm signal initiation shall be by – but not limited to - one or more of the following devices and actions:
   1) Continuously operate alarm notification appliances.
   2) Identify alarm at fire-alarm control unit and remote annunciations.
   3) Transmit an alarm signal to the remote alarm receiving station.
   4) Unlock electric door locks in designated egress paths.
   5) Release fire and smoke doors held open by magnetic door holders.
   6) Activate voice/alarm communication system.
   7) Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   8) Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
   9) Activate staircase lobby and elevator-shaft pressurization systems.
   10) Close smoke dampers in air ducts of designated air-conditioning duct systems.
   11) Recall elevators to primary or alternate recall floors.
   12) Activate emergency lighting control.
   13) Activate emergency shutoffs for gas and fuel supplies.
   14) Record events in the system memory.
   15) Record events by the system printer.

C. Supervisory signal initiation shall be by – but not limited to - one or more of the following devices and actions:
   1) Valve supervisory switch.
   2) Low-air-pressure switch of a dry-pipe sprinkler system.
   3) Elevator shunt-trip supervision.(Signal for Elevator Control Panel)

D. System trouble signal initiation shall be by – but not limited to - one or more of the following devices and actions:
   1) Open circuits, shorts, and grounds in designated circuits.
   2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   3) Loss of primary power at fire-alarm control unit.
   4) Ground or a single break in fire-alarm control unit internal circuits.
   5) Abnormal ac voltage at fire-alarm control unit.
   6) Break in standby battery circuitry.
   7) Failure of battery charging.
   8) Abnormal position of any switch at fire-alarm control unit or Annunciator.
   9) Fire-pump power failure, including a dead-phase or phase-reversal condition.
   10) Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system.

11) Loss of power at PSU

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciator. Record the event on system printer provided in ***Main FACP at remote location (If any).***

1.5.1.2 TECHNICAL REQUIREMENT

A. General Requirements:
1. FACP panel shall be field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
   i. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   ii. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
   i. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   ii. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

C. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.

D. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

E. Circuits:

1. Initiating Device and Signaling Line Circuits: NFPA 72, Class A (as per Fire Alarm Schematic)

2. Notification Appliance: - NFPA 72, Class B (as per Fire Alarm Schematic)

F. Install no more than 230 addressable devices on each signaling line circuit. Loop shall have maximum capacity of connecting 250 devices (Any combination).

G. Serial Interfaces: Two RS-232 and two RS-485 ports.

H. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain ON until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.

I. Pressurization starts when any alarm is received at fire-alarm control unit.

J. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals to start the system.

K. Smoke-Alarm Verification:

   i. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
   ii. Activate an "alarm-verification" sequence at fire-alarm control unit and detector.
   iii. Record events by the system printer.
   iv. Sound general alarm if the alarm is verified.

v. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

L. Elevator Recall:

Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall:

i. Elevator lobby detectors.
ii. Detector in elevator machine room.
iii. Detectors in elevator hoist way.
iv. MCP in Lobby area

M. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.

N. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

O. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located as per tender documents.

P. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL (Nationally registered testing laboratories).

i. Allow the application of evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
ii. Programmable tone and message sequence selection.
iii. Standard digitally recorded messages for "Evacuation" and "All Clear."
iv. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

Q. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

R. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

S. Printout of Events: On receipt of 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 same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

T. **Primary Power**: 24-V dc obtained from 240-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

U. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

V. **Secondary Power:** 240 volts AC power supply, automatic battery charger, 24 volts sealed lead acid batteries sufficient for 24 hours normal working and for 15 min during an emergency conditions and automatic transfer switch.

W. Batteries: Sealed lead acid, Battery sizing calculation shall include 20% safety margin to calculate Amp-hour rating.

X. Instructions: Computer printout or type-written instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

Y. Microprocessor based, soft address type addressable and intelligent (analogue), fire detection and alarm system shall be complete with addressable, intelligent (analogue) heat and smoke sensors, addressable pull stations, beam detectors, addressable interface units, auto dialer for third party control, hooters etc. The system shall be such that each smoke sensor, thermal sensor, manual pull stations, fireman telephone, interface devices, notification devices etc. shall be identified with unique point address.

Z. The panel will allow for resetting individual loop devices or sounder circuits. It shall be possible to mix different fire devices within the same loop to optimize field wiring.

AA. Alarm indication of INDIVIDUAL sensors shall be provided. Systems that provide alarm indication on a zone basis alone will not be acceptable. Panels should provide for detector pre-maintenance alarm indication for dust accumulation. The panel should check each detector once every 24 hours for contamination for this purpose. Based on the site conditions, the user should have the discretion to either clean the detector immediately or manually change the alarm threshold level on the panel (by programming) after ascertaining that it is a pre-maintenance alarm and not a developing alarm condition at the site.

BB. Smoke sensor sensitivity shall be set remotely (from the Intelligent Fire Alarm System) to either high sensitivity manually or on a pre-programmed sequence e.g.(Day/ Night) period. The panel shall regularly supervise all the sensors and devices on the loop and initiate fire or trouble alarm whenever required.

CC. FACP shall process the true continuous analogue signal from the sensors. System using step setting to represent analogue signal will not be accepted. Whenever the detector reaches the alarm threshold the detector should send a dynamic analogue value corresponding to the temperature/ smoke density level for display in the panel. An alarm condition shall be sensed at the central panel when an analogue sensor reports a value greater than the threshold value. Each thermal detector shall be individually accessed from the panel and asked to display the actual temperature sensed by it.

DD. Pre-alarm level for thermal detector and smoke detector shall be user defined. When the pre-alarm level is reached the panel signals warning at which moment the actual temperature/ analogue value corresponding to the pre-alarm smoke density level shall be displayed. When an alarm condition is sensed at the control panel from a smoke or heat detector, a delay time shall be started. If the sensor is still on alarm after the delay time expires, an alarm condition shall be reported. The delay time shall be adjustable from 0 to 990 seconds.

EE. Each detector shall use the minimum of power for economic circuits, so that it shall have capacity to connect 250 detectors per loop and a maximum of 10 loops. These devices can be either Smoke, Heat sensors, multi criteria, interface units etc. as per scheme.

FF. Fault isolation module shall be provided after 20 devices/detectors.

GG. Pull stations shall be of addressable type.

HH. FACP shall have in built digital voice command center & 2 way fire fighter's communication system in-built (microphone) paging system.

II. LCD display at the FACP shall be provided to indicate point in alarm or trouble. It shall be possible to command test, reset and alarm silence from the FACP. FACP's switches shall allow authorized personnel to accomplish the following tasks independent of the central console.

1. Initiate general alarm condition.
2. Silence the local audible.
3. Silence the alarm signals.

4. Reset all zones/ points, after all initiating devices have returned to normal.
5. Perform a complete operational test of the microprocessor and memory with a visual indication or satisfactory communication with each board.
6. Test all panel LEDs for proper operation causing a change in the condition of any zone.
7. Elevators Recall.
8. Elevators shutdown.
9. Menu function keys shall allow users to an extensive range of software based features as:

    a. Last 100 fire events
    b. Last 255 system events
    c. Current fault and warning logs
    d. analysis of analogue sensor information
    e. interrogation of sensor cleanliness
    f. loop map connections

10. fire plan configuration menus
11. address allocation
12. outstation label changes
13. status of outstation
14. status of all cards
15. Test facilities
16. RS 232/ RS 485 computer communication
17. All controls shall be enclosed behind a lockable cover

JJ. LCD display shall indicate the loss of AC power condition and the printer shall record the same. Following restoration to normal AC power, the fault indicator shall be reset and the printer shall record the same. The LCD display shall indicate the loop in trouble and the printer shall record the same.

KK. Walk test function shall be performed such that a operation can be periodically checked out for all initiating devices. As each device is placed into an alarm condition the Intelligent Fire Alarm System shall print the conditions and automatically reset the device. No audible signals shall be initiated from the zone to avoid disturbance to building occupants. If a zone is inadvertently left in the walk-test mode, it shall automatically reset to normal after the idle time is exceeded.

LL. Memory data for panel configuration and operation shall reside in non-volatile memory (EEPROM). Removal of the board shall not cause loss of memory. Intelligent Fire Alarm System shall provide general purpose inputs for monitoring such functions low battery or AC power failure. Intelligent Fire Alarm System shall provide password protection and programmable outputs, which can operate relays or logic level devices. Each Intelligent Fire Alarm System shall have a battery back-up.

MM. Programming functions shall include alarm/ trouble type assignment, point descriptor assignment, alarm message assignment etc. Data file for the LCD display and a printer shall be stored in EEPROM. Programming may be carried out from the panel key board or utilizing PC setup software via laptop/ desktop computer.

NN. Connectivity : BACnet

OO. CAMPUS NETWORKING GATEWAY

The FAVA system is required to provide full integration to a third party ***Main Fire Command Centre located at remote location*** of the same development. A common BACnet IP communication protocol is required for this interface. The FAVA vendor must ensure their FAVA system provide for this interface, the general requirements of which are set-out below:

1. Certified to UL
2. Open Protocol BACnet over IP
3. The following signals shall be capable of being relayed through their Gateway to third party integrator front end.
    a. Status of each devices
    b. Status of each panel

c. Address of each devices including Tower / Panel / Loop / Address / Text description / Status to be capable of being mapped through Gateway.
d. Floor Plans
e. Alarm and Alerts

4. The following controls shall be capable from Main Fire command centre.
    a. Override to all the prerecorded massages.
    b. Voice alarm to each tower independently in case of emergency
    c. Mass notification to all the towers in case emergency.
    d. Two way communication from each tower to Main fire command centre.
5. The site master planning and required interface requirements are set out in the following figure. The Contractor is responsible for provision of a suitable gateway for full interfacing - as described in the Contract document - with the Main Fire Command Centre system integrator to achieve the intent.
6. Throughput of the network shall not be less than 12Mbps.(OEM to declare the throughput network equipment to enable satisfactory performance of the system)
7. True peer to peer network system shall not affect other nodes connected to the network. Each node shall function independently even if any of the nodes fails in the networked system.

PP. System Software :

Software which will allow the user to modify and tailor the Fire Alarm System to the specific and unique requirements of the equipment installed, the programs implemented and to staffing and operational practices shall be provided. On–line modification of system configuration, program parameters and data base shall be provided via menu selection and keyboard entry of data into pre-formatted self-prompting templates.

1. The following modification capability shall be provided.

a) Operator assignment capability shall include designation of operator names, passwords, and privilege(s), starting graphic and auto sign-off duration.
b) Peripheral assignment capability shall include assignment of segregation groups to consoles and printers and designation of backup printers.
c) System configuration / diagnostic capability shall include communications and peripheral port assignments. FACP enables / disables assignment of command trace to points and initiation of diagnostics.
d) System texts add/change capability shall include English descriptors for graphic points, action messages for alarms, and run time and trouble condition messages.
e) Time/Schedule change capability shall include time/date set, time/occupancy schedules, holiday schedules and daylight saving time schedules. All time and calendar scheduling and schedule modification shall be accomplished graphically via color bars and calendars in a hardware independent manner.
f) Points shall be uniquely defined as to coloration, animation, operator messages (480 characters minimum), printer options, alarm archival option, alarm and warning limits, and engineering units. All messages specified and all physical and pseudo point descriptors shall be entered by the vendor.
g) Points related change capability shall include system/point enable/disable, run time enable/disable; assignment of points to point classes, analogue value offset, lockout, run time limits, and setting a fixed input value or output status.

2. Intelligent Fire System Software :

a) The software shall be designed specifically for fire applications and shall provide for polling and demand request to monitor status, processing alarms according to priorities, executing event-initiating programs; controlling / processing communications with operator peripherals, and synchronizing all systems activity. The Contractor shall provide licensed software for testing and operation under this contract.
b) For reasons of reliability and prevent inadvertent changes, system software (operating system and data file) shall be maintained in non-volatile memory.
c) System shall permit reprogramming by authorized personnel, shall be upgradeable (without and cost implications to the Employer's Representative).
d) The OEM shall provide fully licensed original OEM CD copies of all data files & application software as back up, in case system crash or memory failure, contractor shall give one genuine licensed copy

of the integration software & final installed software to the Employer and maintain one copy with him at his own expenses.

e) The software shall provide the facility for future integration to a WAN for information and control from remote location via iOS / Android.

f) The Contractor shall install required software for interactive touch screen. The software shall be UL listed and shall be get approved from Client/Consultant prior to the procurement.

g) BACNET shall be provided as common protocol (BACNET TCP/IP), the contractor shall provide necessary gateway hardware for complete installation of the system.

h) The Contractor shall provide temporary license during commissioning activity with required hardware to complete system and permanent license after commissioning & handover. The type of software, its compatibility, listing under code etc to be checked by the contractor prior to the client's / consultant's approval.

QQ. MICROPHONE UNIT:

1. A multi zone microphone shall be provided under this contract. The microphone shall allow paging on a zone by zone or multiple zone basis and be integrated within the FACP at P0 level.

2. The unit shall be equipped with a high quality dynamic cardioids microphone with flexible gooseneck.

3. The voice alarm shall enable monitoring of the microphone unit for open and short circuit failure. The microphone shall have a microphone preamplifier box fitted adjacent to it & which shall incorporate a 20Khz surveillance generator and compressor limiter to enable clear intelligible speech transmissions.

4. It is possible to mounted microphone unit to reception door, necessary provision shall be included.

1.5.2 DIGITAL VOICE COMMAND CENTRE (DVCC) WITH 2 WAY FIREFIGHTER'S COMMUNCIATION

A. The DVCC shall consist of a modular topology based & shall be designed and manufactured in accordance to NFPA 72.

B. The DVCC shall include a Display & Control Center.

1. Shall operate as a supervisory multi-channel emergency voice communication system.
2. Shall operate as a two-way emergency telephone system control centre.
3. Shall audibly & visually annunciate the active & trouble condition for every Device, speaker circuit & Fire Fighters / emergency telephone circuit.
4. Shall audibly & visually annunciate the active & trouble condition for digital tone & voice units required for normal operation of the system.
5. DVCC shall support a dedicated audio network with up to eight channel of audio, five channels of fire fighter's telephone communication.
6. It shall have Message prioritization
7. It shall have Emergency paging capability
8. Local paging shall be provided
9. Remote microphone connection shall be provided
10. Up to 32 minutes of standard quality or 4 minutes of high quality digital audio storage of user-selected/ created messages/ tones.
11. Fire fighter's telephone communications to local riser on DVCC.
12. Broad all –call functionality
13. All call
14. Page active Evacuation Areas
15. Page active alert areas
16. Page Inactive areas.
17. The Digital voice Command and associated equipment shall be protected against unusually high voltage surges & line transients.

C. Networking shall allow these blocks to be interconnected within a single enclosure or distributed around the development to reduce cable requirements on speaker circuits

D. As a minimum the network shall be expandable to allowing one hundred and fifty (150) zones to be individually addressed.
E. Each DVCC shall contain a ninety-nine event log for paging, alarm and configuration actions; this shall be viewable at access level 1 from the front panel LCD, which as a minimum shall be two lines of forty characters.
F. A real time clock shall be provided on the controller to date and time stamps all events, when multiple controllers are networked the time clocks shall synchronize at midnight or through the serial port on any controller.
G. Manual configuration of the controllers shall take place at three distinct access levels; management functions and VA only functions at access level 1, fire cause & effect, VA and network related functions shall take place at access level 2 and access level 3.
H. The DVCC shall have multiple audio inputs, as a minimum it shall have two dedicated fire microphone ports, a high priority microphone port, a low priority microphone port, and a music input.
I. Each output shall have three associated volumes; Emergency for VA function, Page for general public address, and Music for programme material.
J. In the event of a processor failure, the designated fire microphone shall be able to page all system outputs on an “ALL CALL” basis.
K. The controller shall contain two message stores, to allow the simultaneous broadcast of a minimum of two emergency messages; normally Alert and Evacuate.
L. Each message store shall contain 16Mb of flash memory and be divisible into three discrete segments, allowing the storage of a minimum of six messages on a controller.
M. Messages stored in the controller shall be sixteen bit linear encoded WAV files (or MP3 files) with a choice of sample rate allowing a tradeoff for bandwidth and storage; the nominal sample rate shall be 22.050 KHz (384KbpS) which should achieve a minimum bandwidth of 9 KHz.
N. The fire alarm interface shall consist of a minimum of six photo coupler , optical isolator sounder circuit inputs allowing the FACP to monitor the link
O. These inputs shall be presented to the controller dealing with the evacuation of the specific zone, and also through a system of virtual contacts, be broadcast to all other controllers on the system to allow complex cause and effects scenarios to be achieved.
P. Each controller shall provide selectable monitoring of all input and output ports, and shall report these to the front panel through the LCD.
Q. Any monitored fault on the controller shall open the common fault relay to signal the condition to the FACP.
R. The occurrence of a fault shall also sound the internal fault warning buzzer, which shall under configuration be silenced at access level 1 or 2.
S. In addition to port monitoring the controller shall monitor its’ internal processes and memories, and shall contain an asynchronous watchdog timer to restart the processor in the event of programme lock-up or fatal embrace situation.
T. Any failure of the controllers’ Flash memory, EEPROM configuration memory or RAM shall be indicated in the fault log, as well as any watchdog reboot.
U. The programme for the controller shall be contained within check-summed Flash memory, this memory shall be reprogrammable using an external dongle (access level 3) to prevent unauthorized changing of the programme.
V. The DVCC shall be powered from two low voltage DC power ports to prevent the rupture of a single protective device from effecting the controllers operation. The change over or sharing of load on these ports shall be silent.
W. The DVCC shall be of a low power design and consume no more than 100mAH in normal operation; it shall contain a shutdown circuit with hysteresis which will perform an orderly shutdown of the controller at 20V to prevent battery deep discharge.
X. The paging panel shall be part of the DVCC& integrated with main FACP at **P0 level** and shall allow the manual broadcast of speech or digital messages to the DVCC.
Y. The paging panel shall allow the user to quickly and easily:
    1. Broadcast emergency messages stored on VA routers.
    2. Broadcast emergency broadcast messages stored on the controller.
    3. Route background music.
    4. Initiate weekly fire alarm test.
Z. The selector buttons shall be software configurable under PIN access control to perform the following functions: Zone selection, Message Selection, Music Selection, Fault buzzer silence or remote control of system functions.
AA. Each Zone selector will, under PIN access protection, be configurable to select any or all audio outputs on the system, in addition each zone selector key shall have a tri-color indicator lamp to clearly display the

status of the zone as follows: Green for paging, Yellow for Alert messages being broadcast to the zone, Red for Evacuate messages being broadcast in the zone.

BB. The panel shall provide a monitored goose neck electrets microphone with wind shield to prevent microphone popping; the level of the microphone, as well as the tri-band equalization shall be set digitally through the panel menu structure.

CC. The panel key switches shall be monitored if fitted, and provide the following functions: access control to zone keys, access control to message keys, message reset and priority.

DD. The paging panel shall display system audio status, system fault status, and give access to the menu system and PIN access control system. Navigation keys will be provided to allow the menu structure to be explored, the menu structure will have three levels of access, user (no PIN required), Management, allowing access to faults and status information and Engineer level which allows access to the configuration of the panel.

EE. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
   1. Common-talk type for firefighter use only.
   2. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
   3. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
   4. Selector panel controls shall provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
   5. Display: Liquid-crystal digital to indicate location of caller.

FF. The Fire Alarm / Life Safety System Shall provide a fully integrated Fire Fighters' Emergency Telephone and Communications System to NFPA 72.

GG. A Master Telephone handset shall be provided which will provide a totally independent 2-way communication between the Fire Alarm Control Panel and any of the Fire Fighters' Telephone Stations or jack Telephones located as indicated on the plans for the building (a minimum of one telephone jack shall be provided per level with a fireman telephone provided in each fire alarm panel).

HH. The Fire Fighters' Telephone System shall include an LCD display to show the operator the general area of the call, each jack shall be permanently labeled with a unique reference ID. A laminated legend shall be securely placed beside each Fire Alarm Panel indicating the exact position of each unique ID within the development. The user shall connect a call by pressing the 'connect' switch.

II. Up to 5 telephones may be connected on a conference type call.

JJ. To terminate a call, the operator shall scroll the display cursor over the connected callers' ID message, and press the 'disconnect' switch.

1.5.3 Phone Dialer

Phone dialer shall meet requirements:-

1. Shall be compatible to receive alarm or alert signal from fire alarm panel
2. Shall ne Micro controller based
3. Minimum Trigger Available NO, NC (Normally Open/Close)
4. Shall able to send SMS
5. On Board Keypad With 32 Bit Lcd
6. Instant Call/Sms Alert For Trigger Open
7. Individual Voice and Text message available for Both Trigger
8. Recording for Individual Voice Message
9. Built In GSM Modem

10. Memory Available To Store 10 Phone Numbers

1.5.3.1 INTERACTIVE FIRE FIGHTER'S INTERFACE UNIT

1.5.3.2 TECHNICAL REQUIREMENT

A. An interactive firefighters' display shall be installed in accordance to the project specifications and drawings.
B. The interactive firefighters' display system shall include, but not be limited to, a touch screen interface, network communications media, power supplies, and wire / fiber optic media as shown on the drawings and specified herein.
C. The interactive firefighters' display shall support fire alarm, supervisory, and security events from the fire alarm control panel(s).
D. The interface shall display building floor plans with respective active fire alarm devices, water supplies, evacuation routes, access routes, gas, power and HVAC shutoffs, chemical hazards, and structural hazards in the building.
E. The system shall include an easy one-touch method of viewing building, emergency contacts, the facility site plan, and active event information.
F. A supervised interface to the buildings fire alarm control panels and shall be made provided.
G. The system shall be electrically supervised and monitor the integrity of all conductors.
H. The system shall have the ability to store and access Material Safety Data Sheet (MSDS) safety sheets from at buttons placed on the screen
I. The user shall be able to download system log files from the unit by connecting a USB device.
J. Approvals. The system shall have the following UL listings:

1. 864 Control Units for Fire Protective Signaling Systems (9th edition / Ancillary listing).

1.5.3.3 SOFTWARE REQUIREMENT

A. The network will interface and report the individually monitored system's alarm status via a user-friendly Graphical User Interface (GUI) based software.

B. The software shall operate under Microsoft Windows 7 or latest embedded platform as manufactured by Microsoft Corporation.

C. The GUI based software must be capable of graphically representing the facility being monitored with floor plans and icons depicting the actual locations of the fire alarm device locations.

D. The software shall use a 1280 pixel x 1024 pixel GUI display capable of showing a large primary floor plan display, a site plan representative of an aerial view of the facility.

E. The software shall permit automatic navigation to the screen containing an icon that represents the first fire alarm device in alarm in the event of an off-normal condition.

F. The fire alarm device icon shall be visible only when it is in an alarm (or active) condition.

G. The software shall display the activated smoke detectors in a time sequence to track smoke progression.

H. The software shall allow the importation of externally developed floor plans in Windows Metafile (WMF), JPEG (JPG), Graphics Interchange Format (GIF) and Bitmap (BMP) format.

I. The software shall provide an intuitive and easy way to navigate to different screens representing floors and areas within a facility.

J. The system shall provide for continuous monitoring of all fire alarm conditions regardless of the current activity displayed on the screen.

K. The software shall allow icons that represent hazardous materials stored in a facility.

L. The software shall provide a screen that displays preprogrammed building contact information.

M. The software shall provide a screen the displays building occupancy and other general building information.

N. The software shall allow a site plan to be imported that shows an aerial view of the facility.

O. The software shall display all active fire, supervisory, and security events within an event list.

P. The software shall display the ability to allow the user to zoom in and out on the current floor-plans utilizing embedded icons on the screen.

Q. The software shall have the ability to click and drag the screen to provide the 'Panning' ability on the floor-plans.

R. An overview shall be display on the screen indicating the specific area of zoom present on the floor-plans to the operator.

S. The screen shall display an embedded icon indicating the real-time connections status of the gateway.

T. The software shall display MSDS information if imported for the specific Hazmat symbol.

U. The system shall allow the printing of any screen if an active printer in found on the system.

1.5.4 FIRE ALARM INITIATION DEVICES (ADDRESSABLE):

1.5.4.1 GENERAL REQUIREMENT

A. Initiating Device and Signaling Line Circuits shall be Class A.

B. All sensors shall comprise of 3 parts - termination plate, electronics module and a sensing chamber. Termination plate and the sensing chamber shall not contain any electronics. It shall be possible to clean the sensing chamber locally on site. Upon removal of sensing chamber from the sensor, the fire panel shall report fault condition stating sensor removal status with an exact address

C. 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.

D. All detectors shall be fitted with plug-in system type connections from the maintenance and compatibility point of view. An alarm release shall not effect a detector’s good functioning. After resetting the alarm, the detector shall resume operations without readjustment of any kind.

E. Detector shall have a linear response over all types of fire. It shall be possible to use only a single detector type/ model for both above and below false ceiling applications. The detector shall be capable of detecting fast flaming fires and slow smoldering fires equally well. The detector shall therefore be a multi technology detector or shall be of unique design whereby a single type/ model can be used in applications where either ISD/ CSD would be normally used.

F. Smoke sensor’s sensitivity shall be capable of being adjusted at the FACP for the appropriate purpose. Sensor shall be capable of performing the required transmission of analogue smoke density values, alarm delay, pre-alarm maintenance condition and alarm condition at the Fire alarm panel. Two LEDs shall be provided on opposite sides of sensor head for 360 deg. viewing angle. The detector address shall be suitable for programming by a hand held programmer.

G. For increased smoke detection assurance, all individually addressed smoke sensors shall be provided with alarm verification. Only a verified alarm shall initiate the alarm sequence operation.

H. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value, a "DIRTY SENSOR" trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location. To prevent false alarms, these "DIRTY" conditions shall in no way decrease the amount of smoke obscuration necessary for system activation.

I. Under fire condition, presence of smoke shall trigger the circuit of the detector and send a signal to the control panel. All fire sensors shall be mounted on a common base to facilitate the changing of sensor type if building conditions change.

J. LED on the detector shall blink each time the sensor is scanned by the FACP. If the FACP determines that the sensor is in alarm, the FACP shall command the sensor LED to remain on to indicate them. Each sensor shall be capable of being tested for alarm via command from the FACP. Each sensor shall respond to FACP scan for information for its type identification.

K. Heat detectors shall provide temperature measurement when it reaches pre-alarm in normal course. However the operator shall have the option of calling up the temperature measured by the specific detector as and when required.

L. Secondary response indicators shall be provided for Above False Ceiling Detector.

M. Below are the areas of usage of various types of detectors used in the system.

Sr. No.	Type of Detector	Area
1	**Optical Smoke Detector**	Lift Lobby, Staircase Units, Reception Lobby,
2	**Heat Detector**	
a	Rate of Rise Type	Apartment Kitchen
b	Fixed Temperature Type	Car Park, Lift Pit
3	Combined Heat/ Smoke Detector	Electrical Rooms, Meter Room, Panel Rooms, Bus bar Rooms
4	Duct Detector	As Applicable
5	Open Area Smoke Imaging Detector	Entrance Lobby including double height area.

1.5.4.2 OPTICALSMOKE DETECTORS :

Following shall comply with UL 268; operating at 24-V dc, nominal.

A. Shall be of two wire type.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.

D. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

E. Integral Visual-Indicating Light: LED type indicating detector has operated[and power-on status].

F. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

G. Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Drawings or in "Remarks" column of a detector schedule.

H. Provide multiple levels of detection sensitivity for each sensor.

I. The smoke detector sensitivity shall be ≤3.5% obscuration /ft for an open area and shall be ≤2.0%obscuration/ft for high velocity area. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

J. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Its address.
2. Its status.
3. The device type.
4. Its present average value.
5. Its present sensitivity selected.
6. Its sensitivity.
7. Sensor range (normal, dirty, etc.)

1.5.4.3 COMBINED HEAT & SMOKE DETECTORS :

A. The multi-sensor smoke detector which will have both photoelectric as well as thermal detection elements, shall have inbuilt microprocessor, and shall be capable of taking an independent alarm decision. The scattering of smoke particles shall activate the photo sensor. Each intelligent addressable detectors sensitivity shall be capable of being programmed electronically from Control Panel without any extra tools as: most sensitive, more sensitive, normal, less sensitive or least sensitive.

B. The detector should continue to give TRUE alarms even if the loop controller on the main panel fails.

C. Alarm condition shall be based upon the combined input from the photoelectric and thermal detection elements.

D. Each detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information.

E. It shall be possible to program control panel activity to each level.

F. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient "environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

1.5.4.4 DUCT SMOKE DETECTORS:

A. A Duct Smoke Detector shall be installed inside duct for activation of alarm

B. The Smoke Detector housing shall accommodate intelligent photoelectric detector.

C. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided.

The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided.

D. When sufficient smoke is sensed, an alarm signal to be initiated and appropriate action taken to change over air handling system to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

E. The Smoke Detector housing shall accommodate intelligent photoelectric detector. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet.

F. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided. When sufficient smoke is sensed, an alarm signal to be initiated and appropriate action taken to change over air handling system to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

1.5.4.5 FIXED TEMPERATURE HEAT DETECTORS :

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 58℃.

C. Mounting: Twist-lock base interchangeable with smoke-detector bases.

D. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

1.5.4.6 RATE OF RISE HEAT DETECTORS :

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector: Rate of Rise type. The rate of rise that exceeds (~~11℃~~) 6 to 8 ℃ per minute unless otherwise indicated.

C. Mounting: Twist-lock base interchangeable with smoke-detector bases.

D. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

E. The Rate of Rise characteristic shall be selectable at fire alarm control unit for 15° or 20℉ (8℃ or 11℃) per minute.

1.5.4.7 LED INDICATOR (RESPONSE INDICATOR):

A. The Detector placed above false ceiling shall be provided with LED indicator / response indicator on the false ceiling below it to indicate the performance of detector.

B. Response indicator shall be visual indicating type and shall start flashing when the detector in that particular's area/ zone has been activated due to smoke or fire. This is to be connected with individual detector installed at places where they are not easily visible. Above false ceiling or below false flooring, to give repeat indication of the particular detector state.

C. During normal polling the LED shall blink at a lesser rate same as that of detector. The LED's of the response indicators shall be housed on aesthetically designed PVC/ FRP base with matching color of mounting surface.

D. Response indicator shall be non addressable type.

1.5.4.8 MANUAL PULL STATIONS:

A. **General Requirements for Manual Fire-Alarm Boxes:** Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

B. **Single-action mechanism, pull-lever type**; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

C. **Station Reset:** Key- or wrench-operated switch.

D. **Indoor Protective Shield:** Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

E. **Weatherproof Protective Shield:** Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

F. Manual stations shall be the non-coded resettable key insert type general alarm devices, painted red and suitable for surface or flush mounting. Manual stations shall be addressable. The manual station shall have normally open fire alarm and annunciator contacts and these contacts shall close on activation. Contacts shall remain closed until station is manually reset.

G. Pull stations shall be capable of being tested using a special 'key' without the need for shattering the glass.

H. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

1.5.4.9 BEACON LIGHTING AT H/L ON TOWER ROOF (As listed under CFO NOC)

A. Units to be weather proof and have supervised circuit.

B. Unit shall be complete with control panel to operate the beacon through control module at top of terrace as per tender documents.

C. Unit to be reversed biased to prevent it from operating except under fire mode.

D. Body mounting module and guard to be copper free aluminum

E. Globe to be heat resistant heat and impact resistant glass

F. Gaskets to be Silicon.

G. External hardware to be stainless steel 316.

H. Internal components to be solid state electronics in a moisture resistant and heat dissipating epoxy

I. Unit to be epoxy coated for corrosion resistance.

J. Peak candle power 2,000cd, with LED lamp and flash with RED color.

K. All type of control wiring from control panel to beacon shall be included as part of light fixture.

L. IP 66 rated and factory sealed to come with wall mounting plate

1.5.4.10 OPEN AREA SMOKE IMAGING DETECTOR

A. An open-area smoke imaging detector will be installed for the protection of nominated areas in the building plans.

B. The system will actively measure the attenuation in these areas and be able to distinguish between smoke, intruding objects (e.g. obstructions, insects), and non-smoke particles (e.g. dust).

C. The detector will have at least two beams with different wavelengths.

D. The system will have high alignment tolerances that enable it to compensate for natural shifts in the building structure, and be easily installed and maintained. The system shall consist of a receiving (Imager) and emitting (Emitters) components for installation along the perimeter of the protected space.

E. It shall use dual wavelength imaging principles to determine the smoke obscuration at known locations, while providing a high resistance to false alarms and obstructions.

F. Intruding objects that sufficiently reduce the ability of the system to measure smoke obscuration will be identified as a Trouble (Fault).

G. Imagers that are saturated by sunlight or strong light sources will trigger a fault but never an alarm.

H. The housing will be constructed of a robust plastic material meeting all relevant flammability requirements.

I. **IMAGER (receiving component)**

i. The system will be primarily configured through DIP switches located on the Imager that allow for a number of settings to provide the best possible parameters for the particular site in which it will be installed. The parameters will be least:
- 3 sensitivity settings for fire alarm threshold

- Selection for particle size discrimination (dust rejection on or off)

- Alarm latching or non-latching.

ii. Different Imagers will be available covering different horizontal viewing angles.
iii. There will be Imagers for 7° and 80°.
iv. The vertical viewing angle shall be at least 50% of the horizontal one.
v. Depending on the angles chosen, the respectively covered distances will vary from 150 m/492 ft to 34m/110 ft.
vi. For the 80° viewing angles, the system will allow a configuration of 1 up to 7 Emitters on a single Imager so the system designer can project the most cost-effective, yet complying area coverage.
vii. This set-up will allow installing Emitters on different heights and as such providing an optimum 3D coverage of the area.
viii. The Imager shall be powered from an external power supply at a nominal value of 24 VDC.
ix. The imager will have an on-board memory for diagnostic purposes of minimum 10.000 events.

J. **EMITTER (emitting component)**

i. The Emitters may be powered from an external power supply, or by an internal battery.
ii. When choosing the external power supply, the nominal value will be 24 VDC.
iii. The system shall have a choice between Emitters with two intensities, for long range or short range coverage.
iv. A battery-powered component shall indicate when its battery power is low.
v. The Emitters shall activate automatically once aligned and their position fixed and secured.

K. **Signal Annunciation, Inputs and Outputs**

i. Locations of alarms and troubles (faults) shall be identified through the user interface.
ii. It shall be possible to remotely reset the unit by applying or removing 24 VDC to/from a dedicated input.
iii. There shall be a choice between automatic reset and manual reset. Faults should be reset automatically when the fault has disappeared.
iv. There will be an initiating device circuit (IDC) interface, C/O contacts, to report Alarms and Trouble (Fault) to connected four-wire control panels.
v. A connection to a remote indicator (remote LED) shall be provided, which will activate when a Fire alarm is initiated.
vi. An internal heater shall be provided to prevent condensation build-up in the detector when installed in low temperatures.
vii. The equipment shall be installed to provide addressability to a third-party control panel. Such installations must comply with the control panel manufacturer's specifications.

1.5.5 FIRE ALARM NOTIFICATION DEVICES (NON ADDRESSABLE):

1.5.5.1 GENERAL REQUIREMENTS FOR NOTIFICATION DEVICES:

A. Notification appliances shall be enclosed in MS enclosure / concealed as per site requirement & as indicated on layout drawings.

B. Wiring for notification devices shall be Class 'B' type as indicated in the schematic.

C. All notification devices shall comply with relevant code as mentioned in tender documents.

D. Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

E. Contractor to verify the design intent in terms of coverage of all notification devices indicated/specified in Tender documents as per relevant codes etc as required.

F. Notification devices shall be connected through an addressable interface module as per schematic. Contractor proposal for inbuilt addressable notification devices is acceptable subject to compliance with relevant codes etc as required.

G. Power required for notification devices shall be either drawn from the fire alarm loop or from the external addressable power supply. Contractor to mention the proposed system clearly at the time of tender submission.

1.5.5.2 ELECTRONIC HOOTER

A. Electronic sounders shall operate on 24 VDC nominal with provision for housing the operating mechanism behind a grille.

B. Comply with UL 464. Hooters shall produce a sound-pressure level of 95dBA, measured 10 feet (3 m) from the hooter, using the coded signal prescribed in UL 464 test protocol.

1.5.5.3 STROBES

A. Strobe lights shall meet the requirements of the ADA, UL Standard 1971,

B. Shall be fully synchronized, and shall meet the following criteria: The maximum pulse duration shall be 2/10 of one second.

C. Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd.

D. Wattage and candela settings shall be visible with the cover installed.

E. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring.

F. Application shall include for common area lobby, main lobby, terrace etc as per tender document.

1.5.5.4 Combination Devices (chimes & strobes):

A. Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

1. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
2. Chimes**,** High-Level Output: Vibrating type, 81-dBA minimum rated output.

B. Strobes: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

3. Rated Light Output:
    a. 110 cd.
    b. 15/30/75/110 cd, selectable in the field.
4. Mounting: Wall mounted unless otherwise indicated.
5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
6. Flashing shall be in a temporal pattern, synchronized with other units.
7. Strobe Leads: Factory connected to screw terminals.
8. Mounting Faceplate: Factory finished red.

C. High-Range Units: Rated 2 to 15 W.

D. Low-Range Units: Rated 1 to 2 W.

E. Mounting: surface mounted and bidirectional.

F. Matching Transformers: Tap range matched to acoustical environment of speaker location.

1.5.6 INTERFACE DEVICES (ADDRESSABLE):

1.5.6.1 GENERAL REQUIREMENTS:

A. Each interface device shall be addressable.

B. Wiring for notification devices shall be Class ‘A’ type as indicated in the schematic.

C. Interface devices shall be suitable for surface mounted, above false ceiling application as per site condition complete with enclosure as per relevant codes as required.

D. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller.

E. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status.

F. The module shall be capable of storing diagnostic codes, which can be retrieved for troubleshooting assistance.

G. Input and output circuit wiring shall be supervised for open and ground faults.

1.5.6.2 MONITOR MODULES :

A. Monitor module shall analyze input ‘open’ or ‘close’ status.

B. Monitor module shall have supervised state of monitored device (normal/open/short).

C. Monitor module shall interface with contact devices such as water flow switch, fire pump status etc.

1.5.6.3 CONTROL / RELAY MODULES :

A. Control modules shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive.

B. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

C. Control modules shall be provided to supervise and control the operation of one conventional Network Annunciation Circuits of compatible, 24 VDC powered polarized audio/visual notification appliances.

D. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.

E. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

F. Control modules shall be multiple output type i.e. 2 or 4 as required. Each output shall be addressable & can be programmed from FACP for different output functions.

1.5.6.4 FIREMANS FIGHTER'S TELEPHONE MODULE:

A. Comply with UL S635.

B. Shall have compatibility to monitor & control at least two remote fire fighter telephones with supervision of each telephone jack.

C. Shall have noise reduction feature to allow a clear conversation with Fire alarm panel located as per contract documents & main fire command center.

D. Shall be compatible to loop with DVCC to same SLC fire alarm loop.

1.5.7 REMOTE TELEPHONE JACK

A. Shall be strategically placed as per tender documents.

B. Shall be concealed mounted with single-gang Stainless-steel- face plate with & plug type telephone jack with engraved "Fire Emergency Phone" as per relevant standards as required.

C. Shall be supervised & monitored by fireman Telephone Module.

D. Shall be able to communicate through DVCC unit integrated with fire alarm control panel.

E. Wiring between telephone module & remote telephone jack shall class 'B'.

F. All the telephone jack shall be labeled with tower & floor reference.

G. Architectural approval must be availed before procurement.

1.5.8 PORTABLE TELEPHNOE HANDSETS

A. Shall be mount in a cabinet adjacent to fire-alarm control unit & in main fire command centre as per tender document as required.

B. Shall be push-to-talk-type sets with noise-canceling microphone.

C. Shall comply with relevant codes & standards.

1.5.9 POWER SUPPLY UNITS(ADDRESSABLE) :

A. Power supply units shall be strategically placed to provide power to audio/visual notification devices as per schematic.

B. Power supply unit shall operate on 240 VAC, 50 Hz, and shall provide all necessary power for the Fire Alarm Control Panel / Interface modules.

C. Power supply shall have a switching mode 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.

D. The AH capacity of the charger shall be calculated by the fire alarm vendor and submit to the client's / consultant's approval prior to procurement.

E. Power supply unit shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.

F. Power supply unit shall be power-limited per UL864 requirements.

G. Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 hours and capable of operating the system for five (5) minutes of evacuation alarm on all devices, operating at maximum load.

1.5.10 FAULT ISOLATORS :

A. Fault Isolation Modules shall be provided after each 20 devices/detectors.

B. The fault isolator modules are used to isolate/ bypass the short circuit problem within a loop so that other section can continue to operate normally.

C. 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.

1.5.11 VOICE ALARM SPEAKERS & AMPLIFIERS

1.5.11.1 GENERAL

A. The Contractor shall develop on the issued "**design intent drawings"** to **"detail design drawings**" and install, test, connect and commission a high quality fast-acting electronic Voice Alarm System. All proposals shall be forward for approval to ensure satisfactory audibility is provided throughout & is to be certified as detailed under loss prevention standard LPS 1014.

B. The Digital Audio Amplifiers shall be connected to speakers on Class B circuit as per NFPA 72 (as per Fire Alarm & Voice Alarm Schematic)

C. The final setting out of all VA equipment within the development is subject to design development by the Contractor, who shall prepare and issue his drawings showing code compliant set-outs. The Contractor shall issue this information to the Employer's Representative for comment.

D. ***The VA zones shall be configured as 6 to 8 Class-B circuits per Digital Audio Amplifier accounting all the floors. Zone isolators shall be deemed included part of VA system***.

E. All VA announcements shall be overridden by any fire alarm.

F. The actual messages, signals and timings will be within the remit of the Employer.

1.5.11.2 2 WATTS SPEAKERS(CEILING RECESSED SPEAKER)

A. Architecturally aesthetic circular ceiling recessed speaker. Made from mild steel construction complete with nylon block plug-in connector. Unit to have ceramic terminals, thermal fuses and high temperature wiring. Finished in white in color (RAL 9010) as per architect approval.

B. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.5 to 2.0 Watts.

C. Speakers in corridors and public spaces shall produce a nominal sound output of 84dBA at 10 feet (3m).

D. Frequency response shall be a minimum of 100 HZ to 15,000 HZ. Speaker to have a 150o conical dispersion at 1kHZ

E. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

F. The manufacturer shall provide exact technical data concerning the sound output of the alarm devices proposed to install. Alarm shall have two levels of sound intensity (loud/muted) and shall have five alarm tones (continuous, intermittent, two-tone, siren, wailing). Switchover from continuous tone to another pre-programmed tone shall be remote operated from the fire alarm control unit.

1.5.11.3 10/15/20 WATTS HORN TYPE SPEAKERS (BI DIRECTIONAL SOUND PROJECTOR)

A. Bidirectional architecturally aesthetic surface mounted sound projector. Made from aluminum housing. Suitable for mounting in car parking areas. Unit to have ceramic terminals, thermal fuses and high temperature wiring. Finished in white in color (RAL 9010). IP54 and to come with U mounting bracket (finished in RAL 9010).

B. All speakers shall operate on 25 VRMS or with field selectable output taps from 5 to 20 Watts.

C. It shall have clear speech reproduction to ensure intelligibility of announcements. The taps shall be adjustable to suit the area to be covered.

D. The speaker shall be fitted with 22micro farad bipolar capacitor for line monitoring and a 4 core flying lead for loop-in and loop-out connection.

E. Sound level shall be 108 dB, 1W at 1 Meter & 121 dB, 20W @ 1meter.

F. The manufacturer shall provide exact technical data concerning the sound output of the alarm devices proposed to install. Alarm horn shall have two levels of sound intensity (loud/muted) and shall have five alarm tones (continuous, intermittent, two-tone, siren, wailing). Switchover from continuous tone to another pre-programmed tone shall be remote operated from the fire alarm control unit.

G. Horn type speaker shall be suitable for dry, wet or dusty atmosphere.

1.5.11.4 DIGITAL AUDIO AMPLIFIER (DAA)

A. The Digital audio amplifiers shall be designed and manufactured to NFPA 72.

B. Digital audio amplifier shall be capable of accessing & processing one of the eight channels on DVC Caudio loop, amplifying the signal, distributing it via four of class-B outputs at 50Watts. Two numbers of 50Watts shall be clubbed together to have 2 channel output to relay two different messages as per CFO requirement.

C. 100W total Output (2 Nos. 50W clubbed together) shall be at 25VRMS or 70VRMS.

D. Fire fighter's telephone riser shall support 7 active telephones through fireman's telephone module.

E. Power supply shall be provided with battery backup & battery charger.

F. Battery charger disable shall provide battery sharing option for one or more DAA amplifiers or with a charging power supply.

G. Audio output activation via network control-by-event equations resident within the DVCC.

H. Continuous supervision of active DAA output circuits.

I. Isolated alarm bus input, to be used for backup activation of alarm messages when normal digital communication is lost.

J. Relay contacts that shall activate on a trouble condition.

K. Speaker Circuit: 50Watts dynamically shared among the two outputs (Class-A) or Four outputs (Class-B). Supervision shall be determined by programming.

L. Up to 2minute of standard quality backup digital message storage for use in the event of communication loss.

M. The power amplifiers shall be placed close to DAA, to cover car park areas and common area of resident tower shall be designed and manufactured to NFPA 72.

N. The amplification shall be provided on 500W, 800W units, load monitoring for each amplifier and a monitored power supply and battery charger**(refer scheme for amplifier rating).**

O. The amplification will be provided by a phase shifting class D output stage, driven using two phase-shifted carriers to achieve an efficiency of 85% or better. The amplifier shall contain output filtering to remove the carrier signal, which shall be over-sampled and operate at a frequency of 768KHz.

P. The amplifier will provide two inputs per channel; one priority input and one local paging input each with independent level controls. The priority input will always mix to the amplifier output, and shall mute the page input when a priority access is asserted. The page input shall be configurable to be either permanently mixed to the output while no priority access is asserted, or gated until the page access is asserted.

Q. Load monitoring shall consist of a dedicated 2 wire monitoring system using silent DC techniques to prevent false readings and allow up to eight resistor end of lines units per amplifier output.

R. The amplifier shall provide a SWAP signal to the slave output port on the detection of a fault within the amplifier, facilitating the operation of a reserve amplifier when required.

S. The fault monitoring shall incorporate a digital filter to prevent false indication, a load fault must be present for 2.5 seconds before the front panel indication is given, rear panel indication shall be instantaneous for setup purposes.

T. The end of line device shall be an AC type, and not require the use of the protective earth conductor to return faults to the rack equipment. The EOL device shall be absorptive, and draw the equivalent of 10W of power at 22KHz, and only 100mW of power at 1KHz.

U. The power supply shall be capable of providing power to both amplifier channels at full load, and additionally supply up to 1.5A of current to charge vented sealed lead acid batteries and an auxiliary DC supply of 1A to power routers and matrices. The power supply shall be fully monitored and give indication of the following conditions: AC present, batteries present, fuse failed and PSU fault.

V. An Isolated fault relay output will be provided; this shall be closed when the amplifier is healthy, and open on any amplifier fault.

1.5.11.5 POWER AMPLIFER (POWER AMP)

A. The power Amplifier shall be designed and manufactured to NFPA 72.

B. The main function of the power amplifier is the amplification of audio signals for the loudspeakers. It shall be possible to select the output voltage between 100V, 70V or 50V by changing jumpers. The power amplifiers are provided with a 2 x 16-character display for fault monitoring and status display.

C. The equipment shall be installed in suitable 19" rack.

D. The power amplifiers shall have 2 audio inputs with microphone/line level selection.

E. The audio input of the power amplifier can be selected as automatic volume control input in the configuration software.

F. The 8 x control inputs are freely programmable. These can be programmed for any action to be initiated in the system and can be assigned with priorities.

G. The 5 x control outputs shall be freely programmable and can be programmed for any status change in the system. These outputs can also be used for volume control override.

H. The 2 x 16-character display and rotary control on the front panel are used for status enquiries and monitoring functions. The display shall show the VU meter reading when the audio monitoring mode is selected or shall revert to the default display mode when there is no fault in the unit. The audio output can be monitored by connecting a headphone to the headphone socket. Status changes of the unit shall be monitored continuously and reported to the network controller for fault/status reporting.

I. The control input can be programmed for momentary, single-shot action on break/make, toggle, start action on break/make, stop action on break/make. These selections can be made in the configuration software.

J. The control input shall have the ability to monitor the cable between the control input and the external switch against open and short circuits.

K. The power amplifier shall be designed for redundant network wiring.

L. The amplifier monitoring and changeover facility shall be incorporated in the power amplifier. The changeover relays shall be included in the unit.

M. The unit shall incorporate digital audio processing possibilities for 3 sections of parametric equalization and 2 sections of shelving equalization and audio delay.

1.5.11.6 SPEAKERS SPEECH INTELLIGIBLY REQUIREMENTS

A. ***The systems shall have 50% cross zoning in car park, corridors, lobbies and other public area to be specified for voice evacuation to comply to with NFPA 72 & NFPA 101***

B. The Contractor shall provide suitable quantities of cabinet, recessed circular or loud speakers to ensure broadcast information is comfortably and intelligently heard by all people of normal hearing in all parts of the building. The loudspeaker layouts shall be coordinated with the architectural grid in coordination with the Employer's Representative and the loudspeaker type and layout designed to ensure that the following criteria are met:

C. Acoustic Requirements;

1. Minimum Sound Pressure Level 65dBLAeq or as required to meet speech intelligibility targets with the given loudspeaker layout when the tower is occupied (apartment areas ambient noise level to be taken as 40dB Avg. when occupied)
2. Amplification; the system will be capable of +6dB headroom before internal limiting with 25% spare capacity s
3. Frequency Response for Main (PA) system 150 Hz to 10KHz +/-3dB

D. (STI) Speech Transmission Index; main PA system designs are required to meet the following (STI) levels for operational standard:

1. The minimum requirement is based on STI 0.45 with an allowance for +/- 0.05 tolerances over 5% of the area. STI to be based be measured in unoccupied conditions, but with a simulated background noise level in the offices of 65dBA with speech spectrum Average reverberation time across the 500hz, 1kHz and 2kHz octave bands will be 1.5s.
2. The Contractor shall be responsible for preparing check calculations/modeling to demonstrate the proposed system is capable of achieving the STI requirement above.

E. Testing shall be carried out by the contractor to demonstrate the performance targets are achieved. Testing will be carried out in accordance with relevant British Standards / NFPA 72 Standards.

F. The preferred system shall use the Fire Alarms sounders as loudspeakers and these will be on interleaved A-B circuits to assist with redundancy in the event of a fire. For handing over purposes, acoustically different areas will be placed on separate sub zones ***(e.g. toilets, tower core areas, MEP floors, etc)***. All sounders/speakers shall be NFPA 72 and NFPA 101 compliant, and IP54 or above when used outside.

G. All cabling to be as per noted on SLDs

H. All ancillaries shall be standard manufacturers, finishes to be agreed with Employer.

I. Speaker Types;

1. Areas with suspended ceilings shall utilize dedicated voice alarm speakers.
2. Areas without suspended ceilings shall utilize dedicated voice alarm speakers
3. MEP areas shall use separate IP56 horn type speakers
4. Car park areas shall utilize IP56 projector horn type speakers.

1.5.11.7 BACKGROUND MUSIC SYSTEM

A. The Juke Box shall be provided background music & shall be housed in the FAVA rack at P0 and shall be as per:

1. The Juke Box shall have signal to noise ratio 90DB.
2. The Juke Box shall be made up of Aluminum body with anodized Aluminum color.
3. The Juke Box shall have facility to connect to the amplifier by using USB cable.
4. The Juke Box shall support WAV, WMA, MP3, digital audio system.
5. The Juke Box shall have LCD display with resolution 160x104. The resolution shall be to the pro-net specific.
6. The Juke Box shall suit stereo sound o/p, shall have digital clock & time.
7. The Juke Box shall have battery life of min 10 hr. & shall be provided with power adapter.

1.5.12 TERMINAL BOXES, JUNCTION BOXES, AND CABINETS

A. The interactive firefighters' display shall be housed in a UL-listed 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.

B. The back box and door shall be constructed of 2mm thick steel with provisions for electrical conduit connections into the sides and top.

C. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

D. The key lock shall be a magnetic latch with a key override.

E. All boxes and cabinets shall be UL listed for their use and purpose.

F. The Embedded platform shall be powered by a UL-listed power supply with battery backup.

G. The UL-listed power supply shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FACILITIES MONITORING SYSTEM. Power wiring shall be 12 AWG and grounded securely to either a cold water pipe or grounding rod.

H. 2mm hot dip galvanized surface mounted back shall be included as per typical installation detail attached with tender for Fire Alarm and Voice Annunciation devices.

1.5.13 FIRE COMMAND CENTRE EQUIPMENTS

A. **Graphic & Smoke Control Annunciator -Fire fighters Smoke Control Station (FSCS)**

The FSCS shall provide a graphic representation of the facility HVAC system and stairwell pressurization system. Fan override and control switches and fan/damper status LEDs shall be provided as indicated on the shop drawings. The following system controls and indicators shall be provided on the FSCS: Power ON, Trouble, and Signal Silenced LEDs; System Reset, Silence, Trouble Silence, and Drill push buttons. It shall be possible to annunciate text messages via LCD display mounted in the FSCS enclosure. The FSCS shall provide an integral remote microphone for one-way audio system paging. Specific zone module shall be used for intelligent messaging to critical areas like stair cases in event of an emergency.

B. **Graphic Command Workstation**

The command centre shall function as the centre point for all operational and administration functions required for the systems provided within the specification. The command centre shall contain a console that will display and house any equipment necessary for system operation. Console space shall be provided for other equipment provided under other sections of the specifications.

A single graphical workstation shall be provided that will enable primary control of the systems provided by this specification. An operator shall not have to operate multiple workstations to receive, view, process and record system events for each system provided. The graphical command workstation(s) shall display a different colour text for each message type and colour graphic diagrams/floor plans. Each detector has to be mapped in graphical workstation diagrams/floor plans.

The graphical workstation diagrams/floor plans should have the each detector/devices mapped. The graphical command workstation shall simultaneously display the following system event views;

1. System event display,
2. Graphical diagram display,
3. Detailed event message/instructions, and user event log.

The workstation shall be a latest personal computer which can support the all software & have enough memory to handle the data. The makes will be as per attached list. The workstation(s) shall be capable of annunciation and control of all fire detection and smoke control points. The computer shall be minimum of an Pentium Grade Pentium Processor 2.4 Ghz or higher with a 533Mhz front side bus or higher, 4 GB RAM or higher, 2 TB Hard Drive, and 21" LCD monitor. Installation of the computer or monitor can be either desktop or floor mounting or rack/panel mounting.

The software shall provide multitasking type environment that allows the user to run several applications simultaneously. The operating program shall run within a 32-bit operating system such as Windows® XP. These Windows applications shall run simultaneously with other programs. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel and other Windows based software packages, while concurrently annunciating on-line alarms and monitoring functions.

Equipment included in the command centre shall include:

System annunciation and controls for.

1. Fire detection.

2. Fire suppression.
3. Fire pump status
4. Firefighters smoke control.
5. Emergency one-way voice annunciation.
6. Standby generator status indication and controls.
7. Automatic transfer switch status indication and controls
8. Radio communications
9. Two way fire fighting talk back system
10. Public telephone
11. Elevator monitor, status and controls

The graphic display screen shall organize and structure system events for easy user comprehension. The workstation display shall use four relational quadrants. When any event occurs:

The "list of events area" shall display the address of the alarm or off-normal point with type and description and time of the event in a prioritized colour-coded event list. Highlighting an event in the event list area shall automatically cause the display of a graphical map and other three areas (described below) to display information relating to the highlighted event. The "map area" shall display colour graphical representation of the area location in which the alarm or off-normal device is located. It shall be possible for the operator to manually zoom down to any portion of a vector-based graphic without aliasing, artifacting, or pixilation of the image. Preset zoom levels shall not be considered equal. The "event action area" shall display a customized set of written operator instructions for every state (alarm, trouble, restore, etc.) of each point. An event log shall record all events and operator actions to history for future review. An operator's log shall record operator's comments for each event in system history with time and date. The "image area" shall display a stored image of the device relating to the event highlighted in the event list area.

When processing fire alarm events the graphic workstation:

1. Shall be capable of acknowledging, silencing, and resetting all fire alarm functions.
2. Shall be capable of manually activating, deactivating, enabling, and disabling individual fire alarm points.
3. Shall be capable of generating status, maintenance and sensitivity reports for fire alarm components.
4. Receipt of a fire alarm shall activate an audio(format shall supported by system) file over the workstation speakers alerting the operator

1.5.14 CABLES TRUNKING

A. All trunking shall have removable lids extending over their entire lengths. Lids shall be fixed at interval not exceeding 1 meter by means of brass steel screws which and protected against corrosion by a finish of zinc coating or equivalent to zinc coating.

B. Factory-made bends, joints, elbow, riser, tee, reducer and accessories with same material shall be provided throughout the installation for trunking.

C. Trunking space factor shall be in compliance with latest IS standards.

D. Copper earth link bar shall be fixed at every joint of the cable trunking run.

E. For connection detail from embedded conduit to trunking, Contractor to refer to the standard installation detail sheets.

F. Please refer electrical section **"SECTION-2.14 CONTAINMENT"** for detail construction of cable trunking**.**

1.5.15 FIRE ALARM & VOICE ALARM CABLING :

1.5.15.1 GENERAL REQUIREMENTS:

A. Cable cross sectional area, conductor material, number of cores, rated voltage and type shall be as stated contract documents.

B. Flexible cables shall be of annealed copper conductor insulated with heat resisting FR and of circular construction.

C. Flexible cables shall comply with relevant standards and codes of practice mentioned in the specification.

D. The cables used shall be exclusively for Fire Detection System. The multi-core cables shall not be shared for other low voltage or high voltage circuits.

E. Loop shall also be left where cables connects sounders, panels, dampers etc. Appropriate glands shall be provided where the cables enters the junction box.

F. Care shall be taken while laying cables to avoid kinks. At all the changes in direction (vertical and horizontal planes) the cables shall be bent smooth with a radius as recommended by the manufacturers.

G. No joints shall be allowed between two points. The sleeve at joints shall be shaved off like a pencil and shall not be cut square to avoid cutting of conductors.

H. Cabling shall be complete with installation, field connections made and tested for stray voltage, short circuits, and ground faults prior to connection to the intelligent modules.

I. All loop cabling shall be identified by In's and out's. In's is defined as coming from the panel. Red and Black must be used for 24 VDC panel power circuit. Audio visual indicating circuits shall be colour coded. Colour code shall not be duplicated in the same panel. The cable shall be flexible, multicore embedded in PVC conduit as required.

J. The outer sheath of cables shall be embossed or engraved with:-

1. BIS/BS Certification Marking
2. The voltage designation
    a. Manufacturers identification
3. Number of Cores and nominal cross sectional area of conductors
4. The bundle progressive length of cable at every meter. (The starting point being the cable end at its inner coil on the cable drum).

K. Cable shall have uniformity in insulation and outer sheath colour.

L. Shielded cables/ wires shall be used for Voice Communication.

M. Unshielded cables/ wires shall be used for Fire Alarm signaling.

N. FA & VAS OEM to give written confirmation on the proposed cables for the entire system with construction parameters.

O. Copper conductors shall have a 70ºC operating temperature, the rated voltage of 500V & system voltage up to 1000V with 1 Phase 3 wire AC having neutral solidly earthed. The cable constructions for various types are as detailed below:

1.5.15.1.1 2C X 1.5 SQ MM, FS /PH120 INSULATED,MULTI-STRANDED, TWISTED PAIR, SHILEDED / UNSHIELDED CU.CONDUCTOR CABLE

Intended Usages:

Unshielded : Exposed Fire Alarm cabling runs

Shielded: Exposed Voice Alarm cabling runs

Construction:

Conductors:

Conductors of Cables shall be of solid / multi-stranded, Copper.

Drain wire:-

Drain wire of 0.5sqmm size to be provided.

Insulation, bedding & over sheath :

The conductors are covered with 2 layers of glass mica tape & polyester tape covered by an extruded layer of cross linkable halogen free Ethylene Propylene Rubber (EPR) insulation, shielding if shielded cable and Flame retardant barrier/binding tape covered with LSZH inner & outer sheath as per BS7846, BS 8519 (latest edition) suitable for maximum conductor temperature 950ºC.

Core Identification

Up to four cores – colours

1 core – black, red, green, yellow

1 core – black, red, green, yellow

Laying Up

Cores to be laid up together with glass mica fillers

Fire Performance

BS 6387:2013 CWZ: Performance requirements for cables required to maintain circuit integrity under fire conditions. Applicable to cables rated at voltages not exceeding 450/750 V

a) First sample is tested for fire only @ 950℃ for 180 mins (C)

b) Second sample is tested for fire and water spray@ 650℃ for 30 mins(W)

c) Third sample is tested for fire with Impact @ 950℃ for 15 mins (Z)

Terminations :

Proper types of lugs are crimped to cable leads. Single compression or double compression cable glands shall be used. Nylon glands shall be used as required.

Certification required:

BASEC, BRE, LPCB.

1.5.15.1.2 2C X 1.5SQ MM, FR, MULTI-STRANDED, TWISTED PAIR, SHIELDED UNSHIELDED CU.CONDUCTOR CABLE (IS 694)

Intended Usages:

Unshielded : Embedded Fire Alarm cabling runs

Shielded : Embedded Voice Alarm cabling runs

Construction:

Conductors

Conductor shall be of Copper conforming to IS : 8130 and are compact circular or compact shaped.

Drain wire:-

Drain wire of 0.5sqmm size to be provided.

Insulation, bedding & over sheath

Fire Retardant PVC compound of IS-694 for Maximum conductor Temperature 70ºC.

Core Identification

2 cores – colours

1 Red and other Black

(Black numbers printed on grey coloured insulation)

Fire Performance

FR Type ST-1 of IS: 5831-1984 (Reaffirmed 2001)

IS 5837

IS 8130

IS694

Terminations :

Proper types of lugs are crimped to cable leads. Nylon glands shall be used wherever required

1.5.15.1.3 MULTI MODE FIBRE OPTICS ARMOURED CABLE

Intended Usages: MAIN FIRE COMMAND CENTRE IN T-3 TO T-1 MAIN FACP

Construction: Optical Fibre as per ITU Recommendation G:652 (150 -500 Mtrs. span)

Single mode 36 Fibres Optical fibre. The cable is to be of non-metallic construction. It shall be surrounded with jelly filled in **loose tube.**

The cable shall be filled with PE filler around the FRP to increase the mechanical strength of the cable.

Insulation, Bedding & Over sheath

The filler and the tube shall be wrapped with steel tape. Bedding shall be HDPE, Over sheath of FR PVC ST-1 of IS: 5831-1984 (Reaffirmed 2001) for maximum conductor temperature 70ºC, colour black

Optical Fibre colour Identification

Blue tube – Blue, Yellow, Green, Red, Purple & White

Yellow tube – Brown, Black, Aqua, Orange, Pink & Grey

Cable mechanical requirement

The cable must be able to withstand a directly applied long term crush loads on 1kN per100mm without increase in optical attenuation for any fibre or any decrease in integrity of the optical fibre cable over its designated lifespan.

Terminations :

Cable will be crimped as per Standards and OEM recommendation.

1.5.15.1.4 Communication (TWISTED PAIR) FR CABLE

Intended Usages: CONNECTIVITY BETWEEN DIFFERENT PANELS

Construction: 1.5mmsq Multi-stranded (7x32), copper conductor, twisted pair.

Insulation, Bedding & Over sheath

Minimum of 5mm of Polyethylene insulation, overall aluminium foil-polyester tape (100% coverage),copper braid shield of 24 AWG (90% coverage) 24 AWG stranded TC drain wire, outer PVC/FR Jacket of 0.87mm.

UL Operating temperature range

Maximum conductor Temperature 70ºC.

Terminations :

Cable will be crimped as per Standards & OEM requirement for the data communication port.

1.5.15.2 SPLICE (JOINTING) KITS :

A. Connectors and Splice (jointing) Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.

B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions. Splicing and terminations shall be by an experienced person and duly approved by the Employers Representative.

1.5.15.3 SOLID TERMINATIONS :

A. Multi-conductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations, allow also for gland and bimetallic termination lugs.

1.5.15.4 SEPARABLE INSULATED CONNECTORS :

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

1.5.16 QUALITY ASSUARANCE

A. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Country, State, and authorities having jurisdiction & applicable Standards.

B. Standards: The FAVA System must comply with the standard NFPA72 (latest edition), State PWD, NEC 2011, NBC 2005, IPC, Chief Fire Officer (CFO) of Mumbai, Local Municipal Authorities, MOEF guidelines and subject to approval by the Employers Representatives

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a certified testing agency for the testing work and that is acceptable to authorities having jurisdiction.

D. Testing Agency's Field Supervisor: Person currently certified by the “OEM” to supervise on-site testing.

E. Source Limitations: Obtain complete FA & VAS system through one source from a single manufacturer.

1.5.17 DELIVERY, STORAGE & HANDLING

A. Preparation for Transport: Prepare equipment, according to the following:

1. Ensure that all material to be transported to be protected against rust and corrosion.

2. Protect the material against damage.

3. Set material in best position for handling. Set material closed to prevent rattling.

B. During Storage: Use precautions for material, according to the following:

1. Do not remove end protectors / wrappings etc. unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

3. Electronics components to be stored as per OEM recommendation.

C. Deliver conduits with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent conduits-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored electronics & electrical accessories from moisture and dirt. Elevate above grade.

E. Cable ends shall be sealed and fixed to the bundle so that both ends are accessible. To protect the cable during shipment battens shall be fitted around the entire periphery of the drum. Each cable run shall be manufactured in one length where no through joints shall be allowed.

F. All cable bundles shall be provided with labels showing the Purchase Order Number, Purchase Order Item Number, Drum Number and Stock Code Number clearly stenciled on the outside of both flanges.

G. Bundle identification labels shall be of non-corrosive, non-hygroscopic material and attached to the outside and inside of the drum flanges. Labels shall be protected by transparent plastic envelopes and give the following information:

H. Bundle identification number and its direction of rotation for cable removal.

I. Cable voltage grade

J. Cable construction (e.g. FS/PH 120, etc.)

K. Number of cores and cross sectional area

L. Cable quantity (Meters)

M. Purchase order number and item number

1. Total weight of cable and bundle (kg)
2. Manufacturer's name
3. Year of manufacture
4. Stock code number

N. The Contractor shall provide the following data with his quotation:

1. Standard and maximum bundle lengths for all the types of cable offered and his proposed bundle lengths for all items.
2. Inspection test plan.
3. Cable dimensions (together with tolerances) as follows:

    a. Diameter of (individual in case of multi stranded) conductor wire
    b. Percentage of compaction as per data sheet.
    c. Diameter under conductor screen (where applicable)
    d. Diameter over conductor screen (where applicable)
    e. Diameter over individual core insulators
    f. Lay of cable in case of multi-core cable
    g. Diameter over inner sheath (mm)
    h. Diameter over centre sheath (mm)
    i. Diameter over lead sheath (mm) where applicable
    j. Diameter under armour (mm)
    k. Diameter over armour (mm)
    l. Diameter of armour wires (mm)
    m. Overall diameter (mm)

4. Cable Physical Properties

    a. The filler materials to be used.

b. Cable weight in kg/km
c. Minimum bending radius (x OD)
d. Maximum conductor continuous operating temperature (950℃)
e. Suitability of outer sheath to resist attack from chemicals.

5. Cable electrical data as follows:

a. Conductor dc resistance per km at ambient temperature 40℃
b. Conductor ac resistance per km at operating temperature and system frequency
c. Conductor inductive reactance per km at system frequency
d. Conductor impedance per km at operating temperature and system frequency
e. Conductor capacitance per km
f. Cable armour resistance per km

O. The current carrying capacity of single and multi-core cables when installed in defined conditions in air, in ducts and direct buried in the soil, together with rating factors for varying ambient temperatures, grouping and installation conditions and methods.

P. Cable short circuit withstand capacity to include derating factors for temperature, grouping and burying in the ground as per BS 7671 shall be presented in graphical form or by formulae approved by the Employers Representative.

Q. Descriptive literature (catalogues etc.).

R. Cross sectional view of the physical make up of each cable.

S. Recommended temperatures below which installation of cable should not be carried out.

T. Minimum ambient temperature at which cables can be used.

U. Maximum pulling force for each cable and any special pulling instructions.

V. Maximum unsupported run of cable both horizontally and vertically.

1.5.18 INSPECTION & TESTING

A. The FAVA Panel & their accessories shall be inspected by the purchaser or their nominated Third party inspection agency representative.

B. The vendor/Manufacturer shall submit detailed Quality Assurance plan (QAP), Inspection Test Plan (ITP) & test procedures for review/approval of Lodha.

C. The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

D. All the travelling & accommodation expenses towards the Inspection or witnessing the testing of equipment by the Lodha Representative will be in Contractor scope.

E. The results of all tests carried out shall be tabulated and signed jointly by manufacture and Engineer-in-charge. In case the test results are not satisfactory and in accordance of contract specification and there are defects in the materials the same shall be attended and notified to Engineer-in-charge. The equipment shall be dispatched to site of work only after receipt of acceptance of materials and clearance from Engineer-in-charge.

F. Factory Routine Test: Prior to despatch the out of the factory, each panel & field devices shall be routine tested (in presence of representatives of the Purchaser or their nominated).

G. Type Test: As per relevant code & manufacturer practice.

H. The Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site:-

1. Insulation Resistance Test.
2. Continuity resistance test.
3. Earth test.

I. All tests for cables shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Employer's representative on Site, results will be noted and signed by all present and record be maintained.

J. All the travelling & accommodation expenses towards the Inspection or witnessing the testing of equipment by the Employers Representatives will be in the Contractors scope.

K. The vendor/Manufacturer shall submit detailed Quality Assurance Plan (QAP), Inspection Test Plan (ITP) & test procedures for review/approval of client.

L. The Employers Representative has the right to have the tests carried out at his own cost by an independent agency whenever there is dispute regarding the quality of supply.

M. The results of all tests carried out shall be tabulated and signed jointly by manufacture and Employers Representative. In case the test results are not satisfactory and in accordance of contract specification and there are defects in the materials the same shall be attended and notified to Employers Representative. The equipment shall be dispatched to site of work only after receipt of acceptance of materials and clearance from Employers Representative.

1.6 EXECUTION

1.6.1 FIRE ALARM & VOICE ALARM SYSTEM

1.6.1.1 EXAMINATION

A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting system performance.

A. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1.6.1.2 INSTALLATION

A. All equipment and components shall be installed in strict compliance with manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring & fiber optic diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the riser/connection diagram for all specific system installation /termination / wiring data.

A. The installation should be as per statutory requirements & as recommended by the major equipment manufacturer.

B. All minor civil works such as opening-up false ceiling, boxing, rack coverings, partition walls, making openings, cut-outs, chases, grooves, etc. in walls, floors, making good the civil work, construction

brick/concrete pedestals, supports etc. including all materials required during installation shall be carried out by the contractor at no additional cost to the Employer.

C. All conduits, junction boxes shall be concealed throughout. Wherever conduits, trunking or raceways are already installed by the Employer, the cables/wires shall be installed through that. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period measures shall be taken to protect detectors and other items from contamination, physical damage and theft.

D. All fire detection and alarm system devices, control panels & remote annunciator shall be flush mounted when located in finished areas & may be surface mounted when located in unfinished areas or as required by the Employer's Representative.

E. All termination at the panel & field equipment's shall be checked & rectified if required in coordination with the installation team.

F. Continuity Resistance value of cable (Megger value) shall be checked & recorded. It should show resistance in mega ohms.

G. Interference suppression arrangements shall be ascertained.

H. In general, the entire installation shall be inspected and all shortcomings shall be brought to the notice of the Project Manager/Engineer Necessary rectification shall be carried out by the installation engineer.

I. The system shall be tested as brought out in System Feature and Manufacturer's Manual. Handing over personnel shall co-ordinate with the system integrator. A handing over report shall be prepared. All tests conducted shall be repeated in the presence of the Employer's Representative. Operating Instructions/ Maintenance manuals shall be prepared and handed over to the Employer's Representative. As built drawing shall be part of this document. The Employer's Representative team shall be trained to operate and maintain the system.

J. Fire simulation test shall be carried out on detectors, pull stations, etc., at various locations. Text messages on fire alarm panels shall be checked. If required, sensitive adjustment shall be done.

K. Fire simulation test shall be carried out for checkup sequential operation of following devices:
1. Status of Flow Switches (Sprinkler System)
2. Recall of Lift
3. Opening of fire escape doors
4. All other relevant test, etc.
5. Tripping power supply of alternate floor.
6. Shut down general exhaust fans
7. Startup smoke extract fans
8. Startup exhaust make up fans
9. Startup stair vestibule pressurization fans
10. initiate alert signals to panels in the adjacent buildings where applicable
11. Automatically operate fire dampers
12. Voice evacuation message initiation
13. Compliance to fire mode scenario as per cause & effect matrix.

L. Faults found on fire simulation tests of various devices shall be noted down.

M. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. For all Smoke Detectors, Heat detectors are with listed spacing of 9.1 Meter as per NFPA 72.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
5. HVAC: Locate detectors not closer than 1.5 m from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 300 mm from any part of a lighting fixture.

N. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position**.**

1.6.1.3 FIELD QUALITY CONTROL

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL, CPRI approved/ASTA/KEMA approved), and that is acceptable to local India authorities.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Remove and replace units that do not pass tests and inspections and retest as specified above.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed Satisfactory Test" label to tested component.

F. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

a. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
b. Test audible appliances for the private operating mode according to manufacturer's written instructions.
c. Test visible appliances for the public operating mode according to manufacturer's written instructions.
d. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
e. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
f. Fire-alarm system will be considered defective if it does not pass tests and inspections.
g. Prepare test and inspection reports.
h. Work in two paragraphs below is normally the responsibility of Owner. Retain one or both paragraphs if Owner needs additional time to contract for inspections required by NFPA 72.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

I. Cable shall be tested at site for insulation between phases and between phase and earth for each length of cable, before and after jointing.

J. On completion of cable laying work, the following tests shall be conducted in the presence of the Employer representative.

1. Insulation Resistance Test(Sectional and overall)
2. Continuity resistance test.
3. Earth test.

1.6.1.4 CONNECTIONS

A. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 1 m from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
C. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
D. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
E. Smoke dampers in air ducts of designated air-conditioning duct systems.
F. Alarm-initiating connection to elevator recall system and components.
G. Alarm-initiating connection to activate emergency lighting control.
H. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
I. Supervisory connections at valve supervisory switches.
J. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
K. Supervisory connections at elevator shunt trip breaker.
L. Retain one of three subparagraphs below.
M. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
N. Supervisory connections at fire-pump engine control panel.

1.6.1.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

1.7 DEMONSTRATION

A. General: Manufacturer's factory-authorized service representative to train the Employer's Representative in the operation of the Unit.

B. Equipment: Check operation of each unit with the Employer's Representative present and before Substantial Completion. Determine that operational systems and devices are functioning properly.

C. Instruction: Instruct the Employer's Representative in proper use, maintenance, adjustment, and repair of each system.

1.8 SYSTEM SETUP & CONFIGURATION

A. Provide the services of a factory trained and authorized technician to perform all system.

B. Software modifications, upgrades or changes. Field technicians shall be NICET Level 1(minimum) certified.

C. The factory trained technician shall install initial data and artwork at each interactive firefighter's display.

D. The factory trained technician shall design the graphic layout based on area diagrams and floor plans.

1.9 INSPECTION

A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system function properly in every respect.

1.10 INSTRUCTION/TRAINING

A. Provide instruction as required for operating the system. Hands on demonstrations of the operation of all system components and the entire system including user-level program changes and functions shall be provided. A factory trained and certified representative shall provide instruction.

END OF SECTION- B