

**PROPOSED REDEVELOPMENT OF MATERIAL TESTING LAB WORLI MUMBAI**



ELV + IT + IBMS + AV + ROBOTIC PARKING WATER MIST FIRE PROTECTION SYSTEMS  
DESIGN BRIEF REPORT AND SPECIFICATIONS

PROPOSED REDEVELOPMENT OF MUNICIPAL MATERIAL TESTING LABORATORY,  
WORLI, MUMBAI MAHARASHTRA, INDIA

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**INTERIOR DESIGNER & PROJECT**  
**MANAGEMENT CONSULTANTS**

DESIGN SCHEME

(FULL FSI CONSUMPTION) (1 LEVEL OF BASEMENT + GROUND FLOOR + PODIUM LEVELS P1 TO  
P13 ROBOTIC PARKING + OFFICE FLOORS LEVEL 14 to 29 )

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## 1. DESIGN NOTES

Mentioned below is a brief about the proposed redevelopment building of Material Testing Lab Worli, Mumbai with design concept and technical specifications requirements in subsequent sections which will help guide you to provide best in class **ELV + IT + IBMS + AV + ROBOTIC PARKING ELV SYSTEMS** solutions and latest technology including analytics and artificial intelligence

The above mentioned systems will help to optimize building MEP performance to use less energy, provide good lighting conditions, uninterrupted clean power, right temperature cooling comfort for system to maintain controlled environment for a pleasant experience by control and monitor of the MEP equipment's, space for keeping small and medium items through smart locking system for asphalt workers and intelligent smoke detectors for fire detection, public address system for voice evacuation and paging, intelligent heat sensing cable for basement and robotic parking floors and perimeter and indoor security systems in place to make the complete building safe and secure for occupants

All above systems will seamlessly integrated with each other to provide detailed and valuable data in a centralized manner to help building maintainers to take right decisions to make building experience pleasant and secure.

The building consists of the following floors

1. Basement Floor
2. Separate 2 sets of entry/exit gates for employees and tenants
3. Ground Floor (Material Testing Lab office)
4. 1<sup>st</sup> Floor to 13<sup>th</sup> Floor Robotic Podium Parking (Approx 455 cars)
5. 14<sup>th</sup> to 17<sup>th</sup> Floors (Material Testing Lab office)
6. 16<sup>th</sup> & 19<sup>th</sup> Floors (Road Dept office)
7. 20<sup>th</sup> to 29<sup>th</sup> Floors to be leased out with individual floor metering

Following are the systems which will be installed in the building to achieve centralized WITH IMPORTANT NOTES FOR THE ABOVE MENTIONED SYSTEMS

### **INTELLIGENT ADDRESSABLE FIRE ALARM SYSTEM (CPU & LOOP REDUDANCY)**

- a. All floors ( basement to 29<sup>th</sup> floors) are to be covered with multi-sensor detectors for above ceiling and below ceiling including loop powered Strobe/Sounders at the 5 staircases and critical areas and control and monitor modules for tripping of HVAC systems, ELV

systems, Electrical systems and other systems which require to be shut down in case of fire and addressing of all applicable conventions sensors like flow switches and beam detectors for the Atrium Area. Each floor will have a dedicated loop excluding the parking floors covered by the intelligent line type heat detector sensing cable

b. 2 nos. of 10 loop networkable Fire Panels to be considered as per the specification, dwg qty list, one dedicated for basement, ground, 1<sup>st</sup> to 16<sup>th</sup> floor and one dedicated from 17<sup>th</sup> to 26<sup>th</sup> floor. Each panel will have a dedicated autodialer

c. The **intelligent line type heat detector sensing cable** and associated controllers which will seamlessly integrate with the fire alarm panel protocol including all accessories considered for the parking floors and the basement should ensure that **each car is covered by one dedicatedly individual addressable heat sensor**. So each floor has 35 parking's that means 35 dedicated addresses and in total 35 nos. X 13 floors 455 nos. individual for the entire 13 floors and 49 X 2 = 98 stack parking's in the basement. The addressable heat sensor electronics position in the cable should be designed as per the above requirement.

d. There will be a Central Fire Display of multi-user graphical control system with **4500 Data points** in accordance with ÖNORM F 3003 for central display and operation of fire ALARM systems using the latest IP technology only. All Messages and system states of the connected FAS panels should be collected. This will be located in the BMS room on Ground floor. Please include the latest workstation as per OEM specs at the time of delivery.

e. The 2 nos. 10 loop panel will be located in the BMS room in the Ground Floor.

f. Following areas will have individual dedicated TCP/IP based Active Repeater Panel.

g. Ground Floor 24 X 7 security area

ii. Vigilance Dept Floor

iii. Road Dept Floor

iv. Total 10 nos., one for each leased floor from 20<sup>th</sup> to 29<sup>th</sup> floors

h. All gas suppression systems will be integrated through dedicated gas release module for 2 server and electrical rooms (4/floors X 17 floors = 68 ) on all floors and 2 critical testing labs of the same fire alarm panel proposed for the entire building (Total=70 nos.)

i. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for looping all devices to the fire alarm panel as per technical specifications.

- j. All panels and fire software to seamlessly integrate with BMS system over Modbus/Bacnet
- k. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **PUBLIC ADDRESS SYSTEM**

- a. All floors (basement to 29<sup>th</sup> floors) are to be covered with speakers for open space and enclosed areas like cabins/conference/meeting cubicles/labs/elevators/lifts etc
- b. There will be 2 master controllers one for Basement to 19<sup>th</sup> floor and 2<sup>nd</sup> for 20<sup>th</sup> to 29<sup>th</sup> floor as per the specification which will be the heart of the system integrating speakers, amplifiers, microphone consoles, zone extenders (1 each for both master controllers) 30W volume controllers and rack mount music player (1 each for both master controllers).
- c. There will be a dedicated Digital Class-D power amplifier 4 x 250 watts, 100 volts between 2 floors in total 12 nos. (11 +1 spare) for the entire building in the following format
- i. 4 nos. amplifiers for Basement, Ground, 14<sup>th</sup> to 19<sup>th</sup> floors
  - ii. 2 dedicated for 1<sup>st</sup> to 13<sup>th</sup> parking floors
  - iii. 5 nos. amplifiers for 19<sup>th</sup> to 29<sup>th</sup> floors
- d. There will be a dedicated microphone console at the following locations
- i. BMS Room
  - ii. Ground floor Reception
  - iii. Reception on 17<sup>th</sup> floor
- e. Please consider monitored 30W volume control boxes for enclosed areas like cabins/conference/meeting cubicles/labs/elevators/lifts etc
- f. Entire PA system to be hardwired to Fire Alarm system for voice evacuation in case of fire incidence and with BMS system over 4 to 6 programmable outputs from both the master controllers connected to the DDC controllers in the BMS room
- g. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for looping all devices to the fire alarm panel as per technical specifications.

**h. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

**IG541 INERT GAS SUPPRESSION SYSTEM**

a. OEM certified IG541 monitored gas suppression system is applicable to the following areas on each floor. design calculation. There will be 2 centralized banks in the entire building mounted in the ground floor or basement

i. Bank-1 will consist of 7 floors Ground, 14<sup>th</sup> to 19<sup>th</sup> floor

ii. Bank-2 will consist of 10 floors 19<sup>th</sup> to 29<sup>th</sup> floor

iii. 2 nos. server rooms + 2 nos. electrical rooms on each floor so total 4 X 17 floors = 68 nos. + 2 critical material testing Labs = 70 areas. (Gnd + 14<sup>th</sup> to 29<sup>th</sup> floors) Dimensions 5 X5 mts each room. Ceiling void 800 mm, room void 2200 and floor void 600 mm.

iv. 2 nos. critical material testing labs as per MTL teams. Dimensions 15 X 15 Mts

b. The Electrical Actuator with provision for monitoring of actuator mounting, actuator connection fault and maintenance locking at the BMS

c. VDS Approved Pressure Regulator (Constant Discharge Technology) to be used for each cylinder to reduce the pressure from 300bar to 60bar before the manifold

d. Proper installation completion commissioning of the system as per OEM standards including any reset tools required to successfully complete the job

e. All necessary warning signs to be included as per industry standards including individual manual abort and release switches for each room under gas suppression system.

f. All cylinders to seamlessly integrate with building BMS system for monitoring over hard points

g. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for all signal cabling as per technical specifications.

h. Please submit OEM software certified design sheet for gas qty, cylinder size and nozzle qty with the technical submissions.

### **ASPIRATION SMOKE DETECTION SYSTEM**

a. OEM certified dual pipe, dual zone aspiration type smoke detection system with power supply dual chamber [replaceable] dust indicator is applicable to the following areas on each floor. Please check the correct dimensions for design calculation

i. 2 nos. server rooms + 2 electrical rooms on each floors so total 4 X 17 floors= 34 nos. (Gnd + 14<sup>th</sup> to 29<sup>th</sup> floors). (2nos. dual pipe, dual zone aspiration panels on each floor).  
Server & Electrical Room size 5 X 5 Mts  
Critical MTL Labs 15 X 15 mts

ii. 2 nos. critical material testing labs as per MTL teams. (2nos. dual pipe, dual zone aspiration panels on one single floor or two different floors) Total 34+6+1 spare =37 nos.

b. Aspiration grade 25 mm piping and associated accessories to be used for covering the entire area. Mapping of holes and piping to be designed and certified by the OEM software

c. All panels to seamlessly integrate with building BMS system over Modbus/Bacnet

d. All above panels will seamlessly integrate with the Fire Alarm Panel communication bus for better management of alarms and events and the Fire Alarm Panel in turn seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.

**e. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

### **ULTRASONIC RODENT REPELLENT SYSTEM**

a. To cover all floors from Basement to the 29<sup>th</sup> floor in all voids @ 500 sq ft coverage per transducer.

b. All transducers should be addressable and should not to be looped connected individual to the Rodent Repellent Panels

c. Approx 40 transducers and 2 panels per floor for all floors from basement to 29<sup>th</sup> floors.

d. All parking floors will have individual transducer for each car slot so total 455 for 13 floors and 26 panels including the other areas on each area also to be covered

e. Please include verification Kit comprising of Ultrasound Wave Analyzer (Software and Hardware) for centralized management of the Rodent Repellent System



f. All above panels will integrate with BMS over Modbus/Bacnet

**e. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **DIGITAL WATER LEAK DETECTION**

a. Digital water leak detection cable to cover all floors from Basement to the 29<sup>th</sup> floor for the following areas. Dimensions to be confirmed before commercial bid

i. Server Rooms 2 nos./floor 2 X 17 = 34 Nos. (Approx Size 5 X 5 Mts)

ii. Electrical Rooms 2 nos./floor 2 X 17 = 34 Nos. (Approx Size 5 X 5 Mts)

iii. Material Testing Labs 3/floor X 5 = 15 nos. (Approx Size 15 X 15 Mts)

b. Dedicated Main Leak Detection Panel - 10.1" Touch Screen Panel to installed on each floor (Total 17 nos.)

c. WLD Sensor Interface Module (SIM) to be considered for the following areas which will be looped and connected to the above Main Detection panel. Total 83 Nos.

i. Server Rooms 2 nos./floor 2 X 17 = 34 Nos.

ii. Electrical Rooms 2 nos./floor 2 X 17 = 34 Nos.

iii. Material Testing Labs 3/floor X 5 = 15 nos.

d. All above display panels to be integrated with BMS over Modbus/Bacnet protocol

**e. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **CCTV SYSTEM**

a. The CCTV system is applicable to the entire building in the following manner

i. Basement, Ground, Terrace and 1<sup>st</sup> to 19<sup>th</sup> floors will be covered entirely as detailed camera type and count matrix sheet

ii. 20<sup>th</sup> to 29<sup>th</sup> ( 10 floors) will be covered in the following areas

- Lift lobby + Freight Lift
- Server Rooms (2 nos.)

- Electrical Rooms (2 nos.)
- Fire Staircase (5 nos.)

b. The CCTV system will consist of a combination of Video Management Software and 32 Channel NVR for storage for 550 camera system(min is 32 TB however follow point c for the correct HDD required). Please refer matrix for detailed floor requirements

c. Recording @ H.265 Compression, 1080P/20FPS/continuous recording and storage for 90 days. (Include HDD calculator in technical offer) Bidders to Provide Storage Calculations to substantiate the storage requirements in the Tender. Necessary HDD to be included as per the above data

d. Following are the types of cameras which will be used for the entire building

i. 2 MP varifocal motorized Indoor dome cameras

ii. 5 MP varifocal motorized Indoor dome cameras for Material testing labs

iii. 2 MP varifocal motorized Indoor bullet cameras (3mm to 10 mm)

iv. 2 MP varifocal motorized Outdoor bullet camera (12mm to 40 mm)

v. PTZ Cameras for perimeter 32X

c. Rack mount 3 nos. VMS Servers and 3 nos. client workstation based on 550 camera requirement.

d. A 3 X 3 matrix of 55" Video Wall with necessary hardware to connect to servers and client workstations

e. A Joystick/control board for managing the PTZ cameras

f. 10 nos. of 4 to 6 mts MS powder coated 4" dia mounting poles for all outdoor cameras including complete civil work for installation.

**f. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **ACCESS CONTROL SYSTEM**

a. The access control system is applicable to basement, ground and 14<sup>th</sup> to 19<sup>th</sup> floors and only server rooms and electrical rooms from 20<sup>th</sup> to 29<sup>th</sup> floors. The access control software should meet the requirement of 250 doors minimum and meet all the technical

specifications of the tender with seamless integration with CCTV system and HR SAP software for payroll management.

- b. All doors will have in/out readers and emergency break glass in the inside.
- c. OSDP (Open Supervisory Device Protocol) complaint controllers and readers to be used to reduce the cabling to 4 core and readers to be looped in RS 485 to save 50% cabling qty.
- d. POE based TCP/IP based 2 reader OSDP complaint controllers are used for all doors with necessary hardware and firmware to meet the technical specifications of the tender
- e. 6 nos. Face Readers have been proposed which are to be used at strategic locations like Material testing labs and critical server rooms
- f. In/Out Long Range Parking readers with 10 meters range to be installed for both entry/exit gates and basement entry for parking management and record of vehicle movement within the premises.
- g. Consider 150 UHF tags for parking and 500 mifare smart access cards for employees and visitors
- h. Magnetic locks 600# and 1200# with mounting brackets as per door material, magnetic contacts to be considered as per single and double leaf doors. 2 nos. of SMPS Power Supply in each server rooms of 10 Amp rating of 10 outputs of 1 amp each to considered in case the access control cannot power the magnetic locks.
- i. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **SMART LOCKER SYSTEM**

- a. This system is required **on each floor** in the ASPHALT PLANT WORKER'S OFFICE from Ground, 14<sup>th</sup> to 17<sup>th</sup> floor of the Material testing labs (5 nos. in total and all integrated seamlessly to work as a single system and accessible through a centralised GUI Software)
- b. All above smart Lockers will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.
- c. Include all necessary items required to make the system complete and working at all times

## INDOOR SECURITY SYSTEM

### i. Walk Through Metal Detector

a. This will be required at the Ground Floor both Entrances 2 nos. each for men and women separately total 4 nos.

### ii. X Ray Baggage Scanners ( Hand Held and Freight)

a. Each Entrance will require a Hand held and Freight X ray baggage scanners, so in total 4 nos., 2 each of handheld and 2 each of Freight Xray baggage scanners

### iii. Hand Held Metal Detectors

a. Will require 4 sets at each entrance so total 8 nos.

### iv. Swing Barriers & Wide Opening P Gate

a. Swing Barriers and P Gate will be installed on the ground floor entrance as per the below table for employee, tenant and freight material entries

b. Normal Swing barriers will have 600 mm opening, Handicap Swing Barrier will have 900mm and P gate will be 1200 to 1800 mm max as per site requirements. Swing Barrier opening can have a tolerance of 15 to 25 mm depending on site requirements

| SR. No. | Floors       | Swing Barriers                                  |                   |                         |            | P Gate                                 |                   | Total             |                   |    |
|---------|--------------|---|-------------------|-------------------------|------------|--|-------------------|-------------------|-------------------|----|
|         |              | 2+1 (Normal + Handicap Lane)<br>600 mm + 900 mm |                   | 1 Normal Lane<br>600 mm |            | 1200 to 1800 mm<br>Opening as per site |                   |                   |                   |    |
|         |              | Entrance  | Entrance          | Lift Lobby              | Lift Lobby | Entrance                               | Entrance          | Entrance          | Entrance          |    |
|         |              | Nxt to Elevator-1                               | Nxt to Elevator-4 | Side 1                  | Side 2     | Nxt to Elevator-5                      | Nxt to Elevator-6 | Nxt to Elevator-5 | Nxt to Elevator-6 |    |
| 1       | Ground Floor | 3   | 3                 | 3                       | 3          | 1                                      | 1                 | 1                 | 1                 | 16 |

## INTEGRATED BUILDING MANAGEMENT SYSTEM

a. The BMS system is applicable to the entire building from Basement, Ground, 1<sup>st</sup> to 29<sup>th</sup> floors.

b. The BMS System Architecture will be a 3 tier architecture

- i. BMS software
  - ii. Supervisory Controllers (All soft Integrations)
  - iii. DDC Controllers (field level integration)
- c. Please refer to the bms io summary at the end of the documents for details hard wired through ddc controllers and soft integration via modbus/bacnet protocol through supervisory controllers
- d. Wireless iot sensors will be used along with gateway over mesh network and seamlessly integrating with the bms system over MQTT protocol. Total 8 gateways and 16 to 20 sensors on each floor to monitor temp/rh

### **IT BACKBONE (ACTIVE+PASSIVE+UNDERFLOOR PVC DUCTING)**

#### **PASSIVE**

- a. The IT passive and active hardware and software will be completely installed for Ground, 14<sup>th</sup> to 19<sup>th</sup> floors. However the underfloor raceways and junction boxes will be installed for the complete building from Gnd, 11<sup>th</sup> to 29<sup>th</sup> floors
- b. There will be 100% redundancy for each data point considered in the building for ground, 14<sup>th</sup> to 19<sup>th</sup> floors and hence the passive items will be provided in accordance with the design requirements
- c. All individual POE copper switches will individually collapse on the fibre backbone to the SFP core switches

#### **ACTIVE**

- a. The entire system will be enterprise based system and as per the specifications mentioned in the tender. This is most critical part of the business continuity and hence has to be end to end sourced from a single OEM
- b. 48 Port SFP Core Switch to be considered to manage the entire business network and the OT network as mentioned below. This will be heart of the entire system and will be in the server room (2 Nos.)
- c. 48 ports POE managed switches will be used for the data and voice back bone with 100% redundancy at the LAN points at field side and core side. Accordingly the no. of switches to be considered (Approx 39 Nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

d. 24 ports POE Managed switches will be used for the OT (Operational Technologies) network. OT network consists of entire ELV systems (Approx 40 nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

e. Router, Next generation Firewall, NAC, IP PBX, Voice Gateway 4 PRI, Wifi Controller, Wifi Access Points, IP Phones of 4 types as per the employee grade to be provided in MTL offices.

**f. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **UNDERFLOOR PVC DUCT FOR STRUCTURED CABLING**

a. We proposing Under Floor Trunking made of PVC (Polyvinylchloride) of minimum 2.0 mm thickness, minimum 3000 mm length for Gnd, 14<sup>th</sup> to 29<sup>th</sup> floors, trapezoidal duct profile for high tensile strength to give the required rigidity, including cutting floor chases as per requirement and mending good the damages clearing the debris as per requirement all complete. For 5 to 6 IP points in 13 nos. parking floors we will use same armoured CAT6 cable used for CCTV and access control.

b. All joints between two PVC trunking shall be fixed with a pvc connector as per size and 1 run or 2 runs or 3 runs of pvc trunking should have fastening galvanized clamps every 1 mtr as per duct size. All material should conform to EN 50085-2-2 standard and should be end to end from a single OEM

c. Underfloor junction box to be used for PVC ducts in heights of 25 mm and 35 mm raceways. Under floor Junction boxes sizes and qty should be considered for 1 run or 2 runs or 3 runs of pvc trunking as per the structured cabling required for entire floor and for all floors (Ground, 14<sup>th</sup> to 29<sup>th</sup> floors)

The qty of pvc trunking and junction boxes should be appropriate enough to meet the complete structured cable requirement of the MTL office and leased out floors.

#### **PERIMETER SECURITY**

##### **i. Under Vehicle Scanning System**

a. To be installed at the 2 entrance gates, total 2 nos.

##### **ii. Cantilever Technology MS Gate and Gate Automation**

a. To be installed for entry and exit gates of 6 to 6.5 mts as per site, total 4 nos.

##### **iii. Boom Barriers**

a. 2 nos. of 3 to 3.5 mts (as per site requirement) boom barriers to be installed for each entry and exit gates. So total 4 X 2 = 8 nos.

b. 1 no. will be installed for the basement entrance

**iv. Automatic Bollards**

a. 4 nos. of K4 automatic bollards as 1 set to be installed at 2 entry gates- total 2 sets.

**OTHER SYSTEMS FOR AUTOMATED PARKING FLOORS & DELUGE FIRE PROTECTION**

The proposed below systems are applicable to automated parking floors from basement, 1<sup>st</sup> to 13<sup>th</sup> floors

a. All below mentioned systems will seamlessly work between themselves as independent system but will also share information with the building centralized systems

The automated parking floors will be also be protected by the following additional systems

**1. Intelligent Addressable Fire Alarm (MAF Required. Same make as the building)**

1 loop expandable to 2 loop Intelligent Addressable fire alarm in one with the technical specifications as mentioned above this will be used for the addressable heat sensing cable system installed to monitor each parking slot. This fire panel should be on the same protocol as the building Fire Alarm System and should be integrated with the Automated parking BMS and the building BMS system

**2. Line Type Heat Detector Sensing Cable –Intelligent Addressable (MAF Required. Same make as the building)**

For monitoring of **each and every individual parking slot** for basement+ 13 podium automated parking floors (total 98+455=553 nos.) The hermetically sealed sensor cable contains small hybrid circuits (sensor) which, to be placed at every 4 or 5 meters intervals to ensure that **each and every parking slot will have their individual Heat Detector** . The hybrids, which contain an integrated circuit with a defined address and a semiconductor temperature sensor, are electrically connected by a flat flexible cable. All the data from sensor element encapsulated in sensor cable is processed in the microprocessor-based controller having important LED indications and seamlessly integrate with the above Fire Alarm Panel communication protocol.

The total length of the system may be up to a minimum of 350 meters x 2 runs meters or 99 + 99 sensors whichever is earlier per controller.

**3. ULTRASONIC RODENT REPELLENT SYSTEM (MAF Required. Same make as the building)**

Each **individual parking slot** to be protected by 1 no. ultrasonic rodent repellent transducer with on each floor to protect the cars from rodent menace **for basement+ 13 podium automated parking floors (total 98+455=553 nos.)**. Approx each floor will require 40 transducers and 2 nos. master controller with 128X64 Graphic LCD DISPLAY which will be networked and connected to centralized software for better management. No looping of transducers.

**Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **4. Building Management System (MAF Required. Same make as the building)**

Latest Version Server-Client BMS Software as specified for real-time processing of all IO points being mapped into the system by TCP/IP PLC/DDC Controllers and Protocol Integrators for monitoring of valves and sensor monitoring of the deluge fire protection system including the above Fire Alarm, Heat Sensing cable and Ultrasonic rodent repellent. Please consider minimum **1000 software tags** as per the make to ensure complete monitoring and control of the system. The same system has to seamlessly integrate in the building BMS.

The 32 bit ddc controller panels should have necessary IO and Modbus/bacnet port capacity to the complete requirements for basement + 13 automated parking podium floors.

#### **AUDIO-VISUAL SYSTEMS**

a. These systems are applicable for the occupied floors on Ground, 14<sup>th</sup> to 19<sup>th</sup> floor and following areas

1. 18 Pax Conference Rooms
2. 10 Pax Conference Rooms
3. Meeting Cubicles
4. Deputy Chief Engineer Cabins
5. Executive Engineers Cabin

**b. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **TECHNICAL SPECIFICATIONS FOR INTELLIGENT ADDRESSABLE FIRE ALARM SYSTEM**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**



## DESIGN BRIEF

### **MAKES: SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA**

All floors ( basement to 29<sup>th</sup> floors) are to be covered with multi-sensor detectors for above ceiling and below ceiling including loop powered Strobe/Sounders at the 5 staircases and critical areas and control and monitor modules for tripping of HVAC systems, ELV systems, Electrical systems and other systems which require to be shut down in case of fire and addressing of all applicable conventions sensors like flow switches and beam detectors for the Atrium Area. Each floor will have a dedicated loop excluding the parking floors covered by the intelligent line type heat detector sensing cable

b. 2 nos. of 10 loop networkable Fire Panels to be considered as per the specification, dwg qty list, one dedicated for basement, ground, 1<sup>st</sup> to 16<sup>th</sup> floor and one dedicated from 17<sup>th</sup> to 26<sup>th</sup> floor. Each panel will have a dedicated autodialer

c. The **intelligent line type heat detector sensing cable** and associated controllers which will seamlessly integrate with the fire alarm panel protocol including all accessories considered for the parking floors and the basement should ensure that **each car is covered by one dedicatedly individual addressable heat sensor**. So each floor has 35 parking's that means 35 dedicated addresses and in total 35 nos. X 13 floors 455 nos. individual for the entire 13 floors and 49 X 2 = 98 stack parking's in the basement. The addressable heat sensor electronics position in the cable should be designed as per the above requirement.

d. There will be a Central Fire Display of multi-user graphical control system with **4500 Data points** in accordance with ÖNORM F 3003 for central display and operation of fire ALARM systems using the latest IP technology only. All Messages and system states of the connected FAS panels should be collected. This will be located in the BMS room on Ground floor. Please include the latest workstation as per OEM specs at the time of delivery.

e. The 2 nos. 10 loop panel will be located in the BMS room in the Ground Floor.

f. Following areas will have individual dedicated TCP/IP based Active Repeater Panel.

g. Ground Floor 24 X 7 security area

ii. Vigilance Dept Floor

iii. Road Dept Floor

iv. Total 10 nos., one for each leased floor from 20<sup>th</sup> to 29<sup>th</sup> floors

h. All gas suppression systems will be integrated through dedicated gas release module for 2 server and electrical rooms (4/floors X 17 floors = 68 ) on all floors and 2 critical testing labs of the same fire alarm panel proposed for the entire building (Total=70 nos.)

i. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for looping all devices to the fire alarm panel as per technical specifications.

j. All panels and fire software to seamlessly integrate with BMS system over Modbus/Bacnet

**k. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

The proposed network fire alarm system panel should have minimum 10 loop capacity to meet the current MTL requirement including 100% hot redundancy for CPU and loops cards and capacity of Peer-to-Peer Networking of Panels for future floors in the building. Each loop should have minimum capacity of 250 devices connecting smoke detectors strobe/sounder and modules in any combination including autodialer facility to inform the nearest Fire Dept.

Include Multi-user graphical control system with 4500 Data points in accordance with ÖNORMF 3003 for central display and operation of fire ALARM systems using the latest IP technology only. All Messages and system states of the connected FAS panels should be collected

32-bit microprocessor based Intelligent Addressable TCP-IP Based Repeater panel battery back up to 24 hours installed at minimum 3 locations manned by security team 24 X 7

Fire GUI workstation to be included along with necessary software for centralised monitoring of the entire Fire Alarm System.

**Fire Panel to seamlessly integrated with IBMS system over Modbus or Bacnet protocol.**

Multisensor microprocessor based smoke detectors to be provided with use as heat (Fixed + Rate of Rise or individual ) or smoke or combined both with automatic electronic addressing

All Strobe cum Sounders are individual will be loop powered for centralised management of the power requirements

Manual Call Points, Monitor and control Modules quantity will be considered as per the floor layout requirements and fire norms. Intelligent Beam Detectors to be used for Atrium/double height ceiling and integrate with fire panel

Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for looping all devices to the fire alarm panel. System to comply as per below mentioned technical specifications and list of makes

## 1.0 Approvals:

The control panel, detectors and accessories of the system shall be certified & approved by, at least, one of reputed organizations such as:

- VdS- Verband der Sachversicherer, Germany.
- UL- Underwriters Laboratories

### 1.1 Guidelines:

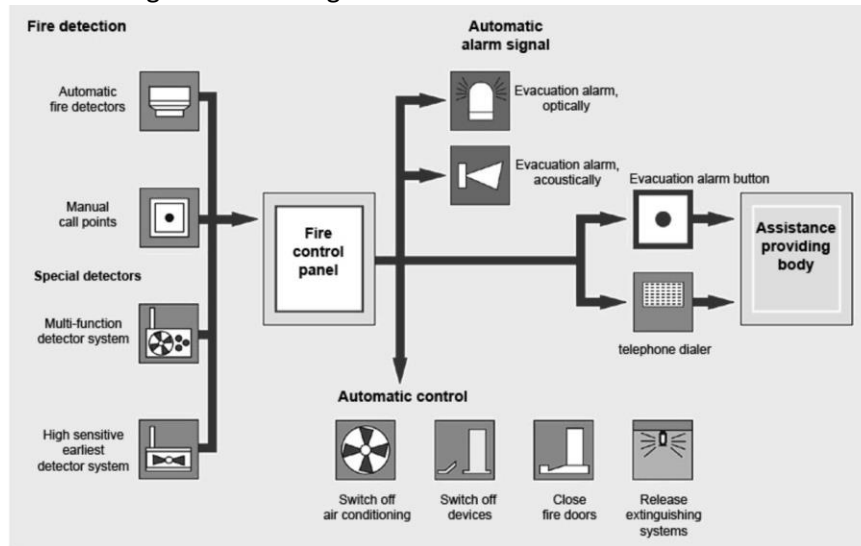
- IS/ ISO 7240: Indian Standard/ International Organization for Standardization
- NFPA72 : National Fire Protection Association
- EN54: European Norms

## 2.0 GENERAL DESCRIPTION

### 2.1 Basic of Fire Alarm System:

If a fire breaks out in a building that is monitored by a fire alarm system, then it will be detected by the detectors in this system. The detection of a fire is forwarded to the fire alarm control panel, which then in turn triggers the relevant alarms and controllers.

Context diagram of FAS is given below.



### 2.1 Brief Description of Fire Alarm System:

The Fire Alarm System equipment shall consist of the following. :-

- Modular Control Panel
- External Indicating & operating Panel (Repeater Panel)
- Automatic Detectors & Field Modules

- Alarm Notification Devices
- Special Detectors
- Accessories
- Management System

The minimum Design Requirements of Fire Alarm System are:

- The Fire Alarm System should constitute the technological state-of-the-art and the latest scientific findings, whilst observing the currently enforced standards.
- One of the main feature of the Panel should be that it should complete, intelligent redundant in a nature.
- The System should be design such a way that a single fault on a system should not affect the operation of any of other components.

## **2.2 General Requirement:**

1. The automatic fire alarm system must be assembled using a modern, redundant system structure and using microprocessor-controlled intelligent detectors.
2. The System should be design such a way that a single fault on a system should not affect the operation of any of other components. The panel shall be modular with hot redundancy in CPU and other cards such as loop card, networks card, motherboard etc..
3. Every detector and every controller module constantly checks its own status and sends status information to the microprocessor-controlled and monitored fire alarm control panel.
4. False alarms are filtered out by backed-up digital data transmission between detectors and the fire alarm control panel.
5. Each Detector & field Devices should have automatic addressing. The manual addressing (Rotary switch type, DIP switch type) or hand held programmer addressing is strictly not acceptable.
6. It must be ensured that a fault in an operating group or a detector does not influence or falsely manipulate the functionality of other operating groups or detectors.
7. In the event of a failure, a short circuit or a wire break in a detector or in the fire alarm system cable, all other detectors and connected input and output modules must remain fully functional. Since a short circuit isolator has been integrated into every connected input and output module, it is possible to optimise cabling into fire zones.
8. Faulty detectors, modules and controller modules as well as short circuits or wire breaks must be located and the information about their precise position must be indicated in plain text on the display and on the printer.

9. Automatic intelligent detectors and manual call points, as well as input and output elements for fire prevention doors, sirens, flashing lights etc. must all be directly connectible to a loop circuit.
10. The assignment and interconnection of detectors into detector zones must be possible from any position on the loop circuit, regardless of the position. Subsequent extensions of a detector zone must be simple to implement and must not require that the addresses of other detectors be changed or that the other detectors require reprogramming.
11. For optimal maintenance of the system, an early warning system must be integrated. Contaminated detectors, or detectors requiring maintenance, must be indicated in plain text on the control panel.
12. The fire alarm control panel must contain a 6 line alphanumeric display for indication purposes. 40 characters per line must allow a plain text indication to be given of all system states.
13. Programmable buttons and LED-displays at the control panel.
14. There must be an individual user management with password and user level possible, furthermore, each user change must be recorded.
15. A section operation at the control panel and an entire operation must be possible.
16. The failure of the alphanumeric display unit or of individual elements must not precipitate the loss or misinterpretation of individual messages, e.g. the display unit should be supplemented by a plain text printer with a log memory.
17. It must be possible to display all alarm messages, fault messages, disablements and actuations by manually "scrolling".
18. If the capacity of the alphanumeric display unit does not permit all messages, faults, disablements and alarms to be simultaneously displayed, then the total number of fire alarms, faults, disablements and actuations must be individually displayed in a separate display.
19. To permit the quick, clear and focused operation of the fire alarm system, it must be possible to fully-redundantly connect up to 8 autonomous remote indicating and operating panels all with alphanumeric plain text displays.
20. For the focused preparation of information, the fire alarm control panel must be equipped with serial data log printers. It must be possible to print out all alterations in the fire detection and fire alarm systems such as alarms, faults, disablements, actuations, processes, operating processes, alarm delays service notes etc. in plain text in English and with the date, time and additional information.

21. It must be possible to save the last 20000 system changes and to print them out repeatedly, to see the saved incidents, printed on data log printer or picked up by means of PC software.
22. The printer must contain a message filter, to concentrate on printing out important messages.
23. The fire alarm system must automatically switch between winter time and summer time.
24. It must be possible to connect the fire alarm system to superordinate computer systems or fire alarm control systems by means of serial data interfaces. It must also be possible to fully redundantly link several control panels together to one another.
25. The fire alarm control panel can, if need be, consist of up to any no of Fire Alarm Panel, with each sub control unit forming an autarchic unit with its own power supply and battery backup supply, to which external operating panels, fire brigade control panels and printers etc. can also be connected as well as detector zones and controllers.
26. Communications between the sub control units take place via a redundantly (duplicated) constructed loop circuit, so that the connection still remains fully- functional even in the event of three simultaneous connection faults.
27. Central download during operation of operating systems and project planning data.
28. The control panel must be equipped with interfaces to be integrated into the customer's network
29. The centralised structure allows the serial data connection of as many fire alarm control panels as required at any time, even subsequently.
30. As a result of the special redundancy concept, detector groups may also be connected to the main control unit and it is therefore possible to not have to install operating panels in the sub control units
31. Display panels and operating panels, log printers, parallel panels and other system components are connection via digital communication circuits, with the devices being able to be used in any possible combination regardless of the devices' locations.
32. Networking:

Module for Networking with Fiber optic with SFP module:

The Network card should be modular installation in the control panel, for dual ring redundant networking of control panels over Single mode fibre optic cable and for the redundant connection of PC applications.

The module has following features:

- 2 x Ethernet 100 Base TX interface max. 100 m, max. 100 Mbit/s

The Fire Alarm System should be capable up to 16 control panels can be linked up without a superior guidance system into a logical unit which features:

- mesh network with up to 4 connections per partial control panel: in case of a failure of a device or a connection failure, it is possible to redirect (routing) the data to continue communication
  - Data transmission speed up to 2500 kbit/s
  - flexible topology: stitch connection at loop possible
  - Ethernet protocol: use of customer's IT infrastructure
  - Access to control panels via Intranet & Internet
  - use of standard IT components
33. Contractor should provide letter of support from the OEM stating tender no and particulars
34. It must be possible to group several fire alarm control panels in different locations together over Internet Protocol to allow their common operation and indication. If existing IT networks are to be used for this purpose, then no further connections and/or cabling are required. The Fire Alarm Panel must feature onboard TCP/IP port with Modbus over TCP/IP interface with BMS System. Any other third-party converter is not acceptable.
35. Modbus TCP-IP

Each and every panel must provide Modbus over TCP-IP separately for integration with SCADA/PLC, necessary hardware and software must be considered by the bidder in every panel.

### **3.0 Modular Control Panel:**

#### **3.1 General Requirement:**

1. 32 bit microprocessor-controlled and monitored system technology
2. The System should be designed such a way that a single fault on a system should not affect the operation of any of other components. The panel shall be modular with hot redundancy in CPU and other cards such as loop card, networks card etc..
3. Alphanumeric display for plain text, 6 line, 40 characters per line,
4. Plain text lettering of display- and operating panels
5. Alphanumeric individual- and group display for all status of alarms
6. Individual programmable alarms, faults, disablements and actuations messages with date and time
7. Up to 15 deposable alphanumeric display- and control panels

8. Automatic restart function of the fire alarm system
9. Permanent automatic cyclic tests of parts of the fire alarm system and programs
10. User-specific software for three programmable receipts and exits
11. Individual addressing and disablement of detectors, I/O modules, as well as operating zones
12. 32 bit dual core processor in the mother board for fast & reliable communication
13. Free allocation of detector groups and single detectors
14. Detector zones can consist of detectors connected to different modules or control panels
15. Integrated short circuit isolator in each detector and module
16. Two detector dependency programmable
17. Two operating groups programmable
18. 2-wire technology
19. To verify deceptive alarms, the system must be able to be equipped with an intervention function, if necessary.
20. Freely selectable time for intervention and delay function
21. Combinations of functions and dependencies of fire controls units must be freely programmable by software
22. The offered fire alarm system must fulfil the demanded performance features without restrictions.

#### **4.0 Repeater Panel:**

External operating panel should be similar to main panel with menu-based operation, including case, membrane keypad, four-line LCD display for indicating all system states in plain text and a controller module. The panel should be VDS/UL approved. The external operating panel should have following features:

- Indication of all conditions of the fire alarm system in plain text (alarm, fault, disablement, actuation of the transmission equipment to the fire brigade, etc.)
- menu controlled user guidance
- Log- and recall function for 65.000 messages
- Indication of freely definable additional text, e.g. information in case of an alarm, depending on programming
- keypad and display indication
- Alarm counter
- Access control by means of entering a code



- Users Switching are logged in the event recorder

## 5.0 Automatic Detectors & Field Devices:

### 5.1 Multi Sensor Detector:

- Interactive multiple Criteria detectors should be intelligent addressable detector.
- The detector can be configured as a smoke detector, heat detector or combination fire detector pursuant to EN 54/UL standard for the early detection of smouldering and open fires with or without smoke formation.
- Principle of function shall be “Scattered light”
- The Detector should have its own inbuilt 8 bit microprocessor.
- Sensitivity: The detectors shall constantly monitor their surrounding conditions with regard to absolute highest temperature and relative temperature increase and shall calculate the optimum smoke and heat sensitivity for the area it is deployed in based on these factors. The sensitivity of the smoke detection part shall permanently and automatically adapt to the surrounding conditions i.e. if the temperature increases above the absolute or relative values, the sensitivity of the smoke detection chamber shall automatically increase and if the temperature falls again, the smoke chamber shall become less sensitive again. The sensitivity shall always remain within the range set out in standards.
- Various detection methods, linked sensors, smoke detection always with temperature support should be possible.
- It should be possible to set temperature detection parts, can be configured for the classes A1; A2; B as well as indices R (Rate of Rise) and S (Static)
- The Detector should have capability of permanent self-monitoring and it should also have inbuilt memory which will keep a log of Smoke density & relevant temperature for self-adjustment to the surrounding condition.
- The Each detector should have intelligent decision-making logical processor which will use the Dynamic signal evaluation method for detecting the alarm condition (Distributed Intelligence).
- The Detector should have inbuilt fault isolator.
- The Detector should have automatic addressing. The Rotary switch type, DIP switch type or hand held programmer addressing is strictly not acceptable.
- The Detector should have working temperature range up to -25 °C to + 60 °C
- Standard Detector Base for fitting automatic fire detectors. Plastic case equipped for surface mounting in dry rooms, with in-built 6 pole terminal block. It should give IP 44 rating protection against dust & moistures when it is fitted with the Detector.

- The Automatic Detector should be VDS/UL approved.

## 5.2 Manual call point

The Manual Call Point should be in a red plastic case, conforming to EN 54-11/UL for manually triggering a fire alarm, suitable for use indoors. The alarm is triggered by smashing the glass panel, with the alarm remaining in alarm state until a new glass panel is inserted. The built-in LED indicates its triggered state. The detector can be installed on the same loop circuit as automatic detectors thanks to the short circuit isolator that is integrated as standard.

- LED alarm indication
- Fault message in the event of a component failure
- Individual detector disablement
- integrated short circuit isolator

IP Rating for Indoor type: IP24, IP Rating for Outdoor type: IP67,

Approval: VdS/UL

## 5.3 Addressable Input/Output Module

Analogue Addressable Input / Output module with IP66 casing shall have require no. Of input & output as per site requirements with in-built short circuit isolator (in case short circuit isolator is not inbuilt, the price of this item shall be inclusive of an independent short-circuit isolator along with each monitor module), it must be VdS/UL approved and as per EN-54/UL standard. The ambient temperature range shall be -20°C to +60°C. The quoted item shall completely comply to the technical specification.

Approval: VdS

## 5.6 ADDRESSABLE LOOP POWERED SOUNDER

Addressable signal emitter for acoustic signalling of a fire alarm in indoor areas, suitable for direct connection to the loop. The siren shall be red in colour, with four different types of tone and the volume being set using DIP switches.

Parameters:

- Signal volume: 89 to 99 dB / 1 m (dependent on sound)
- Short Circuit Isolator: Integrated
- Ambient temperature: -10° to +55°C

Approval: VdS

## 5.7 ADDRESSABLE LOOP POWERED FLASHLIGHT:

Addressable flashing light for optical signalling of a fire alarm in indoor areas, suitable for direct connection to the loop. The flashlight shall be in red colour, with the flash rate being set by means of software and using DIP switches. The flashlight shall have the integrated Short Circuit Isolator and shall be capable to handle the Ambient temperature of -10° to +50°C.

Approval: VdS

## 7.0 Management System with Graphic user Interface (GUI):

### 7.1 General Requirement:

- The management system with GUI software must be suitable and approved for monitoring and operating a connected fire alarm system in accordance with UL/EN54
- Alarms, messages and conditions of the connected fire alarm system are collected and indicated clearly on one or several PC workstations
- The management system with GUI operates on a latest Windows 11/10 basis.
- Operation is carried out by means of mouse and keyboard, the user interface is clearly structured and similar to Windows.
- The management system with GUI consists, apart from the required system software, of a high-performance PC. Connection to the fire alarm system is carried out via the LAN Cable using IP based technology.
- The system is suitable for operation on two (flatscreen) monitors, but can be also operated on a single monitor if necessary.
- In standard operation mode, the left monitor displays building graphics (floor plans, operating plans etc.), whilst the right monitor lists all occurring events (alarm messages, faults, detectors that have been disabled, etc.) in lists.
- In the event of one monitor failing, the interface is automatically refreshed, and displayed in its entirety on the remaining monitor.
- The system must function and be operable in alarm and control modes.
- Up to 8 workstations can be connected to the system, being connected as a PC network connected to the fire alarm control panel(s). The system can also be subsequently extended to include additional workstations.
- The individually configurable floor plans and reaction texts are printed out automatically on the printer and within 60 seconds in the event of an alarm.
- For each detection point / element three independent graphic representations can be printed out (location plan/access plan/detailed plan).
- When using several workstations, each one must have equal rights with regard to functions and also have the full range of functions at their disposal.
- All events in the entire system are continuously and automatically logged, and can be printed out at any time, if necessary using message filters. The system status (status report) can be ascertained at any time using this log function.

- Reaction texts can be made customer-specific and can be added or modified during operation.
- Graphical representations can be loaded and modified during operation.
- The failure of a fire alarm control panel is signalled visually and acoustically by the fire detector control system.
- The failure of the control system is signalled visually and acoustically at the fire alarm control panel. Faults during data transmission are signalled visually and acoustically at the fire alarm control panel and at the fire detector control system.
- Faults or the failure of the control system do not influence the functions of the connected fire alarm control panel(s).
- After the operating system has been restarted, the fire detector control system automatically starts up with the lowest authorisation level.
- The status of the connected fire detector system (alarms, faults, disablements and actuations) is automatically reloaded after the restart.
- During the restart process of start-up and entry into operating status, as well as reloading processes of the fire alarm control panel, the processing times for messages on the fire alarm control panel continue to remain within the intervals permits pursuant to Standards.
- The time span for the generation of alarm messages (from detector to the fire detector control system's display) is allowed to be a maximum of 10 seconds.
- The time span for the generation of other messages (from their source to the fire detector control system's display) is allowed to be a maximum of 100 seconds.

## 7.2 PC Workstation Requirements: **(Latest Specs to be provided at the time of delivery)**

- PC with Intel I3 8<sup>th</sup> generation processor (min. 2300 MHz) and 8 GB RAM
- hard drives, min. 100 GB each
- Windows 10 operating system
- network adapter with 10/100 Mbit
- Dual head graphics card with 256 MB RAM
- 2 serial COM ports, 2 USB ports
- CD-ROM drive
- 2 colour Active TFT matrix monitor (resolution at least 1280 x 1024 pixels), suitable for use in two monitor operating mode.

### 3.4 TECHNICAL SPECIFICATION FOR LINE TYPE HEAT DETECTOR SENSING CABLE

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

#### **DESIGN BRIEF:**

**MAKES: AP SENSING/SHRACK/SIEMENS**

**Line Type Heat Detector Sensing Cable –Intelligent Addressable** will be primarily used for fire detection system of the basement area in the main building and the robotic podium parking floors from 1<sup>st</sup> to 10<sup>th</sup> to ensure each car park slot has a line type heat detector sensing cable addressable (350 total) including other areas in the entire area on each floor.

The above Heat detector sensing cable will have a robust processing controllers which will seamlessly talk to the fire alarm control panel protocol and in turn integrated with the IBMS system. All items used should be end to end from a single OEM to ensure smooth function and protocol compatibility

The above system will work in sync with the high pressure water mist fire protection mentioned in this document for complete protections of all cars parked in the robotic parking system

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

#### **3.4.1 Main Processing Unit Controller:**

All the data from sensor element encapsulated in sensor cable is processed in the microprocessor-based controller having important LED indications. Controller check the temperature values from the sensor cable on a cyclical basis. The thresholds used to create pre- signals or alarms are also stored in the processor unit. The alarm triggering using both an absolute temperature value (maximum temperature evaluation i.e. fixed temperature) and a temperature rise within a set period of time (differential temperature evaluation i.e. rate of rise in temperature). Alarms and temperature data are output via relay contacts, digital interfaces or network, depending on the type. High temperature resolution of 0.1 °C with a repeatability of ±0.1 K along the entire sensor cable length. It is free from false alarms, caused by natural ambient temperature fluctuations, due to intelligent evaluation algorithms.

##### **3.4.1.1 Important Features:**

- The controller represents the central control and evaluation unit, to continually, quickly, and reliably monitor temperatures.
- Alarm triggering via differential and maximum temperature evaluation

- Up to minimum 3 up to max 16 relay contacts each
- High temperature resolution of 0.1 °C with a repeatability of  $\pm 0.1$  K along the entire sensor cable length
- Free from false alarms, caused by natural ambient temperature fluctuations, due to intelligent evaluation algorithms
- Signaling of alarm and fault status to super ordinate systems via galvanically isolated relay contacts and/or data-interfaces with open data-protocols
- Highly durable via utilization of maintenance-free components in a modular configuration, RoHS compliant

### **3.4.2 Line Type Heat Detector Sensing Cable –Intelligent Addressable vis binary addressing**

#### **3.4.2.1 DESCRIPTION**

The hermetically sealed sensor cable contains small hybrid circuits (sensor) which, to be placed at every 1 or 2 or 4 or 7 or 10 meter intervals as per design and site requirement. The hybrids, which contain an integrated circuit with a defined address and a semiconductor temperature sensor, are electrically connected by a flat flexible cable. The flat flexible cable and temperature measuring points, are surrounded by a filling material, which in turn is covered by an aluminium shield protecting against EMI. A flame retarding, halogen free cable sheath completes the sealed structure of the sensor cable.

- Inside the heat measuring cable there are a large quantity of highly sensitive sensors, which report instantly the occurrence of noticeable increases in temperature or fixed temperature. The response behaviour of every single one of these sensors can be individually programmed, so that the cable adapts perfectly to its surrounding conditions and delivers highly relevant data to the system. Alarms can be localized very precisely - the distance between the sensors, which can be customize. The total lengthof the system may be up to a minimum of 350 meters x 2 runs meters or 99 + 99 sensors whichever is earlier per controller. There shall be minimum one controller for each zone measuring up to 1000-meter cable each.

Temperature information is passed on to an evaluation unit through the cable and there it is converted into calibrated temperature values i.e. temperature monitoring can be done using heat sensing cable.

#### **3.4.2.2 IMPORTANT FEATURES**

- Sensor Cable System shall be reliable and perfected system to analyse temperature data & fire detection
- There shall be minimum one controller for each zone measuring up to 1000-meter cable each.

- A fire alarm shall be generated if either a given maximum threshold is exceeded, or if an increase of temperature takes place within a certain time (differential evaluation). The two thresholds (set-points) can be set individually for definable alarm zones. The best way to avoid errors.
- Constant interrogation of the temperature sensors by the control unit every 10 seconds, a functional check of all temperature sensors is always given. Sensor Cable System should be able to detect and signal two or more fires.
- Damaged cable sections can be easily repaired by cutting out the damaged section and connecting a new piece in its place with the aid of sleeve joints. It should be maintenance- and adjustment-free and can be used in areas which are not or only partly accessible during normal operation.
- It is easy to change the pc-boards in the control unit. After switch on, the monitoring starts automatically.
- Components do not have to be calibrated or adjusted regularly
- All round aluminium shield against external electrical influences.
- Sensor cable route can be branched and fits to any requirement.
- The sensor cable reacts on heat radiation as well as on convectional heat
- The sensor cable shall be tested and approved at wind speed up to 10m/s.
- The sensor cable shall meet DIN EN and DIN EN 60332-1-2:2006-06 60332-2-2:2005-06 concerning FLAME spread and DIN EN 61034-2:2006-03 concerning smokey density. The Sensor cable is halogen free.

#### 3.4.2.3 Cable construction

- Hybrid circuits mounted on a flat flexible cable
- Filling material with strain relief
- Shield
- Cable sheath

#### 3.4.2.4 Sensor spacing

freely selectable; min. 0.5 m per sensor up to 20 mtr between each sensor

#### 3.4.2.5 Technical Specifications

- 0.1° resolution
- Measuring range: -40°C ... +120°C
- Cycling time < 10 sec ( 250m)

- Recurring accuracy  $\pm 0.1^\circ$
- Power rating < 5W – bi-directional sensors with fixed addresses
- A permanent functional check of all sensors
- Cable is halogen free and flame retardant
- Easy checking and repairs with modular system
- Operating range -40 °C....+85°C short period +120°C
- According to DIN VDE 0207, part 24
- Sheath color: grey
- Min. bending radius: 0.30 m

**TECHNICAL SPECIFICATIONS FOR DIGITAL PUBLIC ADDRESS AND VOICE EVACUATION:**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**Design Brief:**

- a. All floors (basement to 29<sup>th</sup> floors) are to be covered with speakers for open space and enclosed areas like cabins/conference/meeting cubicles/labs/elevators/lifts etc
- b. There will be 2 master controllers one for Basement to 19<sup>th</sup> floor and 2<sup>nd</sup> for 20<sup>th</sup> to 29<sup>th</sup> floor as per the specification which will be the heart of the system integrating speakers, amplifiers, microphone consoles, zone extenders (1 each for both master controllers) 30W volume controllers and rack mount music player (1 each for both master controllers).
- c. There will be a dedicated Digital Class-D power amplifier 4 x 250 watts, 100 volts between 2 floors in total 12 nos. (11 +1 spare) for the entire building in the following format
  - i. 4 nos. amplifiers for Basement, Ground, 14<sup>th</sup> to 19<sup>th</sup> floors
  - ii. 2 dedicated for 1<sup>st</sup> to 13<sup>th</sup> parking floors
  - iii. 5 nos. amplifiers for 19<sup>th</sup> to 29<sup>th</sup> floors
- d. There will be a dedicated microphone console at the following locations
  - i. BMS Room
  - ii. Ground floor Reception



iii. Reception on 17<sup>th</sup> floor

e. Please consider monitored 30W volume control boxes for enclosed areas like cabins/conference/meeting cubicles/labs/elevators/lifts etc

f. Entire PA system to be hardwired to Fire Alarm system for voice evacuation in case of fire incidence and with BMS system over 4 to 6 programmable outputs from both the master controllers connected to the DDC controllers in the BMS room

g. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for looping all devices to the fire alarm panel as per technical specifications.

**h. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

System Description:

The objective is to have an effective public address and evacuation system for the entire area. The system will combine all the essential EVAC functionality- such as zone wise paging & voice evacuation, event logging, digital mixing & feedback cancellation, digital message management and a relay-based fire alarm panel interfacing as per EN 54-16.

The system shall monitor all the peripherals such as speakers & speaker circuits, amplifiers, battery, voice messages, microphones etc as per EN 54-16 and EN 54-24 or UL. The system should be design and installed such a way so that the 0.5 STI (Speech Transmission Index) should be achieved. The system shall fully comply with IEC / EN60849 and BS5839 part 8 standards . The same also should be comply NFPA 72 codes and Indian Standard IS 2189.

The system consist of Master Controller with automatic voice generator, Digital Class D power amplifiers, Digital Programmable Microphone console, zone expanders for additional zones as required. Ceiling and wall mounted speakers to be used for the MTL occupied floors and the podium parking floors were it is occupied for operation purpose in the building as per the coverage norms.

**The system proposed should be seamlessly integrate with the fire alarm system and the Building Management System. System offered should comply with the tender technical specifications.**

1. APPLICABLE STANDARDS:

- EN 54-16: Components for fire alarm voice alarm systems. Voice alarm control and indicating equipment
- EN 54-24: Voice alarms - Loudspeakers
- BS 5839 part 8: Code of Practice for the design, installation and servicing of voice alarm systems

- EN60849: International Standards Sound Systems for Emergency Purposes
- NEN 2575: System and quality requirements and guidelines for locating of alarm devices
- DIN 0833-4: Planning, design, installation, commissioning, use and maintenance of voice alarm systems
- UL

## 2. Scope:

The contractor shall supply, install, test, connect and commission a high quality fast-acting Public Address and Voice Alarm System and Professional Audio System complying strictly as per the EN 54 standards. The system should be design and installed such a way so that the 0.5 STI (Speech Transmission Index) should be achieved as per EN 54-16 requirement.

The system should comprise of 24 bit digital signal processor, Monitoring Module as per EN 54-16, Digital Amplifier with Option of Battery power, High Quality monitored Speaker as per EN 54-24, Power supplies, Music Aux input, Paging announcement Microphone, Audio Rack and integrated with Fire alarm system.

The system shall provide Paging announcement from Microphone station, emergency message and /or background music simultaneously on different zone. The system should accommodate up to 64 nos programmable microphone console with (Monitored as per EN 54-16) working on RS 485 or LAN topology. The microphone console should have inbuilt preamplifier.

Prior to placing order for any equipment, the contractor shall submit comprehensive document comprising working drawings, catalogues and descriptive literature of components, acoustic calculation to meet with all relevant codes. The contractor shall be required to train and instruct client's personnel in the correct use, operation and supervision of the system, preferably prior to the handing over of the project. In order to ensure whole site integration capability, the fire and voice alarm system will be awarded to a single specialist local System Integrator who will be responsible for the design, global operation, management and interfacing of the system as defined in BS5839 part 1.

The contractor shall make sure that all power tapping of the speakers must be carried out as specified, even if the acoustic calculations indicates less power tapings. The back-ground noise of the project shall be considered 65dBA as minimum and 120dBA as maximum. The contactor must endure minimum of 0.5 STI is achieved.

The system shall be fully programmed to accommodate fire alarm and voice communication zones as indicated on the drawings and schematics. The system shall be configured to allow.

The system must have emergency battery backup in case of failure of Main 230 VAC power supply.

on site modifications with the minimum of disruption using the PC based software to facilitate future changes or alterations to the buildings.

The System shall be capable of identifying the Evacuation Zones via Software, and shall be able to Page, Evacuate, Alert zones as required by the Cause and Effect of the Fire Alarm without any limitation to the number of zones.

The System shall be capable of integrating with SIP based PBX system with zone selection via IVR menu.

The System must be able to seamlessly integrate with Fire alarm System over ESPA protocol. The hardwire integration is not allowed.

### 3. System Description:

The Digital Voice Command Centre located with the FACP, shall contain all equipment required for automatic voice evacuation, Public Address system, Audio Control, Audio Message configuration, Recorded Message storage, Back up for Audio files, Time bound Cause-n-Effect configuration, Audio Zone Selection & Annunciation and all other necessary accessories to complete the system requirements.

#### 4.1 Master Control Unit

The Controller unit is programmable with the software on each specific system configuration, with automatic and permanent monitoring of the system controller and the system components according to EN 50849, BS5839, NEN2575 and EN54-16. Programmable over network interface with code protected access to the processing unit and other components in the system. (modules , amplifiers and paging stations).

#### Features

- Monitored system processors for control of the voice alarm system
- Emergency operation for general call via analog microphone
- 24-bit digital signal processing
- Convenient programming by PC configuration software, individually programmable with 99 different priorities and layers
- Control of all processes in the system
- Possibility of simultaneous announcement and play background music in several lines, groups or zones
- Networking opportunity over LAN (optional) with several conditioning systems and connections, control and individual selection of loudspeaker lines by module extension.
- Management of digital and analog control inputs and outputs
- Interfaces for LAN (optional) , RS-485
- Remote control via microphone units, web server for touch panels (in preparation) and external control units

- Redundant audio network via LAN module with option
- Management for connection and control of one or more digital voice memory modules for playback of digital audio files
- Storage of programming and corresponding controlling of the system
- Monitoring of components according to EN 50849, EN 54-16, NEN 2575, BS 5839 standards
- 2 Input for microphone consoles
- 4 Input for analogue audio signals
- 2 Output for analogue audio signals
- 8 Input for monitored contacts
- 4 Output for floating contacts
- 1 Output for fault indication
- 8 free programmable LED's and buttons
- RC-16 connectivity for remote controls
- APS bus for extending with existing modules and amplifiers
- Service access per ethernet
- 10'000 log file entries
- Switch for network connections and SFP port
- Playback of MP3 files
- Audio and control data transfer between systems via local network
- Processing of audio signals with digital signal processor

### 3.3 VOIP Interface for connecting PAVA system to SIP based telephone system

Interface module for the connection of a loudspeaker system to the telephone installation. It should have

- Announcement from telephone to loudspeaker system
- Interface module for individual and collective calls from telephone keypad
- Automatic busy tone detection
- Programmable authorization recognition
- Up to 9 menu items programmable
- LAN-based device with built-in PC operating system Linux
- Function dialling with telephone keypad according to menu guidance
- Listening to the program of the installation

- Configuration of the module via Internet browser (GUI)
- SIP protocol

#### 4.5 Connection module for digital, serial microphone consoles

Processor controlled interface-module for up to 30 digital microphone consoles with 2 no's of RJ 45 socket for connecting of the system bus. Bi-directional digital data communication with digital microphone consoles for a max. distance of 2000 m. Optional with LAN-Interface for up to 256 digital VoIP microphone consoles. Integrated, programmable matrix function for connecting of the external signal to the system bus.

Technical characteristics:

Controlled by: microprocessor

Input: symmetrical

Input sensitivity: 775 mV

Output level: 0 dBm

Input impedance: 600 Ohm

Connection socket (external) : symmetrical, RJ 45 Connector

Controls for: volume, removable knob

Electromagnetic noise immunity: according EN 55024 / EN 301 489

Emitted interference: according EN 55022 / EN 300 220-1

Operating temperature: 5° C – 55° C..

#### 4.7 Digital , continuous line and line monitoring according to EN 54-16

Processor-controlled line and line monitoring with DSP technology for uninterrupted , permanent (even with music mode) automatic monitoring of up to 16 speaker lines (expandable) for short circuit , open circuit , short to ground and impedance change . High-precision error detection with DSP technology by load measurement, measurement of the phase shift between current and voltage. Determination of the average value from 64 measurements/sec. Displaying errors by front-side LEDs per speaker line. Setting and service operation using the rotary encoder on the front panel. Integrated display for menu-guided operation for :

- Individual deactivation of unused zones or for a service case .
- Lists detailed error analysis .
- Automatic calibration of each individual zone.
- Individual adjustment of the measuring tolerance for each individual zone .
- Maintenance and service
- Call the serial numbers, nominal and actual states

Further features

- Fault signal by collecting floating contact or / and internal fault propagation in the system to the higher-level monitoring module

- Fault memory in an error list in accordance with EN 54-16
- Automatic isolation of the defective speaker line in short-circuit
- Recognition of the re- functioning speaker line without a device reset
- Integrated system clock for watchdog circuit for accurate logging
- Programming and analysis by software.
- Permanent monitoring of each line without additional modules (eg end-of -line)
- No interruption of the line for voice announcements or background music with high-quality DSP technology
- with zone selection function

#### Technical characteristics

Control: DSP processor + co-processor

Power supply: 17 VDC / system

Display: 18 LEDs, LCD display

Inputs: 16-pin terminal connector

Outputs: 16 screw-terminal connector

System: 2 x D-sub 25-pin

CE Conformity: EN 54-16

Electromagnetic. Immunity: to EN 55024 / EN 301 489

Emission standard: according to EN 55022 / EN 300220-1

Operating temperature: -5 ° C - 50 ° C

#### 4.8 Digital Class-D power amplifier 4 x 250 watts, 100 volts

Digital, fully monitored, convection cooled power amplifier, with a continuous output of 4 x 250 watts especially for applications in emergency evacuation warning systems and voice alarm systems according to EN 54-16. The amplifier has a micro-controller including digital fault management and emergency charging electronics for standards-compliant, redundant supply of emergency power unit . The programmable 6 x 4 matrix, the 4 internal digital and 2 external analog LF buses can be set system-specific in the software on each amplifier channel . The power amplifier features a high efficiency, low waste heat from the components, and low power consumption by the digital circuitry.

#### Other performance

- Digital switching power supplies
- High-quality output transformer
- Electronically balanced audio input via XLR jacks
- High-impedance outputs via screw-clamp connectors
- Built in Noise Cancellation
- Speaker output: 100 V
- Emergency power input and output for 48 volt emergency power
- Integrated Digital Charging electronics in support of the emergency device according to EN 54-4
- Complete internal monitoring according to EN 54-16 and BS 5839 (audio signal, output

impedance , ground fault, etc. )

- Serial data bus according to EN 54-16 and BS 5839 for information to the monitoring module
- Digital Bus 2 x DB bus
- 2 x analog audio input per amplifier 0 dB XLR 3-pin , symmetric miscible with system bus.
- 4 x digital audio input per amplifier system bus
- 6 x 4 matrix programmable via software
- Separate volume control for each amplifier stage separately for announcement, alarm and music transmission (knobs removable to prevent incorrect handling)
- A housing address (device ID) per amplifier
- Protection circuits against overload, short circuit, open circuit, overvoltage, power failure, battery failure, data communications failure , thermal overload
- Integrated amplifier monitoring in combination with processor module with front LED per amplifier for the display of defect or failure
- Integrated digital disaster selector for automatic locking on the backup amplifier
- Integrated temperature sensor and connector for an external temperature sensor
- Level meter per channel via LED chain (5 LEDs) for visual level monitoring
- Activatable standby mode

Technical characteristics

Controlling: Microprocessor

Power supply: 230 VAC + / - 10 %

Rated frequency: 50 - 60 Hz

Emergency power supply: 48 VDC

Signal to noise ratio : 84 dB

Signal to noise ratio : > 94 dB

Input Sensitivity: 10 kilohms , balanced

Frequency range: 30 Hz - 20,000 Hz , -3dB

Output Power: 2 x 250 watts ( IEC268-3/19.4 )

Output voltage: 100 volts

CE Conformity: EN 54 -16: 2008

Electromagnetic. Immunity: to EN 55024 / EN 301 489

Emission standard: according to EN 55022 / EN 300220-1

Operating temperature: -5° C - 50° C

4.9 Digital , programmable microphone console, monitored

Microprocessor -controlled digital microphone console for operating the entire voice alarm system in case of fire and normal operation, the transmission of fire announcements, but also of information and call announcements. A manual triggering of alarm signals and the stored emergency announcements, as well as for the selection of speaker lines and groups. Suitable for connection of up to 30 other digital microphone consoles to one input module of the system on a bi -directional communication channel, with permanent monitoring of the

microphone capsule and the processor including serial data exchange with the processor-controlled monitoring CPU to EN 54-16 . Dynamic gooseneck microphone with acoustic monitoring of the microphone capsule by test frequency. 48 freely programmable keys with LED indicator lights in 2 levels, for 16 additional freely programmable additional functions. 3 lighted, monitored push-buttons protected with plastic cover (such as home alarm, amok, gong tripping). A built-in buzzer provides for signalling of fault message conditions.

#### Other line features

- Stable-designed plastic housing, desk form
- LED status indicators for power, alarm, fault and occupied
- Gooseneck microphone
- Microphone preamp with limiter
- 48 programmable keys, each for two levels
- Each button has a 3 colour LED with blue, red, yellow for visualization
- Programmable timer function for each key
- Sound and volume control on the console
- Additional unit with built-in speakers (optional) for control or intercom purposes
- Volume control for intercom between the microphone consoles and between headquarters and delegate units
- Starting with 0 dBm, symm, for serial data transfer.
- Built-in generator for periodic monitoring of NF- line and the microphone capsule

#### Keys can be programmed

- Fire announcement in all loudspeaker lines and groups
- Fire announcement in single loudspeaker lines
- Evacuation signal in all loudspeaker lines and groups
- Evacuation signal single loudspeaker lines
- Announcement in all loudspeaker lines and groups
- Traffic into individual speaker lines and groups
- Background music in all loudspeaker lines and groups
- Background music in single loudspeaker lines
- Selection of individual loudspeaker lines

#### Clear selection -

- Volume control background music
- Volume control announcement
- Display the automatic mode
- Evacuation signal
- Display general announcement
- Show background music
- Delete



Technical characteristics

Control: Microprocessor

Power supply: 17 VDC / system

Display: 8 + 3 LEDs

Levels: 2 (freely programmable)

Port ( external) : XLR, 6-pole

Frequency response: 200 Hz - 12,500 Hz

Microphone Gooseneck (235mm), dynamic

Nominal impedance: 200 ohms

Audio output: transformer balanced, 600 ohms ( 0.775 V)

Execution as a LAN station

CE Conformity: EN 54 -16

Electromagnetic immunity: to EN 55024 / EN 301 489

Emission standard: according to EN 55022 / EN 300220-1

Product safety: according to EN 60950 / EN 60065

Operating temperature: -5 ° C - 50 ° C

relative humidity : 25% to 90 %

#### 4.10 EN 54-24 Ceiling speaker

EN 54-24 certified 6W Ceiling speaker with maximum SPL of 99.1 db @6W/1m. It must have sensitivity of Sensitivity (1 W/ 1 m) 91.3 dB. The speaker should have 1.5W/3W/6W tapping. It should be of EV-Version with ceramic terminal and thermal fuse and with IP 44 protection.

Specification:

Loudspeaker system 1-way

Nominal noise power 100 V 1.5 / 3 / 6 W

Nominal noise power 8 Ω 6 W

Nominal impedance 100 V 6667 / 3333 / 1667 Ω

Sensitivity (1 W / 1 m) 91.3 dB

Sensitivity (1 W / 4 m) 77.9 dB

Maximum SPL (6 W / 1 m) 99.1 dB

Maximum SPL (6 W / 4 m) 85.7 dB

Frequency range (-10 dB) 140–16'000 Hz

Coverage angle (-6 dB) H 180° / 180° / 180° / 68°

(0.5 / 1 / 2 / 4 kHz) V 180° / 180° / 180° / 68°

#### 4.10 EN 54-24 Wall Mounted speaker

EN 54-24 certified 6W wall mounted speaker with maximum SPL of 99.1 db @6W/1m. It must have sensitivity of Sensitivity (1 W/ 1 m) 91.3 dB. The speaker should have 1.5W/3W/6W tapping. It should be of EV-Version with ceramic terminal and thermal fuse and with IP 44 protection.

Specification:

Loudspeaker system 1-way

Nominal noise power 100 V 1.5 / 3 / 6 W

Nominal noise power 8 Ω 6 W

Nominal impedance 100 V 6667 / 3333 / 1667 Ω

Sensitivity (1 W / 1 m) 91.3 dB

Sensitivity (1 W / 4 m) 77.9 dB

Maximum SPL (6 W / 1 m) 99.1 dB

Maximum SPL (6 W / 4 m) 85.7 dB

Frequency range (-10 dB) 140–16'000 Hz

Coverage angle (-6 dB) H 180° / 180° / 180° / 68°

(0.5 / 1 / 2 / 4 kHz) V 180° / 180° / 180° / 68°

#### TECHNICAL SPECIFICATION FOR IG541 INERT GAS SUPPRESSION SYSTEM

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**Design Brief:**

**Makes: TYCO/SIEMENS/KIDDE**

a. OEM certified IG541 monitored gas suppression system is applicable to the following areas on each floor. design calculation. There will be 2 centralized banks in the entire building mounted in the ground floor or basement

i. Bank-1 will consist of 7 floors Ground, 14<sup>th</sup> to 19<sup>th</sup> floor

- ii. Bank-2 will consist of 10 floors 19<sup>th</sup> to 29<sup>th</sup> floor
- iii. 2 nos. server rooms + 2 nos. electrical rooms on each floor so total 4 X 17 floors = 68 nos. + 2 critical material testing Labs = 70 areas. (Gnd + 14<sup>th</sup> to 29<sup>th</sup> floors) Dimensions 5 X5 mts each room. Ceiling void 800 mm, room void 2200 and floor void 600 mm.
- iv. 2 nos. critical material testing labs as per MTL teams. Dimensions 15 X 15 Mts
- b. The Electrical Actuator with provision for monitoring of actuator mounting, actuator connection fault and maintenance locking at the BMS
- c. VDS Approved Pressure Regulator (Constant Discharge Technology) to be used for each cylinder to reduce the pressure from 300bar to 60bar before the manifold
- d. Proper installation completion commissioning of the system as per OEM standards including any reset tools required to successfully complete the job
- e. All necessary warning signs to be included as per industry standards including individual manual abort and release switches for each room under gas suppression system.
- f. All cylinders to seamlessly integrate with building BMS system for monitoring over hard points
- g. Fire Survival cable resistance to Fire @ 950 deg.C for min. 2hrs. to be used for all signal cabling as per technical specifications.
- h. Please submit OEM software certified design sheet for gas qty, cylinder size and nozzle qty with the technical submissions.

Main Benefits of the Fire Suppression System with Inert Gas IG 541 is 100% green/ environmentally friendly, due to its composition of gases existing in the environment. Saves lives and its safe for occupied spaces. Protects assets without damaging property or equipment

The system shall be an IG 541 total flooding, gaseous, clean agent, fire suppression system designed to provide a uniform concentration within the protected area.

Provide 300 Bars IG 541 with constant discharge technology (which reduces the cylinder pressure from 300bar to 60bar before the manifold) gas suppression system for above mentioned rooms in accordance with NFPA 2001.

Include all necessary components like cylinders, discharge nozzles, actuators, flexible hoses,

DP switch, warning sign boards, piping, stands etc to make the system complete.

**Include all necessary items required to make the system complete and working at all times**

**The Gas Release module should be of the same make as the proposed Fire Alarm System and the gas suppression system will be hard wired to Building Management System and comply with the tender makes and specifications.**

The system should comply to the tender specifications.

#### Part - 1: Gas Suppression System

##### 1.1 General

- (1) Provide 300 Bars IG 541 with constant discharge technology (which reduces the cylinder pressure from 300bar to 60bar before the manifold) gas suppression system for above mentioned rooms in accordance with NFPA 2001.
- (2) Provide all engineering design and materials for a complete gas suppression system including IG 541 storage cylinders (For Server Room and critical material testing labs as required. Minimum 3 independent system), nozzles, and all other equipment's necessary for a complete operational system. The control panels, detectors, wiring etc. shall be part of Fire Alarm system.
- (3) Safety Requirements: Safety items such that personnel training, warning signs, discharge alarms, evacuation plan shall be part of the scope
- (4) Electrical Clearance: All system components shall be located to maintain no less than minimum clearance required from energized electrical hazards. NFPA-70 shall be considered as reference to determine the minimum distance requirements.
- (5) The Gas agent containers shall contain nameplate showing pressurization level, level of container and nominal agent volume.
- (6) A flow test using Nitrogen or Inert gas shall be performed on the piping network to verify that the flow is continues and that the piping and the nozzles are unobstructed.
  
- (7) The type of inert gas selected shall have the following characteristics: -

- a) Zero ozone depletion potential.
  - b) Zero global warming potential.
  - c) Suitable for use in human occupied rooms i.e., the gas at its design concentration shall be safe for human to stay in the protected room for a time duration specified by the codes.
  - d) The gas is widely used in around the world.
  
- (8) The system shall be designed for the largest risk volume along with the selector valves covering all the zone with centralized bank.
  
- (9) All components of the inert gas system shall be specifically listed or acceptable and must be interchangeable.
  
- (10) All total flooding systems shall have the enclosure examined and tested to locate and then effectively seal any significant air leaks that could result in a failure of the enclosure to hold the concentration level for the specified holding period. The preferred method is using a blower door fan unit.

#### 1.2 Submittals

- (1) Contract Drawings & Specifications which may be issued with tender are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of nozzles and piping and cylinder location.
  
- (2) Submit shop drawings of all Plant and materials including layouts for Strong Room (Minimum scale of 1:50 with required sections), showing exact location of supports, flanges, bends, tee connections, reducers, detailed piping and type of supports, valves, fittings etc. and get the shop drawings finally approved from Consultant / Client or his authorized representative.
  
- (3) Each item of Plant/material proposed shall be a standard catalogue product of an established Manufacturer strictly from the approved list of Manufacturers.
  
- (4) Approval of shop drawings and other submittals shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are

- approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the General Contractor (GC) of the responsibility or requirement to furnish material and perform work as required by the contract.
- (5) Maximum headroom and space shall be maintained at all points. Where headroom appears inadequate, the General Contractor (GC) shall notify the General Contractor (GC) or his authorized representative before submitting the shop drawings.
  - (6) Furnish sequence of operation, electrical schematics and connection diagrams completely describing the operation of the clean agent (IG 541) fire suppression system controls.
  - (7) Product Data: Furnish a material list with technical data documenting the primary function, quality, and performance of each system to be used in the Work. Furnish a listing for each of the following. Refer Fire Alarm System for the technical specifications of control panel, initiating devices, notification devices and sequence of operation.
    - (a) Air Aspiration / Multi-sensor Detectors / Heat Detectors (Part of Fire alarm system)
    - (b) Manual discharge switches.
    - (c) Control panel. (Part of fire alarm system)
    - (d) Alarm devices. (Part of Fire alarm system)
    - (e) Agent storage cylinders and mounting brackets.
    - (f) Discharge nozzles- with silencer.
    - (g) Abort stations.
    - (h) Piping network.
    - (i) Computer flow calculations.
  - (8) General Contractor (GC) shall determine the location of notification appliances; manual remote pull stations abort switches, bell, sounders, visual strobes and submit detailed shop drawing showing the location of all mentioned appliances along with detectors and fire alarm control panel.
  - (9) Supplementary Product Literature: Submit for General Contractor (GC)'s information. Furnish manufacturer's literature describing the general properties of each product to be used in the Work.
  - (10) Calculations: Submit for Consultant/ Client information. Furnish calculations using a UL Listed / FM Approved / VDS Approved Computerized Program for verification of flow calculations for the clean agent (IG 541) fire suppression system. One or

more room flow calculation must be calculated by the OEM as part of authentication for the proposed system to the Consultant/End-User.

- (11) **Quality Control Testing and Inspection Reports:** Submit for Consultant / Client information. Furnish reports of the Quality Control testing and inspection.

### 1.3 System Description for IG-541 Gas Suppression System

- (1) Furnish engineering design and materials for a complete clean agent (IG 541) fire suppression system including charged storage cylinders, nozzles, detectors, control panel, wiring, annunciators, alarm and all other Plant necessary for a complete operational system in accordance with NFPA2001, NFPA 72, and NFPA 70
- (2) The system shall be an IG 541 total flooding, gaseous, clean agent, fire suppression system designed to provide a uniform concentration within the protected area.
- (3) The amount of IG 541 to be provided shall be the amount required to obtain a uniform (minimum) design concentration of 38.5% for Class C classification, required to extinguish the fire and avoid re-ignition with the risk and as required by NFPA 2001, Latest Edition with a hold time for 10 minutes.
- (4) Take into consideration such factors as enclosable openings (if any), time required for dampers to close (and requirements for any additional dampers), and any other feature of the facility that could affect concentration.
- (5) Since large quantities of clean agent (IG 541) would be dumped in case of fire, adequate provisions shall be made to relieve the excess pressure through adequate pressure relief vents (gravity louvers) as recommended from the software calculations of the original Plant Manufacturer.
- (6) The necessary dump test shall be carried out by General Contractor (GC) in presence of Consultant / Client or his authorized representative for the smallest risk area. Also, Relevant data of the silent nozzles sound level tested must be submitted
- (7) Necessary warning signs shall be displaced in and near each risk (entry and exit) envisaged for clean agent (IG 541) Gas Suppression.

- (8) Provide a permanently piped, fixed nozzle type fire suppression system with all pertinent components furnished by a single Manufacturer and installed in accordance with the Manufacturer's instructions.
- (9) Comply with requirements of the authorities having jurisdiction.
- (10) Design criteria
  - (a) Standard Code: NFPA-2001
  - (b) Temperature of Risk: 21Deg C to 24 deg C
  - (c) Design Concentration 38.5%
  - (d) Cylinder Capacity As per Manufacturer recommendations
  - (e) Flooding Factor As per NFPA 2001
  - (f) Discharge Time 120 Seconds
  - (g) Design Pressure; Upstream 300 Bars
  - (h) Design Pressure; Downstream As per calculation
  - (i) Nozzle Type 360°/180°
  - (j) Nozzle Coverage (L x B) As per UL/VdS Approval
  - (k) Altitude correction factor as per Manufacturer

#### 1.1 Pipe and Fittings (for IG-541 Systems)

- (1) Provide system piping of non-combustible material having physical & chemical characteristics such that its integrity under stress can be predicted with reliability.
- (2) Manifold / Upstream Piping & Fittings:
  - (a) **Pipe:** ASTM A 106A / ASTM A-53A Seamless, Schedule 160. The minimum design pressure for piping shall be adjusted to the maximum pressure in cylinder at maximum expected temperature.
  - (b) **Fittings:** Forged Steel, Threaded. The minimum design pressure for fittings shall be adjusted to the maximum pressure in cylinder at maximum expected temperature.



(3) Downstream Piping and Fittings

- (a) **Pipe:** ASTM A 106A / ASTM A-53A Seamless, Schedule 40. The minimum design pressure for fittings shall be adjusted to the maximum pressure in downstream as per calculations at maximum expected temperature.
- (b) **Fittings:** Forged Steel, Threaded. The minimum design pressure for fittings shall be adjusted to the maximum pressure in downstream at maximum expected temperature, as per calculations.

- (4) Use piping joints suitable for the design conditions and selected with consideration of joint tightness and mechanical strength. The Threads used in joints and fittings shall confirm to ANSI B1.20.1, standards for pipe threads. Joint compound, tape or thread lubricant shall be applied to male threads of joint only. Melting and brazing alloy shall have a melting point above 1000° F. The welding shall be done to meet all requirements of NFPA-2001, latest edition.

1.1.1 Extinguishing Agent

- (1) IG 541 (Nitrogen 52%, Argon 40%, Carbon dioxide 8%). – For Server Room and critical material testing labs

The manufacturer/General Contractor must have and /or provide reference for storage and refilling station with currently valid PESO approval, for both gaseous agent during / after the execution of the project. This is important to ensure that the refilling of the extinguishing agent can be done within 48 hours of release of the agent due to either fire or by accidental discharge. The filling station and the technical staff must be certified by the manufacturer to ensure that the refill procedures are followed to the original manufacturer's standard. OEM Manufactures Authorisation Letter to be submitted during along with the tender to ensure 100% sales& service support during and after execution.

1.1.2 IG-541 Clean Agent Storage Cylinders and Brackets

- (1) UL Listed / VDS Approved
- (2) **Cylinder Assembly:** Provide cylinder assembly of steel construction with standard red epoxy paint finish, hydro tested as per IS7285 Part II. Cylinders shall be

accompanied by original Manufacturer's test certificate, CCOE Nagpur approval and third-party inspection certificate confirming the contents of the cylinder.

- (3) The cylinders shall be from OEM Manufacturers only as per tender list of makes. Equip each cylinder with a pressure seat-type valve and gauge. Construct each valve of forged brass and attach to the cylinder providing a leak tight seal. Include a safety pressure relief device on each valve. Furnish a welded steel bracket with each cylinder assembly for holding the cylinders in a saddle with a front bracket piece that secures the cylinders. The brackets shall be modular in design to allow added bracketing or stacking of cylinders depending on installation requirements.
- (4) Cylinder shall be provided with a certificate provided by the company who charge the vessel with the IG 541 gas mixture. The certificate shall be secured around the cylinder with a chain fastener.
- (5) Each cylinder shall be fitted with a dial faced type pressure gauge with a range from 0 to 350 bars.
- (6) MANIFOLD: Each of the cylinders shall be interconnected with a manifold of suitable schedule and pressure rating along with necessary treadles/weldolets. Each branch connection from the manifold to a vessel shall be fitted with a brass non return valve assembly.
- (7) The cylinders shall be located within the hazard area, or as near as possible, to reduce the amount of pipe and fittings required installing the system.
- (8) Master cylinder shall be actuated by an automatic resettable electric actuator. Master cylinder shall have valve with a removable electrical actuator. Permanent integrated solenoid actuator on the valve shall not be accepted.

#### 1.1.3 Cylinder Discharge Valve

Each Cylinder shall be fitted with a quick action discharge valve. Cylinder valve must be PESO along with UL/VdS approved.

Pressure Gauge provided must have an in-built low-pressure supervisory switch. The pressure gauge must have the provision of connecting to the valve on site and must not be prefixed from the OEM factory.

The system pressure from 300bar to 60bar must be reduced before the manifold and not at/after the manifold level.

- Electric Actuation (For IG-541 Systems)

- (1) General: Provide electric valve actuators of brass construction and of stackable design with swivel connections to allow removal of actuators for maintenance or testing. Actuation devices shall be UL Listed/ VDS Approved for use with the clean agent system.
- (2) The necessary tool required for resetting of actuator once operated shall be part of system.
- (3) The booster actuator shall be directly mounted on cylinder components with reset tool after actuation.
- (4) The Manual lever release actuator shall be provided for manual means of actuating cylinder valve. This shall be provided with cable actuation in conjunction with remote pull station.
- (5) Electric actuator shall have blocking mechanism for maintenance purpose.

#### 1.1.4 Remote Pull Stations (for IG-541 systems)

- (1) General: Provide double action manual releasing stations at each exit of the protected area, as shown in drawings, and when activated, immediately releases the gas agent and causes all audible / visual alarms to activate. In addition, activation of the manual releasing stations causes immediate shutdown of air and power circuits. Manual release unit casings shall be coloured and shall be inscribed with the lettering "MANUAL RELEASE POINT".
- (2) The Manual pull station shall have a glass break window and a spring mounted handle which rotates forward for use, once the glass is broken. Necessary pulley elbow shall be provided, if required, to provide immediate changes in pull cable direction.
- (3) 1.5mm dia cable constructed of stranded, stainless steel wire shall be used to attach remote pull station to cylinder valve, pull equalizers and control boxes. This cable assembly shall be inclusive of brass swaged end filling for attaching to the remote pull station.
- (4) Forged brass corner pulley shall be used to provide 90o change in direction of cable as required.
- (5) Mounting heights for manual release units shall be as agreed on site.
- (6) Auto-manual lock off unit outside the protected area shall be provided for keeping the system in auto/manual mode.

1.1.5 Discharge Hose (For IG-541 Systems)

UL Listed / VDS Approved extra heavy flexible hose which connects the discharge outlet of cylinder to header manifold shall be used. It shall be with female thread at one end for connection to cylinder valve and male thread at other end for connection with header manifold. The withstand pressure of discharge hose shall not be less than two times the system pressure. Each discharge hose shall be provided with in-built check valve that prevents the loss of agent while cylinder is removed.

1.1.6 Check Valve (For IG-541 Systems)

UL Listed / VDS Approved, Bronze body, threaded type checks valve shall be used on system to prevent pressurization of reserve cylinder bank.

1.1.7 Header Vent Plug (For IG-541 Systems)

Brass body, Bronze spring and Neoprene seal type header vent plug shall be provided in the system to release low pressure build-up due to closed system. These in addition to end of manifold header, shall be installed on cylinder side of check valve on main bank and reserve bank cylinder, to relieve any pressure that may leak past the check valve and accidentally actuate the reserve system while main is discharging.

1.1.8 Pressure Switch (For IG-541 Systems)

The pressure switch in malleable iron housing, SS/brass piston shall be provided to open or close necessary electric circuits when agent is discharged. The minimum operating pressure required is 3.5 bars or as per OEM recommendations.

1.1.9 Name Plate / Warning Plate (for IG-541 Systems)

- (1) Aluminium name plates shall be provided in each gas bank showing "MAIN" and "RESERVE" as required.
- (2) Aluminium warning plates shall be provided inside the risk area stating to vacate the area when alarm sounds.
- (3) Aluminium warning plates shall be provided outside the risk area, stating that space protected by gas suppression system, and no one should enter after discharge without being protected.

1.1.10 Selector Valve (not applicable for this project)

- (1) Selector valves shall be VdS/ UL Listed / FM / CE Approved
- (2) Selector valve shall be provided to protect zones where multiple protected zones are in a building.
- (3) Selector valves shall be installed for zones wise so that the Inert gas can be discharged into the rooms.

- (4) A nitrogen line from pilot cylinder(s) shall be connected to each selector valve to open the valve by nitrogen pressure when an electric actuator on each pilot cylinder is activated.

#### 1.1.11 Discharge Nozzles (for IG-541 systems)

- (1) Provide two-piece construction discharge nozzles, sized to provide flow rates in accordance with system design flow calculations and marked with the Manufacturer's part number. Thread the nozzles directly to the discharge piping without using special adapters. Nozzle must be UL/VdS approved.
- (2) Nozzle(s) shall be designed and located so that uniform concentrations are obtained in all parts of the protected room. Therefore, each nozzle shall be identified for its location and orifice size and so on. The identification of each nozzle shall be listed on the nozzle body and designated on the plan drawing.
- (3) Include a UL Listed / VDS Approved nozzle inlet orifice plate/hole, size as determined by the computerized UL Listed / VDS Approved flow calculation program.

#### 1.1.12 Remote Indicator (for IG-541 Systems)

Remote lamp units shall be provided to give indication of an activated Smoke detector within a ceiling or floor void.

#### 1.1.13 Abort Switch Stations (for IG-541 Systems)

- (1) General: Provide abort stations at each exit of the protected area and, when operated, interrupts the discharge of clean agent and emergency power-off functions. Provide abort stations that are momentary devices (dead-man) requiring constant pressure to maintain contact closure. Manual releasing station activation overrides any abort switch operation. Abort switch operation shall comply with UL guidelines.
- (2) System Abort: If the abort switch is initiated before the automatic discharge delay expires, the system will prevent agent release and the automatic delay timer will stop. When the abort switch is restored, the automatic delay timer will resume from the stop point and agent release will occur with the expiration of the timer.

## 1.2 Execution

Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Identify conditions detrimental to the proper and timely completion of the Work.

- (1) Do not allow painting of nameplates, labels, placards, tags, stainless steel or plated items as valve stems, levers, handles, trim strips, etc. Ensure that fire protection Plant, devices and apparatus and exposed fire protection piping is painted.
- (2) Install piping in accordance with good commercial practice, securely supported with hangers and arranged with close attention to the design layout so as not to alter the calculated design flow performance. Bracket piping within 300 mm of all discharge nozzles.
- (3) The installing General Contractor (GC) shall be trained by the supplier to design, install, test, and maintain fire suppression systems.
- (4) The installing General Contractor (GC) shall be an experienced firm regularly engaged in the installation of automatic clean agent, or similar, fire suppression systems, in strict accordance with all applicable codes and standards.
- (5) The installing General Contractor (GC) must have a minimum of five (5) years of experience in the design, installation, and testing, of clean agent, or similar fire suppression systems. A list of systems of a similar nature and scope shall be provided on request.
- (6) The installing General Contractor (GC) shall maintain, or have access to, a clean agent recharging station. The installing General Contractor (GC) shall provide proof of his ability to recharge the largest clean agent system within 48 hours after a discharge. Include the amount of bulk agent storage available.
- (7) The installing General Contractor (GC) shall be an authorized stocking distributor of the clean agent system equipment so that immediate replacement parts are available from inventory.
- (8) A room pressurization test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retro- Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.

## 1.2 Preparation

Do not allow painting of nameplates, labels, placards, tags, stainless steel or plated items as valve stems, levers, handles, trim strips, etc. Ensure that fire protection Plant, devices and apparatus and exposed fire protection piping is painted in Standard Color, Fire Protection Red; unless otherwise directed by the General Contractor (GC).

#### 1.4 Identification

- (1) General: Identification shall be in English and/or Hindi in accordance with requirements of the local authority having jurisdiction, including, but not necessarily limited to the following.
  - (a) Piping.
  - (b) Control valves and test valves.
  - (c) Fire suppression Plant and devices.
  - (d) Control panels.
  - (e) Valve and alarm device schedules.
- (2) Plant and Pipe Identification: Stencil 40 mm high white enamel block type characters on each item of Plant for identification purposes. Also, provide a complete system of pipe identification stencils or labels adjacent to each valve and branch take-off, and at not over 15 m intervals along runs of pipe, with flow arrows at each marking. Use a contrasting colour to the finish coating of the piping, either white or red, for pipe identification stencilling or labels.
- (3) Valve and Device Identification Tags and Signs: Identify valves in main piping, control valves, and alarm devices with 25 mm diameter brass tags, secured to valve or device with brass S-hook or jack chain, and numbered consecutively, as identified on the Valve and Alarm Device Schedule.

#### 1.5 Installation

##### (1) Mechanical Installation

- (a) Install piping in accordance with good commercial practice, securely supported with hangers and arranged with close attention to the design layout so as not to alter the calculated design flow performance.
- (b) Bracket piping within 300 mm of all discharge nozzles.
- (c) Ream, blown clear and swab piping with appropriate solvent to remove mill varnish and cutting oils before assembly.
- (d) Multi-outlet fittings other than tees are not permitted.

- (e) Assembly of all joints shall conform to the appropriate standards. For threaded pipe joints, utilize Teflon tape applied to the male threads only.

## **(2) Electrical Installation**

- (a) All wiring associated with the system shall be FP200, Twisted shielded armoured /unarmoured FRLS cables. Cables shall generally be either clipped to structural soft fit, slab, walls or timber ceiling rafters.

Sequence of Operation (IG-541 for Server, Electrical Room & Critical Testing Labs)

- (1) The clean agent fire suppression system (IG 541) for rooms specified above area shall automatically actuate by operation of two nos of multi-sensor detectors of that data hall. The Air Aspiration detection system installed in rooms specified above shall be for early notification.
- (2) Activation of any detector in the hall zone shall activate the "first-detector" functions described below. Activation of second detector shall start the "confirmation sequence" below. Each interface shall provide supervised connections for: two agent release solenoid valves, two supervised pre-release notification circuits, a supervised manual release circuit, and a supervised abort switch circuit.
- (3) Upon operation of the "first detector" associated with the protected area the system shall:
  - (a) Activate fire alarm system in Fire Alarm Control Panel.
  - (b) Display activated initiating device on FACP and Network Control Station.
- (4) Upon confirmation of the alarm by a "second detector," the system shall:
  - (a) Display second activated initiating device on FACP and NCS.
  - (b) Activate visual pre-discharge notification appliances in protected area.
  - (c) Pulse the audible discharge notification appliances in the protected area.
  - (d) Start the manual discharge delay timer (adjustable). 15 minutes as per NFPA standards.
  - (e) Cause the audible discharge notification appliances in the protected area audible to sound continuously 10 seconds before agent release.



- (f) Activate the agent release selector switch at the expiration of the automatic discharge delay timer.

#### 1.6 Field Quality Control

- (1) **Maintenance and Operating Manuals:** Furnish complete manuals describing the materials, devices and procedures to be followed in operating, cleaning and maintaining the Work. Include Manufacturers' brochures and parts lists describing the actual materials used in the Work. Assemble manuals for component parts into single binders identified for each system.
- (2) **Training:** Prior to final acceptance, provide operational training in all concepts of the system to the Client's key personnel, consisting of the following:
  - (a) Control system operation.
  - (b) Trouble procedures.
  - (c) Abort procedures.
  - (d) Emergency procedures.
  - (e) Safety requirements.
  - (f) Demonstration of the system with nitrogen gas (excluding clean agent gas release).
- (3) **System Checkout and Testing:** Inspect the completed installation using factory authorized and trained personnel. Include a full operational test of all components in accordance with the Plant Manufacturer's recommendations (including agent discharge). Furnish a written certified report to the Consultant / Client
- (4) Perform the inspection in the presence of the General Contractor (GC) and insuring authority and/or the local authority having jurisdiction

#### 1.7 Adjusting

Upon completion of the Work repair surfaces that have been permanently stained, marred, or otherwise damaged. Replace Work which is damaged or cannot be adequately cleaned as directed.

#### **TECHNICAL SPECIFICATION OF ASPIRATING SMOKE DETECTION SYSTEM**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**Design Brief:**

**MAKES: XTRALIS/SIEMENS/SHRACK-SECUTRON**

a. OEM certified dual pipe, dual zone aspiration type smoke detection system with power supply dual chamber [replaceable] dust indicator is applicable to the following areas on each floor. Please check the correct dimensions for design calculation

i. 2 nos. server rooms + 2 electrical rooms on each floors so total 4 X 17 floors= 34 nos. (Gnd + 14<sup>th</sup> to 29<sup>th</sup> floors). (2nos. dual pipe, dual zone aspiration panels on each floor).  
Server & Electrical Room size 5 X 5 Mts  
Critical MTL Labs 15 X 15 mts

ii. 2 nos. critical material testing labs as per MTL teams. (2nos. dual pipe, dual zone aspiration panels on one single floor or two different floors) Total 34+6+1 spare =37 nos.

b. Aspiration grade 25 mm piping and associated accessories to be used for covering the entire area. Mapping of holes and piping to be designed and certified by the OEM software

c. All panels to seamlessly integrate with building BMS system over Modbus/Bacnet

All above panels will seamlessly integrate with the Fire Alarm Panel communication bus for better management of alarms and events and the Fire Alarm Panel in turn seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.

**Include all necessary items required to make the system complete and working at all times**

**Aspiration system description**

An aspirating smoke detector is offered which continuously takes air samples via a pipe network from a monitored room and feeds the samples to one or more smoke detectors. Airflow monitoring ensures that the sensor tube is continuously monitored for pipe breakage and sampling hole soiling.

The detection method should work under extreme ambient conditions conventional point detectors reach their limits.

- Difficult to access areas such as false ceilings, false floors, high-rack warehouses.
- In listed buildings or in aesthetically demanding indoor spaces where point detectors on the ceiling would disturb the décor.
- In areas where very high sensitivity is required, e.g. server rooms electrical & MTL Labs.
- If filters are used, dirty areas can also be monitored.

The aspirating smoke detector should be a new generation active smoke detection system. It does not wait until the smoke rises but rather sucks it in. This means it responds much faster and is more sensitive to incipient fires than conventional solutions.

In addition to soiling evaluation and pre-alarming, sensitivity of the detector can also be adjusted user-specifically. The system itself should detect the smallest glowing and smoldering fires and can be used practically anywhere.

The aspirating smoke detector should have two primary parts: 1 or 2 branchable sampling pipes with individual sampling holes and 1 or 2 small detection chambers. These contain 1 or 2 smoke sensors, a ventilator and the electronic evaluation circuit. The ventilator draws ambient air through the sampling points into the detection chamber(s) and feeds it to the smoke sensor. Smoke particles are registered immediately. If the threshold according to EN 54-20 is exceeded, an alarm is triggered.

The display functions include:

- Operation
- Fault
- Pipe breakage
- Pipe blockage
- Detector dusty/dirty
- Smoke sensor 1:
  - Prealarm 1, 2 and 3
  - Alarm smoke sensor 1
  - 10-level smoke level indicator
- Smoke sensor 2:
  - Prealarm 1, 2 and 3
  - Alarm smoke sensor 2
  - 10-level smoke level indicator

The control functions include:

- Power ON/OFF
- Smoke/airflow sensitivity
- State indicator

The aspirating smoke detector continuously takes air samples via two pipe networks from a monitored room/object and feeds the samples to a smoke sensor.

Technical design:

- Surface-mounted housing
- Two detection chambers,

- Integrated display and control panel for two sensors for which the labelling can be rotated 180 degrees if desired
- Reset buttons integrated in the display and control panel
- Potential-free reset input present as optocoupler
- All criteria (operation, alarm, fault) are visually displayed on the housing interface
- All criteria (alarm and fault) have a potential-free change-over contact and an optocoupler output
- Automatic monitoring of the airflow for sensor pipe breakage and blockage
- Five-level adjustable negative pressure production by the radial high pressure fan from 100 - 420 Pascal resulting in a very high airflow rate
- Smoke sensors and evaluation/display prints are located in chambers which are structurally separate from each other
- Operation noise minimum 32 dB (A) (for lowest fan level); even a medium fan level of 43 dB (A) complies with ISO 11690-1 (directive for low noise machine-equipped workshops)
- Protection type according to IEC 529 of IP 54
- 1 USB PC interface for integration with software for commissioning and maintenance of the system
- EasyConfig commissioning option without PC

- Sampling pipes / sampling holes:
  - Maximum possible system limits:
    - Max. length of the sampling pipe tube network per smoke sensor: 400 m (without EN 54-20 conformity) 300 m (with EN 54-20 conformity)
    - Max. number of sampling holes per smoke sensor: 120
    - Standards compliant calculation of the pipe topology with the software of the aspiration system suitable for planning asymmetrical pipe topologies

Technical data:

Supply voltage: 10.5 to 30 VDC

Power consumption: typically 290 mA (for 24 VDC)

Operating temperature range: -30°C to +60°C

Colour: RAL 2807005 / RAL 3002005

Protection type: IP 54

Dimensions (HxWxD): 397x265x146 mm

Weight: 3.85 kg

Compliant with EN 54-20

The system should be having all the necessary interface cards, memory, power supply lateres firmware so as to be able to connect to its own commissioning software (other than ease Standalone commissioning) and should include card for seamless integration with the BMS system. The system should be complete in all respect to make it functional and continuous operation in normal mode

## TECHNICAL SPECIFICATIONS FOR ULTRASONIC RODENT SYSTEM

(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)

### Design Brief:

**MAKES: VARNA/STAR/MASER/C-SYSTEMS**

- a. To cover all floors from Basement to the 29<sup>th</sup> floor in all voids @ 500 sq ft coverage per transducer.
- b. All transducers should be addressable and should not to be looped connected individual to the Rodent Repellent Panels
- c. Approx 40 transducers and 2 panels per floor for all floors from basement to 29<sup>th</sup> floors.
- d. All parking floors will have individual transducer for each car slot so total 455 for 13 floors and 26 panels including the other areas on each area also to be covered
- e. Please include verification Kit comprising of Ultrasound Wave Analyzer (Software and Hardware) for centralized management of the Rodent Repellent System
- f. All above panels will integrate with BMS over Modbus/Bacnet
- e. **Please refer the matrix for detailed floor wise break-up and tender technical specifications**

The objective is to protect the entire premises viz., all the voids against rodents. The purpose is to keep the rodents away from the floor by generating very high frequency soundwaves (above 20 Khz) which are not legible to human ear but irritates rodents. The objective is to protect all the cables below floor, above ceiling & room void from damage caused by rodents. All floors including the basement and all parking floors to be covered with digital rodent repellent transducers with individual transducers for each car slot and the surrounding areas in the car park to protect the entire building

Include a Kit comprising of Ultrasound Wave Analyzer (Software and Hardware) that can do the following: Capture, Record and Report (in pdf format) One Third Octave Ultrasound Band Frequencies emitted from the transducers thereby ensuring HUMAN SAFETY as per IRPA (International Radiation Protection Association, Geneva) Guidelines. b. Capture, Record and Report (in pdf format) ultrasound output from each transducer depicting

individual frequency peaks along with corresponding sound pressure levels, current operating band and the Controller Name for verifying the product.

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

SCOPE:

1. The system proposed is to protect all the equipments, areas with relevant type of high frequency sound producing device called satellites or transducers.
2. Once powered up these transducers produce very high frequency variable sound waves (above 20 Khz) continuously which irritate the rodents and are forced to evacuate the place.
3. The system shall cover 10000 sq.ft. area per controller for a dedicated connection and shall be able to connect minimum 20 transducers per controller in a dedicated connection. The transducers shall cover a minimum 500 sqft of area.
4. The devices can be tested periodically by means of a transducer testing facility provided on the Main console.

APPLICABLE STANDARD:

The OEM shall have an IDEMI and CFTRI certification for its products.

SYSTEM COMPONENTS:

#### 4.1 SATELLITES :

The satellites or Transducers shall be circular ceiling mounted low profile units that produce high decibel sound waves at very high frequency not less than 20 Khz. These satellites shall cover minimum 500 sq.ft. of area for Room void application, for ceiling Voids & floor void applications.

These shall be powered thru Main Controller to 20 satellites in dedicated connection.

#### 4.2 CONTROLLER :

The controller shall support 20 Transducers in a dedicated connection and shall come with MS Bracket. The controller is installed in the control / BMS room and the transducers in the problematic areas i.e. above and below false ceiling and below false flooring.

4.2.1 Features:

4.2.2 10000 Sq Feet for Dedicated Connection of Area Coverage per system/ Controller.

4.2.1.2 Shall drive up to 20 Transducers in a dedicated connection. With minimum @ 500sft coverage each.

4.2.1.3 Graphical LCD display with on-board controls for changing the following parameters.

4.2.1.3.1 Graphical representation of Wave Speed: Is an indicator for the number of frequency sweeps per minute. It can have a maximum value of 125 and a minimum value of 65. The incremental size is 20 i.e. 65,85,105 and 125.

4.2.1.3.2 Wave Density: Is an indicator for the number of divisions within a frequency band. It can have a maximum value of 100 and a minimum value of 70. The incremental size is 10 i.e.70,80,90 and 100.

4.2.1.3.3 Frequency Band Time: Is an indicator of the time for which the controller would operate in a pre-programmed frequency band. There are 4 bands available: Band A, Band B, Band C and Band

D. This parameter can have a maximum value of 10 minutes and a minimum value of 1 minute per band. Depending upon the time frame set for each band, the controller will switch bands automatically.

4.2.1.3.4 Machine/Controller ID: Is an indicator of the machine/controller identification number. It can have any value within the range of 1 to 255.

4.2.1.3.5 Password Protection: Every controller is password protected. To change the parameters mentioned above you have to key in the password. The password can be changed if required. The password can be any 4 digit number.

4.2.1.3.6 Frequency Testing: This feature will enable the user to test and verify the frequency that is being transmitted from the controller to the transducer. This feature would be particularly useful during systems audit.

4.2.1.3.7 Transducer Testing: All the 20 transducers can be tested in an audible range by using this feature.

- 4.2.1.3.8 Provision for restoring all the parameters to the factory default setting
  - 4.2.1.3.9 Inbuilt RS/EIA-485 transmission upto 1.2 kms to a protected area (BMS Room).
  - 4.2.1.3.10 Provision of a termination switch so that the controller data can be transferred to the computer and can be subsequently viewed by installing CRMS Software.
  - 4.2.1.3.11 Daisy chain protocol for interfacing 64 controllers (nodes).
  - 4.2.1.3.12 Transducer should cover minimum of 500 sq. feet of area above false ceiling, below false ceiling and below false flooring.
  - 4.2.1.3.13 Frequency band of > 20 KHz and <60 KHz is pre tuned for 100 different frequencies.
- 4.3 GUI Software Compatibility having the following Features:
- 4.3.1 Visual Representation of Adherence to Safety Standards for Continuous exposure to one third octave band airborne ultrasound frequencies as per IRPA Guidelines (International Radiation Protection Association) Geneva.
  - 4.3.2 Real Time Graphical Representation of the ultrasonic frequency band spectrum depicting the frequency oscillations within the current band.
  - 4.3.3 Facility to generate a consolidated pdf summary report of all controllers or detailed pdf report of an individual controller in real time or in a predefined schedule.
  - 4.3.4 Facility to configure controller parameters for all controllers in one go (broadcast) or for an individual controller.
  - 4.3.5 Facility to schedule / generate a consolidated Health Status Report of all the controllers and / or an individual controller. This is possible either with the help of the inbuilt scheduler (Daily, Weekly, Fortnightly and Monthly Schedules) or in real time.
  - 4.3.6 Individual folders for individual Controller reports with the folder name same as the machine id. This folder will contain the Report in PDF format and the PCB image of the corresponding controller. One single folder for the consolidated report. This folder will contain only the report in PDF report and shall depict the status of all controllers.
  - 4.3.7 PCB snapshot of the controller for faulty transducer driver.
  - 4.3.8 Admin Level password for report generation and scheduling.



- 4.3.9 Service Level password for parameter configuration of all / individual controllers.
- 4.3.10 Test facility to check if the signal is being transmitted to the transducers from the driver on the PCB.
- 4.3.11 Ping facility to check if all the controllers installed at the customer site are in the daisy chain network. If not then the Corresponding controller will have an 'Offline' status else it will have an 'Online' status.
- 4.3.12 Configurable ping acknowledgment/return time. This would be the time for which CRMS software would wait for the Controller to respond before it confirms the status of the controller as 'Online' or 'Offline'.
- 4.3.13 Test Facility to test all controllers in a sequential mode or in an individual mode.
- 4.3.14 Online servicing/maintenance via web meetings.
- 4.3.15 RS/ EIA 485 to RS/EIA 232C converter to transfer the controller data to the serial port of your computer
- 4.4 Testing, Commissioning & Verification Kit comprising of Ultrasound Wave Analyzer (Software and Hardware)that can do the following:
  - 4.5.1 Capture, Record and Report (in pdf format) One Third Octave Ultrasound Band Frequencies emitted from the transducers thereby ensuring HUMAN SAFETY as per IRPA (International Radiation Protection Association, Geneva) Guidelines.
  - 4.5.2 Capture, Record and Report (in pdf format) ultrasound output from each transducer depicting individual frequency peaks along with corresponding sound pressure levels, current operating band and the Controller Name for verifying the product.
  - 4.5.3 Modbus: Networkable on RS-485 with support for Hardwired Third Party BMS integration via Modbus.

#### **TECHNICAL SEPICIFICATIONS FOR DIGITAL WATER LEAK DETECTIONS**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

##### **Design Brief:**

##### **MAKES: C-SYSTEM/ELSA/TTK/PERMA**

- a. Digital water leak detection cable to cover all floors from Basement to the 29<sup>th</sup> floor for the following areas. Dimensions to be confirmed before commercial bid

- i. Server Rooms 2 nos./floor 2 X 17 = 34 Nos. (Approx Size 5 X 5 Mts)
  - ii. Electrical Rooms 2 nos./floor 2 X 17 = 34 Nos. (Approx Size 5 X 5 Mts)
  - iii. Material Testing Labs 3/floor X 5 = 15 nos. (Approx Size 15 X 15 Mts)
- b. Dedicated Main Leak Detection Panel - 10.1" Touch Screen Panel to installed on each floor (Total 17 nos.)
- c. WLD Sensor Interface Module (SIM) to be considered for the following areas which will be looped and connected to the above Main Detection panel. Total 83 Nos.
- i. Server Rooms 2 nos./floor 2 X 17 = 34 Nos.
  - ii. Electrical Rooms 2 nos./floor 2 X 17 = 34 Nos.
  - iii. Material Testing Labs 3/floor X 5 = 15 nos.
- d. All above display panels to be integrated with BMS over Modbus/Bacnet protocol
- e. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

**Include all necessary items required to make the system complete and working at all times**

#### **Main WLD Panel**

Main Leak Detection Panel - 10.1" Touch Screen Panel installed in metal enclosure with power supply, buzzer, field wire termination with inbuilt Modbus RTU port for BMS integration. Panel shall be 10.1" full color, high resolution SVGA display Touch Screen Panel provides a Graphic user interface to manage and display information from a network of up to 32 external leak detection circuits, capable of indicating the location of the water leak with +/- 1m accuracy, and maintaining event history of minimum 100 events having suitable LCD display, minimum of 8 numbers output circuits / programmable relays. 230V UPS power shall be provided to the master panel.

#### **WLD Sensor Interface Module (SIM)**

WLD Sensor Interface Module (SIM) with relay output, housed with suitable SMPS mounted in Industrial Grade Enclosure. 230V UPS power switch shall be provided to each Sensor Interface Module (SIM) locally by client. The Sensor Interface Module (SIM) shall be capable of monitoring maximum 100 meters of sensing cable length. The Monitoring sensor interfacemodule (SIM) shall have display to flash the leak location on contact with water including all accessories complete as per drawings, specifications, relevant standard

#### **Digital Water Leak Cable**

Embedded digital type Water Leak sensing cables with factory fitted connectors for digital & independent communication between each cable & Sensor Interface Module (SIM), and having identification/mapping tags, etc. all complete as per drawings, specifications, relevant standards

#### **TECHNICAL SPECIFICATIONS FOR CCTV SYSTEM**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

##### **Design Brief:**

##### **MAKES: PELCO/VIVOTEK/AXIS/AVIGILON**

- a. The CCTV system is applicable to the entire building in the following manner
  - i. Basement, Ground, Terrace and 1<sup>st</sup> to 19<sup>th</sup> floors will be covered entirely as detailed camera type and count matrix sheet
  - ii. 20<sup>th</sup> to 29<sup>th</sup> ( 10 floors) will be covered in the following areas
    - Lift lobby + Freight Lift
    - Server Rooms (2 nos.)
    - Electrical Rooms (2 nos.)
    - Fire Staircase (5 nos.)
- b. The CCTV system will consist of a combination of Video Management Software and 32 Channel NVR for storage for 550 camera system(min is 32 TB however follow point c for the correct HDD required). Please refer matrix for detailed floor requirements
- c. Recording @ H.265 Compression, 1080P/20FPS/continuous recording and storage for 90 days. (Include HDD calculator in technical offer) Bidders to Provide Storage Calculations to substantiate the storage requirements in the Tender. Necessary HDD to be included as per the above data
- d. Following are the types of cameras which will be used for the entire building
  - i. 2 MP varifocal motorized Indoor dome cameras
  - ii. 5 MP varifocal motorized Indoor dome cameras for Material testing labs

- iii. 2 MP varifocal motorized Indoor bullet cameras (3mm to 10 mm)
- iv. 2 MP varifocal motorized Outdoor bullet camera (12mm to 40 mm)
- v. PTZ Cameras for perimeter 32X
- c. Rack mount 3 nos. VMS Servers and 3 nos. client workstation based on 550 camera requirement.
- d. A 3 X 3 matrix of 55" Video Wall with necessary hardware to connect to servers and client workstations
- e. A Joystick/control board for managing the PTZ cameras
- f. 10 nos. of 4 to 6 mts MS powder coated 4" dia mounting poles for all outdoor cameras including complete civil work for installation.

**f. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

These technical specifications cover the requirements for designing, engineering, supplying, Delivering, Installing, Testing and Commissioning an IP CCTV Surveillance System. The standards applicable for the CCTV products to be supplied and integrated end-to end for smooth and intelligent working of the project shall have the following Certifications: FCC, CE, UL Certified, BIS certification, NDAA compliant.

The quoted equipment should not support any interconnection/ communication protocol, such as the GB/T 28181 protocol adhered to by the equipment manufacturer and which requires sharing of information or data with any foreign government or agency, nor should the quoted equipment be manufactured in a country that mandates such a protocol.

### 13.1 Scope

This specification covers the general requirements for Supply, Installation, Testing, & Commissioning Closed-Circuit Television systems (CCTV) for Central monitoring of Building/campus Security.

Software version capable of supporting minimum 500 nos. cameras & future expandable to required size, Should include 1no. Base license and licenses for Cameras, Unlimited client (Desktop/Web/Mobile) Licenses to be supplied, Unlimited Server Licenses to be supplied, The Client shall support minimum 5 x 5 Live & Playback View, Compression Technology supported must be MJPEG, MPEG4, MXPEG, H.264 & H.265, Support ONVIF , Software features should include Virtual Matrix Alarms, logs / alarms, memory management, Software should have capability to support Camera's edge Analytics, Failover and standby functionality with server,

Multiple NVR can be connected and monitored seamlessly.

- Cybersecurity Management Solution
- Smart Search II: Powerful Search for Smart Motion Detection
- Smart VCA: AI Powered Video Analytics
- Multi-Monitor Support with Tabbed Windows
- Evidence Lock: Automatically Bookmark Related Recordings

when Alarm Triggered

- 2.5D Visualization eMap
- Evidence Export: Manually Export Video Recordings or

Alarm Clips

- New Matrix for Video Wall Solution
- Automatic Problem Feedback Mechanism
- Multiple Fisheye Dewarp Modes
- System Overview Dashboard
- Add-on Solutions: Failover, Transportation, Transaction and

Data Magnet

- Alarm Grouping for Enormous Number of Alarms
- Mute Alarm Notifications
- Multi-Sensor Display Modes: 1P, 1R, 1P2R, 1P3R
- Easy-to-Use Interface for MAC License Users
- Customize the Accessible Time Range of Playback by Users

The VMS shall incorporate stronger security mechanism to prevent vulnerabilities through embedded cyber security features. The VMS shall have achieved UL/GDPR/NDAA compliance for product & Cyber security

The quoted equipment should neither support any interconnection/communication protocol, (such as the GB/T 28181 protocol adhered to by the equipment manufacturer) and which requires sharing of information or data with any foreign government or agency, nor should the

quoted equipment be manufactured in a country that mandates such a protocol. Necessary evidence to substantiate this has to be submitted by the respective OEM/agency

**Network Video Recorder CMS Station**

|                          |   |
|--------------------------|---|
| General                  |   |
| Max. Number of Cameras*  | Unlimited   |
| Max. Number of Servers*  | Unlimited   |
| Max. Number of NVRs*     | Unlimited   |
| Support OS               | Windows 8, 7, Vista, XP   |
|                          | Windows Server 2012, 2008, 2003, 2000   |
| Support Web Browser      | Internet Explorer 11/10/9   |
| Mobile Support           | (iOS/Android)   |
| LiveView (Local Display) |   |
| Max. Channel             | 128 Channels (with Dual Monitors)   |
| Layout                   | Multi Layout Display: 1x1, 2x2, 1+5, 3x3, 1+12, 4x4, 5x5, 1+31, 8x8, 1P+2, 1P+6, 1P+8, 2V, 3V, 4V, 2V+3       |
|                          | Single Layout Display, Full Screen Display, Sequential Display  |
| Stream Application       | Stream Selection & Auto Stream Size   |
| View Application         | Drag & Drop   |
|                          | Remote I/O Control  |
|                          | PiP (Digital Zoom)  |
|                          | Instant Replay  |
|                          | De-interlace  |
|                          | Video Display Mode (Aspect Ratio, Hide Borders, Keep Top/Down Borders)  |
| Fisheye Dewarp Mode      | Fisheye Display Mode:   |
|                          | Regular: 1O, 1P, 1R, 1O3R, 4R   |
|                          | Wall Mount: 1P2R, 1P3R  |
|                          | Ceiling/Floor Mount: 2P, 4R Pro, 1O8R   |
| Playback                 |   |
| Max. Channel             | 16 Channels   |
| Layout                   | Multi Layout Display: 1x1, 2x2, 1+5, 3x3, 1+12, 4x4, 2V, 3V, 4V, 2V+3   |
|                          | Single Layout Display, Full Screen Display, Sequential Display  |
| Playback Mode            | Asynchronous & Synchronous  |
| Playback Control         | Play, Rewind, Pause, Stop, Next/Previous Video Start, Next/Previous Frame, 1/8X ~ 64X Speed Control, Bookmark |

**MATERIAL TESTING LAB WORLI MUMBAI ELV + IT + IBMS + AV + AUTOMATIC PARKING ELV SYSTEMS  
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|                            |  |
|----------------------------|--|
| Search Mode                | Browsing, Date & Time (Fast), Event, Bookmark, Alarm, Log, Timeline, Timeline Scale  |
| Video                      |  |
| Video Format               | MJPEG, MPEG4, H.264 AVC, H.264 SVC, H.265  |
| Video Resolution           | Up to 9 Megapixels   |
| Video Enhancement          | Basic Mode: Brightness, Contrast, Saturation, Hue  |
|                            | Intelligent Mode: Defog, Rain, Snow, Fire/Smoke  |
| Audio                      |  |
| Audio Format               | G.711, G.726, AMR, AAC   |
| Audio Capability           | Two-way Audio  |
| Audio Control              | Mute, Broadcasting & Sound Play  |
| Record                     |  |
| Recording Time (sec.)      | Pre-Record: 3-15, Post-Record: 10-60   |
| Recording Stream Type      | Unicast  |
| Recording Stream           | Single/Multiple  |
| Recording Mode             | Continuous, Schedule, Manual, Event, Activity Adaptive Streaming   |
| Recording Setting          | Recycle (unit: Size or Day)  |
| Recording File Format      | 3GP  |
| External Storage Recording | NAS (SMB & CIFS)   |
| Alarm Management           |  |
| Alarm Period (sec.)        | Max. 30  |
| Alarm Filter               | Name, Time, Source, Event Type, State  |
| Alarm Setting              | LiveView Alarm Notification: Fixed & Popup   |
|                            | Alert Sound  |
| Schedule Type              | Continuous, Schedule, Manual   |
| Camera Event               | Motion, DI/O, Video Lost/Restore, PIR, Tampering, Temperature, IR, PPTZ, Line Crossing Detection, Loitering Detection, Field Detection |
| Camera Status              | Connection Status, Recording Status, Recording Error   |
| Substation                 | Substation Connection Status   |
| Storage Status             | Storage Connection Status, Storage Capacity Status   |
| Station Status             | License Status, Network Status, Virtual Memory Status  |
| External Devices Event     | DI/O (With I/O Box)  |
| Action                     | Email, Start Recording, Move to preset location, Set DO, GSM Short Message, HTTP & Client notification                                 |
| Alarm State for Management | New, Assigned, In Progress, Resolved, Closed, Later, Reject, Ignore  |
| Alarm Result Export        | .csv File  |
| eMap                       |  |

**MATERIAL TESTING LAB WORLI MUMBAI ELV + IT + IBMS + AV + AUTOMATIC PARKING ELV SYSTEMS  
DESIGN NOTES, DESIGN BRIEF REPORT & TECHNICAL SPECIFICATIONS**

|                            |  |
|----------------------------|--|
| Source                     | Import Picture   |
| Marked                     | Add, Remove, Direction Control, PTZ Control & Indicator LiveView                     |
| Event Notification         | Event Icon Light Flash   |
| PTZ                        |  |
| PTZ/ePTZ Control           | Panel Control & Mouse Click Control  |
| PTZ/ePTZ Operation         | Direction Control, Home, Zoom, Focus, Iris, Preset, Patrol (Group), Pan, Stop, Speed |
| PTZ Operation Mode         | Click to Move & Continuous Move  |
| Export                     |  |
| Print                      | Selection Windows & All Windows  |
| Snapshot                   | BMP & JPEG   |
| Export File                | AVI, 3GP & EXE   |
| Backup                     |  |
| Schedule                   | NAS (SMB & CIFS)   |
| User Management            |  |
| Authentication             | Basic Account/Windows AD Account   |
| User Level                 | Administrator, Power User, User, Operator & Guest                                    |
| User Control               | Permission, Accessible Cameras & Substations   |
| User Login Time Limitation | By Time & By Day   |
| User Login Schedule        | Weekly Setting   |
| System                     |  |
| Date & Time                | Sync PC  |
| Network                    | DDNS, SMTP, UPnP & Proxy, HTTPS  |
| Multicast                  | Matrix Only  |
| Language                   | English  |
| Device Integration         |  |
|                            | All Windows <sup>®</sup> Compatible USB Joystick                                     |
| Camera Integration         |  |
| Camera Insert              | Manual & Search  |
| Basic Setting              | User Name, Password & Camera Model Detection   |
| Connection Setting         | Configuration Protocol: HTTP, HTTPS  |
|                            | Streaming Protocol: TCP, UDP, HTTP, HTTPS  |
| Video Setting              | Video Stream, Compression, Resolution, FPS, Video Quality                            |
| Audio Setting              | Compression & Bitrate  |
| Remote Focus               | Manual Focus Adjustment & Full Range Scan  |
| NTP Setting                | IP Address (NTP Server or VAST Server) & Updating Interval                           |
| ONVIF Core Spec            | Version 2.2 or above (By Project)  |



|                   |   |
|-------------------|---|
| ONVIF Stream      | Video (H.264, MPEG4 & MJPEG) & Audio (G.711, One Way) |
| ONVIF Control     | PTZ Control (Up, Down, Left, Right & Zoom In/Out)     |
| Advanced Features |   |
|                   | Panoramic PTZ   |
|                   | Seamless Recording                                    |

### 32 Channel Network Video Recorder

|                           |   |
|---------------------------|---|
| Product Description       | H.265 32-CH Embedded Plug & Play NVR                  |
| System                    |   |
| OS                        | Embedded Linux  |
| CPU                       | ARM Processor   |
| Flash                     | 256 MB or better                                      |
| RAM                       | 4 GB or better  |
| Storage                   |   |
| HDD Devices               | Internal x 4  |
| HDD Max. Capacity         | 12 TB x 4 or better                                   |
| Disk Management           | Create, Format and Remove Disk                        |
|                           | HDD S.M.A.R.T   |
|                           | RAID 0, 1, 5  |
| Video & Audio             |   |
| Video Output              | HDMI x1, VGA x1                                       |
| Resolution                | 1920x1080, 1280x720                                   |
| Graphics Decoder          | Hardware decoding                                     |
| Decoding Capacity         | H.265/H.264:  |
|                           | 2560x1920 @ 30 fps (1-CH)                             |
|                           | 1920x1080 @ 120 fps (4-CH)                            |
|                           | 1280x720 @ 240 fps (8-CH)                             |
|                           | 1280x720 @ 480 fps (16-CH)                            |
| 720x480 @ 960 fps (32-CH) |   |
| Camera Position           | Change the viewcell position on the Live View screens |
| External Interface        |   |
| USB Interface             | Front: 2 (USB 2.0)                                    |
|                           | Back: 1 (USB 3.0)                                     |
| Alarm In                  | 8   |
| Alarm Out                 | 4   |

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|                          |  |
|--------------------------|--|
| Audio                    | 3.5 Phone Jack Audio Output x1   |
|                          | 3.5 Phone Jack Audio Input (Reserved) x1   |
| External HDD             | USB 3.0 Port x 1   |
| RS485                    | 1 Port (Reserved)  |
| Network                  |  |
| Network Interface        | 10/100/1000Mbps Ethernet (RJ-45) x 2   |
| PoE                      | 16x 802.3at/af Compliant PoE Ports (Total Max. 160W)                                       |
| Protocols                | IPv4, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, SMTP, FTP, DHCP, NTP, DNS, DDNS, IP Filter |
| Power                    |  |
| Power Input              | 100-240V AC, 50/60Hz   |
| Power Consumption        | Max. 260 W   |
| LED Indicator            |  |
| LED Indicator            | Status, Record, HDD1, HDD2, HDD3, HDD4, Net1, Net2, CH1 ~ CH16                             |
| Operating Temperature    | 0°C ~ 40°C (32°F ~ 104°F)  |
| Humidity                 | 0 ~ 95%  |
| General                  |  |
| Safety Certifications    | CE, LVD, FCC, VCCI, C-Tick, UL   |
| Record                   |  |
| Maximum Channel          | 32   |
| Record Throughput (MB)   | 192 Mbps   |
| Network Throughput (MB)  | 96 Mbps  |
| Audio Format             | G.711, G.726   |
| Video Format             | H.265, H.264, MJPEG  |
| Video Resolution         | Up to 12MP Camera  |
| Recording Time (sec.)    | Pre-Record: 5 (Max. 10)  |
|                          | Post-Record: 20 (Max. 300)   |
| Recording Stream         | Single   |
| Recording Mode           | Continuous, Schedule, Manual, Event, Activity Adaptive Streaming                           |
| Recording Setting        | Recycle (unit: Day)  |
| Recording Path           | Local Path   |
| Record Video Format      | 3GP  |
| Watermark                | Supported  |
| LiveView (Local Display) |  |
| Stream Application       | Constant/Auto Adaptive Stream  |
| LiveView Display         | 32 Channels  |
|                          | Multiple Layout Display:   |
|                          | 1x1, 2x2, 3x3, 1P+3, 2P+3, 1M+5, 1P+6, 3V,   |

**MATERIAL TESTING LAB WORLI MUMBAI ELV + IT + IBMS + AV + AUTOMATIC PARKING ELV SYSTEMS  
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|                                 |   |
|---------------------------------|---|
|                                 | 1M+12, 4x4, 1M+31   |
| Monitor Enhancement             | OSD Display (NVR), OSD Display (Camera), Camera Information, Remote I/O Control, Event Notification, Aspect Ratio, Fisheye Dewarp (1O, 1P, 1R, 1O3R, 1O8R)                              |
| PTZ Control                     | Panel Control/Joystick  |
| PTZ Operation                   | Direction Control, Home, Iris, Preset, Patrol (Group), PiP Control  |
| Playback (Local Display)        |   |
| Playback Display                | 4 Channels  |
|                                 | Multiple Layout Display: 1x1, 2x2, 1P+3, 1V+3   |
| Playback Control                | Regular (Play, Pause, Stop), Rewind, Next/Previous Frame, Speed Control, Calendar, Event, Timeline, Timeline Scale, Thumbnail (Storyboard)  |
| Video Search                    | By Calendar, Date/Time, Alarm   |
| Thumbnail Explorer (Storyboard) | Listing the thumbnail of recorded video (Max. 2 CH)   |
| Monitor Enhancement             | OSD Display (Camera), Event Notification, Aspect Ratio, PiP Control, Fisheye Dewarp (1O, 1P, 1R, 1O3R, 1O8R)  |
| Snapshot                        | JPEG  |
| Video Clip Export               | EXE   |
| LiveView (Remote)               |   |
| Stream Application              | Stream Selection  |
| Audio Capability                | One Way   |
| LiveView Display                | 16 Channels   |
|                                 | Multiple Layout Display: 1x1, 2x2, 3x3, 4x4, 1V+3, 1M+5, 1M+12  |
| Monitor Enhancement             | OSD Display (NVR), Drag & Drop, Image Freeze, Audio Control, Remote I/O Control, Event Notification, Bookmark, Fisheye Dewarp (1O, 1P, 1R)  |
| PTZ Control                     | Panel Control   |
| PTZ Operation                   | Direction Control, Home, Zoom, Focus, Iris, Preset, Patrol (Group), PiP Control   |
| Snapshot                        | JPEG  |
| Alarm Management                |   |
| Schedule Type                   | Continuous, Schedule, Manual  |
| Event                           | Motion Detection, PIR Detection, Tampering Detection, Digital Input (Camera), Digital Output (Camera), Connection Abnormal, Storage Abnormal, Storage Full, Camera Network Loss, DI, DO |
| Action                          | Record, Email (Text), Email (Snapshot), FTP, Buzzer, ePTZ Control (Go to Preset), NVR DO, Camera DO, OEM APP Notification   |

|                                |   |
|--------------------------------|---|
| Recording Time (sec.)          | Pre-Record: 5 (Max. 10), Post-Record: 20 (Max. 300)         |
| Backup                         |   |
| Manual                         | USB Dongle (FAT Format)                                     |
| System                         |   |
| User Management                | User Account: 16  |
|                                | User Account Time Limit: 10 mins                            |
|                                | User Level: Administrator, Regular User                     |
|                                | User Feature Definition: By Camera                          |
| Log                            | System, Recording, User, Error                              |
| Date&Time                      | Time Zone, Manual, Automatic Sync NTP, Daylight Saving Time |
| Firmware                       | Manual update   |
| Restore Default                | Supported   |
| Backup/Restore (Configuration) | Supported   |
| Camera Intergration            |   |
| Insert Camera                  | Manual, Search  |
| Video (Media) Setting          | Compression, Resolution, FPS, Video Quality                 |
| Image Setting                  | Image Display, Image Adjustment                             |
| PTZ Control                    | Panel Control, Joystick                                     |
| PTZ Operation                  | Direction Control, Home, Preset, Patrol (Group)             |
| Motion Detection               | Supported   |
| Complaint                      | NDAA Approved   |

**IP based 2 MP Indoor Dome Type POE based Camera (3-10 mm)**

|                               |   |
|-------------------------------|---|
| Camera Features               |   |
| Image Sensor                  | 1/2.8" Progressive CMOS or better   |
| Maximum Resolution            | 1920x1080 (2MP)   |
| Lens Type                     | Vari-focal  |
| Focal Length                  | f = 3.0 ~ 10 mm (+/- 0.5 mm to 1 mm)  |
| Aperture                      | F1.4 ~ F2.8   |
| Auto-iris                     | P-iris  |
| Shutter Time                  | 1/5 sec. to 1/25,000 sec. or better   |
| Day/Night                     | Removable IR-cut filter for day & night function                            |
| Minimum Illumination          | 0.4 Lux @ F1.8 (Color)  |
|                               | 0.01 Lux @ F1.8 (B/W)   |
| Pan/tilt/zoom Functionalities | ePTZ:   |
|                               | 48x digital zoom (4x on IE plug-in, 12x built in)                           |
| IR Illuminators               | Built-in IR illuminators, effective up to 50 meters with Smart IR or better |

|                        |   |
|------------------------|---|
| On-board Storage       | Slot type: MicroSD/SDHC/SDXC card slot<br>Seamless Recording  |
| Video                  |   |
| Compression            | H.265, H.264 & MJPEG  |
| Maximum Frame Rate     | 60 fps @ 1920x1080<br>In both compression modes   |
| Maximum Streams        | 3 simultaneous streams or better  |
| S/N Ratio              | 50dB or better  |
| Dynamic Range          | 120dB or better   |
| Video Streaming        | Adjustable resolution, quality and bitrate  |
| Image Settings         | Adjustable image size, quality and bit rate; Time stamp, text overlay, flip & mirror; Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks; Scheduled profile settings, 3D noise reduction, video rotation, defog |
| Audio                  |   |
| Audio Capability       | Two-way Audio (full duplex)   |
| Compression            | G.711, G.726  |
| Interface              | Built-in microphone   |
|                        | External line input   |
|                        | External line output  |
| Network                |   |
| Users                  | Live viewing for up to 10 clients   |
| Security               | Access list, digest authentication, HTTPS , IEEE 802.1x, password protection, secure boot, signed firmware, Trend Micro IoT Security (brute force attack event, cyberattack event, quarantine event), user access log, user account management  |
| Protocols              | IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, TSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP, ARP, SSL, TLS   |
| Interface              | 10 Base-T/100 BaseTX Ethernet (RJ-45)   |
| ONVIF                  | Profile G, S, T Supported   |
| Intelligent Video      |   |
| Video Motion Detection | Five-window video motion detection, people detection  |
| Alarm and Event        |   |

|                       |  |
|-----------------------|--|
| Alarm Triggers        | Audio detection, camera tampering detection, cyber security events (brute force attack event, cyberattack event, quarantine event), digital input, manual trigger, motion detection, periodical trigger, recording notification, SD card life expectancy, shock detection, system boot |
| Alarm Events          | Event notification via audio clip, camera link, digital output, email, HTTP, FTP/SFTP, NAS server, SD card   |
|                       | File upload via HTTP, SMTP, FTP, NAS server and SD card  |
| General               |  |
| Smart Focus System    | Remote Focus   |
| Connectors            | RJ-45 cable connector for Network/PoE connection   |
|                       | Audio input  |
|                       | Audio output   |
|                       | DC 12V power input   |
|                       | Digital input*1  |
|                       | Digital output*1   |
| LED Indicator         | System power and status indicator  |
| Power Input           | DC 12V [for power redundancy]  |
|                       | IEEE 802.3af/at PoE Class 0  |
| Power Consumption     | Max. 13 W  |
| Casing                | Weather-proof IP66-rated housing (Camera body)   |
|                       | Vandal-proof IK10-rated metal housing (Camera body)  |
| Safety Certifications | CE, LVD, FCC Class A, VCCI, C-Tick, UL   |
| Operating Temperature | Starting Temperature: -10°C ~ 50°C (14°F ~ 122°F)  |
|                       | Working Temperature: -20°C ~ 50°C (-4°F ~ 122°F)   |
| Cyber Security        | Embedded   |
| Complaint             | NDA Approved   |

### IP Based 2 MP Vari-Focal Bullet Camera (3-10 mm)

| Camera Features    |                                     |
|--------------------|-------------------------------------|
| Image Sensor       | 1/2.8" Progressive CMOS or better   |
| Maximum Resolution | 1920x1080 (2MP)                     |
| Lens Type          | Vari-focal                          |
| Focal Length       | f = 3-10 mm (+/- 0.5 mm to 1 mm)    |
| Aperture           | F1.8 ~ F2.8                         |
| Auto-iris          | P-iris                              |
| Shutter Time       | 1/5 sec. to 1/25,000 sec. or better |

|                               |   |
|-------------------------------|---|
| Day/Night                     | Removable IR-cut filter for day & night function  |
| Minimum Illumination          | 0.4 Lux @ F1.8 (Color)  |
|                               | 0.01 Lux @ F1.8 (B/W)   |
| Pan/tilt/zoom Functionalities | ePTZ:   |
|                               | 48x digital zoom (4x on IE plug-in, 12x built in)   |
| IR Illuminators               | Built-in IR illuminators, effective up to 50 meters with Smart IR or better   |
| On-board Storage              | Slot type: MicroSD/SDHC/SDXC card slot  |
|                               | Seamless Recording  |
| Video                         |   |
| Compression                   | H.265, H.264 & MJPEG  |
| Maximum Frame Rate            | 60 fps @ 1920x1080  |
|                               | In both compression modes   |
| Maximum Streams               | 3 simultaneous streams or better  |
| S/N Ratio                     | 50dB or better  |
| Dynamic Range                 | 120dB or better   |
| Video Streaming               | Adjustable resolution, quality and bitrate  |
| Image Settings                | Adjustable image size, quality and bit rate; Time stamp, text overlay, flip & mirror; Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks; Scheduled profile settings, 3D noise reduction, video rotation, defog |
| Audio                         |   |
| Audio Capability              | Two-way Audio (full duplex)   |
| Compression                   | G.711, G.726  |
| Interface                     | External line input   |
|                               | External line output  |
| Network                       |   |
| Users                         | Live viewing for up to 10 clients   |
| Protocols                     | IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP, ARP, SSL, TLS  |
| Interface                     | 10 Base-T/100 BaseTX Ethernet (RJ-45)   |
| ONVIF                         | Profile G, S, T Supported   |
| Intelligent Video             |   |
| Video Motion Detection        | Five-window video motion detection, people detection  |
| Alarm and Event               |   |

|                       |   |
|-----------------------|---|
| Alarm Triggers        | Audio detection, camera tampering detection, cybersecurity events (brute force attack event, cyberattack event, quarantine event), digital input, manual trigger, motion detection, periodical trigger, recording notification, SD card life expectancy, shock detection, system boot |
| Alarm Events          | Event notification via audio clip, camera link, digital output, email, HTTP, FTP/SFTP, NAS server, SD card<br>File upload via HTTP, SMTP, FTP, NAS server and SD card   |
| General               |   |
| Smart Focus System    | Remote Focus  |
| Connectors            | RJ-45 cable connector for Network/PoE connection  |
|                       | Audio input   |
|                       | Audio output  |
|                       | DC 12V power input  |
|                       | Digital input*1   |
|                       | Digital output*1  |
| LED Indicator         | System power and status indicator   |
| Power Input           | DC 12V [for power redundancy]<br>IEEE 802.3af/at PoE Class 0  |
| Power Consumption     | Max. 13 W   |
| Casing                | Weather-proof IP66-rated housing (Camera body)  |
|                       | Vandal-proof IK10-rated metal housing (Camera body)   |
| Safety Certifications | CE, LVD, FCC Class A, VCCI, C-Tick, UL  |
| Operating Temperature | Starting Temperature: -10°C ~ 50°C (14°F ~ 122°F)   |
|                       | Working Temperature: -20°C ~ 50°C (-4°F ~ 122°F)  |
| CyberSecurity         | Embedded  |
| Complaint             | NDAA Approved   |

**IP Based 2 MP Vari-Focal Bullet Camera (12-40 mm)**

| Camera Features      |  |
|----------------------|--|
| Image Sensor         | 1/2.8" Progressive CMOS or better                |
| Maximum Resolution   | 1920x1080 (2MP)                                  |
| Lens Type            | Vari-focal                                       |
| Focal Length         | f = 12-40 mm (+/- 0.5 to 2 mm)                   |
| Aperture             | F1.8 ~ F2.8                                      |
| Auto-iris            | DC-iris/ Fixed                                   |
| Shutter Time         | 1/5 sec. to 1/25,000 sec. or better              |
| Day/Night            | Removable IR-cut filter for day & night function |
| Minimum Illumination | 0.4 Lux @ F1.8 (Color)                           |



|                               |   |
|-------------------------------|---|
|                               | 0.01 Lux @ F1.8 (B/W)   |
| Pan/tilt/zoom Functionalities | ePTZ:   |
|                               | 48x digital zoom (4x on IE plug-in, 12x built in)   |
| IR Illuminators               | Built-in IR illuminators, effective up to 50 meters with Smart IR or better   |
| On-board Storage              | Slot type: MicroSD/SDHC/SDXC card slot  |
|                               | Seamless Recording  |
| Video                         |   |
| Compression                   | H.265, H.264 & MJPEG  |
| Maximum Frame Rate            | 60 fps @ 1920x1080  |
|                               | In both compression modes   |
| Maximum Streams               | 3 simultaneous streams or better  |
| S/N Ratio                     | 50dB or better  |
| Dynamic Range                 | 120dB or better   |
| Video Streaming               | Adjustable resolution, quality and bitrate  |
| Image Settings                | Adjustable image size, quality and bit rate; Time stamp, text overlay, flip & mirror; Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks; Scheduled profile settings, 3D noise reduction, video rotation, defog |
| Audio                         |   |
| Audio Capability              | Two-way Audio (full duplex)   |
| Compression                   | G.711, G.726  |
| Interface                     | External line input   |
|                               | External line output  |
| Network                       |   |
| Users                         | Live viewing for up to 10 clients   |
| Protocols                     | IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, CoS, QoS, SNMP, 802.1X, UDP, ICMP, ARP, SSL, TLS  |
| Interface                     | 10 Base-T/100 BaseTX Ethernet (RJ-45)   |
| ONVIF                         | Profile G, S, T Supported   |
| Intelligent Video             |   |
| Video Motion Detection        | Five-window video motion detection, people detection  |
| Alarm and Event               |   |

|                       |  |
|-----------------------|--|
| Alarm Triggers        | Audio detection, camera tampering detection, cyber security events (brute force attack event, cyberattack event, quarantine event), digital input, manual trigger, motion detection, periodical trigger, recording notification, SD card life expectancy, shock detection, system boot |
| Alarm Events          | Event notification via audio clip, camera link, digital output, email, HTTP, FTP/SFTP, NAS server, SD card   |
|                       | File upload via HTTP, SMTP, FTP, NAS server and SD card  |
| General               |  |
| Smart Focus System    | Remote Focus   |
| Connectors            | RJ-45 cable connector for Network/PoE connection   |
|                       | Audio input  |
|                       | Audio output   |
|                       | DC 12V power input   |
|                       | Digital input*1  |
|                       | Digital output*1   |
| LED Indicator         | System power and status indicator  |
| Power Input           | DC 12V [for power redundancy]  |
|                       | IEEE 802.3af/at PoE Class 0  |
| Power Consumption     | Max. 13 W  |
| Casing                | Weather-proof IP66-rated housing (Camera body)   |
|                       | Vandal-proof IK10-rated metal housing (Camera body)  |
| Safety Certifications | CE, LVD, FCC Class A, VCCI, C-Tick, UL   |
| Operating Temperature | Starting Temperature: -10°C ~ 50°C (14°F ~ 122°F)  |
|                       | Working Temperature: -20°C ~ 50°C (-4°F ~ 122°F)   |
| Cyber Security        | Embedded   |
| Complaint             | NDAA Approved  |

**Outdoor Pan Tilt Zoom (PTZ) Type POE+ based IP Camera**

|                    |   |
|--------------------|---|
| Image Sensor       | 1/2.8" Progressive CMOS or better                 |
| Maximum Resolution | 1920x1080 (2MP)                                   |
| Lens Type          | 40x Optical Zoom, Auto Focus                      |
| Focal Length       | f = 4.25 ~ 170 mm (40x zoom) (+/- 0.5 mm to 2 mm) |
| Aperture           | F1.6 ~ F4.7 or Better                             |
| Auto-iris          | DC-iris   |
| Shutter Time       | 1/5 sec to 1/30,000 sec or better                 |
| Day/Night          | Removable IR-cut filter for day & night function  |

|                               |  |
|-------------------------------|--|
| Minimum Illumination          | 0.5Lux @ F1.6 (Color)  |
|                               | 0.04 Lux @ F1.6 (B/W)  |
| Pan Speed                     | 400° / sec or Better   |
| Pan Range                     | 360 endless  |
| Tilt Speed                    | 400° / sec or Better   |
| Tilt Range                    | -20° to 90°  |
| Preset Locations              | 256 preset locations   |
| Pan/Tilt/Zoom Functionalities | 32x digital zoom   |
|                               | Auto pan mode  |
|                               | Auto patrol mode   |
|                               | Mechanical Auto Flip   |
| IR Illuminators               | Built-in IR Illuminators up to 250 meters IR LED   |
| On-board Storage              | Slot type: SD/SDHC/SDXC card slot  |
|                               | Seamless Recording   |
| Video                         |  |
| Compression                   | H265, H264, MJPEG  |
| Maximum Frame Rate            | 60 fps @ 1920x1080   |
|                               | In all compression mode  |
| Maximum Streams               | 3 simultaneous streams or Better   |
| S/N Ratio                     | 60 dB or better  |
| Wide Dynamic Range            | 120 dB or better   |
| Video Streaming               | Adjustable resolution, quality and bitrate   |
|                               |  |
| Image Settings                | Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks, anti-overexposure, Scheduled profile settings, defog, 3DNR, EIS  |
| Audio                         |  |
| Audio Capability              | Audio input/output (full duplex)   |
| Compression                   | G.711, G.726   |
| Interface                     | External microphone input  |
|                               | External line output   |
| Network                       |  |
| Users                         | Live viewing for up to 10 clients  |
| Security                      | Access list, digest authentication, HTTPS , IEEE 802.1x, password protection, secure boot, signed firmware, Trend Micro IoT Security (brute force attack event, cyberattack event, quarantine event), user access log, user account management |

|                        |  |
|------------------------|--|
| Protocols              | 802.1X, ARP, Bonjour, CIFS/SMB, DDNS, DHCP, DNS, FTP/SFTP, HTTP, HTTPS, ICMP, IGMPv 3, IPv 4, IPv 6, NTCIP, NTP, PPPoE, QoS (CoS/DSCP), RTSP/RTP/RTCP, SMTP, SNMP, SSL, TCP/IP, TLS 1.2, UDP, UPnP   |
| Interface              | 10 Base-T/100 Base-TX/1000 Base-T Ethernet   |
| ONVIF                  | Supported  |
| Intelligent Video      |  |
| Video Motion Detection | Five-window video motion detection   |
| Auto-Tracking          | Auto-tracking on moving object   |
| Alarm and Event        |  |
| Event Trigger          | Audio detection, camera tampering detection, cyber security events (brute force attack event, cyberattack event, quarantine event), digital input, manual trigger, motion detection, periodical trigger, recording notification, SD card life expectancy, smart tracking advanced trigger, system boot, preset reached |
| Event Action           | Event notification via audio clip, camera link, digital output, email, HTTP, FTP, NAS server, SD card File upload via email, HTTP, FTP, NAS server, SD card; trigger track, trigger patrol, move to preset   |
| General                |  |
| Connectors             | RJ-45 cable connector for 10/100 Mbps  |
|                        | Network/PoE connection   |
|                        | Audio input  |
|                        | Audio output   |
|                        | DC 48V power input   |
|                        | Digital input*2  |
|                        | Digital output*1   |
|                        | RS-485 for PTZ control (PelcoD protocol, Baud rate 2400)   |
| LED Indicator          | System power and status indicator  |
| Power Input            | 60W PoH/PoE or better  |
|                        | DC 48V   |
|                        | AC 24V   |
| Power Consumption      | Max. 60W   |
|                        | Max. 50W   |
| Casing                 | Weather-proof IP66, Vandal-proof IK10 and NEMA 4X-rated housing  |

|                       |                                   |
|-----------------------|-----------------------------------|
| Safety Certifications | CE, FCC Class A, VCCI, C-tick, UL |
| Operating Temperature | -30°C ~ 55°C (-58°F ~ 131°F)      |
| Humidity              | 90% or better                     |
| Cybersecurity         | Embedded                          |
| Complaint             | NDA                               |

**IP Based 5 MP Vari-Focal Bullet Camera (3-10 mm)**

|                               |   |
|-------------------------------|---|
| Image Sensor                  | 1/2.7" Progressive CMOS or Better   |
| Max. Resolution               | 2560x1920 (5MP)   |
| Lens Type                     | Vari-focal, Remote Focus  |
| Focal Length                  | f = 3 ~ 10 mm or better (+/- 0.5 to 1 mm)   |
| Aperture                      | F1.4 ~ F2.8   |
| Auto-iris                     | P-iris  |
| Shutter Time                  | 1/5 sec. to 1/25,000 sec. or better   |
| Day/Night                     | Yes   |
| Removable IR-cut Filter       | Yes   |
| Minimum Illumination          | 0.2 Lux @ F1.4 (Color) or better<br><0.08 lux @ F1.4 (B/W)<br>0 Lux with IR illumination on   |
| Pan Range                     | 350°  |
| Tilt Range                    | 80°   |
| Rotation Range                | 180°  |
| Pan/Tilt/Zoom Functionalities | ePTZ: 48x digital zoom (4x on IE plug-in, 12x built-in)   |
| IR Illuminators               | Built-in IR illuminators, effective up to 50 meters with IR LED*4   |
| On-board Storage              | Slot type: MicroSD/SDHC/SDXC card slot<br>Seamless Recording  |
| Video Compression             | H.265, H.264, MJPEG   |
| Maximum Frame Rate            | 30 fps @ 2560x1920<br>60 fps @ 1920x1080  |
| Maximum Streams               | 3 simultaneous streams or better  |
| S/N Ratio                     | 50 dB or better   |
| Dynamic Range                 | 110 dB or better  |
| Video Streaming               | Adjustable resolution, quality and bit rate control   |
| Image Settings                | Time stamp, text overlay, flip & mirror; Configurable brightness, contrast, saturation, sharpness, white balance, exposure control, gain, backlight compensation, privacy masks; Scheduled profile settings, video rotation, 3DNR, DIS, HLC |

|                        |   |
|------------------------|---|
| Audio Capability       | Two-way Audio (full duplex)   |
| Audio Compression      | G.711, G.726  |
| Audio Interface        | External microphone input   |
|                        | External line output  |
| Users                  | Live viewing for up to 10 clients   |
| Protocols              | IPv4, IPv6, TCP/IP, HTTP, HTTPS, UPnP, RTSP/RTP/RTCP, IGMP, SMTP, FTP, DHCP, NTP, DNS, DDNS, PPPoE, QoS, SNMP, 802.1X, UDP, ICMP,   |
| Interface              | 10 Base-T/100 Base-TX Ethernet (RJ-45)  |
| ONVIF                  | Supported   |
| Video Motion Detection | Five-window video motion detection, human detection, time filter  |
| Edge Analytics         | Intrusion detection, loitering detection, line crossing detection, unattended object detection, missing object detection, face detection, crowd detection, running detection        |
| Alarm Triggers         | Motion detection, manual trigger, digital input, periodical trigger, system boot, recording notification, camera tampering detection, audio detection, MicroSD card life expectancy |
| Alarm Events           | Event notification using digital output, HTTP, SMTP, FTP, NAS server and MicroSD card   |
|                        | File upload via HTTP, SMTP, FTP, NAS server and MicroSD card  |
| Connectors             | RJ-45 cable connector for 10/100Mbps Network/PoE connection   |
|                        | Audio line input  |
|                        | Audio line output   |
|                        | AC 24V power input (optional)   |
|                        | DC 12V power input  |
|                        | Digital input *2  |
|                        | Digital output *2   |
|                        | BNC Out   |
| Power Input            | IEEE 802.3af PoE Class 0  |
|                        | DC 12V  |
|                        | AC 24V (optional)   |
| Power Consumption      | PoE: Max. 12 W  |
|                        | DC 12V: Max. 11 W   |
|                        | AC 24V: Max. 11 W   |
| Safety Certifications  | CE, FCC Class B, UL, LVD, VCCI, C-Tick  |
| Casing                 | IP66, IK10 (Metal Housing)  |

|                       |                                     |
|-----------------------|-------------------------------------|
| Operating Temperature | Starting Temperature: -10°C ~ 50°C) |
|                       | Working Temperature: -30°C ~ 50°C   |
| Humidity              | 90%                                 |
| Cybersecurity         | Embedded                            |
| Compliance            | NDA                                 |

#### **TECHNICAL SPECIFICATIONS FOR ACCESS CONTROL SYSTEM**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**MAKES: HID/LENEL/MERCURE/HONEYWELL-PROWATCH**

#### **Design Brief:**

- a. The access control system is applicable to basement, ground and 14<sup>th</sup> to 19<sup>th</sup> floors and only server rooms and electrical rooms from 20<sup>th</sup> to 29<sup>th</sup> floors. The access control software should meet the requirement of 250 doors minimum and meet all the technical specifications of the tender with seamless integration with CCTV system and HR SAP software for payroll management.
- b. All doors will have in/out readers and emergency break glass in the inside.
- c. OSDP (Open Supervisory Device Protocol) complaint controllers and readers to be used to reduce the cabling to 4 core and readers to be looped in RS 485 to save 50% cabling qty.
- d. POE based TCP/IP based 2 reader OSDP complaint controllers are used for all doors with necessary hardware and firmware to meet the technical specifications of the tender
- e. 6 nos. Face Readers have been proposed which are to be used at strategic locations like Material testing labs and critical server rooms
- f. In/Out Long Range Parking readers with 10 meters range to be installed for both entry/exit gates and basement entry for parking management and record of vehicle movement within the premises.
- g. Consider 150 UHF tags for parking and 500 mifare smart access cards for employees and visitors
- h. Magnetic locks 600# and 1200# with mounting brackets as per door material, magnetic contacts to be considered as per single and double leaf doors. 2 nos. of SMPS Power Supply

in each server rooms of 10 Amp rating of 10 outputs of 1 amp each to considered in case the access control cannot power the magnetic locks.

**i. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

The access control system ACS shall be an enterprise class IP access control software solution. It shall be fully Unified within Video Management System (VMS). The Integrated platform shall allow the seamless unification of the ACS with an IP video management system (VMS).

The ACS shall be highly scalable to support configurations consisting of 200+ of doors across floors.

The ACS shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.

The ACS shall support a variety of access control functionalities, including but not limited to:

- Controller (Unit) management, door management and area management.
- Cardholder and cardholder group management, credential management, and access rule management.
- Badge printing and template creation.
- People counting, area presence tracking
- Offering a framework for third party hardware integration such as card and signature scanner.
- The ACS shall support at least 5 different makes of access control manufacturers.
- The ACS shall be certified with UL-294, CSPN.
- The ACS shall support Manufacturer OSDP command.

All TCP/IP controllers, card readers and biometric readers will be OSDP compliant and all doors will have in/out card readers with emergency break glass

All material testing lab doors, compactor room, server/hub room, electrical room etc. will be under access control system

Face Biometric will be used at critical labs for entry and has been considered one on each floor so total 6 nos.

The MTL basement car parking management Long range UHF reader uPass Target, up to 10 meter read range, IP 66 including OEM reader mounting kit UL/ BIS certified installed on the entry/exit gate boom barriers will be integrated with the building Access Control System

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**



**Include all necessary items required to make the system complete and working at all times**

**Please refer the matrix chart to understand the type and no. of cameras required**

### **Access Management**

- The ACS shall be based on an open architecture able to support multiple access control hardware manufacturers (minimum 5).
- The ACS shall be able to integrate with multiple non-proprietary interface modules and controllers, access readers, and other third-party applications.
- The ACS shall be an IP enabled solution. All communication between the ACS and hardware controllers shall be based on standard TCP/IP protocol.
- The ACS shall be able to synchronize all access control hardware units under its control, such as door controllers and I/O modules. It shall also be able to validate and log all access activities and events when the door controllers and I/O modules are online.
- The ACS shall maintain the communication link with the hardware controllers under its control. It shall also continuously monitor whether the controllers are online or offline.
- Synchronization of hardware units shall be automated and transparent to users and shall occur in the background. It shall also be possible to manually synchronize units or to synchronize units on a schedule.
- The ACS shall support doors and controllers located within one or more facilities. The Access Server shall support a minimum of 200 readers and up to 2000 readers per server.
- ACS shall support up to 500000 Cardholder in the software
- The Access Server shall store all access events associated with the doors, areas, hardware zones (hardware input points), and controllers under its direct control.
- The ACS shall support 802.1x authentication.
- The ACS shall support embedded certificate validation engine.
- The ACS shall support the use of TLS 1.2 and certificates.
- The ACS shall support OSDP transparent reader mode to read Desfire credentials.
- The ACS shall support most industry standard card readers that output card data using the Wiegand protocol and Clock-and-Data.

### **Seamless Integration with VMS**

- Through the USP, the ACS shall support integration with an IP Video Surveillance System. Integration with an IP video surveillance system shall permit the user to view live and recorded video.
- Users shall be able to associate one or more video cameras to the following entity types: doors, elevator and hardware zones (input points), and more.

- The Monitoring UI shall present a true Unified Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.
- It shall be possible to view video associated with access control events when viewing a report.
- The ACS shall support the configuration and management of cardholders and cardholder groups. A user shall be able to add, delete, or modify a cardholder or cardholder group if they have the appropriate privileges.
- Custom fields shall be supported for both cardholders and cardholder groups.
- The ACS shall permit the following activation/expiration options for a cardholder's profile: delayed activation of a cardholder's profile, expiration based on the date of first use of credentials, or expiration on a user-defined date.
- It shall be possible to set a start date and expiration date for the association of a cardholder and an access rule for temporary access.
- It shall be possible to associate a picture to a cardholder's profile. The picture shall be imported from a file, captured with a digital camera, or captured from a video surveillance camera. When a cardholder event occurs, the picture of the cardholder shall be displayed in the Monitoring UI. The ACS shall support multiple standard picture formats.

### **ACS Global Cardholder Management**

The ACS shall support global cardholder management and synchronization between a central independent site and remote independent sites, all of which can have their own Directory and databases.

It shall be possible to synchronize the following entities and their configuration data:

- Cardholders (incl. custom fields)
  - Cardholder groups
  - Credentials
  - Badge templates
- Cardholders and other synchronized entities can be added centrally and synchronized to remote sites for central cardholder management
- Cardholders and other synchronized entities can be added at remote sites and synchronized to the central site and other remote sites.

- The ACS shall support the assignment of a single card per cardholder across all of an organization's sites.

### **Dashboards**

- The USP shall support the ability to create multiple dashboards.
- Operators shall be allowed to view respective dashboards depending on user rights.
- A dashboard shall consist of a canvas with various widgets displayed on the canvas.
- All widgets should offer the ability to specify location and size to the widget, a title to the widget, a background color to the widget, and the ability to refresh periodically the content of the widget.
- Dashboard widget types shall be:
  - Image: provides the ability to display an image (JPG, PNG, GIF, BMP) on a dashboard.
  - Text: provides the ability to display a text on a dashboard. The text style shall be configurable, so font, size, color, and alignment can be specified by the user.
  - Tile: provides the ability to display any entity of the USP inside of a tile.
  - Web page: provides the ability to display a URL on a dashboard.
  - Entity Count: provides the ability to display the total number of a specific entity type in the USP.
  - Reports: provides the ability to display the results of any saved reports in the system. The results shall be displayed either by showing the total number of results in the report, a set of top results from the report, or a visual graph from the data returned by the report.
- It shall be possible to extend the widgets of a dashboard using the SDK. This will provide the ability to develop custom widgets to the system.
- The USP shall support the following actions on a dashboard:
  - print dashboard, export dashboard to PNG file, and automatically email a report based on a schedule and a list of one or more recipients.

### **ACS Badge Designer**

- The badge designer shall allow the creation of badge templates that define the content and presentation format of a cardholder badge to be printed.
- Badge production shall consist of selecting the credential, the badge template, and clicking print.
- Batch printing of cards shall be available.
- The contents of a badge template can include: cardholder's first and last name, picture, custom fields, bitmap graphics, lines, ovals, rectangles, dynamic text labels linked to custom fields and static text labels, and barcodes (Interleaved 2 of 5, Extended Code 39).
- Copy and paste of badge template objects shall be available.
- It shall be possible to set the border thickness and color, the fill color of badge objects (content), and the color of text labels.

- Settings, such as object transparency, text orientation, and auto-sizing of text shall be available or transparent to the user.
- Supported badge formats shall be (portrait and landscape): CR70 (2.875" x 2.125"), CR80 (3.37" x 2.125"), CR90 (3.63" x 2.37"), CR100 (3.88" x 2.63"), and custom card sizes.
- Dual-sided badges shall be supported.
- A badge template import and export function shall be available to allow the sharing of badge templates between distinct or independent ACS.
- Chromakey shall be supported.

### ACS Door Management

- The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if they have the appropriate privileges.
- The ACS shall permit multiple access rules to be associated to a door.
- It shall be possible to unlock all doors from an area at once.
- The ACS shall support the following forms of authentication: Card Only, Card or Keypad (PIN), or Card and Keypad (PIN). It shall be possible to define a schedule for when Card Only or Card and Keypad authentication modes shall be required.
- It shall be possible to set an extended grant time on a per-door basis (in addition to the standard grant time). Cardholder properties shall include the option of using the extended grant time. When flagged cardholders are granted access, the door shall be unlocked for the duration of the extended grant time instead of the standard grant time.
- The ACS shall allow the configuration of the relocking mode on doors such as on door open, after a definite time, or on door close.
- The ACS shall support the ability to enforce the use of two valid reads from different cardholders to grant access to an area.
- The ACS shall support the ability to enable access rules for other cardholders once a supervisor has accessed an area.
- The ACS shall support the ability to enable unlocking schedule on a door once an employee has entered the facility.
- Reader less doors.  
The ACS shall support doors configured solely with a lock, a REX, and a door contact but without readers.  
The implementation of a reader less door shall be possible with the use of standard access hardware IO modules. External hardware, such as timers, shall not be required.
- Unlocking schedules shall be programmable for reader less doors.
- Standard door activity reports shall also be possible with reader less doors.
- Unlocking schedules and exceptions to unlocking schedules shall be associated with a door. An unlocking schedule shall determine when a door should be automatically unlocked. The ACS shall also support the use of a specific offline unlocking schedule. Exceptions to unlocking schedules shall be used to define time periods during which unlocking schedules shall not be applied, such as during statutory holidays.

- The ACS shall support one or more cameras per door. Video shall then be associated to door access events, such as access grant or access denied.

### **ACS Elevator Management**

- The ACS shall support the configuration and management of elevators. A user shall be able to add, delete, or modify an elevator if they have the appropriate privileges.
- The ACS shall be able to control access to specific floors using a reader within the elevator cab. Control shall be available through the use of a controller with an interface to a reader and to multiple output modules with relays.
- Elevator floor selections shall be tracked using a controller with an interface to multiple input modules. Floor tracking shall be available within an elevator activity report.
- The elevator control module shall continue to function in offline mode should communication between the ACS and the controller fail.
- The ACS shall support one or more cameras per elevator cab. Video shall then be associated to elevator access events, such as access granted or access denied

### **ACS People Counting**

- The ACS shall support people counting (or area presence tracking). The ACS shall be able to monitor and report the number of cardholders in an area in real-time and for all areas. Monitoring shall be based on the entire access control infrastructure, for both local areas and those in remote geographic locations. People counting can also be used to perform mustering.
- It shall be possible to control the maximum occupancy of an area by setting a threshold and user notification when reaching the limit.
- The ACS shall report area presence counts in the UI. Area presence tracks shall dynamically track the total number of cardholders in an area. Displayed data shall be updated dynamically.

### **ACS Import Tool**

- The ACS shall support an integrated Import Tool to facilitate the import of existing cardholder and credential data. The import of data shall be through the use the CSV file format. The tool shall be available from the Configuration UI.
- The Import Tool shall also support the ability to manually import data that has been exported from a third-party database if it is in CSV format.
- The import tool shall permit the import of the following data:
  1. Cardholder name, descriptions, picture, email, and status.
  2. Cardholder group information.
  3. Credential name, status, format, and card number (including credentials with custom formats).

4. Partition information.
  5. Custom fields.
  6. Activation date and expiration date.
  7. Update cardholder group association.
- Full flexibility in selecting the fields to be imported during an import session shall be available.
  - The option to use a custom and unique cardholder key shall be specified during the import process to ensure that cardholders with duplicate names will not have their data overwritten. Cardholder key generation shall be automated. The end user shall have the option to select which fields will be used to create this unique key, for example credential number, custom fields, or cardholder name.
  - The ACS shall also support re-importing a CSV file containing new information to update existing information in the ACS database. Re-importing shall enable bulk amendments to existing access control data

**Server Requirement –**

Access Manager Server & Management Server

|                |  |
|----------------|--|
| Processor      | Xeon E3-2134 or better   |
| RAM            | 16 GB or better  |
| Drive          | 2 x 240GB SSD RAID 1   |
| OS             | Windows 2016 or latest   |
| Network (NIC)  | 2 x 1G NIC minimum   |
| Power Supply   | Dual Power Supply (Redundant)  |
| Number of Bays | 4 Bay or more  |
| Form Factor    | 1U   |
| Certification  | System shall support up to 2000 number of readers and must be certified by the ACS manufacturer for the performance. |

**Access Control Gateway:**

|                                     |   |  |
|-------------------------------------|---|--|
| <b>General</b>                      | <p>The Access control Gateway(ACG) is an open architecture embedded computer who allow a symmetric hybrid cloud architecture, its task is also to manage one or more access-controlled doors. It offers Additional tasks such as:</p> <ul style="list-style-type: none"> <li>○ Manage downstream reader interface modules, door controllers,</li> <li>○ input/output modules and wireless/PoE locks.</li> <li>○ Monitor one or more input points (zones).</li> <li>○ Log all access control and IO events in a database.</li> <li>○ Send real-time event reporting to an Access Control System (ACS).</li> <li>○ Shall support TLS 1.2 encryption for host software with AES 256 bits</li> </ul>  |  |
| <b>Downstream device management</b> | <ul style="list-style-type: none"> <li>○ The ACG shall control and program downstream devices.</li> <li>○ ACG Shall be able to configure downstream modules in advance</li> <li>○ ACG shall be able to support multi-vendor deployments on the same (e.g. Wireless locks, PoE locks, interface modules, etc.)</li> <li>○ It shall be able to interface with up to 32 downstream devices (or up to 64 readers connected to downstream devices).</li> <li>○ The ACG shall support communication with downstream devices over:                         <ol style="list-style-type: none"> <li>1. TCP/ IP (networked).</li> <li>2. RS485 (serial).</li> </ol> </li> <li>○ The same ACG device shall be able to support hybrid configurations with some downstream devices connected to the ACG over IP, while others are connected to it over a serial communications link (e.g. RS485).</li> </ul> |  |
| <b>Hardware specs</b>               | The ACG shall be an Intel Atom-based dual core embedded computer  |  |
|                                     | The CPU speed shall be at least 1.33 GHz or higher and A minimum of 2 GB of SDRAM shall be available  |  |

|   |  |  |
|---|--|--|
|   | A minimum of 16 GB of compact flash memory shall be available to run the OS and the access control firmware.   |  |
|   | The ACG shall be power by a 12 VDC power supply.   |  |
|   | The IMC shall support PoE+ (IEEE 8.2.3af)  |  |
|   | <ul style="list-style-type: none"> <li>○ Minimum one (1) embedded USB 2.0 port.</li> <li>○ 4 independent RS485 ports onboard</li> <li>○ Integrated heat sink.</li> <li>○ Onboard status LED</li> </ul>   |  |
| <b>Capacities</b>                                 | <ul style="list-style-type: none"> <li>○ 150,000 credentials (cardholders).</li> <li>○ 150,000 offline events.</li> <li>○ unlimited access rules per cardholder</li> <li>○ Unlimited schedule configuration.</li> </ul>  |  |
| <b>Communication</b>                              | <p>TCP/IP (network)</p> <ul style="list-style-type: none"> <li>○ The ACG shall support TCP/IP communications natively.</li> <li>○ No additional network adapter shall be required to install the ACG on a TCP/IP network.</li> <li>○ The ACG shall support two (2) onboard Ethernet (LAN) controllers for network communications.</li> <li>○ The ACG can be configured with either a static or dynamic IP address.</li> </ul>  |  |
| <b>Access Control System (ACS) communications</b> | <ul style="list-style-type: none"> <li>○ The ACS system shall enroll one or more ACG. The ACG shall be configured and programmed by the ACS software.</li> <li>○ The ACS shall synchronize configuration data to each and every ACG it is connected to.</li> <li>○ The ACS shall synchronize and download the following data to an IMC:                             <ul style="list-style-type: none"> <li>○ Credentials (cardholders)</li> <li>○ Access rules</li> <li>○ Unlocking schedules</li> </ul> </li> </ul> |  |



|                 |   |  |
|-----------------|---|--|
|                 | <ul style="list-style-type: none"> <li>○ IO linking rules</li> <li>○ Minimum access levels</li> <li>○ Cardholder's custom fields</li> </ul>   |  |
| <b>FEATURES</b> | The intelligent controller shall execute all access control logic required to manage access door a secured door   |  |
|                 | <p>The intelligent controller shall:</p> <ul style="list-style-type: none"> <li>○ All access control grant/deny decisions and log events.</li> <li>○ Monitor downstream device status and events.</li> <li>○ Lock/unlock doors.</li> <li>○ Activate/deactivate unlocking schedules.</li> <li>○ Monitor inputs (door sensors, REX inputs, etc.).</li> <li>○ Set output states.</li> <li>○ Set downstream device settings and parameters.</li> <li>○ Download credentials (cardholders) to downstream intelligent controllers for offline operation.</li> </ul>   |  |
|                 | <ul style="list-style-type: none"> <li>○ All events shall be pushed to the ACS in real-time. No polling of the intelligent controller shall be required.</li> </ul>   |  |
|                 | <ul style="list-style-type: none"> <li>○ Degraded modes of operation</li> <li>○ Should the IMC lose connectivity with the ACS software (offline mode), the intelligent controller shall continue to perform its activities and log events in an offline buffer.</li> <li>○ When communication with the ACS software is restored, the intelligent controller will push offline events to the ACS software.</li> </ul> <p>Double degraded mode</p> <ul style="list-style-type: none"> <li>○ The ACG shall also support a double degraded mode of operation with intelligent downstream door controllers.</li> </ul> |  |

|  |  |  |
|--|--|--|
|  | <ul style="list-style-type: none"> <li>○ The ACG shall synchronize the (credential) cardholder database to the ACG.</li> <li>○ Should the downstream controller lose connectivity with the ACG, access requests will be processed by the downstream controller without interruption</li> </ul>   |  |
|  | <p>Web-based IMC application</p> <ul style="list-style-type: none"> <li>○ A web-based application shall allow a user to connect to the ACG and monitor all events outside of the ACS.</li> <li>○ The web-based application shall also allow the configuration of the ACG parameters.</li> <li>○ Application shall be able to run on multiple web browsers including the following: Internet Explorer, Safari, and Firefox among others.</li> </ul>                     |  |
|  | <p>Additional functionalities supported by the IMC include</p> <ul style="list-style-type: none"> <li>○ Antipass back (soft and hard)</li> <li>○ Global Antipass back without the connection to the server</li> <li>○ People counting</li> <li>○ Entry detection</li> <li>○ IO linking across multiple downstream devices (input and output modules)</li> <li>○ Global IO linking without a connection to the server</li> <li>○ Card only, and card and PIN</li> </ul> |  |

**Card Technology specification**

**Technology feature for card**

- Available in 8K-Bytes or 16K-Bytes memory
- AES-128/2TDEA cryptographic algorithms for data protection
- Mutual authentication protocol with generation of diversified session key to protect each card session (using secure messaging).
- Secure data storage with flexible data model (file system based) using a firewalled architecture for data separation between applications.

- Supports ISO/IEC standards: 7810, 7816 and contactless cards (14443 A).
- Contactless unique identifier: 4 bytes (random value).
- Generic command set based on ISO/IEC 7816-4.
- Hardware chip integrating co-processor with high performance for cryptographic calculations with symmetric keys.
- One Time Password generation using standards-based solution.
- Card customization available: Magnetic stripe, custom text or graphics (requires minimum quantity).

**SECURITY FEATURES for card**

- Programmable with one or several Secure Identity Objects® (SIOs®) for each application.
- High resistance to common attacks (man in the middle, replay attacks and others).
- Available with anti-counterfeiting features such as holograms, holographic foil, OVI (Optical Variable Ink).

**SINGLE TECHNOLOGY CONTACTLESS FEATURES for card**

- Seos™ with 8K processor card for standard applications or with extended 16K memory for demanding applications.
- Leverages AES-128 based SIO data model and security.

**INTEROPERABILITY for Card**

- Fully supported by HID Signo Readers.
- Fully supported by iCLASS SE® and multiCLASS SE® readers that can process SIO-enabled data formats. Only supported by iCLASS SE readers with firmware Revision E or later.

**Technical Specifications for card technology**

|                                   |  |
|-----------------------------------|--|
| <b>Base Part Number</b>           | 5005 for standard 16K card / 5006 for 8K<br>5015 for embeddable 16K card / 5016 for 8K |
| <b>Operating frequency</b>        | 13.56 MHz with ISO/IEC 14443 Type A  |
| <b>Typical Maximum Read Range</b> | 3-4" (depending the reader used)   |
| <b>Dimensions</b>                 | 2.127" x 3.375" x 0.033" max (5.40 x 8.57 x 0.084 cm)                                  |
| <b>Construction</b>               | Composite with 60% PVC / 40% PET   |
| <b>Operating Temperature</b>      | -40° to 158° F (-40° to 70° C)   |
| <b>Weight</b>                     | 0.20 oz (5.5g)   |
| <b>Memory Size</b>                | 8K or 16K  |
| <b>Privacy Mode</b>               | Privacy-preserving mode (with encryption of device identifiers)                        |

|  |  |
|--|--|
| <b>Secure Messaging</b>                | EN 14890-1 and 7816 aligned using AES/2TDEA algorithm  |
| <b>Mutual Authentication Mechanism</b> | Based on ISO/IEC 24727-3 2008 with NIST SP800-56A (for session key derivation)   |
| <b>TUViT SEAL-5 Certified</b>          | Yes - Currently available with 16K option only   |
| <b>Write Endurance</b>                 | Min 500,000 cycles   |
| <b>Data Retention</b>                  | Min 20 years   |
| <b>HID Proximity</b>                   | No   |
| <b>Contact Smart Chip Embeddable</b>   | Yes  |
| <b>Printable</b>                       | Yes (white/white card)<br>Usable with direct imaging and thermal transfer printers<br>(from HID but also from other suppliers)<br>Exclusion areas for printing may apply in some areas of the card plastic |
| <b>Slot Punch</b>                      | Not available  |
| <b>Secure Identity Services</b>        | Customized cards are available through HID Identity on demand  |
| <b>Visual Security Options</b>         | Optional including hologram, anti-counterfeiting, holographic foil   |
| <b>Additional Security Options</b>     | Corporate 1000, Secure Identity Object (SIO) programming with SE-Elite   |
| <b>Warranty</b>                        | Lifetime, see complete warranty policy for details   |

**MANUFACTURERS of Access control card reader**

Access control card readers shall be as manufactured by a global company who is a recognized leader in the production of access control devices. Card readers manufactured for non-access control applications shall not be acceptable.

- A. Substitutions: No substitutions allowed.

**2.02 ACCESS CONTROL CARD READER**

- A. Read Only Multi-technology contactless smart card and Mobile ID reader

The multi-technology contactless smart card reader(s) shall be designed to securely read, interpret, and authenticate access control data from 2.4 GHz mobile devices, 13.56 MHz contactless smart card credentials and 125 kHz proximity cards.

The multi-technology contactless smart card reader shall be optimally designed for use in access control applications by providing:

Customized security protection through support of the device-independent Secure Identity Object™ (SIO) portable credential methodology to provide enhanced security and performance features.

Unique read selection that enables reading of the Secure Identity Object™ (SIO), standard iCLASS, 125 kHz proximity, or multiple technologies at the same time.

Participates in an advanced, bounded and trust-based security system utilizing the Trusted Identity Platform™ (TIP) architecture.

A migration platform to upgrade from the most popular 125 kHz proximity technologies to SIO on iCLASS Seos smart cards and Mobile IDs by reading both 125 kHz proximity technology and 13.56 MHz contactless smart card technology / NFC and 2.4GHz Bluetooth Smart technology

Guaranteed compatibility to read all HID data formats and Desfire EV3 and ensuring card-to-reader interoperability in multi-location installations and multi-card and reader populations when used with Genuine OEM products.

Backwards compatibility with legacy 13.56 MHz contactless smart card and 125 kHz proximity access control formats (e.g... 26-bit, 32-bit, 35-bit, 37-bit, 56-bit, and HID Corporate 1000 formats). Compatibility across the product line shall be assured without the need of special programming.

Global, off-the-shelf availability.

Enables secure access with a mobile device by leveraging standard communication technologies that work with both iOS® and Android™ operating systems. Including validation of support with minimum 15 different mobile device models

Enhances the transactional experience by opening doors with a "Tap" or "Twist and Go" gesture, merging security with convenience. Including ability to configure the read range and interaction mode via mobile device app.

Simultaneously support of BLE Mobile Devices, NFC Mobile Devices and 13.56MHz and 125kHz contactless credentials. Supporting new Mobile IDs and existing card populations for seamless migration to a more secure standard.

Reader can be purchased as "mobile-ready" to be installed in preparation for moving to mobile at a later time. Once user decides to move to mobile, the reader can be configured for the users specific requirements.

No special system modifications are required to read mobile credentials. Existing Wiegand readers can easily be replaced and work with existing access control panel hardware.

The multi-technology contactless smart card reader shall provide enhanced security technology and features.

The multi-technology contactless smart card reader shall be Secure Identity Object™ (SIO) enabled. The multi-technology contactless smart card reader platform shall support the standards-based, device-independent Security Identity Object™ (SIO) portable credential that binds the credential to the physical media to ensure data authenticity and privacy. The SIO shall be able to reside on any number of identity devices, including Mobile ID, iCLASS Seos, iCLASS SE, iCLASS SR, MIFARE Classic, and MIFARE DESFire EV1/EV2 credentials.

The multi-technology contactless smart card reader shall be a certified end-point (TIP Node) within a Trusted Identity Platform™ (TIP) infrastructure. TIP shall provide a scalable, on-demand, secure identity delivery system that validates, registers and provides lifecycle management support for certified trusted end-point multi-technology contactless smart card readers.

The multi-technology contactless smart card reader shall increase security by narrowing the possibility of unwanted configuration changes and denials of service. The multi-technology contactless smart card reader shall utilize TIP-enabled secure configuration of multi-technology contactless smart card readers with counters and uniquely diversified configuration cards.

The multi-technology contactless smart card reader shall utilize Secure Element Technology™ to protect keys and cryptographic functions, minimally, to the international standard Evaluation Assurance Level of EAL 5+.

The multi-technology contactless smart card reader shall be configurable to utilize Velocity Checking to provide breach resistance against electronic attacks that invoke multiple improper authentication attempts.

The multi-technology contactless smart card reader shall be configurable to provide multiple hierarchical degrees of key compatibility for accessing the smart card access control data. Compatibility shall be provided for the following key structure options:

Compatibility with the standard SIO and iCLASS access control application data model to ensure convenient off the shelf compatibility with Mobile IDs, iCLASS Seos, iCLASS SR, and iCLASS credentials.

Compatibility with higher security SE Elite credential programming that uniquely assigns a reader and credential keyset that provides site-specific security.

The multi-technology contactless smart card reader shall have a unique electronic serial number.

The multi-technology contactless smart card reader reads Mobile IDs powered by the Seos standard-based software application or applet technology. Seos technology is independent of communication medium (e.g... 13.56Mhz ISO14443A or 2.4HGz BLE allowing for a unified security platform across credentials using BLE, NFC and contactless smart card credentials.

The multi-technology contactless smart card reader shall provide enhanced usability features.

The multi-technology contactless smart card reader shall simplify troubleshooting through Anti-passback Notification that the card has already been processed and it must be removed from reader field temporarily prior to processing again.

The multi-technology contactless smart card reader shall provide enhanced user feedback options through the use of clear and bright tri-colored LEDs configurable to support any three color combinations (RGB - Red, Green, and Blue).

The multi-technology contactless smart card reader shall enable ease of installation through identical wiring methods as legacy 13.56MHz and 125 kHz proximity readers.

The multi-technology contactless smart card reader shall enable backwards compatibility with legacy 13.56 MHz and 125 kHz proximity access control formats (e.g... 26-bit, 32-bit, 35-bit, 37-bit, 56-bit, and HID Corporate 1000 formats).

The multi-technology contactless smart card reader manufacturer shall provide a full product line of compatible products including readers, readers with integral keypads and, credentials and cards without the need of special programming.

The multi-technology contactless smart card reader manufacturer shall provide global, off-the-shelf availability.

The multi-technology contactless smart card reader shall provide universal compatibility with most access control systems by outputting card data in compliance with the SIA AC-01 Wiegand standard.

Multi-technology contactless smart card reader shall be configurable to provide secure, bidirectional communication in compliance with v2 of the SIA OSDP (Open Supervised Device Protocol) standard

Multi-technology contactless smart card reader shall allow the reader firmware to be upgraded in the field without the need to remove the reader from the wall through the use of HID- provided programming utilities or applications.

Multi-technology contactless smart card reader shall allow for secure installation practices through mounting methods utilizing tamper resistant screws.

Multi-technology contactless smart card reader shall provide the ability to transmit an alarm signal via and integrated tamper relay if an attempt is made to remove the reader from the wall. The tamper function shall be programmable to provide a selectable action compatible with various tamper communication schemes provided by access control panel manufacturers. The selectable action shall include one of the following:

The reader tamper line changes from a closed state to an open state.

During a tamper state, the "I'm Alive" message is inverted.

Multi-technology contactless smart card reader shall provide ability of an on-line "I'm Alive" message so the reader's functional health can be monitored at all times when paired with a compatible access control panel.

The multi-technology contactless smart card reader shall provide customizable reader behavior options either from the factory, or defined in the field through the use of pre-configured command cards. Reader behavior programming options shall include:

- Audio/Visual Templates for card reads, proximity enabled, and attack detection.
1. Velocity Check timing and thresholds
  2. 125 kHz ASK, FSK and PSK configurations and outputs
  3. Tamper actions
  4. RF scan delay
  5. Hold Mode
  6. Intelligent Power Management
  7. Key diversifiers
  8. Key rolling



9. CSN output configuration
10. Data Model prioritization
11. Default LED color
12. Default Keypad LED backlight color
13. Keypad visually impaired mode

Multi-technology contactless smart card reader shall provide the following programmable audio/visual indication:

An audio beeper shall provide various tone sequences to signify: access granted, access denied, power up, and diagnostics.

A high-intensity red/green/blue (RGB) light bar shall provide clear visual status. The light bar shall provide uniform distribution of light eliminating individual bright spots.

Multi-technology contactless smart card reader shall allow the reader firmware to be upgraded in the field to face security threats and enable the potential read of future credential technologies. Both firmware and configuration updates shall be executed via a secure channel created between HID Origo enabled utilities/applications and the reader secure element.

Multi-technology contactless smart card reader shall provide the ability for mounting to standard electrical boxes through the use of universal international mounting holes.

Multi-technology contactless smart card reader shall be designed to accept hardware expansion modules that add processing power or communication functionalities.

Multi-technology contactless smart card reader will support BLE communication to Mobile Access Configuration Mobile Application running on iOS or Android devices. This will enable the following features.

Bluetooth communication Controller Firmware version identification.

Bluetooth communication Controller Firmware update.

Mobile ID *Application* Brand configuration: **(WILL BE CONSIDERED FOR FUTURE)**

Reader operation modes configuration: "Tap" OR "Twist and Go" OR "Tap" and "Twist and Go".

Mobile Range and Power Setting configuration for following settings: Tap Range, Twist and Go Range, or Transmit Power

Mobile Configuration options can be configured without power cycling reader

Mobile Configuration options can only be modified with secure element based Mobile Admin Card authentication with reader.

Multi-technology contactless smart card reader must support Bluetooth communication to Mobile Device credential. This communication must use Bluetooth Low Energy (BLE) communication and not require pairing with mobile devices.

Multi-technology contactless smart card reader must support NFC communication card emulation mode. This communication must only occur with credentials stored via Host Card Emulation or a Secure Element in the mobile device. This communication must not occur via NFC peer-to-peer or Reader/Writer mode.

Multi-technology contactless smart card reader must support, by default, Apple's Enhanced Contactless Polling (ECP) to support credentials in the Apple Wallet

Multi-technology contactless smart card reader must support being connected and managed in a modern ecosystem to allow for control and administration of reader configuration, reader updates and functionality upgrades.

Multi-technology contactless smart card reader must support the following 2 modes of interaction with BLE credentials:

Tap Mode: The mobile device must be brought very close to or touching the reader (a similar user experience to that observed using Prox cards)

Twist and Go: The mobile device holder must initiate the read by twisting the mobile device in using a sharp 90° rotation in either direction.

Multi-technology contactless smart card readers shall provide the following enhanced performance features

The multi-technology contactless smart card reader shall provide built-in support for 125 kHz proximity FSK (HID Proximity, AWID). PSK (Indala), and ASK (EM4102) 125 kHz technology to increase credential technology migration options.

The multi-technology contactless smart card reader shall enable user prioritization of High-frequency/High-frequency and High-frequency/Low-frequency credential reads. Technology prioritization shall synchronize a site's credential technology read priority to the access panel configuration while reducing unintended credential reads.

The multi-technology contactless smart card reader shall have the ability to provide consistent optimal read range by implementing an auto-tune surface detection function that adjusts for mounting environment and manufacturing tolerances to enhance consistency of read performance.

The multi-technology contactless smart card reader shall be field programmable to provide secure upgrades for migration and extended lifecycle.

The multi-technology contactless smart card reader shall be designed as a system to provide optimal read range and read speed for increased access control throughput.

The multi-technology contactless smart card reader firmware shall be based on Common Language Infrastructure implemented by a .NET virtual machine complying to ECMA-335 standard. This virtual machine shall execute applications stored in a library. Applications that execute on this virtual machine shall be implemented or revoked without modification of the underlying firmware.

The multi-technology contactless smart card reader must have spacer available as optional accessory from reader manufacturer to space reader away from metallic surfaces and reduce the impact the metal will have on read range, and/or the optional spacer accessory may be used for flush mount installation.

The multi-technology contactless smart card reader utilizes directional BLE antenna enabling long range reading distances of up to 6.6' in correct orientation – in front of the reader and not behind it.

Multi-technology contactless smart card reader shall provide enhanced environmental and sustainability features.

The multi-technology contactless smart card reader shall reduce power consumption by as much as 50% through the use of Intelligent Power Management (IPM) technology.

Multi-technology contactless smart card reader shall be fully compliant with Restriction of Hazardous Substances directive (RoHS) restricting the use of specific hazardous materials found

in electrical and electronic products. The substances banned under RoHS are lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (CrVI), polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE).

Multi-technology contactless smart card reader shall comply with the following 13.56MHz-related standards to ensure product compatibility and predictability of performance:

ISO 15693

ISO 14443A

Multi-technology contactless smart card reader shall implement the following high security 2.4 GHz and 13.56 MHz applications out-of-box.

Secure Identity Object on Mobile Devices

Secure Identity Object on iCLASS Seos

Secure Identity Object on iCLASS SE

Secure Identity Object on iCLASS SR

Secure Identity Object on MIFARE Classic

Secure Identity Object on MIFARE DESFire EV1 / EV2

Multi-technology contactless smart card reader shall be suitable for global deployment by meeting worldwide radio regulatory, safety regulatory, and environmental ratings including:

UL294 (US)

cUL (Canada)

FCC Certification (US)

IC (Canada)

CE (EU)

RCM (Australia, New Zealand)

SRRC (China)

KCC (Korea)

NCC (Taiwan)

iDA (Singapore)

RoHS

MIC (Japan)

Green Circle

Bluetooth SIG certification

Multi-technology contactless smart card reader shall be provided with a full enclosed assembly.

Multi-technology contactless smart card reader shall provide the following typical Mobile ID read ranges:

6.6' (2m) reading twist and go SIO on Mobile ID using Bluetooth & Seos

5.9" (15cm) reading tap SIO on Mobile ID using Bluetooth & Seos

1.0" (2.5 cm) reading Mobile ID using NFC

Multi-technology contactless smart card reader shall provide the following typical contactless read ranges:

Up to 1.6" to 4" (4 to 10 cm) Seos<sup>®</sup> , MIFARE Classic, MIFARE DESFire EV1/EV2 & ISO14443A Single Technology Cards

Up to 2.8" to 6" (7 to 15 cm) iCLASS SE<sup>®</sup>, iCLASS SR<sup>®</sup>, iCLASS & ISO15693 Single Technology Cards

Up to 2.4" to 4" (6 to 10 cm) HID / AWID Proximity<sup>®</sup> EM Proximity & 125kHz Single technology cards

Multi-technology contactless smart card reader shall be designed for low current operation to enable contactless smart card migration from most legacy proximity applications without the need to replace existing access control panels and/or power supplies. Contactless smart card power requirements shall be:

Operating voltage: 12V DC, reverse voltage protected. Linear power supply recommended.

Current requirements and power consumption:

97 mA (Standard AVG Current)

250 mA (Peak Current Draw)

Multi-technology contactless smart card reader shall meet the following physical specifications:

Dimensions : 1.77 x 4.78 x 0.77 (44.9mm x 121.5mm x 19.5mm)

Weight: 3.35oz (95g) Pigtail and 2.65oz (75g) Terminal Strip  
Material: UL94 Polycarbonate

Plastics: Consist of two-piece design with mounting plate and either separate front bezel and reader body (totaling three-pieces) or combined front bezel/reader body (totaling two-pieces).

Color: Black Bezel with Silver Trim baseplate. Black Trim baseplate is available as an additional accessory item.

Multi-technology contactless smart card reader shall meet the following environmental specifications:

Operating temperature: -35°F to +150°F (-35°C to +66°C)

Operating humidity: 0% to 95% non-condensing

Storage Temperature: -40°F to +185°F (-40°C to +85°C)

Weatherized design suitable to withstand harsh environments with a rating of IP65 per IP Code of International Electrotechnical Commission.

Multi-technology contactless smart card reader cabling requirements shall be:

Cable distance:

RS-485 (OSDP): 4000 feet (1200m)

Cable type:

RS-485 (OSDP): 4-conductor #24 AWG

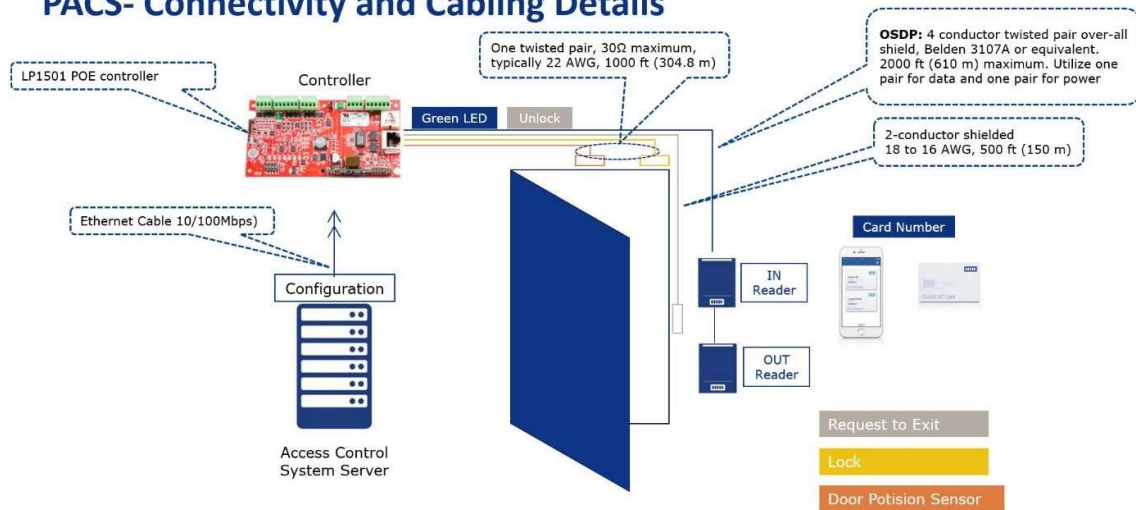
Standard reader termination: 18" (0.5m) cable pigtail

Optional reader termination: terminal strip

The multi-technology smart card reader shall be provisioned through secure connections utilizing Trusted Identity Platform's™ Secure Delivery Infrastructure (SDI) where all cryptographic keys governing system security are delivered with end-to-end privacy and integrity.

The multi-technology contactless smart card reader shall provide a lifetime warranty against defects in materials and workmanship.

## PACS- Connectivity and Cabling Details



## PART 2 – PRODUCTS: - IP Controller

### 2.01 GENERAL SPECIFICATIONS FOR IP CONTROLLERS

- The family of intelligent controllers and peripheral interface devices must provide an open architecture family of products that enables a choice of host software system vendor without replacement of hardware.
- The Linux based intelligent controller must provide decision making, event reporting, and database storage as a hardware platform. Two reader interfaces must provide control for one door and capable of supporting up to an additional 16 doors paired and or alternate reader configurations with peripheral interface devices.
- The controller must communicate with the host via on-board 10BaseT/100BaseTX Ethernet port and support TLS encryption as a minimum security implementation.
- The intelligent controller must be capable of elaborate processes and procedures without host intervention. Once configured, the intelligent controller must function independently of the host, and must be capable of controlling access, managing alarms, interfacing with an array of hardware devices, all while providing the decision-making oversight that each system configuration requires.
- The intelligent controller must provide centralized biometric template management and support a wide range of reader technologies, including OSDP, Wiegand, magnetic stripe and biometric.
- One physical barrier must be controlled. Each reader port must accommodate a read head that utilizes OSDP (RS-485), OSDP SC, Wiegand, magnetic stripe, or F2F

protocol/electrical signaling, one or two wire LED controls, and buzzer control. One reader port will also accommodate two-wire RS-485 electrical signaling standards.

- Controller must support, as a minimum the following open standards, PSIA Area Control, SNMPv3/v2c, OSDP and OSDP SC.
- The controller must utilize a cryptographic module, like OpenSSL FIPS Object Module RE, that is validated to FIPS 140-2 thus providing a certified implementation of TLS.

## 2.01 TECHNICAL SPECIFICATIONS FOR CONTROLLERS

- The interface is for use in low voltage, Class 2 circuits only.
- The installation of this device must comply with all local fire and electrical codes.
- Power Input
  - PoE (12.95 W), compliant to IEEE 802.3af or
  - PoE+ (25 W), compliant to IEEE 802.3at or
  - 12 Vdc +/- 10%, 1.8A maximum
- Power Output
  - PoE: 12 Vdc @ 625 mA including reader and Auxiliary Power output \*
  - PoE+ or external 12 Vdc: 12 Vdc @ 1.25 A including reader and Auxiliary Power output \*
  - \* Excluding micro USB port
- Micro USB Port: 5 Vdc maximum (deduct 270 mA from reader and Auxiliary Power output)
- SRAM Backup Battery: Rechargeable battery
- Host Communication: Ethernet: 10-BaseT/100Base-TX
- Inputs:
  - Two unsupervised/supervised, Programmable End of Line resistors, 1k/1k ohm, 1 %, ¼ watt standard
  - One unsupervised input dedicated for cabinet tamper
- Outputs: Two relays: Form-C contacts: 2 A @ 30 Vdc, resistive
- Reader Interface
  - Power: 12 Vdc ± 10 %: PoE, PoE+ or local power supply, 300 mA maximum
  - Data Inputs
    - Reader port 1: TTL compatible, F/2F or 2-wire RS-485
    - Reader port 2: TTL compatible or F/2F
  - LED Output: TTL compatible, high > 3 V, low < 0.5 V, 5 mA source/sink maximum
  - Buzzer Output: Open collector, 12 Vdc open circuit maximum, 40 mA sink maximum
- Cable Requirements
  - Power: 1 twisted pair, 18 AWG (when using local 12 Vdc power supply)
  - Ethernet: CAT-5, minimum



- Reader data (TTL): 6-conductor, 18 AWG, 500 ft. (152 m) maximum
- Reader data (F/2F): 4-conductor, 18 AWG, 500 ft. (152 m) maximum
- Reader data (RS-485): 1 twisted pair, shielded. 24 AWG, 120 ohm impedance, 2000 ft. (610 m) maximum
- Alarm Input: 1 twisted pair per input, 30 ohm maximum
- Outputs: As required for the load
- Environmental
  - Temperature:
    - Storage -55 to +85 °C
    - Operating 0 to +70 °C
    - Humidity: 5 to 95 % RHNC
- Mechanical
  - Dimension:
    - 5.5 in. (140 mm) W x 2.75 in. (70 mm) L x 0.96 in. (24 mm) H without bracket
    - 5.5 in. (140 mm) W x 3.63 in. (92 mm) L x 1.33 in. (34 mm) H with bracket
  - Weight
    - 3.6 oz. (103 g) without bracket
    - 4.43 oz. (125.5 g) with bracket
- Product Compliance:
  - UL294 Recognized. Note: For UL, the Power Sourcing Equipment (PSE) such as a PoE or PoE+ enabled network switch. and/or PoE or PoE+ power injectors must be UL Listed under UL294B.
  - FCC Part 15 Class A
  - CE Compliant
  - RoHS (2011/65/EU & 2015/863)
  - EU REACH (1907/2006)
  - California Proposition 65
  - NIST Certified Encryption
- Warranty: Mercury Security warrants the product is free from defects in material and workmanship under normal use and service with proper maintenance for one year from the date of factory shipment.

## 2.02 TECHNICAL FEATURES FOR CONTROLLERS

- Connectivity: Primary Port: 10/100 Ethernet
- Security:
  - Host/Controller connection protected by TLS 1.2/1.1 or AES-256-128
  - Controller/IO Expansion connection protected by AES
  - Generate and load custom peer certificates for TLS
  - Port based network access control using 802.1X

- Crypto memory chip
- FIPS 140-2 user of OpenSSL
- HTTPS protection for installer web pages
- Secure cookies
- SNMPv3/v2c
- DIP switch toggle sets 5 minute time to disable webpage access
- Disable default login credentials
- Authorized IP address filtering
- IP Client Proxy
- Bulk erase controller and periphery devices during replacement
- Strong password enforcement
- Door Control: One physical barrier can be controlled using single or paired readers.
  - Two-reader ports:12VDC regulated power, 150mA maximum
    - Port 1: clock/data, data-1/data-0, F2F or 2-wire RS-485 (2 devices)
    - Port 2: clock/data, data-1/data-0 or F2F
  - Two (2) programmable inputs, Two (2) relays, diagnostic LEDs
- Access Control:
  - 240,000 Cardholder capacity
  - 50,000 Transaction buffer
  - If/Then Macro capability
  - Adjustable Cardholder Capacity
  - Supports up to 130 inputs and 130 outputs
- Card Formats:
  - 16 card formats per active reader, 8 per offline reader
  - Entire card number reported on invalid read
  - 19 digit (64-bit) User ID and 15 digit PIN numbers maximum
  - PIV, CAC, TWIC card compatible
  - 255 Access Levels per cardholder
  - Activation/Deactivation Date or Date & Times
- Card Reader Functions
  - Multiple card format support by reader
  - Paired reader support
  - Alternate reader support
  - Elevator support
  - Turnstile support
  - Biometric device support
  - Open Supervised Device Protocol (OSDP) and OSDP SC compliant
  - Occupancy count
  - Support of multi-occupancy rules
  - Anti-passback support
  - Area-based, reader-based, or time based

- Nested area, hard, soft, or timed forgiveness
- Supports host-based approval rules
- Keypad support with programmable user commands, card input
- Shunt relay support
- Strike follower relay support
- Threat level and Operating Modes
- Host controlled OSDP reader passthrough
- Elevator floor override
- Database Functions
  - Encrypted database
  - Configurable card database
  - Supports up to nineteen (19) digital card numbers
  - Supports pin codes up to fifteen (15) digits
  - Programmable card activation and deactivation times and dates
  - Card issue code up to 32 bits, ADA and VIP flags; PIV (75 bits); Smart Card (200 bits)
  - Ability to track people and objects
- Intrusion Alarm Functions
  - Supports entry delays and exit delays
  - Area monitoring
  - Standard alarm masking
  - Provides control and alarm processing from the keypad
- Supported Integrations
  - Regional I/O shares I/O status
  - Wireless locks
  - Map Power Supply Alarms and Events using PSIA
  - Reader firmware and configuration download
  - Supports 1 total RS-485 I/O protocol
- System Functions
  - Map LifeSafety PSU alarms and events using PSIA
  - Regional IO shares IO states amongst multiple controllers
  - Relay count activations
  - Interoperability with older host software using Legacy Mode feature
  - Synchronize time using NTP

**Specifications for (Face + QR scanner + iclass reader + pin)**

- The face readers algorithm should create a 3D face template to cope up with face changes such as Helmet, Mask, Beard, bandage, Sun glass and spectacles
- The face reader & Algorithm must be of same OEM to support future upgrades and seamless compatibility

- The face algorithm should be certified by NIST( National Institute of standard & Technology) in FRVT ( Face Recognition vendor test)
- The Liveness of reader for Anti spoofing must be certified by some authorised agency such as iBeta (A US firm to test the world’s best algorithms) and must comply to iBeta Level 1 OR 2 and device must support Anti spoofing against 2D printed photo,3D mask, digital Photo and Video in electronic media
- The device should comply to GDPR ( General Data Protection Regulation) to ensure the biometric data privacy and security
- The device should comply to the human safety from Infrared
- The device hardware should have CPU and GPU as equivalent or higher to Nvidia ARM Cortex-A15 Quad-Core 2.0 GHz to adopt the future Artificial Intelligence based algorithms. GPU in face readers required for quick and better image processing.
- The device shall support face reading of users wearing masks and shall also support make non wearing alert.
- The device should support the lighting condition from 0 to 25,000 Lux
- The devices should immune to external environmental such as dust & water logging complying with IP65 and IK07
- The device must read all smart card technology such as Mifare, Desfire, iCLASS and Proximity and face template shall also be encoded to the smart card.
- The devices must support the intentional authentication only to avoid proxy access and attendance punches. Authentication shall only be done once the person look towards device
- The device reading range for face authentication shall not be more than 2.0 feet or less to avoid the Tailgating/proxy attendance & Access in narrow lobby.
- The device shall have UL294 (Access Control specific), CE, BIS and RoHS.

**Technical Specifications of FACE READER**

| Face Biometric with Built in Card Reader Compliance Sheet |               |   |                   |
|---|---------------|---|-------------------|
| SL.No   | SPECIFICATION | REMARKS   | Compliance Yes/No |
| 1   | Display       | 6" WVGA color capacitive touchscreen Display  |                   |
| 2   | Device OS     | Linux   |                   |
| 3   | OEM           | Fae matching Algorithm and hardware shall be of same OEM for best of performance, Longevity, future upgrades, Backword compatibility, Post sales service and repair |                   |
| 4   | Algorithm     | OEM own algorithm   |                   |

|    |                             |   |  |
|----|-----------------------------|---|--|
| 5  | Anti-spoofing               | Certified by thirty party agency  |  |
| 6  | Sensor                      | <b>Optical set</b> consist of ( 3D+ NIR+ RGB) Cameras to create 3D model of face and to perform in all lighting conditions from Zero light and outdoor. |  |
| 7  | Processing Power            | <b>GPU/CPU:</b> Nvidia ARM Cortex-A15 Quad-Core 2.1GHz  |  |
| 8  | Key Pad                     | On screen Touch keypad  |  |
| 9  | Input Keys                  | Configurable Input keys on Device   |  |
| 10 | Network/Communication:      | - Ethernet, RS485, RS422, USB<br>- Wi-Fi and 4G options   |  |
| 11 | Other Communication         | Built in speaker  |  |
| 12 | Display Customisation       | Corporate video Playback, wallpapers, custom Greetings.   |  |
| 15 | Time & Attendance           | Touchscreen Time Clock, featuring programmable function keys  |  |
| 16 | Verification Technology     | Template on Card and Template on device   |  |
| 17 | Face Template Capacity      | 20,000 users and go upto 40,000 users;  |  |
| 18 | 1:N and 1:1 In Device       | 40,000 Templates - One face template per person and identification time with 40,000<=1 sec  |  |
| 19 | Template on Card 1:1        | 250,000 IDs in authorized user list,  |  |
| 20 | Template Size               | 1:N 1962 bytes max ( Template on device)<br>1:1 900 bytes max ( Template on Card)   |  |
| 21 | Lighting conditions support | 0 to 25,000 lux ( ( No additional LED/light shall be required to perform function in the low light)   |  |
| 22 | Log Capacity                | 1 Million transaction logs (10,00,000 logs)   |  |
| 23 | Card reader                 | Contact less Mifare (13.56MHz),Desfire, HID Prox & HID Iclass   |  |
| 24 | Multi Factors               | Contactless smartcard, PIN and BioPIN   |  |
| 25 | Matching Method             | 1:1, 1:N  |  |
| 26 | Authentication Type         | FACE Only, Card + FACE, Card + PIN + FACE   |  |
| 27 | Inputs/outputs:             | Wiegand In & Out (customizable up to 512 bits),and Door Relay, 3 General Purpose Inputs (including Door monitoring), 3 General Purpose Outputs          |  |
| 28 | Secured communication       | Server to Device: TLS & SSL<br>Controller to face device: OSDP Secure and OSDP, Wiegand   |  |
| 29 | Internal Relay              | Deadbolt, EM lock, door strike, automatic door  |  |
| 30 | Tamper Evident              | Anti tamper switch  |  |

|    |                                   |   |  |
|----|-----------------------------------|---|--|
| 31 | Operating Temperature             | -10°C to 55°C (14°F to 131°F)   |  |
| 32 | Humidity                          | 10% to 80% (non condensing)   |  |
| 33 | Certification                     | CE, UL294 , FCC,  |  |
| 34 | Ingress protection:               | IP65  |  |
| 35 | Impact protection:                | IK06  |  |
| 36 | Anti-fraud features               | Liveness detection, timed anti-pass back, Banned/authorized user lists and Anti poofing shall be tested by some authorised agency |  |
| 37 | Smart Card support                | Mifare/Desfire, iCLASS(PACS number & template on card), Seos  |  |
| 38 | Mobile Credentials                | The device will offers inbuilt Mobile credentials an option HID Bluetooth & NFC credentials                                       |  |
| 39 | Safety and quality certifications | EMC/Safety standards: CE, CB, FCC, RoHS, REACH and WEEE compliant , UL 294  |  |

**Specifications for LONG RANGE READER**

Frequency Range : Standard ISM 902-928 MHZ or ISM 865-868 MHZ  
 Read range : 12M  
 Operation Mode : FHSS  
 RF Power : 0-30dBm, software adjustable  
 Reading speed: Software Programmable, Average Reading per 64Bits :< 6ms  
 Reading Mode: Timing or Touch, Software Programmable  
 Date Ports : Standard Wiegand26/24, Rs485, Rs232:Softwareprogrammable  
 Data Input Port : Trigger input one team, anti-collision and multi-reading  
 Reading Clue : Buzzer  
 Antenna : Build-in line polarization Antenna, Gain: 12 dbi  
 Power Supply : DC +9V (Power Adapter), DC+12  
 Dimension :440mm x 440mm x 50mm  
 Weight : 5 Kg  
 Operation Temp :-20oC +80oC  
 Certification : CE, FCC.

**G) Specifications for Active RFID Tags**

- a. Compatible with long range reader and pre encoded with an unique Serial No.
- b. Tag Tamper proof
- c. Special adhesive to provide strong adhesion on vehicle windscreen/asset surface, even at high temperature
- d. Type : Contactless Read Only
- e. Operating Frequency : 125 ± 6 kHz. (LF-Low Frequency)

- f. Capacity : 64 bits
- g. Data Coding Type : Manchester, Biphase, PSK
- h. Standard Deployment : Attached to object or placed on object
- i. Tested ReadRange : 2-6 cm (1 - 3 in.)
- j. Multi-Detection : No
- k. Max read quantity : 1 tags/sec
- l. Size: Approx. Dia :  $\Phi$ 30mm
- m. Material : Plastic or other resin material
- n. Weight : Around 3.0 grams
- o. Compliance : EM4100 or other compatible RFID tags
- p. Operating Specifications: Waterproof, Resistance to immersion in salt water, oil, Resistant to Shock and Vibration
- q. Temperature : Storage upto 100°C, Operating upto to 85°C

**H) Specifications of Single/Double leaf Magnetic Door Locks:**

- 1. Low energy consumption (DC 12V / 24V)
- 2. Silent and continuous duty operation
- 3. Applicable to wide variety of swing and sliding door
- 4. Instantaneous release in the event of emergency
- 5. 600/1200 lbs holding force with LED indicator
- 6. Safety feature: LED will be GREEN colour if the door is closed properly. Otherwise, LED will be RED colour.

**I) Specifications of Magnetic Contacts / Door Position Sensor:**

- 1. The magnetic contact shall be of flush / surface mount type.
- 2. The contacts shall be corrosion resistant and completely hermetically sealed.
- 3. 3 million cycles of operation shall not affect the contact.

**TECHNICAL SPECIFICATIONS FOR SMART LOCKER SYSTEM (HARDWARE, SOFTWARE, AMC & PROFESSIONAL SERVICES)**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**Design Brief:**

**MAKES: FONZEL/SMARTBOX/ VECOS/ELOCKER**

a. This system is required **on each floor** in the ASPHALT PLANT WORKER'S OFFICE from Ground, 14<sup>th</sup> to 17<sup>th</sup> floor of the Material testing labs (5 nos. in total and all integrated seamlessly to work as a single system and accessible through a centralised GUI Software)

b. All above smart Lockers will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.

c. Include all necessary items required to make the system complete and working at all times Supply, Installation, Testing & Commissioning of Smart Locker System for Indoor Use terminal with following specs for total of **192-200 nos. of smart locker system in total including all the floors**. You have to consider the associated items as per the no. of lockers in one whole system. The requirement is that there should be 1 payment console and associated lockers for ease of use. Below mentioned items are for one set of 30 to 32 nos. lockers and associated items as mentioned below

- Range of 30 to 32 nos. of smart lockers with a Mix of S, M & L size compartments,
- 30 to 32 nos. electronic locks,
- 1 x 15" touchscreen,
- 1 x 2-D scanner,
- 1 x pinhole IP camera,
- 2 x dome camera,
- 1 x 4 channel NVR (with 6 TB HDD for 90 days' back-up),
- 1 x Main Controller,
- 7 x Relay Controller Board (8 Channel),
- 1 x Dual SIM Router,
- 1 x set of industrial pc, boards, cables etc., Point of Sale (POS) machines minimal visual indication on the lockers to give the status of the locker to users

Custom branding on the metal body as per MCGM Material Testing Lab requirement

Necessary plug points will be provided for electricity, however copper or fiber network switches, loaded patch panels, racks, converters pig tails, etc. as required for all 6 terminals on respective floors for LAN or Wi-Fi for data to be included in this scope. This should be isolated from the business IT backbone of the building and can be included as part of the ELV and IBMSIT backbone under Operational Technologies (OT).

The cameras and NVR offered should be compatible with the proposed/offered CCTV of the building for easy of back-up management, maintenance & audit trails

Compartment Sizes: Standard RAL Color 9010 powder coated

- Small: 415mm (Width) X 500mm (Depth) X 110mm (Height)

- Medium: 415mm (Width) X 500mm (Depth) X 200mm (Height)



- Large: 415mm (Width) X 500mm (Depth) X 400mm (Height)

All Annual charges to be included for next 5 years after the 1<sup>st</sup> year of warranty period including hosting as a multi-tenant setup on Cloud infrastructure hosted at Mumbai.

- Also Includes updates, upgrades & maintenance costs.
- MCGM Material Testing Lab branded notifications
- Hardware Maintenance
- SMS Gateway Provider
- Immediate remote support and for major break down short notice support to be included for 24 X 7

Resend notification feature should be there

The admin can decide the valid time slot for the package expiration.

#### **Locker Operation Authorization**

- Maintain lock open and close event history.
- It also allows authenticated and verified users to fetch their respective locker
- Sends open command to Locker hardware.
- Acknowledges Close Locker event.
- Sends event to notification module for open and close event

#### **Dashboard**

1. Transaction management details
2. Entire locker network health monitoring
3. Reports & analytics (real time as well as auto-scheduled)
4. Logging & troubleshooting reports
5. Adding/deleting/editing lockers or user access
6. Configuration of notification templates via email, SMS or WhatsApp
7. Remote opening of lockers and monitoring (to be decided by MCGM)

8. Compartment type, availability, count, non-working count, reservation history, etc data should be available on dashboard
9. Any new dashboard details required by client should be configured as part of the scope of work and necessary cost to be included.

#### **Physical Security, Safety and Control Features**

The design of each Locker is highly durable and reasonably damage proof and cannot be easily tampered.

The main control panel housing IPC, POE, and Router is secured at all times, requiring customized unique key to access them.

All the locker compartments remain closed in the event of any power outage or power supply failure.

If any Locker Compartment door is left open for a period longer than the period specified by the client, then the following processes will be triggered an alert will be sent to Central Smart Locker software if a compartment door is left open for more than one (1) to two (2) minutes or as decided by MCGM management

#### **Security features:**

1. 3 tier architecture
2. Firewall and Web Application Firewall (WAF)
3. HTTPS and Site wise SSL
4. SHA256 encryption
5. Protection against SQL injection
6. No hard coded credentials
7. Avoid excessive data over exposure public API's
8. Account lockout policies
9. Application hardening
10. Passcode mechanism for customer, courier-agents, and maintenance engineer for limited time.

#### **ONE TIME PROFESSIONAL CHARGES**

To be included for SOW changes as per MCGM/Architect/Consultant requirements

1. Option for workers/visitors to choose the preference of language Marathi, Hindi, English, voice guided facility & in Marathi, Hindi & English, choose size of box, time slot, price, OTP for authentication, reminder to collect their items after time ends, extension of time, master enter, instruction manual etc
2. Payment gateway and software to be made available to make easy payment through Local, International Debit Card, Credit Card, Payment Wallets, BHIM/UPI, RUPAY, VISA, MASTERCARD etc if MCGM decides to make it chargeable basis.
3. Any other requirement deemed fit during the execution process and for 12 months after the handing over process is signed off by MCGM/Architect/Consultant

**TECHNICAL SPECIFICATIONS FOR INDOOR SECURITY SYSTEMS:**

**(For all 5 below products, OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**i. Walk Through Metal Detector**

a. This will be required at the Ground Floor both Entrances 2 nos. each for men and women separately total 4 nos.

**ii. X Ray Baggage Scanners ( Hand Held and Freight)**

a. Each Entrance will require a Hand held and Freight X ray baggage scanners, so in total 4 nos., 2 each of handheld and 2 each of Freight Xray baggage scanners

**iii. Hand Held Metal Detectors**

a. Will require 4 sets at each entrance so total 8 nos.

**iv. Swing Barriers & Wide Opening P Gate**

a. Swing Barriers and P Gate will be installed on the ground floor entrance as per the below table for employee, tenant and freight material entries

b. Normal Swing barriers will have 600 mm opening, Handicap Swing Barrier will have 900mm and P gate will be 1200 to 1800 mm max as per site requirements. Swing Barrier opening can have a tolerance of 15 to 25 mm depending on site requirements

| SR. No. | Floors | Swing Barriers                                  |                         | P Gate                                 | Total |
|---------|--------|---|-------------------------|--|-------|
|         |        | 2+1 (Normal + Handicap Lane)<br>600 mm + 900 mm | 1 Normal Lane<br>600 mm | 1200 to 1800 mm<br>Opening as per site |       |

|   |              | Entrance          | Entrance          | Lift Lobby | Lift Lobby | Entrance          | Entrance          | Entrance          | Entrance          |    |
|---|--------------|-------------------|-------------------|------------|------------|-------------------|-------------------|-------------------|-------------------|----|
|   |              | Nxt to Elevator-1 | Nxt to Elevator-4 | Side 1     | Side 2     | Nxt to Elevator-5 | Nxt to Elevator-6 | Nxt to Elevator-5 | Nxt to Elevator-6 |    |
| 1 | Ground Floor | 3                 | 3                 | 3          | 3          | 1                 | 1                 | 1                 | 1                 | 16 |

**1 WALK THROUGH METAL DETECTOR (MAF required)**

**MAKES: SMITH(CEIA)-HI-PE PLUS/GARRETT-PD 6500I/RAPISCAN-ORION 900M**

**Design Brief:**

Since there are 2 set of entry gates to the building we will require separate WTMD for men and women as there is high foot fall of people and hence will require 4 nos.

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

The required Walk-Through Metal Detector (WTMD) shall be latest technology (Enhanced) and it shall have very high threat detection uniformity over the whole transit area and shall have ultra high discrimination of personal metallic effects of people that transit through the gate in order to ensure an high throughput. The WTMD should be Networked enabled and functionality like Alarms, Error’s should be remotely available for the Operator. Requisite Hardware and Software for the same shall be available with the WTMD unit.

**DETECTION PERFORMANCE REQUIREMENTS & ALARM INDICATIONS**

**DETECTION CAPABILITY**

- The equipment shall detect metal weapons carried on a person, however they are worn through the archway, independently of their orientation, trajectory and transit speed. More specifically, the equipment shall be able to detect magnetic, non magnetic and magnetic/non magnetic mixed alloy metal weapons singularly, assembled and/or disassembled (considering for each weapon the highest metallic contribution) or combined.
- The detection capability of the WTMD shall be stable without variation. The WTMD shall not require periodic recalibration.
- The sensitivity of the archway shall be adjustable in order to provide the widest dynamic threat object detection range from guns to very small blades like a half cutter blade (HCB security level).

### **CANCELLATION EFFECTS**

- The detection capability shall not be degraded by combinations of different types of metals.

### **DETECTION SPEED**

- The Metal Detector shall detect the metal test pieces independently of their speed of transit through the archway (range: 0.3 ... 15m/s). This requires constant sensitivity for variations in speed.

### **ERGONOMICS – VISUAL AND ACOUSTICAL INDICATIONS**

- The WTMD shall be fitted with four full-height luminous bars, placed two at the entrance (right and left side) and two at the exit side of the archway (right and left side) to provide very clear visual indications according to the different conditions of the daylight.
- Zone indication shall be with minimum 20 vertical floating zones for the best pinpointing of the detected metal object and the maximum resolution with a total of 60 zones (20 vertical x 3 horizontal) in the complete archway.
- The four multi-zone display bars shall be programmable independently as entry Stop/Go (pacing lights) indication and/or localization lights in order to improve the ergonomics and visibility of the indications and the easiness of installation.
- It shall be possible to operate the WTMD in both transit directions. Pacing lights (Stop/Go indication) and/or localization lights shall be activated simultaneously on both sides of the archway.
- Metal type indication: in case of alarm, the control unit shall be able to display the type of metal detected (ferrous/no ferrous). It shall be possible to enable/disable the metal type indication through the WTMD programming.
- The WTMD must have an automatic procedure for daily test activated with a Chip-card. The test result shall be displayed on the control unit.

### **MECHANICAL DIMENSIONS/WEIGHTS**

- The minimum WTMD's passage width shall be 700 mm and the minimum WTMD's passage height shall be 2010 mm.
- The WTMD's external dimensions shall be lower than 880 x 2300 mm (Width x Height)

### **MECHANICAL CHARACTERISTICS**

- The WTMD mechanical structure shall maximize the protection against wear and tear. The WTMD mechanical structure shall be very robust in order to guarantee the maximum protection against damages.
- The construction of the WTMD shall be modular and designed in order to minimize the number of components.
- The WTMDs shall be designed in order to be assembled and disassembled quickly. The maximum allowed time for the assembling of the complete gate shall be lower than 10 minutes.
- The WTMD shall be a stand-alone unit, provided with smooth, robust and washable surfaces.
- The WTMD shall be equipped in the lower side with protections against damages due to bumps of floor cleaning machineries and sprinkling of water or other substances.
- All of the electronics shall be mounted to the crosspiece at the top of the archway.
- The WTMD shall be equipped with four anchoring points to the floor.
- The equipment shall have the IP65 rating for outdoor applications.

#### **ELECTRICAL CHARACTERISTICS**

The WTMD shall be designed in order to provide the highest immunity towards external electrical and mechanical interferences in order to improve the easiness of installation in any kind of environment-layout.

- The correct working of the WTMD is required even when two WTMDs are installed at a reciprocal gate distance of 15 cm, without the use of synchronization cable(s) and/or jumpers.
- The WTMD shall be equipped with a self diagnosis system which ensures the immediate signaling of faults or performance changes at start-up and during operation as well.
- The WTMD shall be equipped with two photocells for an automatic and very high precision bidirectional counting (number of entering and exiting persons) and statistical evaluation of transiting people and alarms.
- For security reasons the WTMD shall be always active. The use of photocells (infrared sensors) to avoid the alarm of the WTMD caused by nearby moving metallic materials or external electrical interferences is not allowed.
- The maximum allowed power absorption of the WTMDs shall be 40W.

#### **PROGRAMMING AND CONNECTIVITY**

- The WTMD shall have a minimum of five programming methods:
  - Chip-card
  - Local using keypad on the control unit

- Remote through a RS232 port and a laptop
- Infrared (IR) Remote Control (password protected)
- Bluetooth
- The selection of the security level shall be extremely quick by the use of dedicated chip-card.
- The WTMD's programming access shall be protected by a mechanical lock and by a password made up of 6 alphanumeric characters. The WTMD shall have two independent levels of programming (user and super user), each one protected by a password.
- The equipment shall be designed in order to improve the easiness and quickness of programming and set-up: a "one touch self installation" procedure shall be available. The self-installation procedure shall consist of a sequence of tests and adjustments, regarding the following aspects: operation of the signaling devices, relevant electrical parameters, archway configuration and the electromagnetic compatibility with the installation site (instruction for each step shall be displayed on the control unit display).
- A function that searches automatically a suitable transmission channel, i.e. a channel with minimum interaction with possible sources of interference present in the installation site, shall be available. The selected transmission channel shall be shown at the end of the process.
- The equipment shall be able to acquire the value of the signals received by the probe and shall adjust itself in order to increase its immunity against possible sources of interferences (environmental noise adjustment function). An additional function shall provide in the control unit display the read out of the signals measured by the probe as a percentage of the alarm threshold in order to identify a suitable detector position if the installation site contains sources of interferences.
- A procedure to acquire and compensate the interferences generated by mechanical vibrations due, for instance, to floor oscillations, strong air compressions or wind shall be available.

#### **ENVIRONMENTAL CHARACTERISTICS**

- Storage temperature: from -31°F (-35°C) to 158°F (70°C).
- Working temperature from -4°F (-20°C) to 158°F (+70°C).
- Relative storage humidity: from 0 to 95 % without condensation
- Relative working humidity: from 0 to 95 % without condensation

#### **ELECTRICAL SAFETY, HARMLESSNESS AND CERTIFICATIONS**

- The WTMD shall be certified by an accredited and operating independent Laboratory as conforming to International Standards on the Human Exposure to Electromagnetic Fields. Manufacturer shall provide documentation.

- Electrical Safety: for safety reasons, in order to avoid any probability of electrical hazard, the WTMD shall be powered by a nominal voltage to ground not exceeding 50V (CAT.0) to prevent the risk of people in transit coming into accidental contact with parts of the gate powered at mains voltage.
- The WTMD must use CW (continuous wave) magnetic fields (pulsed fields are not allowed) for best pace-maker and vital supports harmlessness.
- The WTMD shall not interfere with medical devices such as hearing aids, cardiac stimulators, defibrillators, neurological stimulators.

#### **Hand Held Metal Detector (MAF required)**

**MAKES: SMITH(CEIA)-PD140E/GARRETT-SUPERWAND/RAPISCAN-METOR28E**

#### **Design Brief:**

Since there are 2 set of entry gates to the building we will require separate total 8 nos. of HHMD 4 nos. each at entry gate. 2 will be in use and 2 will in charge condition at any given point of time. **All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

The required Hand Held Metal Detector (HHMD) shall be latest technology and it shall combine high reliability and ergonomics with advanced detection and operator signaling features.

#### **Detection Performance Criteria**

##### **Detection Capability and Discrimination**

- The HHMD shall be fully compliant with the NIJ Standard 0602.02. A Test Report demonstrating the compliance shall be submitted.

- **SENSITIVITY TEST**

The HHMD shall detect a real disposal razor blade (43mm x 22 mm) at a minimum detection distance of 3 cm when passed in any orientation, parallel and perpendicular to the detection area.

- **BODY DISCRIMINATION**



When the sensitivity of the HHMD is set to pass the test indicated at paragraph 2 it shall not produce a positive alarm indication when operated at a distance from the back of the clean tester (a person without metal content on the body) equal or lower of 1 cm. Reference NIJ Standard 0602.02 Paragraph 2.4.3.3.

- **DISCRIMINATION OF A METAL GRID**

When the sensitivity of the HHMD is set to pass the test indicated at paragraph 2 the HHMD shall not produce a positive alarm indication when operated with the tip perpendicular with respect to metal grid used in floor rebars at a distance of 25 cm (distance measured from the tip of HHMD to the metal grid surface). Buttons to reduce the sensitivity are not accepted.

Metal grid dimensions: 20 cm x 20 cm ferrous metal rod with 8 mm diameter.

- **DISCRIMINATION OF A METAL WALL**

When the sensitivity of the HHMD is set to pass the test indicated at paragraph 2 the HHMD shall not produce a positive alarm indication when operating with detection area parallel with respect to a metal surface at a distance of 35 cm (distance measured from the tip of HHMD to the metal wall). Buttons to reduce the sensitivity are not accepted. The metal wall shall be simulated with a cold-finished sheet carbon steel UNS G10150 to G10200, 1 m ± 0.1 m by 1 m ± 0.1 m by 0.75 mm ± 0.13 mm thick. Reference NIJ Standard 0602.02 Paragraph 2.4.3.2.

- **OPERATING DISTANCE BETWEEN TWO METAL DETECTORS**

When the sensitivity of the HHMD is set to pass the test indicated at paragraph 2, two HHMDs shall not produce a positive alarm indication when operating at a distance of 20 cm one from the other.

- The HHMD shall be fully digital and microprocessor control. The inspection field transmitter-receiver shall be based on Digital Signal Processing (DSP) technology.
- The HHMD shall have durable Printed Circuit Board (PCB) antenna.
- The HHMD electronics boards shall be completely manufactured in SMT technology protected by a layer of conformal coating.
- The HHMD shall have a wide detection area. The length of the detection area shall not be less than 200 mm.

- HHMD weight shall not exceed 500 grams (battery included).
- The HHMD shall operate without performance changes from -40°C to +70°C.
- The HHMD shall be suitable for indoor and outdoor use.
- The HHMD shall have the following alarm indications:
  - **Optical Alarm** fixed or proportional to the intensity of the detection signal
  - **Acoustic Alarm** with constant tone or a tone which is proportional to the size of the object detected.
  - **Vibrating Alarm**
- It shall be possible for the administrator of the HHMD to lock one or more operator commands
- The HHMD shall be equipped with anti-tampering enclosure and anti-tampering battery compartment.
- The HHMD shall be powered by two AA-size rechargeable batteries with a battery life over 100 hours.
- The HHMD shall have the possibility to set an automatic low power mode function that is automatically activated during screening pauses. When Low Power mode function is activated, the battery life shall be extended up to 200 hours.
- The HHMD shall switch-off automatically after a programmable time following the entering in sleep mode.
- The HHMD shall have embedded fast and reliable battery charger and shall be supplied with a dedicated holder that acts as minimum space table stand and mains connection for battery charge.
- The battery charger shall completely recharge the battery in the maximum time of 5 hours, in order to guarantee the 100 hours battery life. To guarantee the maximum reliability of the HHMD, the recharge of the battery shall not require to remove the battery from the HHMD and shall not require the connection or insertion of any plug/jack/cable into the HHMD.
- The HHMD shall have a USB port. Through the USB port shall be possible to connect the HHMD to a PC in order to personalize the settings with a dedicated Graphic User Interface.

- The HHMD shall be equipped with a Configuration Software for programming of the user preferred operation mode.
- The HHMD shall have the certificate of compliance to CE and FCC Standards.
- The HHMD shall be certified by an accredited and operating independent Laboratory as conforming to International Standards on the Human Exposure to Electromagnetic Fields. Manufacturer shall provide documentation.

**X-RAY BAGGAGE INSPECTION SYSTEM (SMALL SIZE) (MAF required)**

**MAKES: SMITH-6040C/LIEDOS-ACX 6.4/RAPISCAN-ORION 920 CX**

**Design Brief:**

Since there are 2 set of entry gates to the building we will require separate 2 nos. of Small Size Baggage Scanners

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

| <b>S. No.</b> | <b>Description</b>   |
|---------------|--|
|               | <b>Technical Specifications</b>  |
| 1             | Tunnel Size – Minimum 60 cm W (width) x 40 cm H (Height) or better   |
| 2             | Conveyor belt speed should be between 0.18 and 0.3 meter per second. Conveyor movement bidirectional.  |
| 3             | All machines should operate on 230 VAC, 50 Hz power supply and should be able to withstand voltage fluctuations in the range of 170V to 260 V. Single Phase, 3 to 5 Amp.           |
| 4             | Conveyor Capacity- 160 kg or more  |
| 5             | Through put should be more 400 bags  |
| 6             | Sensors > 1100 diodes, L-shaped detector (Folded array type), In case of defective diode arrays, scanning should be disabled, and error message should be displayed on the screen. |
| 7             | X-Ray Voltage – Maximum 160 KV operating   |
| 8             | X-Ray Source/Generator with Dual Energy. It should be capable to operate smoothly for a period of at least six years.  |
| 9             | Duty Cycle-100%  |

|        |  |
|--------|--|
| 10     | The X-ray beam divergence should be such that the complete image at maximum size of bag is displayed without corner cuts.  |
| 11     | The radiation level should not exceed accepted health standard (0.1m R/Hr at a distance of 5 CM from external housing). Valid Type Approval Certificate from Atomic Energy Regulatory Board to be submitted  |
| 12     | The operating temperature normally should be 0 deg C to 40 deg C. Valid Test Reports from NABL should be available.  |
| 13     | Storage temperature -20 degree C to 60 degree C. Valid Test Reports from NABL should be available.   |
| 14     | Humidity 90 % non-condensing. Valid Test Reports from NABL should be available.  |
| 15     | Resolution: The machine should be able to display single un-insulated tinned copper wire of 42-SWG or 38 AWG. All penetration and resolution condition should be met without pressing any functional key and should be online.   |
| 16     | Penetration should be 35 mm thickness of steel (Guaranteed) or more.   |
| 17     | Continuous Electronic Zoom facility should be available to magnify the chosen area of an image sixty four 64X or more. Image features shall be keyboard controllable.  |
| 18     | Video display 22" or better LCD/LED Monitor SVGA High resolution, low radiation, flicker free, resolution at least 1280 x 1024, 24 bit colour real time processing.  |
| 19     | The machine should have features of Multi-energy X-ray imaging facility where materials of different atomic number will be displayed in different colours to distinguish between organic and inorganic materials. With this method to distinguish high density organic materials including explosives. Machine should have variable colour or materials stripping to facilitate the operator to monitor images of organic materials for closer scrutiny. All suspicious items (Explosives, High density, material narcotics) should be displayed in one mode and that should be online. Explosive should be framed in RED color, High Density Materials in Blue Color and Narcotics/Drugs in Green Color |
| 20     | Radiation Safety<br>The machine must comply with requirements of health and safety regulations with regard to mechanical electrical and radiation hazards. Before installation of the machine, the supplier/manufacturer should furnish relevant certificate from Atomic Energy Regulatory Board of India regarding radiation safety. The company manufacturing the equipment should have ISO certification for manufacturing and servicing of X-ray Screening machines for minimum of 5 years. A copy of the same should be submitted.  |
| 21     | Film Safety Guaranteed safety for high-speed films up to ISO1600. The machines should be film safe. In other words photographic films must not be damaged due to x-ray examination. Certificate issued by any national Govt. accredited agency approved by AERB should be provided. A copy of the same should be submitted.  |
| 22     | Machine should be properly sealed from all the sides for pest proof.   |
| S. No. | Description  |

|    |  |
|----|--|
| 23 | Facility for variable contrast must be incorporated to allow enhancement of lighter and darker portion of the image.   |
| 24 | The machine should be so designed that software enhancement can be easily implemented to take care of new technique in image processing and pattern recognition.   |
| 25 | Full diagnostic built in test facility. All models should have software controlled diagnosis report facility and system should give printout if printer is connected.  |
| 26 | All software features of machine should be online and password protected.  |
| 27 | Machine should be capable for recalling 15 or more previous images.  |
| 28 | It should have the capability of archiving 100,000 or more images with date & time stamp.  |
| 29 | The operator personal identification number should be entered the keyboard along with generation of log.   |
| 30 | Facility of image enhancement should be available.   |
| 31 | All models should have online recording facility and images can be recorded USB.   |
| 32 | Lead impregnated safety screens should be available at either ends of the tunnel. Idle rollers of 500mm each to be provided at either ends of the tunnel to facilitate placing of baggage at input and output. |
| 33 | All software features should be controlled from keyboard of machine only. Keyboard function should be user friendly. To enable/disable the software features system should not be rebooted                     |
| 34 | If the machine fails to penetrate a particular item, then an alarm video and audio both should be generated to notify the operator   |
| 35 | The threat image projection (TIP) system software to be incorporated in all X-Ray BIS operation as per details in Annexure-1.  |
| 36 | Operational Training- Operating staff has to be provided free training.  |
| 37 | Operating & service manual shall be provided with each machine.  |
| 38 | Other Features   |
| a) | Inverse Video  |
| b) | Set up time not more than 10 minutes   |
| c) | Pseudo colour  |
| d) | Date & Time display.   |
| 40 | Minimum Computer Configuration: -  |
| a. | CPU: Should be able to deliver the output to meet the specifications mentioned as above.   |
| b. | Hard Disk Drive: 1 TB or better. 7200 rpm serial ATA HDD or Better   |
| c. | Ports: 2 USB Ports   |
| d. | USB slot must be provided on the machine   |
| 6. | Networking facility : 10/100/1000 on board integrated Network Port with remote booting facility remote system installation, remote wake up, out of band management using any standard management software.     |

|        |   |
|--------|---|
| 41     | UPS: - 1 KVA  |
| 42.    | The Bidder/OEM should submit an Undertaking that there are not using any component manufactured in China in the offered equipment ( GFR 144-11 compliant ) – In accordance to Restriction Under rule 144 (xi) of GFR 2017, Office OM No 6/18/2019-PPD dated 23rd July 2020, Ministry Of Finance, Department of Expenditure, Public Procurement Division): Respective OEM should submit an Undertaking that they are not using the equipment or any of its components manufactured in any country that shares an International Land Border with India. In the offered equipment the “Intellectual Property Rights” of equipment must not reside in any country that shares an International Land Border with India. No equipment/ Major Parts of the X-Ray Baggage Scanner should be supplied which is manufactured by any entity in a country which shares an international land border with India. The equipment not adhering to the above conditions shall out rightly be rejected. |
| 43     | If the machine fails to penetrate a particular item, then an alarm should be generated to notify operator. The Conveyor Belt of the XBIS should STOP Automatically upon identification of High Density Material   |
| 44.    | CE & DIN IEC 61010-2-091; Ed. 2.0 Compliant. Relevant copies should be submitted with the Bid.  |
| S. No. | Para of Tender Enquiry Specifications   |
|        | THREAT IMAGE PROJECTION   |
| 01     | Tip software facility shall be incorporated in the offered X-ray machine to assist supervisors in Testing the operator alertness and training X-ray screeners to improve their ability in identifying specific threat object. The system will create a threat object and the same will be superimposed on the monitor screen while a bag is being screened. To acknowledge that the operator has seen the false object, operator must press the control panel key that will cause the computer generated threat object to disappear from X-rayed bag image on the VDU screen. Each operator’s action shall be recorded in the hard disc of the computer for the auditing purpose by the supervisor or other authorized person.  |
|        | DESIGN OF THE SYSTEM:   |
| 2      | Tip software should be compatible with other X-ray technologies such as automatic reject unit, Dual X-Ray screen technologies, automatic threat recognition system etc. All X-ray image function must be available at the same time along with the TIP.   |
|        | IMAGE LIBRARY   |
| 3      | The image library should have an image library containing at least 100 explosive devices. 100 knives and 100 firearms is various sizes, shapes, location and orientation. However, the system shall have facility to expand the library to incorporate additional images by user without assistance of the Manufacture.   |
| 4      | The image library should contain images of the threats at different orientations both plan and end on orientation should be used. Although these will be assigned different   |

|    |   |
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|    | file names and preferences, it must be possible to cross reference these as the same threat. All threat image Projection images must be realistic, representative and non distinguishable from real threat items.   |
|    | TIME INTERVAL   |
| 5  | Programming facility shall be available to project threat images in different intervals. The time period for threat images as well as well as image mix in percentage shall be user programmable e.g. software shall select 40% images of explosive devices, 35% of fire arms & 25% knives of random etc.   |
| 6  | Once the screener has responded to identify the computer generated threat image, it should remain on the screen for a predefined user programmatic feedback message shall be visible to the screener.   |
|    | SYSTEM ADMINISTRATION   |
| 7  | The threat image projection facility shall have details of user data-base such as Department name, screener name, Organization, User ID Number, level of access such screener, administrator, Maintenance & Password etc.   |
| 8  | Access to start up menu should be restricted only to the authorized individuals. A login procedure by means of "Password" or "Security Key" could achieve restricted access to each of the comment. The log-in procedure should not take longer than 20 seconds. The system should have facility to by pass the TIP facility, if programmed so by the system administrator. It is to be ensured that the TIP software shall not be hindrance to normal functioning of x-ray machines.   |
| 9  | When the operator logs-in or logs out message should be displayed on x-ray BIS VDU Screen to confirm that he/she has been correctly logged-in or logged-out.  |
|    | FEEDBACK REPORT   |
| 10 | The threat image Projection should be capable of giving feedback "Hit, MISS or FALSE ALARM" message. No message will be presented if a screener correctly passed as clear bag.  |
| 11 | A "HIT" message to be presented when a screener has correctly identified a Threat image projection image. A "MISS" message shall be presented when screener fails to identity the TIP image. A "False Alarm" message shall be given when screener incorrectly indicate TIP image when in fact no threat image projection is present. The feedback should clearly indicate in a screen that a tip object has been correctly identified/ tip object has been missed that a TIP object has been missed/ no TIP object was present. Information should be recorded in the database. |
| 12 | Different colour coding shall be used for feedback to the Screener. It is recommended that colour code "Red for MISS" Green for "HIT" and Yellow to "False Alarm on interrupt" be used.   |
| 13 | The system shall automatically prepare the daily log of events for each shift and for each Screener performance. TIP log shall include particulars of Name of Screener, Time date of threat image, weather threat image was successfully identified or missed etc.  |

|    |   |
|----|---|
| 14 | The report on Threat Image Projection system may have date and time (From-To) as per requirement. Screener particulars and decision/ outcome i.e., MISS, HIT or False Alarm in percentage as well in absolute numbers, numbers of bags screened, categories such as explosives devices knife or weapon etc.                                       |
| 15 | As a standard, daily/ weekly/ monthly report shall be retrieved. Report shall be for any given time and period, as per command.   |
| 16 | All data should be stored on the system for a minimum of two months, after it has been down loaded. No individual, regardless of access rights of the Threat Image Projection components would delete or amend any of threat image protection data or time i.e., Threat Image Projection data on the actual X-Ray machine will be read only file. |

**X-RAY BAGGAGE INSPECTION SYSTEM (FREIGHT SIZE) (MAF required)**

**MAKES: SMITH-100100T/LIEDOS-PX™ 10.10-MV/RAPISCAN-628 XR**

**Design Brief:**

Since there are 2 set of entry gates to the building we will require separate 2 nos. of Freight Size Baggage Scanners

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

| S. No. | Description  |
|--------|--|
|        | <b>Technical Specifications</b>  |
| 1      | Tunnel Size – Minimum 1000 cm W (width) x 1000 cm H (Height) or better   |
| 2      | Conveyor belt speed should be between 0.18 and 0.3 meter per second. Conveyor movement bidirectional.  |
| 3      | All machines should operate on 230 VAC, 50 Hz power supply and should be able to withstand voltage fluctuations in the range of 170V to 260 V. Single Phase, 3 to 5 Amp. |



|    |  |
|----|--|
| 4  | Conveyor Capacity- 200 kg or more and Conveyor Height :- 350mm from the Ground.  |
| 5  | Through put should be 200 bags   |
| 6  | Sensors > 2000 diodes, L-shaped detector (Folded array type), In case of defective diode arrays, scanning should be disabled, and error message should be displayed on the screen.   |
| 7  | X-Ray Voltage – Maximum 160 KV operating   |
| 8  | X-Ray Source/Generator–It should be capable to operate smoothly for a period of at least six years.  |
| 9  | Duty Cycle-100%  |
| 10 | The X-ray beam divergence should be such that the complete image at maximum size of bag is displayed without corner cuts.  |
| 11 | The radiation level should not exceed accepted health standard (0.1m R/Hr at a distance of 5 CM from external housing).  |
| 12 | The operating temperature normally should be 0 deg C to 40 deg C, Valid Test Reports from NABL should be available.  |
| 13 | Storage temperature -20 degree C to 60 degree C , Valid Test Reports from NABL should be available.  |
| 14 | Humidity 90 % non-condensing. Valid Test Reports from NABL should be available.  |
| 15 | Resolution: The machine should be able to display single un-insulated tinned copper wire of 42-SWG or 38 AWG. All penetration and resolution condition should be met without pressing any functional key and should be online.   |
| 16 | Penetration should be 32 mm thickness of steel (Guaranteed) or more.   |
| 17 | Continuous Electronic Zoom facility should be available to magnify the chosen area of an image sixty four 64X or more. Image features shall be keyboard controllable.  |
| 18 | Dual Video display 22” or better LCD/LED Monitor SVGA High resolution, low radiation, flicker free, resolution at least 1280 x 1024, 24 bit colour real time processing.   |
| 19 | The machine should have features of Multi-energy X-ray imaging facility where materials of different atomic number will be displayed in different colours to distinguish between organic and inorganic materials. With this method to distinguish high density organic materials including explosives. Machine should have variable colour or materials stripping to facilitate the operator to monitor images of organic materials for closer scrutiny. All suspicious items (Explosives, High density, material narcotics) should be displayed in one mode and that should be online. Explosive should be framed in RED color, High Density Materials in Blue Color and Narcotics/Drugs in Green Color |
| 20 | Radiation Safety<br>The machine must comply with requirements of health and safety regulations with regard to mechanical electrical and radiation hazards. Before installation of the machine, the supplier/manufacturer should furnish relevant certificate from Atomic   |

|    |  |
|----|--|
|    | Energy Regulatory Board of India regarding radiation safety. The company manufacturing the equipment should have ISO certification for manufacturing and servicing of X-ray Screening machines for minimum of 5 years. A copy of the same should be submitted.                     |
| 21 | Film Safety Guaranteed safety for high-speed films up to ISO1600. The machines should be film safe. In other words photographic films must not be damaged due to x-ray examination. Certificate issued by any national Govt. accredited agency approved by AERB should be provided |
| 22 | Machine should be properly sealed from all the sides for pest proof.   |
| 23 | Facility for variable contrast must be incorporated to allow enhancement of lighter and darker portion of the image.   |
| 24 | The machine should be so designed that software enhancement can be easily implemented to take care of new technique in image processing and pattern recognition.   |
| 25 | Full diagnostic built in test facility. All models should have software controlled diagnosis report facility and system should give printout if printer is connected.  |
| 26 | All software features of machine should be online and password protected.  |
| 27 | Machine should be capable for recalling 15 or more previous images.  |
| 28 | It should have the capability of archiving 50,000 or more images with date & time stamp.   |
| 29 | Control desk with security housing and locking provision should be available. The operator personal identification number can be entered the keyboard along with generation of log.  |
| 30 | Facility of image enhancement should be available.   |
| 31 | All models should have online recording facility and images can be recorded USB.   |
| 32 | Lead impregnated safety screens should be available at either ends of the tunnel. Idle rollers of 1 meter to be provided at either ends of the tunnel to facilitate placing of baggage at input and output.  |
| 33 | All software features should be controlled from keyboard of machine only. Keyboard function should be user friendly. To enable/disable the software features system should not be rebooted   |
| 34 | If the machine fails to penetrate a particular item, then an alarm video and audio both should be generated to notify the operator   |

|     |   |
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| 35  | The threat image projection (TIP) system software to be incorporated in all X-Ray BIS operation as per details in Annexure-1.   |
| 36  | Operational Training- Operating staff has to be provided free training.   |
| 37  | Operating & service manual shall be provided with each machine.   |
| 38  | Other Features  |
| a)  | Inverse Video   |
| b)  | Set up time not more than 10 minutes  |
| c)  | Pseudo colour   |
| d)  | Date & Time display.  |
| 40  | Minimum Computer Configuration: -   |
| a.  | CPU: Should be able to deliver the output to meet the specifications mentioned as above.  |
| b.  | Hard Disk Drive: 500 GB or better. 7200 rpm serial ATA HDD or Better  |
| c.  | Ports: 2 USB Ports  |
| d.  | USB slot must be provided on the machine  |
| 6.  | Networking facility : 10/100/1000 on board integrated Network Port with remote booting facility remote system installation, remote wake up, out of band management using any standard management software.  |
| 41  | UPS: - 2 KVA  |
| 42. | The Bidder/OEM should submit an Undertaking that there are not using any component manufactured in China in the offered equipment ( GFR 144-11 compliant ) – In accordance to Restriction Under rule 144 (xi) of GFR 2017, Office OM No 6/18/2019-PPD dated 23rd July 2020, Ministry Of Finance, Department of Expenditure, Public Procurement Division): Respective OEM should submit an Undertaking that they are not using the equipment or any of its components manufactured in any country that shares an International Land Border with India. In the offered equipment the “Intellectual Property Rights” of equipment must not reside in any country that shares an International Land Border with India. No equipment/ Major Parts of the X-Ray Baggage Scanner should be supplied which is manufactured by any entity in a country which shares an international land border |

|               |   |
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|               | with India. The equipment not adhering to the above conditions shall out rightly be rejected.   |
| 43            | If the machine fails to penetrate a particular item, then an alarm should be generated to notify operator. The Conveyor Belt of the XBIS should STOP Automatically upon identification of High Density Material   |
| <b>S. No.</b> | <b>Para of Tender Enquiry Specifications</b>  |
|               | <b><u>THREAT IMAGE PROJECTION</u></b>   |
| 01            | Tip software facility shall be incorporated in the offered X-ray machine to assist supervisors in Testing the operator alertness and training X-ray screeners to improve their ability in identifying specific threat object. The system will create a threatobject and the same will be superimposed on the monitor screen while a bag is being screened. To acknowledge that the operator has seen the false object, operator must press the control panel key that will cause the computer generated threat object to disappear from X-rayed bag image on the VDU screen. Each operator's action shall be recorded in the hard disc of the computer for the auditing purpose by the supervisor or other authorized person. |
|               | <b><u>DESIGN OF THE SYSTEM:</u></b>   |
| 2             | Tip software should be compatible with other X-ray technologies such as automatic reject unit, Dual X-Ray screen technologies, automatic threat recognition system etc. All X-ray image function must be available at the same time along with the TIP.   |
|               | <b><u>IMAGE LIBRARY</u></b>   |
| 3             | The image library should have an image library containing at least 100 explosive devices. 100 knives and 100 firearms is various sizes, shapes, location and orientation. However, the system shall have facility to expand the library to incorporate additional images by user without assistance of the Manufacture.   |

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| 4  | The image library should contain images of the threats at different orientations both plan and end on orientation should be used. Although these will be assigned different file names and preferences, it must be possible to cross reference these as the same threat. All threat image Projection images must be realistic, representative and non distinguishable from real threat items.   |
|    | <b><u>TIME INTERVAL</u></b>   |
| 5  | Programming facility shall be available to project threat images in different intervals. The time period for threat images as well as well as image mix in percentage shall be user programmable e.g. software shall select 40% images of explosive devices, 35% of fire arms & 25% knives of random etc.   |
| 6  | Once the screener has responded to identify the computer generated threat image, it should remain on the screen for a predefined user programmatic feedback message shall be visible to the screener.   |
|    | <b><u>SYSTEM ADMINISTRATION</u></b>   |
| 7  | The threat image projection facility shall have details of user data-base such as Department name, screener name, Organization, User ID Number, level of access such screener, administrator, Maintenance & Password etc.   |
| 8  | Access to start up menu should be restricted only to the authorized individuals. A login procedure by means of "Password" or "Security Key" could achieve restricted access to each of the comment. The log-in procedure should not take longer than 20 seconds. The system should have facility to by pass the TIP facility, if programmed so by the system administrator. It is to be ensured that the TIP software shall not be hindrance to normal functioning of x-ray machines. |
| 9  | When the operator logs-in or logs out message should be displayed on x-ray BIS VDU Screen to confirm that he/she has been correctly logged-in or logged-out.  |
|    | <b><u>FEEDBACK REPORT</u></b>   |
| 10 | The threat image Projection should be capable of giving feedback "Hit, MISS or FALSE ALARM" message. No message will be presented if a screener correctly passed as clear bag.  |

|    |  |
|----|--|
| 11 | A "HIT" message to be presented when a screener has correctly identified a Threat image projection image. A "MISS" message shall be presented when screener failsto identify the TIP image. A "False Alarm" message shall be given when screener incorrectly indicate TIP image when in fact no threat image projection is present. The feedback should clearly indicate in a screen that a tip object has been correctly identified/ tip object has been missed that a TIP object has been missed/ no TIP object was present. Information should be recorded in the database. |
| 12 | Different colour coding shall be used for feedback to the Screener. It is recommended that colour code "Red for MISS" Green for "HIT" and Yellow to "False Alarm on interrupt" be used.  |
| 13 | The system shall automatically prepare the daily log of events for each shift and for each Screener performance. TIP log shall include particulars of Name of Screener, Time date of threat image, weather threat image was successfully identified or missed etc.   |
| 14 | The report on Threat Image Projection system may have date and time (From-To) as per requirement. Screener particulars and decision/ outcome i.e., MISS, HIT or False Alarm in percentage as well in absolute numbers, numbers of bags screened, categories such as explosives devices knife or weapon etc.  |
| 15 | As a standard, daily/ weekly/ monthly report shall be retrieved. Report shall be for any given time and period, as per command.  |
| 16 | All data should be stored on the system for a minimum of two months, after it has been down loaded. No individual, regardless of access rights of the Threat Image Projection components would delete or amend any of threat image protection data or time i.e., Threat Image Projection data on the actual X-Ray machine will be read only file.  |

**TECHNICAL SPECIFICATIONS FOR SWING BARRIERS (MAF required)**

**MAKES: KABA-ARGUS/MAGNETIC-MPW-112/BOONEDAM-LIFELINE SPEEDLANE/ GUNNEBO-SPEEDSTILE FLS EV**

**Design Brief:**

Swing Barriers and P Gates are proposed to ensure only employees and authorized personnel entry the building with or without heavy material at the freight gates. Since there are 2 sets of

entry/exit gates for employees and tenants separately there will in 4 separate sets of Swing Barriers for each of the entrance

The configurations of Normal + Handicap lanes and P Gates for employee, tenant and freight entrance to be installed is as below mentioned areas.

| SR. No. | Floor        | Swing Barriers                               |                     |            |            |                                |                    | P Gate             |                    | Total |
|---------|--------------|--|---------------------|------------|------------|--------------------------------|--------------------|--------------------|--------------------|-------|
|         |              | 2+1<br>(2 nos. Normal + 1 no. Handicap Lane) |                     |            |            | 1 no.<br>Normal Lane<br>600 mm |                    | Entrance           | Entrance           |       |
|         |              | Entrance                                     | Entrance            | Lift Lobby | Lift Lobby | Entrance                       | Entrance           | Entrance           | Entrance           |       |
|         |              | Next to Elevator -1                          | Next to Elevator -4 | Side 1     | Side 2     | Next to Elevator-5             | Next to Elevator-6 | Next to Elevator-5 | Next to Elevator-6 |       |
| 1       | Ground Floor | 3  | 3                   | 3          | 3          | 1                              | 1                  | 1                  | 1                  | 16    |

OSDP card reader will be installed for entry and exit at each of the lane

All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.

Include all necessary items required to make the system complete and working at all times

| P Gate Specifications |                          |  |
|-----------------------|--------------------------|--|
| Sr. No.               | Technical Specifications | Data   |
| 1                     | Passage Width            | max. 1800 mm with barrier tubes. (as per site requirement) |
| 2                     | Opening/closing time     | 1.4 to 4 sec depending upon barrier element                |
| 3                     | Opening angle            | adjustable from 0 to 300 degrees                           |
| 4                     | Drive technology         | High torque DC brushless motor drive                       |
| 5                     | Voltage                  | 110-240 VAC , 50/60 Hz                                     |
| 6                     | Power Consumption        | 45 W maximum   |
| 7                     | Duty Cycle               | 100%   |
| 8                     | Housing height           | 1000mm   |

|    |                       |  |
|----|-----------------------|--|
| 9  | housing material      | Stainless steel V2A                              |
| 10 | housing diameter      | 159 mm   |
| 11 | enclosure rating      | IP 44  |
| 12 | operating temperature | - 25 to + 45 degrees                             |
| 13 | Power Failure         | Free rotation                                    |
| 14 | MCBF                  | 10 million cycles                                |
| 15 | Spare availability    | All required spares should be available in India |



| SWING BARRIERS (ATRIUM & PASSAGE ENTRANCE GROUND FLOOR) (MAF required)   |  |
|--|--|
| Supply, Installation, Testing and Commissioning of Brand New Swing Barrier with AL/SS304 Stainless Steel semi-glass smooth finish and minimum IP20 rated including associated civil works complete as required with following specifications:  |  |
| (a) Wing Material  | 2 door leaf of at least 10 mm thickness and made up of transparent Polycarbonate/toughened Glass |
| (b) Passage Width  | 1. Normal Lane: 600 mm to 625 mm   |
|  | 2. Wide Lane: 900 mm to 925 mm   |
| (c) Housing Dimension  | 1. Length: 1400 mm to 1776 mm  |
|  | 2. Width: Maximum 200 mm   |
|  | 3. Height: 900 mm to 1100 mm   |
| (d) Passage Direction  | Bi-Directional   |
| (e) Wings Operating Time ( 0 deg to 90 deg)  | 1. Normal Lane: Maximum 0.7 Sec.   |
|  | 2. Wide Lane: Maximum 1.1 Sec.   |
| (f) Space between two door leaves when closed  | Maximum 60mm.  |
| (g) Certification: CE or UL Approved   |  |
| (h) Other Features:  |  |
| (i) Wings shall be free to open or automatically open in case of power failure or emergency.   |  |
| (ii) Programmable array of sensors mounted in the housings shall be suitable to restrict all of these security features like Tailgating, Piggybacking, Wrong Entry, Intrusion, Child crawling, etc. by way of audio alarms and bottom mounted sensor for trolley detection. LED Strip/Arrow indication on the lanes to highlight status and noiseless operation. |  |
| (iii) These swing type barriers shall have suitable housing arrangement to Flush Mount HID Signo Card reader.  |  |
| 1. The product should be factory finished as per approved TDS. No custom made solution or deviation form the standard approved TDS of the product shall be accepted.   |  |
| 2. The product shall be installed by OEM or under direct supervision of OEM and the installation report shall be signed by OEM   |  |
| 3. All civil related works for installation of the swing barriers to be included by the vendor in consultation with General Contractor   |  |
| passage width lane 550 mm and above 8 Million MCBF   |  |
| passage width lane 900 mm 6 Million MCBF   |  |

## TECHNICAL SPECIFICATIONS FOR INTEGRATED BUILDING MANAGEMENT SYSTEM

(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)

**MAKES: SCHNEIDER/TRIDIUM/SIEMENS/PCVUE/BECKHOFF/ENLITE**

Design Brief:

- a. The BMS system is applicable to the entire building from Basement, Ground, 1<sup>st</sup> to 29<sup>th</sup> floors.
- b. The BMS System Architecture will be a 3 tier architecture
  - i. BMS software
  - ii. Supervisory Controllers (All soft Integrations)
  - iii. DDC Controllers (field level integration)
- c. Please refer to the bms io summary at the end of the documents for details hard wired through ddc controllers and soft integration via modbus/bacnet protocol through supervisory controllers
- d. Wireless iot sensors will be used along with gateway over mesh network and seamlessly integrating with the bms system over MQTT protocol. Total 8 gateways and 16 to 20 sensors on each floor to monitor temp/rh

The building management system is a micro-processor based system which centralizes and simplifies...

1. Controlling
2. Monitoring
3. Operation and Management



of heating, air-conditioning, ventilation & other building services to achieve safe and comfortable working environment, energy saving & efficient operation at reduced time & cost

### **CENTRALIZED WORKSTATION COMPUTER**

With powerful user-friendly software.



Used for everyday building operation.

### DDC CONTROLLERS

Micro-processor based

Pre-configured / Freely programmable

Control or monitor or both the HVAC equipment of the building like VRF, AHU, CSU, types of fans Exhaust Fans, Fresh Air Fans & LT Panel status.

The system should also seamlessly integrate 3<sup>rd</sup> party equipment's mentioned below over Bacnet, Modbus or LonWorks

VRF, Energy Meters, DG Set, Elevators, Fire Alarm System, UPS, Light Management System

User-friendly data presentation

co-ordination of the flow of information through the system by implementing customized graphics.

floor plans of the building

graphical representation of the equipment.



The BMS System Architecture will be a 3 tier architecture

- i. BMS software
- ii. Supervisory Controllers ( All soft Integrations)
- iii. DDC Controllers ( field level integration)

Please refer to the bms io summary at the end of the documents for details hard wired through DDC controllers and soft integration via modbus/bacnet protocol through supervisory controllers

Wireless iot sensors will be used along with gateway over mesh network and seamlessly integrating with the bms system over MQTT protocol. Total 5 sets of gateway and 16 to 20 sensors on each floor to monitor temp/rh

The system should comply to the tender specifications

**include all necessary items required to make the system complete and working at all times**

## GENERAL

### 1.01 DESCRIPTION

This section defines the Basic Materials and Methods used in the installation of the INTEGRATED AUTOMATION SYSTEM (IAS).

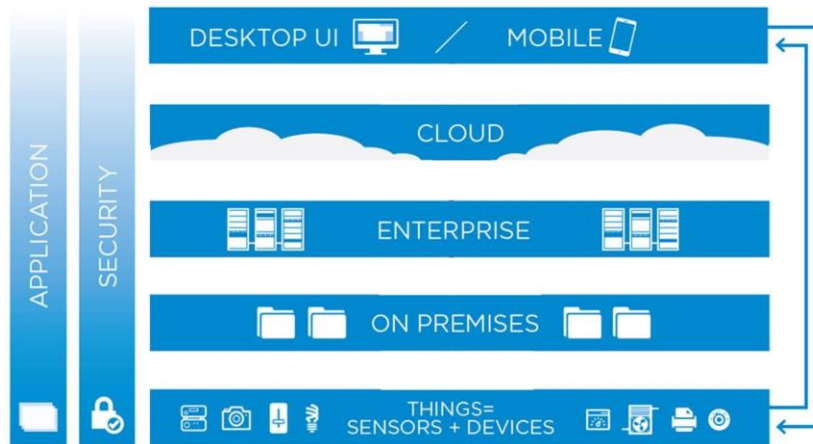
### 1.02 SCOPE

This Smart Buildings Guide specification outlines the Functions and Features of a Framework which can be deployed across any network connected systems, locally and remotely and accessible via the Internet via WEB Browsers over the IoT (Internet of Things).

A Smart Building approach differs from a traditional building systems and services approach where each M&E, Facilities and Enterprise systems are connected via their own infrastructures, a Smart Building facilitates connectivity of any system over common communications Infrastructure (Cabling, Network Infrastructure) using industry standard open protocols and Application Programme Interfaces (API's) allowing data to be shared and manipulated to provide cause and effects between systems

Building Services Technologies and Systems Data Integration can provide many possibilities and benefits for system data to be connected to allow inter-process control and interaction as well as providing common management level visualization and operation via Desktops and Mobile devices.

There are different levels of integration available depending on the various systems, services and applications, and the Framework should be architected around the IoT and takes the form of the following:



### 1.03 SMART BUILDING BENEFITS

- Benefits when adopting a “Smart Building” approach on the Framework which should include the following value propositions:
- Open, no lock in to a specific manufacturer, freedom of choice in future system upgrades
- Backup as a Service (Baas) included.
- Extensible and flexible – can be extended to support any device and protocol, allowing owners to adjust as technology changes
- Browser Based User Interface and visualization using HTML 5, no Browser Plugin required
- All open protocols included as standard e.g. BACnet, KNX, LON, M-Bus, Modbus, oBiX, SNMP etc.
- Can be used with Multiple Protocols on one platform, e.g. Supervisory controller or Server, either open and/or legacy types providing cost effective integration
- Native built in Analytics at Platform and Supervisor Levels.
- One WEB Based Software engineering tool for Integration, Visualization, Cyber Security, Enterprise data exchange and analytics.
- Same software should be used for Engineering, building GUI, integrations, analytics, alarm management, dashboard and operations.
- Flexible secure access either locally and/or remotely

- Cyber Security capabilities that provide strong authentication, role-based authorization, encrypted communications, encrypted sensitive information at rest, digitally-signed code validated at run-time, and auditing – customizable for meeting the Cyber Security policies of any organization
- Real time Cloud Based information for better business decisions
- Lower total cost of ownership
- Opportunity to improve business processes
- Savings in Operational management
- Automation and Optimization of Systems and Processes

1.04 SUMMARY

Section includes:

Central Software Supervisor (CSS)

Network Controller (NC).

Direct Digital Controllers (DDC).

The IAS shall be comprised of new Central software Supervisor (CSS), Network Controllers, BACnet control devices and interface devices (MODBUS)

Provide BTL certified products that communicate on MS/TP and IP channels to meet the functional specifications of this Division and the dedicated product functional specifications and profiles specified in other Sections of this Specification.

Provide BACnet BTL AWS (advanced work station) certification for the CSS. All NCs (Network controllers) shall BTL BBC certified.

Provide Intelligent Sensors and Actuators (ISAs) and direct digital controllers (DDC) as herein specified and as indicated on the IAS drawings. Provide I/O and ancillary devices as herein specified, as indicated on the IAS drawings, and as necessary to perform the sequences of operation. The following equipment shall be controlled and/or monitored:

This is a tentative list of 3<sup>rd</sup> party integration. However vendors to consider 20% spare capacity of soft IO Points for any future addition of 3<sup>rd</sup> party equipment's or enhancement of IO's in the list mentioned below

| VII | Third Party Integration |  | Qty | Per Device | Total Points |  | Remarks |
|-----|-------------------------|--|-----|------------|--------------|--|---------|
|-----|-------------------------|--|-----|------------|--------------|--|---------|

|    |                                |  |    |      |      |  |                                   |
|----|--------------------------------|--|----|------|------|--|-----------------------------------|
| 1  | Fire Alarm System              |  | 2  | 2000 | 4000 |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 2  | PA System                      |  | 2  | 5    | 10   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 3  | Basement Ventilation System    |  | 1  | 100  | 100  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 4  | Rodent Repellent               |  | 54 | 5    | 270  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 5  | Aspiration Panels              |  | 20 | 5    | 100  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 6  | Water Leak Detection           |  | 17 | 10   | 170  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 7  | Smart Lockers                  |  | 4  | 150  | 600  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 8  | CCTV VMS Integration           |  | 1  | 550  | 550  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 9  | Access Software Integration    |  | 1  | 500  | 500  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 10 | UVSS Integration               |  | 2  | 20   | 40   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 11 | Automatic Bollards Integration |  | 2  | 20   | 40   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 12 | Boom Barriers                  |  | 9  | 5    | 45   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 13 | Swing Barriers                 |  | 14 | 5    | 70   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 14 | Gate Automation                |  | 4  | 5    | 20   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 15 | WTMD                           |  | 4  | 5    | 20   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 16 | X Ray Baggage Scanners         |  | 4  | 5    | 20   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 17 | DG Set                         |  | 4  | 20   | 80   |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 18 | UPS                            |  | 34 | 20   | 680  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 19 | Utility Energy Meters          |  | 13 | 12   | 156  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 20 | DG Set Energy Meters           |  | 13 | 12   | 156  |  | Modbus-Bacnet<br>MSTP/IP Protocol |

|    |                                     |  |    |     |              |  |                                   |
|----|-------------------------------------|--|----|-----|--------------|--|-----------------------------------|
| 21 | LT Energy Meters                    |  | 17 | 5   | 85           |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 22 | Smart Lockers                       |  | 4  | 150 | 600          |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 23 | Automatic Parking<br>Dousing System |  | 1  | 300 | 300          |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 24 | Water Treatment Plant               |  | 1  | 40  | 40           |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 25 | Sewage Treatment<br>Plant           |  | 1  | 40  | 40           |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 26 | Transformer                         |  | 2  | 10  | 20           |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 27 | BMS Water Meters                    |  | 4  | 5   | 20           |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 28 | Material Testing Lab<br>Equipment's |  | 42 | 25  | 1050         |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 29 | Elevators and Lifts                 |  | 12 | 20  | 240          |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 30 | IOT Sensors Gateway<br>Router       |  | 17 | 25  | 425          |  | MQTT                              |
|    | <b>TOTAL SOFT IO POINTS</b>         |  |    |     | <b>10447</b> |  |                                   |

Provide wire, raceway systems, back boxes, 24 DC and/or 24 AC power supplies, enclosures, and final connections to nodes provided by this Division.

The number of network controllers required is dependent on the type and quantity of devices installed. It is the responsibility of the Contractor to determine the quantity and type of devices and to properly install the correct number (increase if required) of network controllers from the designed minimum shown on the IAS documents. The Contractor shall confirm the designed network load and architecture with the capabilities of the selected Network Controller

The CSS shall provide global supervisory control functions over the network controllers. The network controllers shall provide global supervisory control functions over the control devices that are connected to each network controller. The network controller shall be capable of executing application control programs to provide:

- Calendar functions
- Scheduling
- Trending



Alarm monitoring and routing (locally and to Web Server)

Time synchronization

Integration of LONWORKS®, BACnet® IP (client), BACnet® MSTP, Modbus®, OPC controller data, SNMP devices.

Connectivity for Network Management and programming functions for all BACnet based devices.

Energy management functions

Control functions

#### 1.05 REFERENCE STANDARDS

The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

#### 1.06 QUALITY ASSURANCE

All DDC controllers shall conform to the Interoperability requirements outlined in BACnet® Testing Laboratory Guidelines. All BACnet® products shall be BTL certified prior to delivery of submittals to the Owner for review.

Utilize standard PC components for all assemblies. Custom hardware, operating system, and utility software are not acceptable.

### PRODUCTS

#### 1.07 GENERAL

All materials shall meet or exceed all applicable referenced standards, Federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

#### 1.08 CENTRAL SOFTWARE SUPERVISOR (CSS)

- General

The Smart Building system shall be based on a design for an Open Systems Architecture (OSA) within a multi-user, multi-tasking environments allowing for simultaneous access by multiple users and distributed network interfacing to provide connectivity to multiple sub-systems via the Internet / cloud.

Data exchange shall be facilitated by utilizing a Framework to interface with Open and proprietary 3rd party systems over the Common Network Infrastructures and to present data into an overarching Management Level System via HTML 5 and Visualization.

The architecture shall be based on a scalable framework to accommodate any changes in data usage and connectivity within the buildings and their systems to meet with any future requirements, thus future proofing client's investment into Smart Buildings Systems, infrastructures and services.

- ARCHITECTURE  
Systems Integration

The Smart Building Middleware system shall be based on a Framework architecture, designed around open and secure communications standards using HTML5 WEB technology.

The Middleware shall have the capability to communicate via multiple industry open protocols running over Building Network Infrastructures and computer networks which provides support for the following protocols as standard:

- BACnet
- Lon Works
- KNX/EIB
- Modbus
- M-Bus
- oBIX
- OPC
- SNMP
- HTTP (HTML 5 / XML Mark-up Languages)
- Niagara (FOX/FOXs)

Once any subsystem are integrated into the Framework via supervisory controller platforms to form a distributed middleware layer, the associated system data point objects shall then be normalized into the Framework objects for data manipulation, alarming and visualization requirements.

The Middleware shall provide the capability to allow Open development of specific solutions or any 3rd Party drivers or Applications (Apps) to meet current or future requirements and to connect to IoT Services.

The Middleware Server shall provide access to the 3rd Party systems via HTML5 compatible Browsers over the Network Infrastructures, e.g. ActiveX components or JAVA Plugins to be installed on to the Client PC's or any other user interfaces (UI's).

Communication between the HTML Web Browser UI's and Middleware Server shall be secured via encryption using 128-bit encryption technology within Secure Socket Layers / Transport Layer Security (TLS/SSL) over HTTPS.

In order to protect the Cyber Security of all connected systems, Systems shall not be directly exposed on the Internet. If remote access to these systems is required, systems can be protected by a VPN gateway, providing security protection. Keeping stations behind a properly configured VPN ensures that they are not exposed, reducing the system's attack surface

As part of the Middleware deployment requirements, Server Software shall be setup to operate on its own dedicated Server environment but shall have the capability to operate under a Virtual server environment if required.

The framework architecture shall provide Operator(s) complete access to the Middleware system via HTML5 WEB browsers for at least 20 concurrent connections, both operationally and also for engineering requirements via Software Engineering Tools (Workbench).

The functionality provided through the HTML5 Browser interface shall be not altered, or restricted, based on the location, or type of device used to access the system, the only applicable restrictions shall be those associated with each individual Role based Access based on their Login credentials.

- SOFTWARE COMPONENTS
- 

The Framework architecture shall provide a Middleware layer which is fully extensible and scalable to meet any future expansion or enhancement requirements. The Middleware shall also facilitate Enhanced Cause and Effect between systems which can be designed, delivered and commissioned via Trained and certified Specialists.

All components of the Middleware software shall be configured, setup and completed in accordance with the required specifications, software components shall include:

- Server Software including latest Operating System (Windows or Linux RHEL)
- Core Software and Licenses
- Single WEB based Application & Tools (Workbench)
- Graphical Programming Tool
- Control Logic Software Tool
- Application Software (Alarming, Trending, Time Scheduling, Logging)
- Analytics
- ENTERPRISE CONNECTIVITY
- 

Subject to licensing and requirements, the Enterprise Management Level shall allow real time Connectivity of data via any of the following accepted methods:

- SQL (Structured Query Language)
- Oracle
- OPC (Object Link Embedding for Process Control)
- oBIX (Open Building Information eXchange)
- SNMP (Simple Network Management Protocol)
- API (Application Programme Interface)
- MQTT.
- Shall support ODBC, JDBC, json Integrations

Whilst still employed a common means of transferring data, Simple Text file transfer e.g. Comma Separated Value (CSV) mechanisms are not recommended as part of the Open System Architecture requirements as this are inherently prone to failure and data loss, oBIX (XML) and API based data transferred are the recommended data transfer methods into the software.

- ACCESS AND PERMISSIONS

Framework Access and Permissions shall be based on Role-Based Access Control (RBAC) whereby User Groups, Categories and Permissions are defined by User Roles.

Each User Group shall be granted a set of permissions in each category. This combination of categories and permissions shall define exactly what each User Group can do with each object defined within the system, the following sections outline the “Station” Security requirements

- i. User Groups
- ii. Defined access to the database
- iii. Role based access
- iv. Data modelling based on Hierarchy

Database transfer to the NC should be password protected which will allow only authorized person to access, edit or modify the database.

A set of pre-defined Roles based on User Groups” shall be defined across all Stations and every User of the system shall be given a unique “Username” and “Password” Login to provide audit logs.

“Admin” - Shall always be a Super User, having all permissions in every Category and can thus access everything in a Station that cannot be deleted or renamed.

“Engineers” - Shall provide Station access from the Web browser with Individual User Accounts and Login Authentication having Read / Write permissions to all Categories and to be able to undertake all Engineering and Graphics configuration including Project Backup and Restore.

“Operator” - Shall provide Station access from the Web browser and shall have the ability to navigate to following assigned objects:

- a. “Read” Permission (All Objects)
- b. “Write” permission (Alarms)

Groups and Users shall be stored in the Station's local database by default and verified by the Station's “User Service”.

Should support LDAP and Kerberos integration of database access management.

## PART 2 - Categories

Categories shall be defined for logical grouping of items or components. Categories shall be typically named to reflect each Grouping, as a minimum the following Categories shall be defined for each 3rd Party Subsystem:

Objects requiring further protection with individual security rules shall also be assigned to additional categories as required.

### PART 3 - Permissions

Permissions shall be used to define the rights a User has within each of the Categories in the station.

Within each account level, Separate user rights shall be applied to “Read Access” and “Write Access”

Every “User” defined in the Station shall be configured with a “Permissions Map” which shall be used to grants the “User” permissions for each Category defined in the Station

### PART 4 - Authentication

There are three authentication points in the Framework

- a. Workbench to Station via the FOXS Protocol
- b. Station to Station via FOXS Protocol

Web Browser-to-Station (HTTPs)

- a. Workbench to Station
- b. Station to Station
- c. Web Browser-to-Station

- SOFTWARE & DATABASE BACKUP
- 

Application software/operating system software shall be backed up onto suitable digital media such as a Network Attached Storage (NAS).

The System Supervisor shall be automatically configured to backup any Historical Trend, Logging, Alarm and System/User Event databases according to user configurable periods to ensure databases are consistently and automatically maintained and Databases regularly compacted to ensure maximum performance at all times.

Back-up of the entire Management Level systems, including configuration and setup data shall be automatically performed on a weekly basis or any time a change is made to the system configuration to ensure that even in the most catastrophic of events the system can be fully restored from the back-up files and, at worst, only one week of data would be lost.

In the case where system changes are carried out, a backup copy shall be taken prior to commencement of any software changes, each version shall be version controlled and date/time stamped, in the event of any failure the system can be reverted to previous backup version.

The software should be capable to automatically backup all the database from the NCs periodically and can load the database to the controller as and when required.

#### **Backup as a Service (Baas).**

BaaS allows any station to be securely backed up to the cloud whereby should any hardware failure or corruption happen, the latest or historical can be traced tracked and downloaded 24/7/365 by authorized individuals from a secure cloud login, and then manually installed on the NC.

This facility includes the following features:

Initiate backups with 1GB of storage

- Automated/scheduled backups
- View, delete backups
- Add, edit and delete notes
- Notifications
- Geo-located backup service
- Soft backup limits
  - GRAPHICS USER INTERFACE
    - 7.1.1 General

This section outlines the Middleware HTML5 WEB based Graphics User Interface (GUI) as well as the Single Pane of Glass (SPoG) deployment philosophy which shall be to unify the display of multiple sub systems to present a single operational view of data in a way that's easier to interpret and manage.

Each of the connected subsystems has their own Management Level Operator Workstations and different graphical user interface standards. The Middleware requirements are to bring a common set of Graphics that shall provide Operators with intuitive and instant overview / status information across these systems and where required detailed system graphics.

The WEB based GUI standard shall detail the visual layout and design of graphics, static and dynamic symbols and their representation on graphic pages for the systems covered by these works along with site plan and hierarchy/navigational requirements. The Trade Contractor shall develop a 2/3D dynamic/active graphics library for each subsystem discipline covered by these works along with Landing Page, System Overview Status and Graphical hierarchy/navigation for future expansion.

Active 2/3D color graphics shall be provided depicting the connected Middleware systems monitored by the Middleware system.

The Graphics shall be designed to be intuitive and operated either from a Workstation which shall be mouse / keyboard driven or via Smart Devices using Touch screens and be intuitive.

All Graphic Pages shall be submitted to the clients engineer for comment as part of each system design requirement, together with all necessary overviews and navigational requirements.

#### 7.1.2 Graphic Browser Navigation

The Graphics Browsing shall be designed to facilitate operation via:

- Middleware Operator Work Station
- Smart / Mobile devices such as Smart phones and/or tablet computers

The Client UI shall provide a comprehensive user interface using a collection of pages to provide a seamless link to all applications and subsystem data.

It shall be possible to navigate through the system using a browser to accomplish the functionality detailed within this specification without the need for any mouse or keyboard. The Graphics Browser Interface shall as a minimum provide:

- A Landing Page with an Overview of Systems and overall Alarm Status Information
- A Navigation area with Navigation tree
- A Common Navigation bar with shall be used on all graphical displays
- Action area for display and operation of graphics
- Access to Applications such as Alarms and Events & Histories, Time Scheduling
- Live Graphic Programming
- Administration Configuration
- Reports and Reporting actions for Alarms and Events.



The “Look and Feel” for the UI pages representing each of the above applications shall be developed in a consistent manner and the WEB Application shall fully utilize the same developed graphics and standards.

## 7.2 USER INTERFACE (UI)

### 7.2.1 User Logon

On launching the Logon from the Client Workstation or Tablet device and selecting the appropriate entry via SPoG HTML5 WEB Graphics, the operator shall be presented with a login page based on the User Roles that shall require a unique Login Name and Password.

Navigation within the Middleware system shall be wholly dependent on the operator’s role, privileges, and geographic area of responsibility.

The Middleware system shall be capable of complete scalability in terms of User Access and Object privileges. This shall apply to, but not be limited to, individual systems access, functionality and subsystem interaction.

### 7.2.2 SPoG Landing Page

The Landing Page shall provide access for each connected subsystem together with Alarm Overview / Status. An operator shall be able to select the required System and associated Graphics pages by clicking on buttons / hot spots, corresponding to the highlighted system.

### 7.2.3 Navigation Task Bar

SPoG shall provide the ability for any user to accomplish the following actions by clicking appropriate Button Icons / menu’s in a Graphical Navigation Taskbar which shall be common to all Graphic pages:

- Log In / Out
- Navigation Tree
- Alarm Status Display
- Home Page
- Page Forward/Back
- System Topology
- Application Access (Time Scheduling, Trending, Alarming & Event Logging)
- Print

- Help Menu
- Hide / Show Navigation Pane

### 7.3 SYSTEM GRAPHICS DEVELOPMENT

#### 7.3.1 Specific Graphical Requirements

The Middleware UI shall make extensive use of 2D / 3D static and dynamic symbols together with iconic representation of system components in the graphic area to communicate information related to Viewing and Operational elements of each subsystem, the Middleware UI shall provide the following:

- Graphical Display Size: The Trade Contractor shall make allowances to fully develop a Graphical Standard to meet the requirements as detailed. The UI shall as a minimum be optimized to graphically display in HD 1080p, True Color or higher and shall be compatible with High Resolution Touch screens and WEB UI's without Horizontal or Vertical scroll bars.
- Screen Display: Client Workstations shall have 1080p HD Wide Screens suitable for displaying High Resolution Graphics.
- Bitmaps, JPEG's shall be optimized for 1080p HD Resolution screen display following the UI standards as detailed.
- Should support SVG graphics and dynamically displayed values and units of any input/ output values shall correspond to the quantity it represents throughout all levels of graphics.
- Colour Concept: The Graphic backdrop colour shall be a passive colour that shall be non- invasive and consistent across all subsystem disciplines and shall allow dynamic objects to be displayed clearly, the Plant Graphics shall be designed to be clean and non-cluttered and shall use:

Dynamically Displayed Values and units of any input / output values shall correspond to the quantity it represents throughout all levels of Graphics.

Analogue values shall be capable of being displayed to 2 decimal places which shall include inputs, outputs and calculated values.

Digital values shall be represented by either an Icon representation or a full English word that truly and correctly represents the status and type of point being displayed; this shall include inputs, outputs and calculated values.

The Trade Contractor shall submit a Project Specific HMI Standards Document to the engineer, fully detailing all proposed symbols, icons, page layouts and graphic standards to be deployed on this project.

## 7.4 APPLICATION REQUIREMENTS

As well as the subsystem specific graphic requirements the following WEB based Applications shall be accessible via SPoG:

### 7.4.1 Schedules

CSS shall provide time scheduling capability for all connected systems and commandable software Objects.

Utilizing the navigation area displayed in the GUI, an operator with password access levels shall be able to define a Normal, Holiday or Override schedule priorities for each individual piece of equipment or zones, or choose to apply a single schedule to part of the system, site or floorarea.

For example, a schedule for one floor in the system would be created by selecting the designated floor and entering the relevant schedule at that location.

No further operator intervention would be required and every control module controlling that floor would be automatically downloaded with the data for that newly entered schedule.

The system shall include the option to have an area opt out of the tiered scheduling criteria to allow specific and separate scheduling of that area with minimal intervention.

All schedules that affect the system, area or piece of equipment highlighted in the navigation area shall be shown in a summary schedule table and graph.

- Schedules shall be compatible with BACnet standards and verified using the 3rd Party PIC's Statement, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:

- i) Types of schedule shall be Normal, Holiday or Override
- ii) A specific date
- iii) A range of dates
- iv) Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)
- v) Wildcard (example, allow combinations like second Tuesday of every month).

- The system shall allow operators to define and edit scheduling categories, different types of items to be scheduled; for example, lighting, HVAC occupancy, etc. The categories shall include:

name, description, icon representation to display in the hierarchy tree when icon option is selected and type of value to be scheduled.

- In addition to a tiered system of scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas, rooms or equipment scattered throughout the facility and site. For example, the operator shall be able to define “Individual” plant groups to reflect the usage occupancy of the different areas within each of the buildings Floors / Area’s.

Group Schedules, when applied shall automatically be downloaded to control modules associated with the relevant area’s spaces.

- The system shall be designed to automatically turn on any supporting equipment needed to control the environment in an occupied space. Demand shall be created at the point of delivery and that demand shall be passed back through to all plant and equipment necessary to achieve the demand at the point of delivery. For example, if an operator schedules an individual rooms / area’s served by Re-heaters for occupancy, the system shall automatically enable the respective AHU, Chiller, Boiler, pumps and/or any other equipment required to achieve and maintain the specified comfort and environmental conditions within the room.

- It shall be possible to setup and apply Site Wide as well as local exception Schedules to accommodate a time range specified by the operator (e.g.: Operating Theatres that need to be operated in an Emergency from 6pm to 12pm overrides Normal schedule), including any Bankor Public Holidays.

- The Schedule summary shall clearly show Normal versus Holiday versus Exception Schedules, and the net operating schedule that results from all contributing schedules. Where more than one schedule is applied, it shall be possible to prioritise.

- The system shall be capable of maintaining Master Schedules for reliability and performance, which shall maintain a single schedule in a NC that writes over the network to notify other devices when a scheduled event occurs.

#### 7.4.2 Alarm Handling, Notification and Management

The software Alarming System shall provide any required Alarm and Event Management setup and configuration for the data points and devices associated with each connected subsystem.

Alarms and Events shall be configured to generate system messages that provide operators with information such as communications failure and subsystem specific alarms such as breaker status monitoring, elevator status etc.

The Alarm Handling and Management System shall have the capability of providing any of the following possible actions:

- Display of the most recent Highest Priority Alarms for each system category in the Landing Page Alarm Banner
- Initiate a Pop-up Window on any designated Alarm Monitoring Workstations
- Operator Acknowledgement and Reset capability subject to object access and privileges
- Routing to Specified Workstations or Receiving devices
- Routing to Help Desk for further action
- Send to key personnel e-mail account with the relevant alarm information

An alarm matrix shall be produced for each system which shall include:

- System
- Categories
- Priorities
- Messages
- Annunciation
- Network Printing, Email, Mobile Devices)

Alarms associated with a specific system, area, or equipment shall have the following capabilities:

- Each currently active alarm shall be displayed using different icons together with date/time of occurrence, current status and a context link to the associated graphic for the selected system, area or equipment.

An operator shall be able to sort events on any available data field.

- Systems shall be defined for each subsystem type such as BMS/HVAC, SCADA/PLC, EMS, Lighting, Lifts, EMS or Fire. An icon shall be associated with each category, enabling the operator to easily sort through multiple alarm events displayed using a built-in filter capability.
- Alarm Categories shall be defined for different types of alarms types such as Life Safety, Critical, Maintenance and Abnormal together with their associated properties. As a minimum, properties shall include a reference name, Category, Priority, text description at least 256 characters in length, severity of event, Acknowledgement and Reset requirements, high/low limit out of range and reliability information.

- All Alarm shall be Time/Date Stamped, all events shall be generated at the NC and shall comprise the Time/Date Stamp using the synchronized time and date.

- Operator Actions shall also be logged for each associated Alarm which shall include any Acknowledgement or Reset notification as well as return to Normal status.

- Alarm Summary Counters for each system shall be displayed across the top of each Graphic page. The view shall provide a numeric counter, indicating how many alarm events are active(In Alarm) and require acknowledgement, and total number of events in the Middleware Alarm Server database.

- Alarm Events that have been Acknowledged, Reset (Where Required) and have returned to Normal shall be auto-deleted from the Alarm Banner view and stored in the Server Log database and archived after an operator-defined period.

- Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:

- Alarm.
- Return to normal.
- To default.
- Alarms shall be annunciated in any of the following manners as defined by the user:
- Screen message text.
- Email of complete alarm message to multiple recipients.
- Pagers via paging services that initiate a page on receipt of email message.
- Graphics with flashing alarm object(s).
- The following shall be recorded by the SNC for each alarm (at a minimum):
- Time and date.
- Equipment (air handler #, access way, etc.).
- Acknowledge time, date, and user who issued acknowledgement.

- Alarm Reporting Actions specified shall be automatically launched under certain conditions on receiving an event request. Operators shall be able to fully define these Reporting Actions using the Navigation Tree and Graphic Area in the WEB Browser GUI.

Reporting Actions shall be as follows:

i) Alarms shall be routed and printed to any networked printer and shall print immediately after the previous Alarm.

ii) Email shall be sent via any Exchange compatible email server. Email messages may be routed to several email accounts.

iii) The Simple Network Management Protocol (SNMP) shall be used where reporting Network Events and shall send an SNMP trap to the Network Management system (NMS).

- The SPoG Web Browser Interface shall provide an Event Simulator to test assigned Reporting Actions. Any operator with sufficient object access and privilege shall have the option of using current time or scheduling a specific time to generate the Event.

- Utilizing the Navigation Tree and drop-down menus in the Graphic Area, the operator shall be able to select any Alarm / Event Type, Category, Status, Notification, Priority, Message, and whether Acknowledgement and Reset is required.

A. System logic shall be able to monitor the status of each process variable in the system, and perform specific functions based on the following parameters:

Normal Status

Alarm Status

LoLo Alarm Status

Lo Alarm Status

Hi Alarm Status

HiHi Alarm Status

Logical Result of Boolean Expression Individual Bit in Word Status (0-31)

Acknowledged Alarm Status

Unacknowledged Alarm Status

#### 7.4.3 Histories

The system shall be able to Trend and Display graphically via SPoG any analogue, digital or calculated point. A Trend log's properties shall be editable using the Navigation Tree and shall provide the following:

- The operator shall have the ability to view trends by using the Navigation Tree and selecting a Trend button in the Graphic Area. The system shall allow y-axis and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.

- Trend data shall be collected from any connected subsystem and periodically uploaded based on automatic configuration to the Server; Trend data shall be retained in non-volatile module memory and archived after an operator-defined period.

- Sample intervals shall be as small as one second. Each trended point shall have the ability to be trended at a different trend interval. When multiple points are selected for display, which have different trend intervals, the system shall automatically scale the axis.
- Trends shall be able to dynamically update at operator-defined intervals.
- It shall be possible to zoom-in on a particular section of a trend for more detailed examination; the system shall be able to Zoom Out or Reset the Trend view to the standard range.
- It shall be possible to pick any sample on a trend and have the numerical value displayed without moving to a different screen.

The system shall extract information directly from any relevant data within the Middleware NC's to initiate trend logging facilities, retrieving real time values of any I/O or from process control loops and then display/print the logged data for tuning/diagnostic purposes. The measured value shall be the actual reading at the sensing device.

The capacity of each NC shall allow all for all points to be logged in the system at 1 minute intervals for a minimum of 24 hours within the same controller that they are connected to. In addition, each controller shall be able to log all calculated points and shall have the capacity to log 75% of these points at 5 minute intervals within the same controller that they are held.

The data collected from a point shall be stored in non-volatile memory. The time periods of data logging shall be variable between a minimum of 1 minute to a maximum of once per day. This shall be selectable at the time of initiation of the logging period.

The Operator shall have the option to specify the start and/or stop time of the trend log period. The logs shall also be capable of being held, overwritten on a first-in first-out basis.

The value stored periodically shall be the average reading since the previous reading. Spot readings at the time of the sample shall not be acceptable. The Operator shall have the option to read the maximum and minimum logged values.

All Trend log data shall be initially stored in memory buffers of the NC's which shall also support short term

(1 Day) logging requirements.

The Middleware NC's shall archive Trend values to the Middleware Server prior to them being over-written in the NC. The Middleware Server hardware shall be sized such that one year's worth of archived data may be held for retrieval on an "Instantaneous" basis.

The Middleware system shall have the facility to automatically archive trend data older than one year to the Network Attached Storage (NAS) with the capability of being retrieved for viewing at any time in the future.



System operating Logs shall be configured to log all events during commissioning and samples shall be included within the Trade Contractors system commissioning report. These system operating logs shall contribute towards providing evidence of the satisfactory completion of commissioning.

#### 7.4.4 Reporting

The Middleware Management system shall have the facility to configure to generate the following daily/monthly management and system reports on an ad-hoc and on-line basis:

- i) Alarm Console
- ii) Energy Usage
- iii) Monthly Service Call
- iv) Response Time Monitoring

- The Reporting function will allow for the creation of configurable (user-defined) reports via a report builder tool. The Reporting function will provide functionality to ensure that certain types of user-defined reports are made available only to specific user roles.

- The Reporting function will allow for specification of filter conditions to refine the data being displayed in standard and user-defined reports.

- The Reporting function will allow for dynamic analysis on both standard and user-defined reports by providing the following features:

- i) Changing of row and column orders for different presentation layouts.
- ii) Grouping/aggregation to view data at a summary as well as detailed level within the same report
- iii) Slice-and-dice capabilities for advanced analysis

- The Reporting function will allow for exporting of data into Microsoft Excel, comma-separated text (CSV), PDF or other suitable formats.

- The Reporting function will be compatible with standard reporting engines so that new reporting templates can be developed.

- The Reporting function will have facility for the users to select whether to generate a report on-line or in batch mode.

- The Reporting function will allow preview of all reports on screen before it is sent for printing on desktop printers or network printers.

- The Reporting function will allow the user to generate reports in a graphical format, forexample, bar chart, pie chart, etc.
- The reporting function should support transmitting reports over emails periodically preferably in PDF or csv format, based on the defined schedules and should be configurable any given point of time.

Analytics:

Software should support following functionality.

1. Support for analytics on the same software application and without requirement of any additional software tool.
2. Support for FBD algorithm which can be customized based on the project requirement.
3. Support for analytics on the embedded controllers.
4. Advanced alarming
5. Fault detection & diagnostics
6. Support for HTML-5 based visualizations and user specific dashboard and graphics.
7. Software should have a library of components like data sources, math objects, logic objects, filters, stings, and pre-defined algorithms which will be used to build the project specific algorithms.

## 7.5 ENTERPRISE SERVER & WEB BROWSER GUI

### 7.5.1 System Overview

Rack mounted Enterprise Servers shall be deployed in the Clients IT Rack Space and shall be configured to Run the Middleware Application as a “Service” and be capable of multiple client logins.

To allow the users to view the monitored middleware system data, dedicated Client Workstations shall be provided in all required locations.

Additionally, the Middleware Server shall be configured to provide WEB Services to any WEB Client Device such as Tablets or any Client Desktop dependent on network Security and User Access and Privileges.

The Server Manufacture type and model shall be approved by the Clients IT who shall also ensure that the environments comply with their own corporate Security and Management requirements.

Servers shall be of sufficient specification to meet this specification plus 50% expansion in the future with Remote Desktop Access for Administrators.

The Server shall be supplied to allow a minimum of twenty concurrent Client users without any performance degradation.

As detailed above, Servers, NAS and Workstations connected to the Network Infrastructure, shall subject to User Login and any Security Privileges and User Base Roles.

#### 4.01 NETWORK CONTROLLER (NC)

General Requirements: The Network Controllers shall be JAVA based application controllers. The contractor shall develop the new system to accomplish the following as part of this project.

The NC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve supervisory control shall be executed within the NC independent of any other device. All control strategies performed by the NC(s) shall be both operator definable and modifiable through the Operator Interfaces.

The NC shall utilize I/O Expansion Module (IO-16-485) for direct control of equipment.

The NCs shall utilize the Framework for discovery, installation, setup, configuration and commissioning of user defined BACnet devices.

NCs shall perform overall system coordination, accept control programs, perform automated global HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions.

NCs shall share information with the entire network of NCs (FAC LAN) for full global control directly without requiring other NCs, LAN devices, Local Supervisory LAN gateways, routers etc. to assist, perform, or act as an intermediate device for communicating.

The network controller shall support standard Web browser access via the Intranet/Internet. It shall support unlimited users.

If network communications issues arise as a result of a limited Network Controller resource count the Contractor shall furnish, install, and implement additional Network Controllers to reduce the network traffic on each Network Controller's Local Operating Network to less than 50% of maximum network bandwidth or 60% of the available controller resource count.

#### Event Alarm Notification and Actions

- a. The network controller shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

- b. The network controller shall be able to route any alarm condition to any defined user location whether connected to a local, remote or wide-area network.
- c. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
  - i. To alarm
  - ii. Return to normal
  - iii. To fault
- d. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and or classes of alarms, i.e., security, HVAC, fire, etc.
- e. Provide routing of alarms by class, object, group, or node and time.
- f. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- g. Escalation of unacknowledged alarms to other recipients for up to three levels.

Control equipment and network failures shall be treated as alarms and annunciated.

Alarms shall be annunciated in any of the following manners as defined by the user:

- h. Screen message text
- i. Graphic with flashing alarm object(s).
- j. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
  - i. Day of week
  - ii. Time of day
  - iii. Recipient
- k. Mobile devices using SMS.
- l. Printed message, routed directly to a dedicated alarm printer.

The following shall be recorded by the NC for each alarm (at a minimum).

- m. Time and date
- n. Location (building, floor, zone, office number, etc.)
- o. Equipment (air handler #, VAV #, etc.)
- p. Acknowledge time, date, and user who issued acknowledgement
- q. Number of occurrences since last acknowledgement
- r. User defined notation

Alarm actions may be initiated by user defined programmable objects created for that purpose.

- s. Required alarms shall be generated within the network controller. Alarms may be based on information from various sources, including information from Control Units, Programmable Controllers, and other integrated devices and systems. Information will be processed in the network controller, and alarms generated accordingly.
- t. When required alarms are not available directly from the control devices, information obtained from the devices can be tested against alarm thresholds and set-points within the network controller, and alarms generated accordingly.
- u. Alarm points created in the network controllers shall have set-points which are adjustable from appropriate browser based workstations by users with sufficient password levels.
- v. Users with sufficient password levels shall be authorized to acknowledge alarms, enter notes, etc., individually from the browser based operator workstations.
- w. Alarms generated by the network controllers shall be presented to appropriate workstations in a manner consistent with the presentation of other alarms.

Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

A log of all alarms shall be maintained by the network controller and a server (if configured in the system) and shall be available for review by the user.

Provide a “query” feature to allow review of specific alarms by user defined parameters.

A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

Data Collection and Storage:

- x. The network controller shall collect data for any property of any object and store this data for future use.
- y. The data collection shall be performed by log objects, resident in the network controller that shall have, at a minimum, the following configurable properties:
  - i. Designating the log as interval or deviation.
  - ii. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
  - iii. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
  - iv. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
  - v. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- z. All log data shall be stored in a relational database in the network controller and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
- aa. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- bb. All log data shall be available to the user in the following data formats:
  - i. HTML
  - ii. XML
  - iii. Plain text
  - iv. Comma or tab separated values

- cc. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
- dd. The network controller shall have the ability to archive its log data either locally (to itself), or remotely to a server or other network controller on the network. Provide the ability to configure the following archiving properties, at a minimum:
  - i. Archive on time of day
  - ii. Archive on user-defined number of data stores in the log (buffer size)
  - iii. Archive when log has reached its user-defined capacity of data stores
  - iv. Provide ability to clear logs once archived

#### Audit Log

- ee. Provide and maintain an Audit Log that tracks all activities performed on the network controller. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the network controller), to another network controller on the network, or to a server. For each log entry, provide the following data:
  - i. Time and date
  - ii. User ID
  - iii. Change or activity (change set point, add or delete objects, commands, etc.)

#### Database Backup and Storage

- ff. The network controller shall have the ability to automatically back up its database. The database shall be backed up based on a user-defined time interval.
- gg. Copies of the current database and, at the most recently saved database shall be stored in the network controller. The age of the most recently saved database is dependent on the user-defined database save interval.
- hh. The network controller's database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

- ii. Provisioning - Automatic downloading of software updates, backups to the entire system database etc. based on user defined parameters.

#### Network Controller and Server Licensing Requirements

- jj. All New and Existing Network Controllers and Server equipment and software furnished by or integrated with this project shall be fully licensed to the Owner. The licensing rights shall include the rights for the Owner to authorize any Contractor of their choosing to perform work on the IAS system. The installing contractor shall hold no exclusive rights to the system as it pertains to software, hardware, system updates, system access, modifications, developed databases, etc.
- kk. Provide the Owner all required user names and passwords for system access yielding full administration and configuration rights. These shall apply to work stations, servers, network controllers, configurable network electronics, controllers, system software / database and the like.
- ll. The Contractor shall not limit in any fashion the ability for other contractors, vendors or operators the ability to manage, configure, or modify the parameters of each Network Controller, server or system software / database.
- mm. The Contractor shall coordinate and hold no exclusive rights pertaining to inter-station links between Network Controllers.
- nn. The owner shall have rights to update and modify site specific graphics, application programs and database files associated with the sequence of operation.
- oo. The owner shall reserve the right and possess the ability to hire a contractor to service, maintain and modify the system. The ability to program, configure, and perform database modifications associated with of all the DDC controllers shall likewise be the property of the Owner. The Contractor shall hold no exclusive rights, or access levels to the system. Third party Contractors shall have full rights and access to the system at any point for system expansion or existing system modifications. All configurations shall be performed via Supervisor.
- pp. Upon substantial completion the Contractor shall deliver as part of the O&M manuals to the owner electronic copies containing the current databases, Systems Usernames, Passwords and Access Levels for the following components:



- 1) Network Controllers
- 2) Server Machine
- 3) DDC Controllers

The network controller must provide the following hardware features as a minimum:

- TI AM3352: 1000MHz ARM® Cortex™-A8
- Processor should be a single 32 bit processor chip and not 2 16bit processor chips.
- 1GB DDR3 SDRAM
- Removable micro-SD card with 4GBflash total storage/2GB user storage
- Wi-Fi (Client or WAP) WPAPSK/WPA2PSK supported
- USB type A connector Back-up and restore support
- (2) isolated RS-485 with selectable bias and termination
- (2) 10/100MB Ethernet ports
- 24VAC/DC power supply
- BACnet, LON Modbus, KNX and SNMP drivers included by default
- BACnet server and Modbus master slave compatible by default
- Supports Analytics engine to run on this NC
- Network controller must support up to 200 devices on any of the below mentioned protocols. No of points per NC should not exceed 10000 data points
- Supports BACnet IP, BACnet MSTP, Modbus TCP IP, Modbus RTU, Lon IP, Lon works FTT10, SNMP, Mbus and KNX by default. Optional drivers can be added.
- Can extend up to total of (6) RS-485 ports or (4) Lon FTT 10 ports or (4) RS-232 ports or combination of above ports.
- The network controller must be capable to withstanding operating temp of (-20°C) to 60°C and storage temperature of (-40°C) to 85°C.

- Relative Humidity from 5% to 95%

Agency Certifications:

PART 5 - UL 916

PART 6 - CE EN 61326-1

PART 7 - FCC Part 15 Subpart B, Class B

PART 8 - FCC Part 15 Subpart C

PART 9 - C-UL listed to Canadian Standards Association (CSA) C22.2 No. 205-M1983 "Signal Equipment"

PART 10 - 1999/5/EC R&TTE Directive

PART 11 - CCC

PART 12 - SRRC

PART 13 - RSS

PART 14 - ROHS

#### 14.01 DIGITAL DIRECT CONTROLLERS (DDC)

A BACnet based DDC shall be provided where required to perform the sequence of operation. The DDC shall be fully configurable and programmable via the GUI web browser without using any proprietary tools. The controller shall store all specific control sequences and program settings in non-volatile memory. DDCs should be of the same make and brand as the NC's

10 year memory retention between program downloads.

Each DDC shall perform all intended control functions in a 'standalone' mode should the unit incur a loss of communications.

The complete DDC including accessory devices such as relays, transducers, power supplies, etc., shall be factory-mounted, wired and housed in a NEMA 1 enclosure or as required by the location and local code requirements.

Each DDC shall allow <MS/TP, IP or Peer-to-Peer> communications.

All DDCs shall be provided as self-sufficient units to maximize reliability and shall include internal 'soft' clock, operating systems, communication timing and interrupt controls, and shall be suitable for the specified applications.

In the event of a power outage or controller reset, each DDC shall enter a preprogrammed state on power re-application. Upon application of power to the DDC, all control conditions will start from an 'off' / 'closed' position or the default state. This state will be maintained for an automatically adjusted amount of time. Once this time delay has passed, the DDC control sequence shall resume according to current values

Network and controller-to-controller communications must conform to BACnet standards.

All DDCs shall be provided with a communications port to allow connection of any industry standard laptop PC and custom configuration tools. Program access via this communications port allows direct field modification of the configuration parameters.

#### DDC Specifications

32-bit processor, 80MHz

Baud rate: 9.6K, 19.2K, 38.4K, 76.8K, 115.2K bit/s

Operating Temperature: 0°C to 55°C (32° to 131°F)

Storage Temperature: 20°C to 85°C (-4° to 185°F)

Operating Humidity: 0% to 95% Relative Humidity, Non-condensing

Should have inbuilt Real time clock

#### Agency Listing:

- C-Tick
- UL
- CE
- FCC

#### Digital Inputs

All digital inputs shall be over voltage protected.

Digital Input types supported by the DDC:

- a. Normally open contacts (24V and 120V).
- b. Normally closed contacts (24V and 120V).
- c. Current/no current.
- d. Voltage/no voltage.
- e. Pulse/Totalizer contacts.

#### Digital Outputs

All digital outputs shall be 24 volt AC, current sinking, and 0.5 amp opto-isolated triacs.

Digital outputs shall be capable of handling maintained as well as pulsed outputs for momentary or magnetic latching circuits. It shall be possible to configure outputs for 3- mode control (fast-slow-off) and 2-mode control.

#### Analog Inputs

All analog inputs shall be over voltage protected.

The analog to digital resolutions shall be a minimum of 10 bit.

Analog inputs shall accept the following temperature types: 10K Ohm thermistor, 20K Ohm thermistor, or 1K Ohm RTD.

Inputs shall be configurable to accept a wide range of inputs including: 4-20mA, 1-5Vdc, 2-10Vdc, etc.

#### Analog Outputs

The PCU shall accommodate true analog outputs. Voltage (0-10V) and current (4-20 mA) outputs shall be accommodated.

All analog outputs shall be proportional current or voltage type.

The digital to analog resolution shall be a minimum of 12 bit.

Outputs shall be configurable so that 0-100% output commands can represent any portion of the output voltage/current range.

Outputs shall be reversible so that an increasing output command yields a decreasing electrical signal.

In addition to local physical or internal I/O, each DDC shall support distributed or 'bound' I/O. This bound I/O can be used to allow the DDC to provide I/O data to another controller on the network or to allow another controller to provide data to the controlling PCU.

The following general modes of control shall be incorporated into each DDC.

<Occupied shall be a mode designed for normal occupied control of an area during regular business hours. This mode shall have unique heating and cooling setpoints associated with it.

Unoccupied shall be a mode designed for after hours control of an area. This mode shall have unique heating and cooling setpoints associated with it.

Override shall be a mode designed to invoke normal occupied control during after hours of an area. This mode shall use the occupied heating and cooling setpoints.

Economy shall be a mode designed for normal occupied times when energy demand usage is high and control setpoints need to be adjusted for lower energy use. This mode shall have unique heating and cooling setpoints associated with it.

Morning Warm-Up on units with a outdoor air economizer shall be a mode designed for the pre-heat/pre-cool time before normal occupancy occurs. This mode shall allow heating or cooling as required by the occupied setpoints but it will prevent outdoor air from entering the space. The outdoor air will move to its minimum position once the morning warm-up mode is over and the occupied

**BMS SENSORS:**

**MAKES: GREYSTONE/SONTAY/ BAPI/VAISLA**

**i. WALL MOUNT CARBON DIOXIDE/ RH/ TEMPERATURE SENSOR**

Provide a wall mount carbon dioxide / RH/ Temperature sensor as indicated within the field termination schedules and/or control diagrams. Carbon dioxide / RH/ Temperature sensors shall meet, at minimum, the following requirements:

1. The sensor shall be fully microprocessor based with Concealed LCD.
2. CO<sub>2</sub> Sensor shall be NDIR type, RH Sensor shall be thermoset polymer based capacitive type and Temperature Sensor shall be thermistor.
3. CO<sub>2</sub> range shall be 0-5000ppm, RH range shall be 0-100 %RH, non-condensing and Temperature range shall be 0 to 50°C.
4. CO<sub>2</sub> accuracy shall be +50ppm +3% of reading, RH accuracy shall be ±2%RH, non-condensing and Temperature accuracy shall be 0.2°C.
5. The power supply shall be 24Vac/dc.
6. The output shall be 4-20 mA or 0-10/ 0-5 Vdc.
7. Optional BACnet or Modbus communications output
8. Optional programmable relay output - Form C contact.
9. Operating environment shall be -10 to 50°C (32 to 122°F), 5-95 %RH non-condensing
10. Enclosure shall be IP65 (NEMA 4X) rated polycarbonate

**ii. WALL MOUNT SPACE CARBON DIOXIDE/ RH/ TEMPERATURE SENSOR**

Provide a wall mount space carbon dioxide / RH/ Temperature sensor as indicated within the field termination schedules and/or control diagrams. Carbon dioxide / RH/ Temperature sensors shall meet, at minimum, the following requirements:

1. The sensor shall be fully microprocessor based with Concealed or Viewable LCD.
2. CO<sub>2</sub> Sensor shall be NDIR type, RH Sensor shall be capacitive type and Temperature Sensor shall be thermistor.

3. CO<sub>2</sub> range shall be 0-10000ppm, adjustable, Default is 0-2000ppm, RH range shall be 0-100 %RH, non-condensing and Temperature range shall be 0 to 50°C.
4. CO<sub>2</sub> accuracy shall be  $\pm$  (30ppm + 3% of measured value), RH accuracy shall be  $\pm$ 2%RH, and Temperature accuracy shall be 0.2°C.
5. The power supply shall be 24Vac/dc.
6. The output shall be 4-20 mA or 0-10/ 0-5 Vdc.
7. Optional programmable relay output - Form A contact.
8. Optional push button momentary override switch
9. Optional setpoint control, 2 wire resistive slide pot.
10. Operating environment shall be 0 to 50°C (32 to 122°F), 5-95 %RH non-condensing
11. Enclosure Shall be IP30 (NEMA 1) rated ABS.

### iii. DUCT DEWPOINT SENSOR

Provide a duct dewpoint sensor as indicated within the field termination schedules and/or control diagrams. Duct dewpoint sensor shall meet, at minimum, the following requirements:

1. The sensor shall be fully microprocessor based with LCD.
2. The sensor shall have five measurement variables which include dewpoint, dry-bulb temperature, wet-bulb temperature, Relative humidity, and enthalpy.
3. Two analog outputs (2X) 4-20 mA or 0-5/0-10 Vdc (field selectable) shall support any of the five measurements by field configuration.
4. Optional BACnet or Modbus communications output
5. RH range shall be 0-100 %RH, non-condensing, Dry Bulb Temperature range shall be 0to 50°C, calculated values Dewpoint Temperature range shall be -30 to 50°C (-22 to 122°F),Wet Bulb Temperature range shall be -30 to 50°C (-22 to 122°F) and Enthalpy range shall be 0 to 340 kJ/kg (0 to 146 BTU/lb).
6. RH accuracy shall be  $\pm$ 2 %RH, 10 to 90 %RH @ 25°C, Dry Bulb Temperature accuracy shall be 0.2°C, Dewpoint Temperature range shall be  $\pm$ 1.0°C ( $\pm$ 1.8°F) @ 40 %RH / 25°C, Wet Bulb Temperature range shall be  $\pm$ 1.0°C ( $\pm$ 1.8°F) @ 50 %RH / 25°C, and Enthalpy range shall be  $\pm$ 2 kJ/kg ( $\pm$ 1 BTU/lb) @ 50 %RH / 25°C
7. The power supply shall be 24Vac/dc.
8. Probe length shall be 230mm (9")
9. Operating environment shall be -30 to 50°C (-22 to 122°F), 0 to 95 %RH non-condensing
10. Enclosure shall be IP65 (NEMA 4X) rated polycarbonate

### iv. DUCT MOUNTED CARBON DIOXIDE/ RH/ TEMPERATURE SENSOR

Provide a duct carbon dioxide / RH/ Temperature sensor as indicated within the field termination schedules and/or control diagrams. Carbon dioxide / RH/Temperature sensors shall meet, at minimum, the following requirements:

1. The sensor shall be fully microprocessor based with LCD.
2. CO<sub>2</sub> Sensor shall be NDIR type, RH Sensor shall be capacitive type and Temperature Sensor shall be thermistor.
3. CO<sub>2</sub> range shall be 0-10000ppm, adjustable, Default is 0-2000ppm, RH range shall be 0-100 %RH, non-condensing and Temperature range shall be 0 to 50°C.
4. CO<sub>2</sub> accuracy shall be  $\pm$  (30ppm + 3% of measured value), RH accuracy shall be  $\pm$ 2%RH, and Temperature accuracy shall be 0.2°C.
5. The power supply shall be 24Vac/dc.
6. The output shall be 4-20 mA or 0-10/ 0-5 Vdc.
7. Optional BACnet or Modbus communications output
8. Optional programmable relay output - Form A contact.
9. Probe length shall be 152mm (6")
10. Operating environment shall be 0 to 50°C (32 to 122°F), 0-95 %RH non-condensing
11. Enclosure shall be IP65 (NEMA 4X) rated polycarbonate

**v. DIFFERENTIAL PRESSURE SWITCH – AIR**

Provide air differential pressure switches as indicated in field termination schedules and/or control diagrams. Air differential pressure switches shall meet, at minimum, the following requirements:

1. The switch shall be designed for use with Air, non-combustible, and non-aggressive gases
2. The construction shall be spring loaded diaphragm type and diaphragm shall be Silicone, tempered at 200°C
3. The switch shall be with range adjustment Knob and ranges shall be 20 to 300Pa/ 50 to 500 Pa/ 500 to 2500Pa. Select range as required, taking into consideration pressure drop across filter or coil.
4. The set point shall be concealed type
5. The maximum operating pressure shall be 1.45 PSI (10 kPa) for all pressure ranges
6. Medium and Ambient Temperature range of -20 to 60°C (-4 to 140°F)
7. The contact shall be SPDT type with electrical rating Max. 1.0A (0.4A) / 250 Vac, 50/60 Hz.
8. The mechanical working life shall be Over 10 million switching operations
9. Enclosure Shall be IP54 with cover (NEMA 13) with Switch body made of PA 6.6, cover made of PC.
10. Automatic reset.

**viii. WATER DIFFERENTIAL PRESSURE TRANSMITTER**

Provide a Water differential pressure transmitter as indicated within the field termination schedules and/or control diagrams. Water differential pressure transmitter shall meet, at minimum, the following requirements:

1. The water differential pressure transmitter shall be with a dual remote sensor.
2. Field selectable pressure ranges, at least 4 ranges from the single model selection
3. The differential pressure transmitter shall be with accuracy  $\pm 1\%$  F.S. of selected range (lowest pressure range is  $\pm 2\%$  F.S.)
4. The differential pressure transmitter shall have port swapping option.
5. The output shall be 4-20 mA or 0-10/ 0-5 Vdc (switch selectable)
6. The power supply shall be 24Vac/dc.
7. The differential pressure transmitter shall be with LCD display
8. 17-4 PH stainless steel media compatibility
9. Proof pressure shall be 2X highest range per model and Burst pressure shall be 20X highest range per model
10. The differential pressure transmitter shall have push button zero adjustment.
11. The temperature range of the fluid shall be  $-40$  to  $105^{\circ}\text{C}$  ( $-40$  to  $221^{\circ}\text{F}$ ).
12. Operating environment shall be  $0$  to  $50^{\circ}\text{C}$  ( $32$  to  $122^{\circ}\text{F}$ ),  $10$  to  $90\%$  RH, non-condensing
13. Enclosure shall be IP65 (NEMA 4X) rated polycarbonate.
14. Sensor pressure connection shall be  $1/4''$  NPT male
15. Reverse voltage protected, transient protected.
16. Remote sensor cable shall be FT-6 plenum rated or optional armored cable available in different lengths

#### **ix. WATER GAUGE PRESSURE TRANSMITTER**

Provide a Water gauge pressure transmitter as indicated within the field termination schedules and/or control diagrams. Water pressure transmitter shall meet, at minimum, the following requirements:

1. The water gauge pressure transmitter shall be with a single remote sensor.
2. Field selectable pressure ranges, at least 4 ranges from the single model selection
3. The pressure transmitter shall be with accuracy  $\pm 1\%$  F.S. of selected range (lowest pressure range is  $\pm 2\%$  F.S.)
4. The output shall be 4-20 mA or 0-10/ 0-5 Vdc (switch selectable)
5. The power supply shall be 24Vac/dc.
6. The pressure transmitter shall be with LCD display
7. 17-4 PH stainless steel media compatibility
8. Proof pressure shall be 2X highest range per model and Burst pressure shall be 20X highest range per model
9. The pressure transmitter shall have push button zero adjustment.
10. The temperature range of the fluid shall be  $-40$  to  $105^{\circ}\text{C}$  ( $-40$  to  $221^{\circ}\text{F}$ ).
11. Operating environment shall be  $0$  to  $50^{\circ}\text{C}$  ( $32$  to  $122^{\circ}\text{F}$ ),  $10$  to  $90\%$  RH, non-condensing
12. Enclosure shall be IP65 (NEMA 4X) rated polycarbonate.
13. Sensor pressure connection shall be  $1/4''$  NPT male
14. Reverse voltage protected, transient protected.



15. Remote sensor cable shall be FT-6 plenum rated or optional armored cable available in different lengths

#### **x. DIFFERENTIAL PRESSURE SWITCH – WATER**

Provide water differential pressure switches as indicated in field termination schedules and/or control diagrams. Air differential pressure switches shall meet, at minimum, the following requirements:

1. The switch shall be designed for use with water and non-aggressive gases
2. The switch range shall be 0.5 to 3.5 Bar (7.25 to 50.75 PSI), Factory set 1 Bar (14.5 PSI)
3. The maximum working pressure shall be 16.5 Bar (239 PSI)
4. Fluid temperature range shall be -20 to 120°C (-4 to 248°F)
5. The contact shall be SPDT type with electrical rating 10A / 250 Vac (Non-Inductive Current), 8A / 250 Vac (Inductive Current).
6. The switch pressure connection shall be 1/4" NPT male
7. Enclosure Shall be IP33 or IP65 rated
8. Automatic reset.

#### **xii. IMMERSION TEMPERATURE SENSOR**

Provide a Water temperature sensor with thermowell as indicated within the field termination schedules and/or control diagrams. Temperature transmitter shall meet, at minimum, the following requirements:

1. Temperature sensor shall be Thermistor or RTD type.
2. Thermistor sensors shall have an accuracy of  $\pm 0.2^{\circ}\text{C}$  @  $25^{\circ}\text{C}$ , Platinum RTDs shall have an accuracy of  $\pm 0.3^{\circ}\text{C}$  @  $0^{\circ}\text{C}$ , and Nickel RTDs shall have an accuracy of  $\pm 0.4^{\circ}\text{C}$  @  $0^{\circ}\text{C}$ .
3. The sensing element shall be encapsulated in rigid 6 mm (0.236") SS304 stainless steel probe and of different lengths (50, 100, 150, 200, 300, and 450 mm) to suit the application
4. The probe sensing range shall be  $-40^{\circ}$  to  $100^{\circ}\text{C}$
5. Enclosure shall be IP65 (NEMA 4X) rated ABS.
6. Operating environment shall be  $-40$  to  $50^{\circ}\text{C}$  ( $-40$  to  $122^{\circ}\text{F}$ ), 5 to 95 %RH non-condensing
7. Thermowell shall be of Stainless steel 304 or 316 and of different lengths (50, 100, 150, 200, 300, and 450 mm) to suit the application.
8. Thermowell connection to the pipe shall be  $\frac{1}{2}$ " NPT.

#### **LIQUID FLOW SWITCH**

The Liquid Flow Switch is suitable for flow monitoring and control of water and normal media in industrial plants, heating,

air conditioning, and refrigeration systems. Enclosed in a water-proof IP65 enclosure, it includes an adjustable stainless

steel paddle sizes for pipes up to 203.2mm (8") in diameter. The switch is suitable for liquid temperatures up to 120°C

(248°F) and a maximum working pressure of up to 13.5 Bar (195.8 PSI).

### **TECHNICAL SPECIFICATIONS OF DATA & TELECOMMUNICATION NETWORKING SYSTEM**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**MAKES: SIEMON/SYSTIMAX/PANDUIT**

## **1.0 INTRODUCTION**

### **1.1 Design Brief:**

#### **PASSIVE**

a. The IT passive and active hardware and software will be completely installed for Ground, 14<sup>th</sup> to 19<sup>th</sup> floors. However the underfloor raceways and junction boxes will be installed for the complete building from Gnd, 11<sup>th</sup> to 29<sup>th</sup> floors

b. There will be 100% redundancy for each data point considered in the building for ground, 14<sup>th</sup> to 19<sup>th</sup> floors and hence the passive items will be provided in accordance with the design requirements

c. All individual POE copper switches will individually collapse on the fibre backbone to the SFP core switches

#### **ACTIVE**

a. The entire system will be enterprise based system and as per the specifications mentioned in the tender. This is most critical part of the business continuity and hence has to be end to end sourced from a single OEM

b. 48 Port SFP Core Switch to be considered to manage the entire business network and the OT network as mentioned below. This will be heart of the entire system and will be in the server room (2 Nos.)

c. 48 ports POE managed switches will be used for the data and voice back bone with 100% redundancy at the LAN points at field side and core side. Accordingly the no. of switches to be

considered (Approx 39 Nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

d. 24 ports POE Managed switches will be used for the OT (Operational Technologies) network. OT network consists of entire ELV systems (Approx 40 nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

e. Router, Next generation Firewall, NAC, IP PBX, Voice Gateway 4 PRI, Wifi Controller, Wifi Access Points, IP Phones of 4 types as per the employee grade to be provided in MTL offices.

**f. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

#### **UNDERFLOOR PVC DUCT FOR STRUCTURED CABLING**

a. We proposing Under Floor Trunking made of PVC (Polyvinylchloride) of minimum 2.0 mm thickness, minimum 3000 mm length for Gnd, 14<sup>th</sup> to 29<sup>th</sup> floors, trapezoidal duct profile for high tensile strength to give the required rigidity, including cutting floor chases as per requirement and mending good the damages clearing the debris as per requirement all complete. For 5 to 6 IP points in 13 nos. parking floors we will use same armoured CAT6 cable used for CCTV and access control.

b. All joints between two PVC trunking shall be fixed with a pvc connector as per size and 1 run or 2 runs or 3 runs of pvc trunking should have fastening galvanized clamps every 1 mtr as per duct size. All material should conform to EN 50085-2-2 standard and should be end to end from a single OEM

c. Underfloor junction box to be used for PVC ducts in heights of 25 mm and 35 mm raceways. Under floor Junction boxes sizes and qty should be considered for 1 run or 2 runs or 3 runs of pvc trunking as per the structured cabling required for entire floor and for all floors (Ground, 14<sup>th</sup> to 29<sup>th</sup> floors)

The qty of pvc trunking and junction boxes should be appropriate enough to meet the complete structured cable requirement of the MTL office and leased out floors.

A portion of the cabling system shall comply with the proposed link and channel performance requirements of the latest revision of ANSI/TIA-568-C.2 "Performance Specifications for 4-pair 100 Ohm Category 6A Cabling".

The successful contractor / OEM must have a Certified ITS Professional system integrator or any competent International acceptable authorities to review the drawings and meet with representatives from IT department of the Employer to discuss the project and to ensure that a structured cabling system is installed that provides a comprehensive Data and Telecommunication Networking infrastructure.

## 1.0 Original Equipment Manufacturer Qualification Criteria

### 1.0.1 Structured Cabling Systems

1. OEM should be ISO 9001 ISO 14000 Certified.
2. All networking passive material (Fiber, Copper and pathways for Structured Cabling within the Building) shall be from one OEM only.
3. The Passive Connectivity Components, Racks and associated hardware Material should have been manufactured/ tested/ assembled at OEM factories and other supply chain locations, and shall be covered by OEM warranty.
4. The OEM of Passive Components to be quoted by the bidder should be present in India from at least past 20 years.
5. OEM shall have minimum of two BICSI-RCDD (Registered Communication Distribution Designer), two BICSI-DCDC (Data Center Design Consultant) and one BICSI-OSP (Outside plant designer) certified personal sitting in India whose services can be utilized during the project. Certificate and HR letter from OEM to be submitted along with the bid as proof of the person being on OEM payrolls and sitting in India.
6. The OEM Shall have the partners listed in the Web portal which can be viewed by the customer at any time.
7. OEM shall have product Web portal by which customer can view and download the factory test reports of products at any time. Products proposed should be listed on e- catalogues available on Company website.
8. All passive components should be RoHS complied. Declaration of – ROHS compliant should clearly be mentioned on data sheets of each Passive Components, or a separate RoHS declaration must be submitted.
9. The OEM Shall have Company owned ISO Certified manufacturing facility in India, which shall be visited by the customer when needed. ISO certificate shall be provided along with Bid.
10. 25 years of performance warranty certificate (from OEM via Bidder) after successful testing done by bidder and material purchase from original source of OEM.
11. The vendor /OEM should provide test reports generated from any testing software/ device for minimum **3000 nodes** in support of experience to executing such requirement of margin (3 dB or higher) for Cat 6A of NEXT (worst case) for entire frequency range specified in ISO/IEC 11801.
12. OEM should be part of Production Linked Incentive Scheme (PLI) as per the MeityCircular F.No. No. W28/1/2019-1PHW-Meity. Proof of the same shall be submitted.

13. The OEM should have a Sustainability Program, provide Corporate Sustainability Report as documentary proof of the same shall be attached with the bid.

**1.0.2 Installer / System Integrator / Contractor Qualification Criteria**

1. The Contractor / Installer / System Integrator should be authorized channel partner of the OEM Suppliers mentioned above.
2. The Contractor / Installer should be able to produce minimum 3 references of clients with whom they have worked for more than 1000 Fiber and 3000 Copper Port counts.
3. The Contractor / Installer should have own in-house team of structured cabling installers for copper and fiber, especially pre-terminated systems. (NO sub-contract / outsourcing)
4. The Contractor / Installer should have one RCDD Professional and one PMP professional for better technical and project management expertise.

**TECHNICAL SPECIFICATIONS FOR COPPER PASSIVE COMPONENTS**

**Specifications for Horizontal Cabling Infrastructure**

**Specification for CAT 6A LSZH U/UTP Cable**

| Standard Compliance  | Compliance (Yes/No) |
|--|---------------------|
| <b>Channel Performance</b>   |                     |
| The Category 6A/ Class EA UTP SCS shall comply with the following standards<br>a) ISO/IEC 11801:2010<br>b) EN 50173 Part 1 through Part 5:2010 and 2011<br>c) ANSI/TIA-568.2-D<br>d) IEC 60603-7-41<br>e) IEEE 802.3bt (Type 4) applications |                     |
| The Category 6A/ Class EA UTP system should support the following IEEE Ethernet applications   |                     |
| a) 802.3e - 1BASE5<br>b) 802.3i - 10BASE-T<br>c) 802.3u - 100BASE-TX, 100BASE-T4<br>d) 802.3y - 100BASE-T2<br>e) 802.3z - 1000BASE-X<br>f) 802.3ab - 1000BASE-T  |                     |

|  |  |
|--|--|
| g) 802.af - Power Over Ethernet (15.4W)<br>h) 802.3at - Power Over Ethernet Enhancements (25.5W)<br>i) 802.3bt (Type 4) - Safe delivery of power over LAN cable when installed according to ISO/IEC 14763-2, CENELEC EN 50174-1, CENELEC EN 50174-2 or TIA TSB-184-A<br>j) 802.3az - Energy Efficient Ethernet   |  |
| It is critical that guaranteed worst-case values are provided to ensure the SCS can support 10G transmission without risk. "Average value" or "Typical Value" is not acceptable as they do not account for lower performance channels. The proposed Category 6A UTP SCS, when configured as a worst-case 100-meter channel shall provide performance headroom over limits specified by Cat6A |  |
| NEXT - Minimum 3 dB above the standards;<br>Should support a minimum of 4 connector Channel with a minimum 3 dB guaranteed NEXT  |  |
| Insertion Loss - 3%  |  |
| Return Loss - 1.0 db   |  |
| The SCS must consist of individual components provided by the same manufacturer. "Mix and Match" products are not allowed as there is no guarantee that the overall channel will meet Category 6A Channel requirements if constructed with components from different vendors.  |  |
| The Category 6A cable and Category 6A channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6A channel cable, components, and applications for a period of 25 years.  |  |
| The 25-year performance warranty shall be a transferable warranty and has component replacement policy in case of manufacturing defect   |  |
| The SCS must be tested by an ISP 17025 accredited 3rd Party test facility to ANSI/TIA 568.2-D, ISO/IEC 11801 Amendment 1 and for the channel testing must be provided as part of the bid response.   |  |
| The Category 6A system should support channels that are shorter than 15 meters for 2, 3, 4 connector channels without any minimum length requirements.   |  |
| <b>Horizontal Cable</b>  |  |
| The Cable should meet ANSI/TIA 568.2-D Category 6A Specifications  |  |

|   |  |
|---|--|
| Cables should have TRACKING Number to check the Genuity / details of the test reports   |  |
| The cable should consist of Eight 23 AWG copper conductors. Copper Clad Aluminum or any other combinations are not allowed  |  |
| There should be filler separating all 4-pair as well as individual insulated conductor  |  |
| The Cable should be round in shape  |  |
| The weight of the cable box of 1000 Feet should not be less than 34.7 lb  |  |
| The nominal Jacket thickness should be 0.05 inches  |  |
| The nominal Outside diameter should not be more than 0.285 inches   |  |
| The cable should support the installation temperature: 0 to 60 0 C<br>It should support Operating temperature of -20 to 60 0 C  |  |
| The cable shall be available in Low-Smoke, Zero Halogen (LSZH) compatibility.<br><br>The LSZH version must comply with the following Fire Safety standards:<br><br>1) ISO/IEC 60332-3-22: Vertical Flame Spread<br>2) ISO/IEC 60754-2: Acidity<br>3) ISO/IEC 61034-2: Smoke Density |  |
| Cable shall comply to below mechanical specifications:<br><br>Conductor Material- Bare copper<br><br>Insulation Material- Polyolefin<br><br>Jacket Material- Low Smoke Zero Halogen (LSZH)<br><br>Separator Material- Polyolefin<br><br>Separator 2 Material-Polyolefin             |  |
| The cable and cordage shall be "True UTP" components that do not include internal or external shields, screened components or drain wires. No Special Grounding requirements.   |  |
| The horizontal cable shall have a unique print string on the cable jacket. This unique identifier shall also be used for on-line reference to a full set of factory tests that were performed on a sample from the same mater reel. The test parameters shall include NEXT, PSNEXT, |  |

|  |  |
|--|--|
| Return Loss, Attenuation, ELFEXT and PSELFEXT. The on-line reference must be available on the SCS vendor public website, such that it can be accessed at any time. |  |
| ETL Verified Certificate for Cat 6A UTP cable.   |  |
| Channel performance shall be supported 10G up to 100mtr and 1G up to 115 mtrs. with 25 years of warranty.  |  |

**Specification for Category 6A U/UTP Information Outlets**

| <b>Standard Compliance</b>   | <b>Compliance (Yes/No)</b> |
|--|----------------------------|
| The 8-pin modular (RJ-45) jacks shall comply with IEC 60603-7-41   |                            |
| The Category 6A outlets shall be backward compatible with Category 6 and 5E cords and cables.  |                            |
| The Category 6A outlets shall be of a universal design supporting T568 A & B wiring.   |                            |
| The information outlet shall have a Current Rating of 1.5 A at 20°C  |                            |
| The information outlet must support 90-degree cable termination. As some mounting hardware does not allow for cable entry directly from the rear, this capability is necessary.                |                            |
| 3rd Party Verification test certificates shall be provided to show compliance to ISO/IEC 11801 Amendment 2 testing for Cat 6A components.  |                            |
| The 8-pin modular (RJ-45) jacks shall comply with IEC 60603-7-41   |                            |
| The information outlet will have insertion life of 750 cycles minimum.   |                            |
| Universal design and label support both T568 A & B wiring  |                            |
| The rear protective strain relief cap, protects against contamination and secures the connection   |                            |
| Fully supports the safe delivery of power over LAN cabling described by IEEE 802.3bt (Type 4) and complies with the unmating under electrical load requirements prescribed by IEC 60512-99-002 |                            |
| UL 94 V-0 Complied flammability rating   |                            |
| Shall be available in different colors for different services identification   |                            |



**Specification for Category 6A U/UTP Information Outlets**

|   |  |
|---|--|
| <b>Faceplates</b>   |  |
| Color- White  |  |
| Mount Type -Flush   |  |
| Total Ports, quantity -2  |  |
| Shall support Cat 6, Cat 6A unshielded and shielded jacks         |  |
| Depth 13.72 mm   0.54 in  |  |
| Height 86.36 mm   3.40 in   |  |
| Width 86.36 mm   3.40 in  |  |
| Weight 0.05 kg   0.10 lb  |  |
| Should be with accessories like mounting screws and label holders |  |

**Specification for CAT 6A LSZH U/UTP RJ45 Patch Cords-**

| <b>Standard Compliance</b>  | <b>Compliance (Yes/No)</b> |
|---|----------------------------|
| SCS must support different lengths patch cord starting from 6". The Patch cords shall be available in Stranded and solid core construction  |                            |
| Cords shall be equipped with 8-pin modular plugs on each end.   |                            |
| All cords shall be round, and consist of copper conductors, tightly twisted into individual pairs.  |                            |
| Nominal cordage diameter shall not exceed 7.24 mm.  |                            |
| Plugs shall be designed with an anti-snag latch to facilitate easy removal during move, add and change processes.   |                            |
| The LSZH version must comply with the following Fire Safety standards:<br>ISO/IEC 60332-3-22: Vertical Flame Spread<br>ISO/IEC 60754-2: Acidity<br>ISO/IEC 61034-2: Smoke Density |                            |

|   |  |
|---|--|
| 3rd Party verification of the Fire Safety/ Environmental tests listed above must be provided as part of the bid response. |  |
| The cordage shall be UTP components that do not include internal or external shields, screened components or drain wires. |  |
| The patch cords will have insertion life of 750 cycles minimum.   |  |
| Supports IEEE 802.3af, 802.3at, and 802.3bt PoE requirements.   |  |

**Specification for CAT 6A Loaded Patch Panel**

| <b>Standard Compliance</b>   | <b>Compliance (Yes/No)</b> |
|--|----------------------------|
| <b>24 Port Patch Panel</b>   |                            |
| The Cat 6A panel shall be fully loaded with 24 jacks and shall be backward compatible with Cat 6 and Cat 5E  |                            |
| The ganged adapter style patch panel will utilize increments of six RJ-45 style jacks in a common moulded component.   |                            |
| The ganged adapters shall have RJ45 jack in the front and Insulation Displacement Connector (IDC) at the rear of the module.   |                            |
| Termination managers must be provided with the panel. These termination managers provide proper pair positioning, control, and strain relief features to the rear termination area of the panel.                               |                            |
| 3rd Party Verification test certificates shall be provided to show compliance to ISO/IEC 11801 Amendment 2 testing for Cat 6 components.   |                            |
| The patch panel type shall be a 1U (24 port) capable of supporting 24 unshielded modular 8-pin connectors compliant with IEC 60603-7-4 while meeting the Channel Performance as specified in Amendment 1 to ISO/IEC 11801:2002 |                            |
| The panel shall be available in 24-port configurations with universal A/B labeling and 110 connector terminations on rear of panel allowing for quick and easy installation of 22 to 24 AWG cable                              |                            |
| The panel shall be equipped with a removable rear mounted cable management bar and front labels  |                            |
| The panel shall be UL and cUL Listed   |                            |
| Operating Temperature Range = 14°F to 140°F (-10°C to 60°C)  |                            |

|   |  |
|---|--|
| Storage Temperature Range = -40°F to 158°F (-40°C to 70°C)  |  |
| Humidity = 95% (noncondensing)  |  |
| Nominal Solid Conductor Diameter = 0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)   |  |
| Nominal Stranded Conductor Diameter:=0.025 to 0.020 in (0.64 to 0.51 mm (22 to 24 AWG)  |  |
| Insulation Types = All plastic insulates (including PVC, irradiated PVC, Polyethylene, Polypropylene, PTF Polyurethane, Nylon, and FEP) |  |
| Insertion Life = 750 minimum insertions of an FCC 8-Position Telecommunications Plug  |  |

**Specification for Ceiling connector Assembly**

| Standard Compliance   | Compliance (Yes/No) |
|---|---------------------|
| Ceiling Connector Assembly (CCA) shall provide a means to connect horizontal cable to a short, single-ended patch cord assembly in the field.   |                     |
| Shall be available in with card and without cord constructions  |                     |
| Shall be available in Cat 6 and Cat 6A variants as per requirement  |                     |
| Shall be able to terminate without any specific tool  |                     |
| Shall meet or exceed the standards ANSI/TIA-568-C.2 Category 6 and 6A / ISO 11801 Class E and EA performance. Shall Meet or exceed all ANSI/TIA-568-C.2 Category 6 and 6A and ISO 11801 Class E and EA connector and channel transmission performance requirements. |                     |
| Shall Meet applicable requirements of IEC 60603-7   |                     |
| Shall supports IEEE 802.3af, 802.3at, and 802.3bt PoE requirements  |                     |
| Shall be compatible with solid & stranded conductor from 26 to 22 AWG   |                     |
| Shall have plug insertion life as 750 times minimum   |                     |
| Flammability Rating: UL 94 V-0  |                     |
| Safety compliance: ETL   cETL   |                     |

### Specifications for Backbone Cabling Infrastructure

#### Multimode OM4 Fiber cable

Cable shall support current and next generation LAN, SAN, and WAN applications through laser-optimized 50/125 micrometer optical fibers and shall extend distance of low-cost 850- nanometer vertical cavity surface-emitting laser (VCSEL) based electronics

Cable shall also support existing and legacy multi-mode applications that traditionally operate in 850 and 1300 nanometer regions

The OM4 Multimode Fiber SCS shall be capable of supporting, at minimum, the following IEEE Ethernet applications

|         |                             |
|---------|-----------------------------|
| 802.3j  | 10BASE-F 10 Mb/s            |
| 802.3j  | 10BASE-FL 10 Mb/s           |
| 802.3u  | 100BASE-FX 100 Mb/s         |
| 802.3u  | 100BASE-SX 100 Mb/s         |
| 802.3z  | 1000BASE-SX 1000 Mb/s       |
| 802.3ae | 10GBASE-SR 10Gb/s           |
| 802.3aq | 10GBASE-LRM 10Gb/s with EDC |
| 802.3ba | 40GBASE-SR4 40 Gb/s         |
| 802.3ba | 100GBASE-SR10 100 Gb/s      |

| Standard Compliance   | Compliance (Yes/No) |
|---|---------------------|
| <b>Multi-mode (OM4) Fiber cable</b>   |                     |
| The OM4 multimode fiber shall comply with the following specifications                      |                     |
| Fiber Core: 6/12/24/48  |                     |
| Cable Type: Loose Tube, Gel filled, Armored   |                     |
| Cladding Diameter: 125 $\mu\text{m}$  |                     |
| Cladding Diameter Tolerance: $\pm 1.0 \mu\text{m}$<br>Cladding Non-Circularity, maximum: 1% |                     |
| Coating Diameter (Colored): 254 $\mu\text{m}$   |                     |
| Coating Diameter (Uncolored): 245 $\mu\text{m}$   |                     |
| Coating Diameter Tolerance (Colored): $\pm 7 \mu\text{m}$                                   |                     |
| Coating Diameter Tolerance (Uncolored): $\pm 10 \mu\text{m}$                                |                     |
| Coating/Cladding Concentricity Error, maximum: 6 $\mu\text{m}$                              |                     |
| Core Diameter: 50.0 $\mu\text{m}$   |                     |
| Core Diameter Tolerance: $\pm 2.5 \mu\text{m}$  |                     |
| Core/Clad Offset, maximum: 1.5 $\mu\text{m}$  |                     |
| Numerical Aperture: $0.200 \pm 0.015$   |                     |
| Zero dispersion wavelength: 1297 – 1316 nm  |                     |
| Zero dispersion slope: $\leq 0.105 \text{ ps/nm}^2\text{-km}$                               |                     |
| Tensile Load, long term, maximum: 800N  |                     |
| Bend Radius- Loaded- 15 X OD  |                     |
| Bend Radius Unloaded- 10 X OD   |                     |
| Tensile Load, short term, maximum: 1200N  |                     |
| Compression: 15N/mm   |                     |
| Compression Test Method: IEC 60794-1-2 E3   |                     |
| Strain Test Method: IEC 60793-1-2 E1  |                     |

|   |  |
|---|--|
| Flame Test Method: IEC 60332-1   IEC 60332-3-24   IEC 60754-2   IEC 61034-2 |  |
| Water Penetration Test Method: IEC 60794-1 F5B                              |  |
| Water Penetration: 24 h   |  |
| Attenuation @ 850nm (maximum): 3.00 dB/km                                   |  |
| Attenuation @ 1300nm (maximum): 1.00 dB/km                                  |  |
| Installation temperature: -10 °C to +60 °C                                  |  |
| Operating Temperature: -20 °C to +70 °C                                     |  |
| Storage Temperature: -40 °C to +70 °C                                       |  |
| <b>Multimode Fiber Pigtail</b>  |  |
| Fiber Type: MM (OM4)  |  |
| Connector: Simplex LC   |  |
| Jacket Colour: Aqua   |  |
| Jacket Material: LSZH   |  |
| Connector Ferrule Material: Zirconia  |  |
| Installation temperature: -10 °C to +50 °C                                  |  |
| Operating Temperature: -20 °C to +60 °C                                     |  |
| Storage Temperature: -20 °C to +60 °C                                       |  |
| Standard Compliance: ANSI/ICEA S-83-596   Telcordia GR-409                  |  |
| Insertion Loss Change, mating: ≤ 0.2 dB                                     |  |
| Insertion Loss, maximum: ≤ 0.24dB   |  |
| Return Loss, minimum: ≥ 27dB  |  |
| Tensile Load, long term, maximum: 20N                                       |  |

|   |  |
|---|--|
| Tensile Load, short term, maximum: 67N  |  |
| Flame Test Method: IEC 60332-3   IEC 60754-2   IEC 61034-2   IEEE 383   UL 1666   UL 1685                 |  |
|   |  |
|   |  |
| <b>Multimode Fiber Patch Cord</b>   |  |
| Fiber Type: MM (OM4)  |  |
| Connector: LC-LC Duplex   |  |
| Jacket Colour: Aqua   |  |
| Jacket Material: LSZH   |  |
| Installation temperature: -10 °C to +50 °C  |  |
| Operating Temperature: -20 °C to +60 °C   |  |
| Storage Temperature: -40 °C to +70 °C   |  |
| Standard Compliance: ANSI/ICEA S-83-596   Telcordia GR-409  |  |
| Insertion Loss Change, mating: ≤ 0.2 dB   |  |
| Insertion Loss, maximum: ≤ 0.24dB   |  |
| Return Loss, minimum: ≥ 27dB  |  |
| Tensile Load, long term, maximum: 53N   |  |
| Tensile Load, short term, maximum: 178N   |  |
| Flame Test Method: IEC 60332-1-2   IEC 60332-3   IEC 60754-2   IEC 61034-2   IEEE 383   UL 1666   UL 1685 |  |
|   |  |
| <b>Multimode Fiber Adapters</b>   |  |

|   |  |
|---|--|
| Shall be Duplex Multimode OM3/OM4                                 |  |
| Shall comply standard TIA/EIA-568-B.3   TIA/EIA-604 FOCIS-3       |  |
| Alignment Sleeve Material shall be Phosphorous bronze             |  |
| Number of Fiber: 2<br>Interface, Front: LC<br>Adapter Color: Aqua |  |
| Shall be provided with dust covers                                |  |

| Standard Compliance   | Compliance (Yes/No) |
|---|---------------------|
| <b>Fiber Shelf</b>  |                     |
| The width shall be 19 inches and height of 1U (1.75 inches), with a maximum of 19-inch depth.   |                     |
| The same Panel Shall accommodate 24 Duplex LC adapters supporting 48 fiber terminations in 1U   |                     |
| The Panel shall have 24 LC slots for individual adapter replacement for easy maintenance and terminations as per requirement          |                     |
| Shall support single mode and multi mode LC adapters  |                     |
| The Shelf shall be able to Support splice trays to splice minimum 32 fibers, and Stackable tray support for 24/48 Splices/tray in 1U. |                     |
| Panel shall made up of steel material & flammability rating of UL 94 V-0.   |                     |

### CABLING SYSTEM TESTING

All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. The contractor prior to system acceptance shall verify all conductors of each installed cable useable. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors



in all cables installed. All cables shall be tested in accordance with this document, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of the project manager for clarification and/or resolution.

## **PERFORMANCE VERIFICATION**

### **COPPER**

Category 6A data cable shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard currently ANSI/TIA-568-C.2, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

### **FIBER**

All 50/125um multimode optical Fiber and/or Single mode optical Fiber must be manufactured by Approved Brand of Cable Systems and it would be preferable that all Fiber cable is from the same manufacturer lot number. After installation, it must be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/ EIA Standard currently ANSI/TIA-568-C.3, and the results shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

## **DEFAULT LABELING SCHEME**

All cable outlets and termination panels/bays or blocks will be appropriately labeled to match the cable using the following default labeling scheme is an approved scheme has not been negotiated:

Floor and Room number

– (dash)

Device Code (O-outlet, P-Patch Panel, B-Block)

Device number (devices numbered 1-9 going around the room in a clockwise direction from the entrance)

D or V (for data or voice)

Outlet number on the plate, port number on the panel.

## AS-BUILT DRAWINGS

The installation contractor will be provided with 2 sets of A-1-size drawings at the start of the project. One set will be designated for as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by Employer OR IT personnel of Employer

The Contractor shall provide the central drawing set to the Employer IT PERSONNEL OF EMPLOYER at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the Data and Telecommunication Networking system.

### Requirements for As-built drawings

#### Backbone diagrams shall include:

One line diagrams for UTP copper cabling with cable counts.

One line diagrams for optical Fiber cabling with cable counts (including lot number).

#### Floor Diagrams shall include:

DTR locations and room numbers.

Work area outlets (WAO) and faceplate labels.

TR wiring zones, which identify WAOs served.

Horizontal cabling pathways including penetrations and fire stopping.

#### TR Diagrams shall include:

TR room number.

Rack locations.

Power outlet locations.

Conduit locations.

## TEST DOCUMENTATION

Test documentation shall be provided in a three ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major

heading shall be further sectioned by test type. Within the horizontal and backbone sections, and scanner test results (Category 6A), shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test. Scanner tests shall be printed on 8-1/2" x 11" paper.

When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

## DOCUMENTATION

The Category 6A Unshielded Twisted Pair (UTP) shall be provided with a complete set of documentation such that the design, installation and commissioning of the system can be done properly.

This documentation shall consist of the following, to be included in the bid response:

Design and Installation guidelines, which shall include configurations for typical local-area network and data centre applications for 2, 3 and 4 connector channels

Performance specifications, which shall state the maximum supportable distance for all protocols which are anticipated to be transported by the structured cabling

Zone cabling guidelines

Power separation guidelines

## CABLING VENDOR CHECK LIST – in progress, to be filled out for each numbered item

| Section                | Compliance (Yes/No) | Notes |
|------------------------|---------------------|-------|
| Standards Compliance   |                     |       |
| Application Support    |                     |       |
| Channel Performance    |                     |       |
| Component Requirements |                     |       |
| Documentation          |                     |       |

## Product warranty and application assurance

The Structured Connectivity Solutions Extended Product Warranty and Application Assurance

| Standard Compliance   | Compliance<br>Yes/No |
|---|----------------------|
| <b>Extended Product Warranty</b>  |                      |
| The Extended Product warranty and Application Assurance shall be for 25 years from the date of Installation.  |                      |
| The Extended Product Warranty shall cover all passive Registered SCS components (i.e., cable and connectivity components that make up the passive data and telecommunications signal transmission infrastructure).  |                      |
| The Registered SCS compliant links/channels will meet or exceed the applicable requirements of the TIA 568-C series, and ISO/IEC 11801: 2002 standards for cabling links/channel configurations specified in these standards  |                      |
| Under the Extended Product Warranty, the authorize supplier (or authorize installer) will either repair or replace the defective Registered SCS product at the supplier’s cost. The supplier will pay an installer for the cost of labor to repair or replace any such defective product on behalf of the supplier, provided, that such repair or replacement and associated labor costs receive the prior written approval of the supplier. If the supplier chooses to repair products, the supplier may use new or reconditioned replacement parts. If the supplier chooses to replace products, the supplier may replace such products with new or reconditioned products of the same or similar design. |                      |

|   |  |
|---|--|
| <p>The Customer shall not be charged either the cost of the labor or the product at such an incident.</p>   |  |
| <p>The Application Assurance shall cover the Registered SCS compliant channels to support operations of the application(s) that the system was designed to support, as well as additional application(s) defined below. The supplier warrants that the Registered SCS will be free from defects that prevent operation of the specific application(s) for which the Registered SCS was initially designed as long as the design is in compliance with the SCS Performance Specifications for said applications and is in compliance with all other terms and conditions of this warranty.</p> |  |
| <p>That all Passive Components in the Registered SCS meet or exceed the relevant component specification of the TIA 568-C series and ISO/IEC 11801: 2002 standards;</p>   |  |
| <p>The Application Assurance shall also cover the current (at the time of installation) and in accordance with application standards specifications, any application introduced in the future by recognized standards or user forums that use the relevant TIA/EIA 568-C series or ISO/IEC 11801 2nd edition (September 2002)</p>   |  |
| <p>The Supplier shall provide tools to calculate the Application performance for a given channel by calculating and Displaying the Optical loss.</p>  |  |
| <p>The Supplier Shall provide Document with details of Application Performance, for different topologies, Number of Connectors and Length of the Channel.</p>   |  |

## TECHNICAL SPECIFICATIONS OF IT ACTIVE PARTS TECHNICAL SPECIFICATIONS

**(MAF Manufacturers Authorization Form required from OEM to ensure complete technical configuration, proposed model certification and after sales service support)**

**MAKES SWITCHES: ARUBA/CISCO/JUNIPER MAKES**

**MAKES IP PBX/IP PHONES: ARUBA/CISCO/AVAYA**

The entire system will be enterprise based system and as per the specifications mentioned in the tender. This is most critical part of the business continuity and hence has to be end to end sourced from a single OEM

48 Port SFP Core Switch to be considered to manage the entire business network and the OT network as mentioned below. This will be heart of the entire system and will be in the server room (2 Nos.)

48 ports POE managed switches will be used for the data and voice back bone with 100% redundancy at the LAN points at field side and core side. Accordingly the no. of switches to be considered (Approx 39 Nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

24 ports POE Managed switches will be used for the OT (Operational Technologies) network. OT network consists of entire ELV systems (Approx 40 nos.) Sufficient amount of Passive items to be considered to meet the switch requirement.

Router, Next generation Firewall, NAC, IP PBX, Voice Gateway 4 PRI, Wifi Controller, Wifi Access Points, IP Phones of 4 types as per the employee grade to be provided in MTL offices.

### **Please refer the matrix for detailed floor wise break-up**

Underfloor PVC Duct For Structured Cabling (applicable to all floors Ground.,11<sup>th</sup> to 26<sup>th</sup> floors)

We proposing Under Floor Trunking made of PVC (Polyvinylchloride) of minimum 2.0 mm thickness, minimum 3000 mm length, trapezoidal duct profile for high tensile strength to give the required rigidity and including cutting floor chases as per requirement and mending good the damages clearing the debris as per requirement all complete All joints between two PVC trunking shall be fixed with a pvc connector as per size and 1 run or 2 runs or 3 runs of pvc trunking should have fastening galvanized clamps every 1 mtr as per duct size. All material should conform to EN 50085-2-2 standard and should be end to end from a single OEM

Underfloor junction box to be used for PVC ducts in heights of 25 mm and 35 mm raceways. Under floor Junction boxes sizes and qty should be considered for 1 run or 2 runs or 3 runs of pvc trunking as per the structured cabling required for entire floor.

**Include all necessary items required to make the system complete and working at all times**

| <b>Enterprise Router</b> |  |                   |
|--------------------------|--|-------------------|
| Sr. No.                  | <b>General Specifications</b>  | <b>Compliance</b> |
|                          |  | <b>Yes/No</b>     |
| <b>1</b>                 | <b>General Requirement</b>   |                   |
| 1.1                      | The Router should support fixed form-factor , multi-core Processor, internal redundant field replaceable power supply (from Day1). The Router Should have capabilities of seamless field upgrade/replacement (without interrupting running processes and services ). |                   |
| 1.2                      | Router should have a physical separation between control and data planes processor. Router should support inline hardware accelerated encryption for high-throughput IPsec and MACsec on WAN Ports.  |                   |
| <b>2</b>                 | <b>Hardware and Interface Requirement</b>  |                   |
| 2.1                      | Router should have minimum 4x1G LAN / WAN interfaces along with 2x 1/10G interface slots and additional 2 slots for accommodating service and network modules like ethernet, LAN , Voice modules.  |                   |
| 2.2                      | Router should have minimum 8GB of on-board/inbuilt DRAM/RAM for data plane + control plane processes and 8GB storage from Day 1.   |                   |
| <b>3</b>                 | <b>Performance Requirement</b>   |                   |
| 3.1                      | Router should have minimum IP forwarding throughput of 19 Gbps   |                   |
| 3.2                      | Router should support minimum 1.5M IPv4 & IPv6 routes  |                   |
| 3.3                      | No. of Firewall session : 512K   |                   |
| 3.4                      | The router must support IKEv1, L2TP, IKEv2, GRE and IPSEC from day 1. The proposed solution should serve the GRE encryption for traffic from any location to other location on demand and also should able to create GRE tunnel.                                     |                   |
| 3.6                      | Router should be scalable to support up to 4000 tunnels .  |                   |
| 3.7                      | Router should support VRF level segmentation with min support for 4000 VRF segments  |                   |
| 3.8                      | Router should support IGMP v1/v2/v3 and PIM multicast routing  |                   |
| <b>4</b>                 | <b>Layer3 Features &amp; Security</b>  |                   |
| 4.1                      | Router should support static Routes, OSPFv2, OSPFv3, BGP4, MBGP, BFD, Policy based routing, IPv4 and IPv6 tunnelling from Day 1  |                   |
| 4.2                      | The Router should support Zone Based Firewall feature or an external appliance for the same functionality can be provided.   |                   |
| 4.3                      | Router should Support Traffic Optimization feature built in the router operating system or an external appliance for the same functionality can be provided.   |                   |

|     |  |  |
|-----|--|--|
| 4.4 | Shall have 802.1p class of service and marking, classification, policing and shaping.  |  |
| 4.5 | Should support advanced encryption algorithms like AES-256 and AES-GCM   |  |
| 4.6 | The router should be able to support Hierarchical QoS. QoS should be supported both at Physical and sub-interface level  |  |
| 4.7 | Router should be able to do deep packet inspection and identify applications at layer-7 and we should be able to define QoS and access control based on application.                       |  |
| 5   | <b>Manageability</b>   |  |
| 5.1 | Router should support SSHv2, SNMPv2c, SNMPv3 and NTP   |  |
| 5.2 | Routers should support AAA using RADIUS and TACACS+  |  |
| 5.3 | Should have extensive support for IP SLA or equivalent and best path selection for metrics like delay, latency, jitter, packet loss to assure business-critical IP applications from Day1. |  |
| 5.4 | Router should support monitoring of network traffic with application level insight with deep packet visibility into web traffic, RTP-Based VoIP traffic.                                   |  |
| 5.6 | Router shall have capability to add on demand IPsec VPN tunnels dynamically established multipoint-to-multipoint IPSEC based spoke-to-spoke VPN tunnels matching traffic conditions        |  |
| 6   | <b>Certification</b>   |  |
| 6.1 | Router shall conform to UL 60950 or IEC 60950 or CSA 60950 or EN 60950 Standards for Safety requirements of Information Technology Equipment.  |  |
| 6.2 | Router shall conform to EN 55022 Class A/B or CISPR22 Class A/B or CE Class A/B or FCC Class A/B Standards for EMC (Electro Magnetic Compatibility) requirements.                          |  |
| 6.3 | Router/Router's Operating System should be tested and certified for EAL 3/NDPP or above under Common Criteria Certification  |  |
| 6.4 | Router should be IPv6 Certified/IPv6 logo ready  |  |

#### Next Generation Firewall

| S No     | Technical Specifications                      | Compliance |
|----------|---|------------|
|          |   | Yes/No     |
| <b>1</b> | <b>Interface and Connectivity Requirement</b> |            |
| 1.1      | 8 X 1G Copper/RJ45 Day 1                      |            |
| 1.2      | 8 X 10G SFP/SFP+ Day 1                        |            |
| 1.3      | 8 X 10G SFP+ module for future scalability    |            |
| <b>2</b> | <b>Hardware Architecture</b>                  |            |



|     |  |  |
|-----|--|--|
| 2.1 | The appliance based security platform should provide Next-Gen Firewall functionality like IPS, Application Control, URL filtering and Anti-malware functionality in a single appliance from day one.   |  |
| 2.2 | The appliance hardware should be a multicore CPU architecture and should not be proprietary ASIC based in nature & should be open architecture based on multi-core cpu's to protect & scale against dynamic latest security threats. The appliance hardware should have a hardened operating system from the OEM and should support support minimum of 64 GB of RAM to make sure all the security capabilities are provided without degradation form day one |  |
| 2.3 | Proposed firewall should not consume more than 1RU of rack space to make sure sustainability goals of the organization.  |  |
| 2.4 | The firewall should have integrated redundant hot swappable fan tray and dual redundant power supply to remove any single point of failure in the solution   |  |
| 3   | <b>Performance &amp; Scalability</b>   |  |
|     | The NGFW throughput of the firewall should be a minimum 10 Gbps with application identification and firewalling enabled with real world/enterprise/ production traffic. The IPS throughput should be 10 Gbps   |  |
|     | The firewall should provide 5 Gbps of IPSEC VPN throughput   |  |
|     | NGFW Firewall should support at least 1,300,000 Layer 7/app-id Concurrent sessions   |  |
|     | NGFW Firewall should support at least 150,000 connections per second L3/L4 or Layer 7/app-id connections per second – Min 85,000   |  |
|     | High Availability Configurations shall support Active/ Passive or Active/Active-Clustering   |  |
| 4   | <b>Next Gen Firewall Features</b>  |  |
| 4.1 | Firewall should support creating security policies with source/destination zones , network subnets/ranges, geolocation objects, ports/protocols, applications, user/group attributes, URL/URL categories and action on traffic . The actions on the traffic should be to allow, alert, block, block and continue , reset. The firewall should provide time based polices with options for recurring schedule or one time schedule.                           |  |
| 4.2 | The firewall should supports NAT's like source NAT , destination NAT , U-Turn NAT. Firewall should support Nat66, Nat 64 & Nat46 functionality.  |  |
| 4.3 | Solution should provides capabilities like dynamic real-time metrics based , policy-based, application path selection across multiple WAN connections and supports service chaining for additional services such as WAN optimization and firewalls.  |  |

|      |   |  |
|------|---|--|
| 4.4  | The solution should provide the following routing capabilities: OSPF, EIGRP, BGP, RIP, Multicast, Static,   |  |
| 4.5  | Route Tracking(SLA) PBR, ISIS, BFD, ECMP, VRF, Application based Routing  |  |
| 4.6  | The solution should be able to provide contextual information about the hosts and the network subnets present such that the admins are able to capture all the required information and build the security profiles based on the details shown on the solution . The details captured should consist of the following: IOC's , MAC addresses, IP address , Applications , Ports and protocols, vulnerabilities etc. |  |
| 4.7  | Should support capability to integrate with other security solutions to receive contextual information like security group tags/names.  |  |
| 4.8  | Should support more than 5000+ (excluding custom application signatures) distinct application signature as application detection mechanism to optimize security effectiveness and should be able to create 40 or more application categories for operational efficiency   |  |
| 4.9  | Should be capable of dynamically tuning IDS/IPS sensors (e.g., selecting rules, configuring policies, updating policies, etc.) with minimal human intervention.   |  |
| 4.10 | Should support more than 30,000 (excluding custom signatures) IPS signatures or more. Solution should be able to passively detect endpoints and infrastructure for threat correlation and Indicators of Compromise (IoC) intelligence. The signatures should also have categorization based on MITRE TTP's.   |  |
| 4.11 | The firewall solution should have the following capabilities to make sure the current solution is future ready for technologies like WAN routing , SASE etc. The firewall should have application aware routing with HTTP and ICMP ping , ZTNA based clientless access to applications.   |  |
| 4.12 | The firewall solution should have capabilities like Application Aware Routing, Health Monitoring, DIA, Dual ISP, Data interface Management for simplified branch capabilities   |  |
| 4.13 | Should be capable of automatically providing the appropriate inspections and protections for traffic sent over non-standard communications ports.   |  |
| 4.14 | The solution should be able to identify, decrypt and evaluate both inbound and outbound SSL traffic on-box. The NGFW shall support the ability to have a SSL inspection policy differentiate between personal SSL connections i.e. banking, shopping, health and non-personal traffic.  |  |
| 4.15 | The solution should have ML/AI capability to detect client apps and process . Moreover it should be able identify malicious encrypted traffic even when it is destined for a trustworthy service. This is required to help administrators control specific applications and improve network security  |  |

|          |  |  |
|----------|--|--|
| 4.16     | The solution should provide Change Management capability for the organizations needs to implement more formal processes for configuration changes, including audit tracking and official approval before changes are deployed.   |  |
| 4.17     | Should support the capability to quarantine end point by integrating with other security solution like Network Admission Control.  |  |
| 4.18     | The solution must provide IP reputation feed that comprised of several regularly updated collections of poor reputation of IP addresses determined by the proposed security vendor. Solution must support IP reputation intelligence feeds from third party and custom lists of IP addresses including a global blacklist. The solution should have the capability to detect MD5, SHA256 and SHA512 traffic hashes to detect any malicious traffic pattern |  |
| 4.19     | The solution should provide Configuration Deployment History, Pending Changes and Policy Compare capability before the security policies are deployed on the firewall. It should also provide configuration rollback capability to the last good configuration running on the firewall.  |  |
| 4.20     | Should must support DNS threat intelligence feeds to protect against threats   |  |
| 4.21     | The Appliance OEM must have its own threat intelligence analysis center and should use the global footprint of security deployments for more comprehensive network protection.   |  |
| 4.22     | The detection engine should support capability of detecting and preventing a wide variety of threats (e.g., network probes/reconnaissance, VoIP attacks, buffer overflows, P2P attacks, etc.).   |  |
| 4.23     | Should be able to identify attacks based on Geo-location and define policy to block on the basis of Geo-location   |  |
| 4.24     | The detection engine must incorporate multiple approaches for detecting threats, including at a minimum exploit-based signatures, vulnerability-based rules, protocol anomaly detection, and behavioral anomaly detection techniques.  |  |
| 4.25     | Should support Open based Application ID / Custom Application ID for access to community resources and ability to easily customize security to address new and specific threats and applications quickly   |  |
| <b>5</b> | <b>URL Filtering Features</b>  |  |
| 5.1      | Should must support URL threat intelligence feeds to protect against threats   |  |
| 5.2      | Should support Reputation- and category-based URL filtering offering comprehensive alerting and control over suspect web traffic and enforces policies on more than 250 million of URLs in more than 75+ categories.   |  |
| 5.3      | Should support safe search for YouTube EDU enforcement   |  |
| <b>6</b> | <b>Anti-APT / Malware Features</b>   |  |

|          |  |  |
|----------|--|--|
| 6.1      | Should support the capability of providing network-based detection of malware by checking the disposition of unknown files using SHA-256 file-hash or signature as they transit the network and capability to do dynamic analysis.   |  |
| 6.2      | Solution shall have capability to analyze and block TCP/UDP protocol to identify attacks and malware communications. At minimum, the following protocols are supported for real-time inspection, blocking and control of download files: HTTP, SMTP, POP3, IMAP, NetBIOS-SSN and FTP |  |
| 6.3      | Proposed solution shall have required subscription like Threat Intelligence for proper functioning   |  |
| <b>7</b> | <b>Management</b>  |  |
| 7.1      | The management platform must be accessible via a web-based interface and ideally with no need for additional client software and must provide centralized logging and reporting functionality  |  |
| 7.2      | The management platform must be a dedicated OEM appliance and VM running on server will not be accepted  |  |
| 7.3      | The management appliance should have 2 x 10G port and integrated redundant power supply from day one   |  |
| 7.4      | The management platform must be capable of integrating third party vulnerability information into threat policy adjustment routines and automated tuning workflows   |  |
| 7.5      | The management platform must be capable of role-based administration, enabling different sets of views and configuration capabilities for different administrators subsequent to their authentication.   |  |
| 7.6      | Should support troubleshooting techniques like Packet tracer and capture   |  |
| 7.7      | The management platform must provide multiple report output types or formats, such as PDF, HTML, and CSV. The management platform support running on-demand and scheduled reports  |  |
| 7.8      | The management platform must support multiple mechanisms for issuing alerts (e.g., SNMP, e-mail, SYSLOG).  |  |
| 7.9      | The centralized management platform must not have any limit in terms of handling logs per day  |  |
| 7.10     | The management platform must provide built-in robust reporting capabilities, including a selection of pre-defined reports and the ability for complete customization and generation of new reports.  |  |
| 7.11     | The management platform must risk reports like advanced malware, attacks and network   |  |

|      |  |  |
|------|--|--|
| 7.12 | The management platform must include an integration mechanism, preferably in the form of open APIs and/or standard interfaces, to enable events and log data to be shared with external network and security management applications, such as Security Information and Event Managers (SIEMs), and log management tools. |  |
| 8    | Proposed solution should support 24x7x365 OEM TAC support and advance Next Business Day Hardware replacement   |  |

Network Access Control

| S No | Technical Specifications  | Compliance |
|------|---|------------|
|      |   | Yes/No     |
| 1    | The proposed solution should be available on Hardware with easy license migration between them.   |            |
| 2    | The proposed solution should provide a highly powerful and flexible attribute-based access control solution that combines authentication, authorization, and accounting (AAA); posture; Guest; profiling; and BYOD services on a single platform.   |            |
| 3    | The proposed solution should control access to the network with policies, including pre-admission endpoint security policy checks and post-admission controls over where users and devices.   |            |
| 4    | The proposed solution should operate within a heterogeneous network with switches, routers, etc. from multiple vendors. NAC appliance should support vendor agnostic switch infrastructure.   |            |
| 5    | The proposed solution should allow to authenticate and authorize users and endpoints via wired, wireless, and VPN with consistent policy throughout the enterprise.   |            |
| 6    | The proposed solution should provide comprehensive visibility of the network by automatically discovering, classifying, and enforcing policy for endpoints connected to the network and must have capacity to enable the appropriate services for atleast a total of 1500 endpoint devices. |            |
| 7    | The proposed solution should support on-demand health-check of the hardware nodes.  |            |
| 8    | The proposed solution should support the backup and recovery of policies/configuration.   |            |
| 9    | The proposed solution should support consistent policy in centralized and distributed deployments that allows services to be delivered where they are needed  |            |
| 10   | The proposed solution should support Federal Information Processing Standard (FIPS) 140-2   |            |

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| 11 | The proposed solution should support remote access capabilities on its management interface via HTTPS or SSH access   |  |
| 12 | The proposed solution must support a managed switch environment having 802.1 x support.   |  |
| 13 | Should support multiple Admin Group Roles and responsibilities like HelpDesk Admin, Identity Admin, Monitoring Admin, Network Device Admin, Policy Admin, RBAC Admin, Super Admin, Read-Only Admin and System Admin   |  |
| 14 | The proposed solution to be in High availability so that even if one appliance/server fails, the other server takes over.   |  |
| 15 | The proposed solution should have capability to send alerts regarding the health of the solution through emails.  |  |
| 16 | The proposed solution should support API ERS and Open API   |  |
| 17 | The proposed solution should be able to control the user even before IP address is assigned. It should act as a pre-admission solution  |  |
| 18 | The proposed solution should supports a wide range of authentication protocols, including PAP, MS-CHAP, Extensible Authentication Protocol (EAP)-MD5, Protected EAP (PEAP), EAP-Flexible Authentication via Secure Tunneling (FAST), TEAP , and EAP-Transport Layer Security (TLS). |  |
| 19 | The solution should provide a wide range of access control mechanisms, including downloadable access control lists (dACLs), VLAN assignments, URL redirect, and Security Group Access (SGA) tagging.  |  |
| 20 | The proposed solution should have capability to assign services based on the assigned user role, group, and associated policy (job role, location, device type, and so on).   |  |
| 21 | The proposed solution should be capable of being bypassed in the event of any failure of the solution.  |  |
| 22 | The solution should be able to block unauthenticated/rogue machine without giving any access to the network.  |  |
| 23 | The proposed solution should support Real time Policy hit counts  |  |
| 24 | The proposed solution should provides complete guest lifecycle management by empowering sponsors to on-board guests.  |  |
| 25 | The proposed solution should provides sponsors to extend, terminate & manage password for the registered guest.   |  |
| 26 | The portal used for Device registration should be customizable, allowing to customize portal theme by changing text, banners, background color, and images  |  |
| 27 | The proposed solution should support multiple guest types to differentiate between external guest based on time period for which the account is created for.  |  |

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| 28 | The proposed solution should have provision for Sponsor admin to approve the request coming from external guest and after approval the credentials will be shared.  |  |
| 29 | The proposed solution should have provision to provide grace period to guest till the time Sponsor admin approves the request.  |  |
| 30 | The proposed solution should support testing of the Guest portal before pushing it into production.   |  |
| 31 | The proposed solution should have provision to customise the Guest portal with Logos and text.  |  |
| 32 | The proposed solution should automatically enforce security policies by blocking, isolating, and repairing noncompliant machines in a quarantine area with appropriate notifications to the administrator   |  |
| 33 | The proposed solution should support running custom scripts to remediate non-compliant endpoints.   |  |
| 34 | The solution should provide granular compliance checks for Windows, MAC and Linux in terms of: - Check operating system , service packs , hotfixes- Check process, registry, file & application - Check for Antivirus installation , Version , Antivirus Definition Date- Check for Antispyware installation , Version , Antispyware Definition Date- Check for windows update running & configuration - Ability to run custom scripts and policies |  |
| 35 | The proposed solution should permit admin to define thresholds for Anti-Virus Defination checks, if defination is not updated then Endpoint should be blocked.  |  |
| 36 | The proposed solution must be able to integrate with Endpoint Patch management such as WSUS for Auto or Manual Remediation  |  |
| 37 | The proposed solution should provide automatic remediation.   |  |
| 38 | The proposed solution should update the latest definition and product versions automatically.   |  |
| 39 | The proposed solution should permit configuring baseline version of the AV/AM to be checked on the endpoints.   |  |
| 40 | The proposed solution should have predefined device templates for a wide range of endpoints, such as IP phones, printers, IP cameras, smartphones, and tablets.   |  |
| 41 | The proposed solution should allow Administrators to create their own device templates. These templates can be used to automatically detect, classify, and associate administrative-defined identities when endpoints connect to the network. Administrators can also associate endpoint-specific authorization policies based on device type.  |  |
| 42 | The proposed solution should have capability to see endpoints attribute data via passive network telemetry or alternatively from the  |  |

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|    | infrastructure via device sensors on switches at Core, Distribution and Access Layer.   |  |
| 43 | <p>The solution should have profiling capabilities integrated into the solution in order to detect headless host. The profiling features leverage the existing infrastructure for device discovery. Should support the use of attributes from the following sources or sensors:</p> <ul style="list-style-type: none"> <li>- Profiling using MAC OUIs</li> <li>- Profiling using DHCP information</li> <li>- Profiling using RADIUS information</li> <li>- Profiling using HTTP information</li> <li>- Profiling using DNS information</li> <li>- Profiling using NetFlow information</li> <li>- Profiling using SPAN/Mirrored traffic</li> </ul>   |  |
| 44 | The proposed solution should support importing endpoints from a comma-separated values (CSV) file in which the list of endpoints appears with the MAC address and the endpoint profiling policy details separated by a comma.   |  |
| 45 | Solution should have capability which allows users to add a device on a portal, where the device goes through a registration process for network access. Should allow users to mark as lost any device that you have registered in the network, and blacklist the device on the network, which prevents others from unauthorized network access when using the blacklisted device. Should have capability to reinstate a blacklisted device to its previous status in Device Portal, and regain network access without having to register the device again in the Devices Portal. Should also support removing any device in the enterprise network temporarily, then register the device for network access again later. |  |
| 46 | The solution should support BYOD workflow for Partner/Contractor or Employees for BYOD scenario by automatically provisioning the supplicant such that Owner & the device are authenticated based on certificate.   |  |
| 47 | Solution should support configuring MDM policy based on the attributes lie: Device Register Status, Device Compliant Status, Disk Encryption Status, PinLock Status, Jail Broken Status, Serial Number, Manufacturer, IMEI, Os Version & phone number, etc  |  |
| 48 | Solution should have capability to determine whether users are accessing the network on an authorized, policy-compliant device.   |  |



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| 49 | Should provide a Registered Endpoints Report which provides information about a list of endpoints that are registered through the device registration portal by a specific user for a selected period of time. The report should provide the following details<br><ul style="list-style-type: none"> <li>• Logged in Date and Time</li> <li>• Portal User (who registered the device)</li> <li>• MAC Address</li> <li>• Identity Group</li> <li>• Endpoint Policy</li> <li>• Static Assignment</li> <li>• Static Group Assignment</li> <li>• Endpoint Policy ID</li> <li>• Device Registration Status</li> </ul> |  |
| 50 | The solution must have internal CA server functionality with flexibility to create certificate template to be used by other network services   |  |
| 51 | The proposed solution should have capability to revoke the issued certificate.   |  |
| 52 | The proposed solution should have capability to integrate with External CA for issuing the certificates  |  |
| 53 | The proposed solution should support configuring multiple Identity sources to validate for user credentials. Solution should support the following databases:•Internal Users•Internal Endpoints•Active Directory•Azure Active Directory•LDAP•RSA•RADIUS Token Servers•ODBC•Certificate Authentication Profiles   |  |
| 54 | The proposed solution should support enabling or disabling authentication towards any child domain that is part of the same forest.  |  |
| 55 | The proposed solution should have capability to re-write the incoming Identity to a different format which LDAP/Active directory understands.  |  |
| 56 | The proposed solution should be able to integrate with proposed Firewall to share User-IP and IP-SGT mapping to create more granular policies.   |  |
| 57 | The proposed solution shall monitor, detect, alert, report and provide remediation for any unauthorized access.  |  |
| 58 | The proposed solution should have capability to establish user identity, location, and access history, which can be used for compliance and reporting.   |  |
| 59 | The proposed solution should have extensive troubleshooting capabilities to collect packet captures, debugs particular endpoint , run commands on switch to collect information to provide visibility for an administrator.  |  |

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| 60 | The proposed solution should have built-in web console for monitoring, reporting, and troubleshooting to assist help-desk and network operators in quickly identifying and resolving issues. Offers comprehensive historical and real-time reporting for all services, logging of all activities, and real-time dashboard metrics of all users and endpoints connecting to the network. |  |
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| <b>48 Port Enterprise Managed POE Switch</b> |   |            |
|--|---|------------|
| S. No.                                       | Technical Specifications  | Compliance |
|  |   | Yes/No     |
| <b>1</b>                                     | <b>General Features :</b>   |            |
| 1.1  | Switch should be 1U and rack mountable in standard 19" rack.  |            |
| 1.2  | Switch should support internal field replaceable redundant power supply unit  |            |
| 1.3  | Switch should have minimum 2 GB RAM and 4 GB Flash.   |            |
| 1.4  | Switch should have dedicated slot for modular stacking, in addition to asked uplink ports. Should support for minimum 48 Gbps of stacking throughput with 8 switch in single stack. |            |
| 1.5  | Should support a stacking bandwidth of 80 Gbps.   |            |
| <b>2</b>                                     | <b>Performance :</b>  |            |
| 2.1  | Switch shall have minimum 176 Gbps of switching fabric and 130 Mpps of forwarding rate.   |            |
| 2.2  | Switch shall have minimum 16K MAC Addresses and 250 active VLAN.  |            |
| 2.3  | Should support minimum 11K IPv4 routes or more  |            |
| 2.4  | Switch shall have 1K or more multicast routes.  |            |
| 2.5  | Switch should support atleast 16K flow entries  |            |
| 2.6  | Switch should support 128 or more STP Instances.  |            |
| 2.7  | Switch should have 6MB or more packet buffer.   |            |
| <b>3</b>                                     | <b>Functionality :</b>  |            |
| 3.1  | Switch should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z.                             |            |
| 3.2  | Switch must have functionality like static routing, RIP, REP PIM, OSPF, VRRP and QoS features from Day1.  |            |
| 3.3  | Switch should support network segmentation that overcomes the limitation of VLANs using VXLAN and VRFs.   |            |

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| 3.4      | Switch shall have 802.1p class of service, marking, classification, policing and shaping and eight egress queues.   |  |
| 3.5      | Switch should support management features like SSHv2, SNMPv2c, SNMPv3, NTP, RADIUS and TACACS+ .  |  |
| 3.6      | Switch should support IPv6 Binding Integrity Guard, IPv6 Snooping, IPv6 RA Guard, IPv6 DHCP Guard, IPv6 Neighbor Discovery Inspection and IPv6 Source Guard.  |  |
| 3.7      | Switch should support 802.1x authentication and accounting, IPv4 and IPv6 ACLs and Dynamic VLAN assignment and MACSec-128 on hardware for all ports.  |  |
| 3.8      | Switch must have the capabilities to enable automatic configuration of switch ports as devices connect to the switch for the device type.   |  |
| 3.9      | During system boots, the system's software signatures should be checked for integrity. System should capable to understand that system OS are authentic and unmodified, it should have cryptographically signed images to provide assurance that the firmware & BIOS are authentic. |  |
| <b>4</b> | <b>Interface</b>  |  |
| 4.1      | Switch shall have 48 nos. 10/100/1000 Base-T ports and additional 4 nos. SFP+ uplinks ports.  |  |
| 4.2      | All 48 port should support PoE (802.3af) and PoE+ (802.3at) with a PoE power budget of 740 W.   |  |
| <b>5</b> | <b>Certification:</b>   |  |
| 5.1      | Switch shall conform to UL 60950 or IEC 60950 or CSA 60950 or EN 60950 Standards for Safety requirements of Information Technology Equipment.   |  |
| 5.2      | Switch shall conform to EN 300 386, EN 55022 Class A/B or CISPR22 Class A/B or CE Class A/B or FCC Class A/B Standards for EMC (Electro Magnetic Compatibility) requirements.   |  |
| 5.3      | Switch / Switch's Operating System should be tested for EAL 2/NDPP or above under Common Criteria Certification.  |  |
| 5.4      | OEM should be listed in Gartner Leader Quadrant for Wired and Wireless LAN Infrastructure from last 5 years before releasing this RFP.  |  |

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|  | 48 SFP Ports Enterprise Managed Core Switch |  |
|--|---|--|

| Sr. No.  | Technical Specifications  | Compliance |
|----------|---|------------|
|          |   | Yes/No     |
| <b>1</b> | <b>General Features :</b>   |            |
| 1.1      | Switch should be 1U and rack mountable in standard 19" rack.  |            |
| 1.2      | Switch should support internal field replaceable redundant power supply unit  |            |
| 1.3      | Switch should have minimum 2 GB RAM and 4 GB Flash.   |            |
| 1.4      | Switch should have dedicated slot for modular stacking, in addition to asked uplink ports. Should support for minimum 80 Gbps of stacking throughput with 8 switch in single stack. |            |
| <b>2</b> | <b>Performance :</b>  |            |
| 2.1      | Switch shall have minimum 128 Gbps of switching fabric and 95 Mpps of forwarding rate.  |            |
| 2.2      | Switch shall have minimum 16K MAC Addresses and 250 active VLAN.  |            |
| 2.3      | Should support minimum 11K IPv4 routes or more  |            |
| 2.4      | Switch shall have 1K or more multicast routes.  |            |
| 2.5      | Switch should support atleast 16K flow entries  |            |
| 2.6      | Switch should support 128 or more STP Instances.  |            |
| 2.7      | Switch should have 6MB or more packet buffer.   |            |
| <b>3</b> | <b>Functionality :</b>  |            |
| 3.1      | Switch should support IEEE Standards of Ethernet: IEEE 802.1D, 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1p, 802.1Q, 802.3, 802.3u, 802.3ab, 802.3z.                             |            |
| 3.2      | Switch must have functionality like static routing, RIP, REP PIM, OSPF, VRRP and QoS features from Day1.  |            |
| 3.3      | Switch should support network segmentation that overcomes the limitation of VLANs using VXLAN and VRFs.   |            |
| 3.4      | Switch shall have 802.1p class of service, marking, classification, policing and shaping and eight egress queues.   |            |
| 3.5      | Switch should support management features like SSHv2, SNMPv2c, SNMPv3, NTP, RADIUS and TACACS+ .  |            |
| 3.6      | Switch should support IPv6 Binding Integrity Guard, IPv6 Snooping, IPv6 RA Guard, IPv6 DHCP Guard, IPv6 Neighbour Discovery Inspection and IPv6 Source Guard.                       |            |
| 3.7      | Switch should support 802.1x authentication and accounting, IPv4 and IPv6 ACLs and Dynamic VLAN assignment and MACSec-128 on hardware for all ports.                                |            |

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| 3.8      | Switch must have the capabilities to enable automatic configuration of switch ports as devices connect to the switch for the device type.   |  |
| 3.9      | Switch should support Network Plug-and-Play application, network settings, device credentials, LAN automation, host onboarding  |  |
| 3.10     | During system boots, the system's software signatures should be checked for integrity. System should be capable of understanding that system OS are authentic and unmodified, it should have cryptographically signed images to provide assurance that the firmware & BIOS are authentic. |  |
| <b>4</b> | <b>Interface</b>  |  |
| 4.1      | Switch shall have 24 nos. 10/100/1000 Base-T ports and additional 4 nos. SFP+ uplinks ports.  |  |
| 4.2      | All 24 port should support PoE (802.3af) and PoE+ (802.3at) with a PoE power budget of 370 W  |  |
| 4.3      | Switch should be able to support Switch-port auto-recovery ("err-disable" recovery) automatically attempts to reactivate a link that is disabled because of a network error.  |  |
| 4.4      | Switch Should be able to support Fast PoE. When power is restored to a switch, Fast PoE starts delivering power to endpoints without waiting for the operating system to fully load, thereby speeding up the time for the endpoint to start up.   |  |
| <b>5</b> | <b>Certification:</b>   |  |
| 5.1      | Switch shall conform to UL 60950 or IEC 60950 or CSA 60950 or EN 60950 Standards for Safety requirements of Information Technology Equipment.   |  |
| 5.2      | Switch shall conform to EN 55022 Class A/B or CISPR22 Class A/B or CE Class A/B or FCC Class A/B Standards for EMC (Electro Magnetic Compatibility) requirements.   |  |
| 5.3      | Switch / Switch's Operating System should be tested for EAL 2/NDPP or above under Common Criteria Certification.  |  |
| 5.4      | OEM should be listed in Gartner Leader Quadrant for Wired and Wireless LAN Infrastructure from last 5 years before releasing this RFP.  |  |

|             |  |                   |
|-------------|--|-------------------|
|             | Wireless Controller  |                   |
| <b>S.No</b> | <b>Technical Specifications</b>  | <b>Compliance</b> |
|             |  | <b>Yes/No</b>     |
| <b>1</b>    | <b>Hardware</b>  |                   |
| 1.1         | Wireless controller should support 1000 AP and 10000 clients from day 1. |                   |

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| 1.2      | The controller shall support deployment flexibility without compromising any features   |  |
| 1.3      | Wireless Controller shall support link aggregation and load sharing between Access Point to WLC links   |  |
| 1.4      | The Controller shall provide standalone Virtual Wireless Controller option without requiring physical, additional Controller appliance  |  |
| 1.5      | The controller shall be proposed with complete feature set including licensed feature   |  |
| <b>2</b> | <b>High Availability</b>  |  |
| 2.1      | High Availability mode shall support controller inline data plane mode as well as local switching mode and Mesh mode  |  |
| 2.2      | High Availability mode shall allow geographically dispersed installation between Controllers  |  |
| 2.3      | The controller failover shall not trigger client de-authentication and re-association   |  |
| 2.4      | The redundant Controller shall sync Access Point and Client Status, including DHCP IP lease status  |  |
| <b>3</b> | <b>Software</b>   |  |
| 3.1      | Access Point shall be able to proactively distributes Client connection before and after association and tracking client condition in real time using data packet RSSI                  |  |
| 3.2      | The controller shall support standard-based, secure AP-Controller data & control protocol like CAPWAP. protocol that has known vulnerability like PAPI cannot be used.                  |  |
| 3.3      | The controller shall support Inter-Controller Wireless Roaming  |  |
| 3.4      | The controller shall maintains per-user Application usage and shall be able to export it for network analytic.  |  |
| 3.5      | The controller shall support Multi Languages options from embedded GUI Management   |  |
| 3.6      | The controller shall provide per-Client Connection Scoring and provide reasoning of Client Connection Score   |  |
| 3.7      | The controller shall support Cellular offload using IPv6 tunneling to Mobile Core network   |  |
| <b>4</b> | <b>RF Management</b>  |  |
| 4.1      | The controller shall be able to support multiple RF Management profile per group of APs, including Transmit Power Control and Dynamic Channel Assignment on both <u>2.4GHz</u> and 5Ghz |  |
| 4.2      | The controller shall be able to identify and avoid interferers with network performance impact analysis report  |  |

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| 4.3      | The controller shall support optimized, automatic channel width (20~160Mhz) selection over 5GHz, 802.11ac   |  |
| <b>5</b> | <b>Mesh</b>   |  |
| 5.1      | Mesh AP nodes shall provide quick convergence and fast failover to new root mesh node   |  |
| 5.2      | Mesh Backhaul interface shall support full duplex operation using wired daisy chaining  |  |
| 5.3      | Mesh AP shall support fast roaming for Wired-client through wired-to-wireless bridge client   |  |
| <b>6</b> | <b>Application Recognition and Control</b>  |  |
| 6.1      | The controller shall support per-user and per-WLAN based application recognition and control that throttle usage by rate-limiting   |  |
| 6.2      | The controller application recognition technology shall support exporting to 3rd party compatible format, such as NetFlow v9  |  |
| 6.3      | The controller shall provide policy-based mDNS gateway including chromecast gateway   |  |
| 6.4      | The controller shall support new application signatures without upgrading controller software   |  |
| <b>7</b> | <b>BYOD &amp; Security</b>  |  |
| 7.1      | The controller shall provide Device Profiling using multiple profiling methods to reduce false-detection  |  |
| 7.2      | The system shall provide secure onboarding service for both employee and guest based on standard-based security protocol Proposed system shall not use public cloud as user data repository |  |
| 7.3      | The controller shall be able to embedded custom web portal page (HTML) to fully customize user experience without additional cost or extra box  |  |
| 7.4      | The controller shall provide rule-based rogue classification and automatically run rogue mitigation action  |  |
| 7.5      | The controller shall be able to detect employee device connection to Rogue Access Point and contain it automatically. It should also support protection from Honeypot or Evil twin.         |  |
| 7.6      | The controller shall support Content Security using DNS integration, Web Classification shall be fully customizable   |  |
| 7.7      | The system shall support control plane encryption on both IPv4 and IPv6   |  |
| 7.8      | The Controller's image upgrade shall be done through secure, encrypted transport  |  |

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| 7.9  | The controller shall be able to provide unique pre-shared keys to the devices that do not support the 802.1x security protocol |  |
| 7.10 | The controller shall support Identity PSK for on boarding  |  |
| 7.11 | The controller shall support identification & mitigation of threats inside encrypted traffic                                   |  |
| 7.12 | The controller shall support mapping of specific VLANs to single SSID, depending on Access Point location and user             |  |

| Access Point |   |            |
|--------------|---|------------|
| Sr. No.      | Technical Specifications  | Compliance |
|              |   | Yes/No     |
| 1            | Access Point shall support 4x4 MIMO on both radio interfaces  |            |
| 2            | •<br>Access Point shall be able to powered up using PoE (.af)   |            |
| 3            | •<br>Access Point shall support assurance, packet capture, RF sensing capabilities  |            |
| 4            | Access Point shall support application visibility and control   |            |
| 5            | •<br>Access Point shall support encrypted traffic visibility  |            |
| 6            | Access Point should have Bluetooth5 radio to support use cases of location, asset tracking and analytics.                     |            |
| 7            | Access Point shall ship with metal-based mounting bracket for durability and reliability                                      |            |
| 8            | Access Point shall be able to leverage current Access Point mount kit and cable conduit                                       |            |
| 9            | Access Point shall support Console port that uses Standard Port (RJ-45) type connection                                       |            |
| 10           | Access Point should have 1x 100, 1000, 2500 Multigigabit Ethernet (RJ-45) – IEEE 802.3bz                                      |            |
| 11           | Access Point should have USB port for future requirement.   |            |
| 12           | Must have atleast 3 dBi Antenna gain on each radios   |            |
| 13           | Must Support data rate upto 5gbps.  |            |
| 14           | Must support minimum of 23dbm of transmit power in both 2.4Ghz and 5Ghz radios. And should follow the local regulatory Norms. |            |
| 15           | Must support AP enforced load-balance between 2.4Ghz and 5Ghz band.   |            |



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| 16 | Must incorporate radio resource management for power, channel and performance optimization   |  |
| 17 | Must have -97 dB or better Receiver Sensitivity.   |  |
| 18 | Must support Proactive Key Caching and/or other methods for Fast Secure Roaming.   |  |
| 19 | Must support Management Frame Protection.  |  |
| 20 | Should support locally-significant certificates on the APs using a Public Key Infrastructure (PKI).  |  |
| 21 | Must support the ability to serve clients and monitor the RF environment concurrently.   |  |
| 22 | Same model AP that serves clients must be able to be dedicated to monitoring the RF environment.   |  |
| 23 | Must be plenum-rated (UL2043).   |  |
| 24 | Must support 16 WLANs per AP for SSID deployment flexibility.  |  |
| 25 | Access Point Must continue serving clients when link to controller is down. It should also have option to authenticate user through Radius server directly from Access Point during link unavailability to controller. |  |
| 26 | Must support telnet and/or SSH login to APs directly for troubleshooting flexibility.  |  |
| 27 | 802.11e and WMM  |  |
| 28 | Must support QoS and Video Call Admission Control capabilities.  |  |
| 29 | Access point should be wifi 6 certified.   |  |

| IP PBX Call Manager |  |            |
|---------------------|--|------------|
| Sr.No.              | Technical Specifications   | Compliance |
|                     |  | Yes/No     |
| <b>1</b>            | <b>Call Manager</b>  |            |
| 1.1                 | The network will have SIP based call control architecture with call control functionality centralized or distributed across multiple nodes across WAN for enhanced redundancy with a capacity of more than 4000 extensions on the same hardware and license for 1300 IP Phones to be provided from day 1 |            |
| <b>2</b>            | <b>General Specifications</b>  |            |
| 2.1                 | A comprehensive IP based solutions based on a Server Gateway Architecture  |            |
| 2.2                 | Support for integrated telephony solution for Video conferencing devices, Analog & IP Phones, PSTN gateways over IP architecture.  |            |

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| 2.3      | The solution should offer users the ability to use their UC clients and IPPhones outside of the enterprise (Internet) to make audio and video calls along with IM/Presence with or without VPN.   |  |
| 2.4      | The solution should allow for business to business (B2B) video calls using SIP, H.323 with other organizations without bypassing existing firewalls.  |  |
| 2.5      | The solution should allow provisioning of gateways and it should also be in redundancy  |  |
| <b>3</b> | <b>System Architecture</b>  |  |
| 3.1      | The call control system should be fully redundant solution with No single point of failures & should provide 1:1 redundancy. Both the server should do call processing all the time and act as backup in case of the failure of one server.                       |  |
| 3.2      | The call control should support clustering over WAN   |  |
| 3.3      | The proposed system should be Integratable with ACD, IVR.   |  |
| 3.4      | The call control system should support IPv4 and IPv6 from day one.  |  |
| 3.5      | The system should natively support tenant partitioning so as to comply with TRAI regulations for not allowing VoIP (CUG calls) and PSTN calls to be bridged. Any third party applications to manage tenant partitioning should not be quoted in the architecture. |  |
| 3.6      | The proposed call control server should provide support for standards based SIP IP Phones (Wired & Wireless), Analog Phones, Video Phones, Video Conferencing endpoints and soft clients to provide centralized management and unified dial plan.                 |  |
| 3.7      | Conference Bridge—provides software conference bridge resources that can be used by IP EPABX.   |  |
| 3.8      | The system should support an inbuilt reporting tool for calls. Reports that are provided include Calls on a user basis, Calls through gateways, Simplified Call Quality.  |  |
| 3.9      | Should support signaling standards/Protocols – SIP, H.323, Q.Sig.   |  |
| 3.10     | CODEC support - G.711, G.729, G.729ab, g.722, iLBC  |  |
| 3.11     | The system should provide the ability to perform tasks in bulk i.e. Add, Remove, Update users, phones, gateways, dial plan etc.   |  |
| 3.12     | The system should support creation of users and their authentication locally and via an integration with LDAP.  |  |
| 3.13     | The system should support an inbuilt reporting tool for calls. Reports that are provided include Calls on a user basis, Calls through gateways, Simplified Call Quality.  |  |

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| 3.14     | The system should support call admission control to configure number of calls that can be active between locations – intercluster and intracluster.   |  |
| 3.15     | Call preservation – redundancy and automated failure – on call-processing failure. In progress PSTN calls at each of the locations should not be interrupted in the event of any WAN failure or call control server failure.  |  |
| 3.16     | Open API should be provided when required which will help to develop customized IP applications which will integrate with call processing.  |  |
| 3.17     | It is required to provide Survivable Call Control functionality so that the survivable system at the remote location i.e. Media Gateway shall provide fall back call control service in case the remote site loses all connectivity to the main Call Control system placed. It is expected that the survivability call control system will provide a minimal set of essential telephony features to the end-users that could be a subset of the feature that are available from the main call control system. |  |
| <b>4</b> | <b>Security</b>   |  |
| 4.1      | All the appliances in the call control system should have dual redundant and hot swappable power supply and fans for high availability.   |  |
| 4.2      | All appliances in the call control system should have hot swappable storage media to ensure high availability.  |  |
| 4.3      | Support for configuration database (contains system and device configuration information, including dial plan)  |  |
| 4.4      | Having inbuilt administration web based administration. No additional thick client for administration on the Admin PC. Should also support HTTPS for management.  |  |
| 4.5      | Access to the system should be secure for the purpose of access over IP network. The protection of signaling connection over IP by means of authentication, Integrity and encryption should be carried out using TLS.   |  |
| 4.6      | There should be provision of defining password aging, one time passwords. Provision shall be available to bar unauthorized user to connect to the system. The system should monitor and report the following types of security \ violation login Violations, authorization code violation Station security code violations etc.   |  |
| 4.7      | IP Phones should not support direct, external initiated, connections via HTTP, telnet, FTP, TFTP or any other protocol as means to prevent distributed Denial of Service attack exploitation, except those required for routine firmware upgrades.  |  |
| 4.8      | Role Based Account Management to define different levels of administrator access depending on specific function responsibility  |  |

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| 4.9      | The system should support complete encryption capabilities with the ability to encrypt all traffic (media and call control signalling) between IP phones, softphones, call controllers, gateways and all other associated endpoints using a strong encryption algorithm (AES, IPSec and SRTP, for example). |  |
| 4.10     | All management traffic between the remote console/session and control server should be encrypted (SSH for Direct Command Line Sessions, Interface, HTTPS (SSL) for Web Sessions, SFTP for File Transfer Etc.).  |  |
| 4.11     | Should support SSL for LDAP directory integration.  |  |
| 4.12     | All Hardware & Software with license required for providing above Security measures must be incorporated for 5 years.   |  |
| <b>5</b> | <b>System Capabilities Summary</b>  |  |
| 5.1      | The System should have IP capability for interfacing & Communicating with Voice, Video and Data infrastructure  |  |
| 5.2      | The architecture should support a minimum of 1000 IP phones and VC systems per Server   |  |
| 5.3      | The System should support Alternate Call Routing  |  |
| 5.4      | The System should have GUI support web based management console   |  |
| 5.5      | <b>System backups:</b> The management system should have the provisioning for taking manual as well as scheduling of automatic periodic backup of complete system & data.   |  |
| 5.6      | The System should support Audio message-waiting indicator (AMWI)  |  |
| 5.7      | The System should have Automated bandwidth selection  |  |
| 5.8      | Should support SNMP v2, v3  |  |
| 5.9      | It should be possible to monitor the call control system i.e. system performance, device status, device discovery, CTI applications, voice messaging ports etc.   |  |
| <b>6</b> | <b>Video Telephony Support</b>  |  |
| 6.1      | The call control system should provide integrated video telephony features to the users so that user with IP Phone / Soft phone and video telephony end point should be able to place video calls with the same user model as audio calls.  |  |
| 6.2      | The users should be able to transfer video calls as audio calls   |  |
| 6.3      | Call-Server should provide a common control agent for signaling, configuration, and serviceability for voice or video end points.   |  |
| 6.4      | Call control system should handle CODEC and video capabilities of the endpoints, bandwidth negotiation to determine if video/audio call can take place.   |  |
| <b>7</b> | <b>End user Features required:</b>  |  |

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| 7.1  | Extension mobility   |  |
| 7.2  | Call forward all   |  |
| 7.3  | Message-waiting indicator (MWI)  |  |
| 7.4  | Privacy  |  |
| 7.5  | Device mobility  |  |
| 7.6  | Do not disturb   |  |
| 7.7  | Hunt groups  |  |
| 7.8  | Dial-plan partitioning   |  |
| 7.9  | Distributed call processing  |  |
| 7.10 | Deployment of devices and applications across an IP network  |  |
| 7.11 | "Clusters" of Call-Servers for scalability, redundancy, and load balancing   |  |
| 7.12 | Intercluster scalability to 100+ sites or clusters through H.323 gatekeeper  |  |
| 7.13 | Fax over IP—G.711 pass-through and Fax Relay   |  |
| 7.14 | Forced authorization codes and client matter codes (account codes)   |  |
| 7.15 | H.323 interface to selected devices  |  |
| 7.16 | Hotline and private line automated ringdown (PLAR)   |  |
| 7.17 | Interface to H.323 gatekeeper for scalability, CAC, and redundancy   |  |
| 7.18 | Language support for client user interfaces (languages specified separately)   |  |
| 7.19 | Multi-Level Precedence and Preemption (MLPP)   |  |
| 7.20 | Multilocation—dial-plan partition  |  |
| 7.21 | Multiple ISDN protocol support   |  |
| 7.22 | Multiple remote CallServer platform administration and debug utilities   |  |
| 7.23 | Prepackaged alerts, monitor views, and historical reports with Real Time Monitor Tool (RTMT).  |  |
| 7.24 | Real-time and historical application performance monitoring through operating system tools and Simple Network Management Protocol (SNMP)           |  |
| 7.25 | Remote terminal service for off-net system monitoring and alerting   |  |
| 7.26 | Real-time event monitoring and presentation to common syslog   |  |
| 7.27 | Trace setting and collection utility   |  |
| 7.28 | Cluster wide trace setting tool.   |  |
| 7.29 | Trace Collection tool.   |  |
| 7.30 | Multisite (cross-WAN) capability with intersite CAC  |  |
| 7.31 | Q.SIG (International Organization for Standardization [ISO])   |  |
| 7.32 | Video calls to be placed with the same user model as audio calls.  |  |
| 7.33 | Call-Server should support new video end points.   |  |
| 7.34 | SIP Video endpoints which should inherit the functionality of audio calls which gives the user the same call model for both video and audio calls. |  |

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| 7.35     | Call-Server should have the infrastructure to handle codec and video capabilities of the endpoints, bandwidth negotiation to determine if video/audio call can take place, single point of administration, management of media devices such as gateways and MCUs. |  |
| 7.36     | Call-Server should provide a common control agent for signaling, configuration, and serviceability for voice or video end points.   |  |
| <b>8</b> | <b>Virtulised Hardware Specification</b>  |  |
| 8.1      | Rack Server shall have a minimum of one (1) Intel latest generation icelake Processors with minimum 2.90 GHz & 16 cores, 16 Nos 600 GB 10K HDD drives, 96 GB of DDR4 Memory and 2 * 10 GbE (embedded) LAN ports from day one                                      |  |
| 8.2      | Server should have 05 years warranty. HW, SW support should be provided by single OEM and appropriate OS - Vmware to be provided by Bidder  |  |

| <b>Voice Gateway - 4 PRI</b> |   |                   |
|------------------------------|---|-------------------|
| <b>Sr.No</b>                 | <b>Technical Specifications</b>   | <b>Compliance</b> |
|                              |   | <b>Yes/No</b>     |
| <b>1</b>                     | <b>General Requirement</b>  |                   |
| 1.1                          | The Router should support modular architecture, multi-core Processor from Day1. The Router Should have capabilities of seamless field upgrade/replacement (without interrupting running processes and services ) for modular interfaces.  |                   |
| <b>2</b>                     | <b>Hardware and Interface Requirement</b>   |                   |
| 2.1                          | Router should have 2 ports RJ45 and 2 ports of SFP from day one and the Router should support interfaces like Channelized E1/T1, Serial V.35, G.703, LTE, and Gigabit Ethernet. All the modular interfaces on the router should support hot-swapability feature to accommodate field upgrades without rebooting the router. |                   |
| 2.2                          | The Router should have at least 1 empty slot for future use.  |                   |
| 2.3                          | Router should have minimum 6 GB of on-board/inbuilt DRAM/RAM for data plane + control plane processes and 6 GB Flash from Day 1. Should support expandability up to 16 GB DRAM  |                   |
| 2.4                          | The router should have 4 Port E1 Voice PRI card along with required PVDM resources to make all PRI up from day 1  |                   |
| <b>3</b>                     | <b>Performance Requirement</b>  |                   |
| 3.1                          | Router should have minimum 2 Gbps WAN Throughput and it should support up to 70K IPv4 / IPv6 routes   |                   |

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| 3.2      | The router must support IKEv1, L2TP, IKEv2, GRE and IPSEC from day 1. The proposed solution should serve the GRE encryption for traffic from any location to other location on demand and also should able to create GRE tunnel.                          |  |
| 3.3      | The router should support upto 500 Mbps of IPSEC Bandwidth, incase required in the future and Router should support IGMP v1/v2/v3 and PIM multicast routing   |  |
| 3.4      | The router should support minimum MTBF value of 692,000 and above, Bidder should provide the required OEM supporting document for the same.   |  |
| <b>4</b> | <b>Layer3 Features</b>  |  |
| 4.1      | Router should support static Routes, OSPFv2, OSPFv3, BGP4, MBGP, BFD, Policy based routing, IPv4 and IPv6 tunneling from Day 1 The Router should support Zone Based Firewall feature or an external appliance for the same functionality can be provided. |  |
| 4.2      | Router should Support Traffic Optimization feature built in the router operating system or an external appliance for the same functionality can be provided.  |  |
| 4.3      | The Router should support signature- based intrusion detection system and intrusion prevention system. (IDS and IPS)  |  |
| 4.4      | Shall have 802.1p class of service and marking, classification, policing and shaping.   |  |
| <b>5</b> | <b>Manageability</b>  |  |
| 5.1      | Router should support SSHv2, SNMPv2c, SNMPv3 and NTP  |  |
| 5.2      | Routers should support AAA using RADIUS and TACACS+   |  |
| 5.3      | Should have extensive support for IP SLA and best path selection for metrics like delay, latency, jitter, packet loss to assure business-critical IP applications from Day1.  |  |
| 5.4      | The router should support cRTP to compress voice (RTP) streams  |  |
| 5.5      | The router should support call processing backup mechanism that allows IP phones to register to the router  |  |
| 5.6      | Router should support monitoring of network traffic with application level insight with deep packet visibility into web traffic, RTP-Based VoIP traffic.  |  |
| 5.7      | Router should have traffic load balancing capability on dual WAN Links based on based on advanced criteria, such as reachability, delay, loss, jitter and bandwidth utilization.  |  |

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| 5.8      | Router shall have capability to add on demand IPsec VPN tunnels dynamically established multipoint-to-multipoint IPSEC based spoke-to- spoke VPN tunnels matching traffic conditions.   |  |
| 5.9      | Should support minimum 4000 IPsec tunnels   |  |
| 5.10     | The device should be capable to work in SDWAN architecture as well, keeping future scalability in mind. The SDWAN feature / capability if required, would be deployed later. The SDWAN feature should be supported on the same hardware |  |
| <b>6</b> | <b>Certification</b>  |  |
| 6.1      | Router shall conform to UL 60950 or IEC 60950 or CSA 60950 or EN 60950 Standards for Safety requirements of Information Technology Equipment.   |  |
| 6.2      | Router shall conform to EN 5502 Class A/B or CISPR22 Class A/B or CE Class A/B or FCC Class A/B Standards for EMC (Electro Magnetic Compatibility) requirements.  |  |
| 6.3      | Router/Router's Operating System should be tested and certified for EAL 3/NDPP or above under Common Criteria Certification.  |  |
| 6.4      | Router should be IPv6 Certified/IPv6 logo ready.  |  |

| <b>Entry Level IP Phone Cisco 7811/Equivalent</b> |  |                   |
|---|--|-------------------|
| <b>Sr.No.</b>                                     | <b>Technical Specifications</b>  | <b>Compliance</b> |
|   |  | <b>Yes/No</b>     |
| 1   | The phone should support Power over Ethernet IEEE 802.3af class 1/2/3 and should also have AC power adapter option                                       |                   |
| 2   | Should feature a LCD display of at least 3.5" for information such as calling party name, calling party number, and digits dialed to be displayed.       |                   |
| 3   | The phone should have two ethernet ports of at least 10/100 BASE-T Ethernet ports, one for the LAN connection and the other for connecting to PC/laptop. |                   |
| 4   | Corporate directory and Lightweight Directory Access Protocol (LDAP) integration.  |                   |
| 5   | Ready access to missed, received or placed calls (plus intercom history and directories).  |                   |
| 6   | The phone should support QoS mechanism through 802.1p/q.   |                   |
| 7   | IP address Assignment by DHCP or statically configured   |                   |
| 8   | Hands-free operation with full-duplex speaker-phone  |                   |
| 9   | The phone should be a SIP based Phone i.e session Initiation protocol (SIP) supported  |                   |



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| 10 | The phone should support XML based services and applications.   |  |
| 11 | The phone should have a distinct LED indicator for message waiting.   |  |
| 12 | Should have keys for specific functionalities such as – voicemail, directories, settings, transfer, speakerphone, mute on/off, headset etc  |  |
| 13 | Media Encryption (SRTP) using AES   |  |
| 14 | Signalling Encryption (TLS) using AES   |  |
| 15 | Should support 802.1x   |  |
| 16 | Encryption of Configuration Files   |  |
| 17 | The phone should have the ability to register to call control server over an internet link with or without VPN.   |  |
| 18 | The phone should support IPv4 and IPv6 from day1.   |  |
| 19 | The phone should support at least 100 entries for call history i.e. missed, received, placed etc.   |  |
| 20 | It should support the following codecs: G.711a/μ-law, G.722, G.729a, iLBC   |  |
| 21 | The phone also includes the following settings - Display contrast, Ring type, Network configuration, Call status  |  |
| 22 | The Phone should support the ability to provide different ringtones for internal and external calls.  |  |
| 23 | Should have volume control button for easy volume adjustments for the speakerphone, handset and ringer.   |  |
| 24 | The phone should support mounting against a wall  |  |
| 25 | The phone should support 1 programmable lines key.  |  |
| 26 | The phone should the following features:i. Call forwardii. Call pickupiii. Call waitingiv. Extension Mobilityv. Auto answervi. Message waiting indicatorvii. Music on holdviii. Forced Authorization Code (Account Code/FAC)ix. Conferencex. Music on Hold (MoH)xi. Corporate directoryxii. Auto-detection of headsetxiii. Busy Lamp Field (BLF)xiv. Callbackxv. Immediate Divert |  |

| <b>Mid Level IP Phone Cisco 8841/Equivalent</b> |   |                   |
|---|---|-------------------|
| <b>Sr. No.</b>                                  | <b>Technical Specifications</b>   | <b>Compliance</b> |
|   |   | <b>Yes/No</b>     |
| 1   | Should have min 5" screen (800 × 480 resolution) with color display and at least 4 programmable line keys |                   |
| 2   | The phone should be a SIP based Phone i.e session Initiation protocol (SIP) supported                     |                   |

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| 3  | The phone should support Power over Ethernet IEEE 802.3af class 1/2/3 and should also have AC power adapter option                                    |  |
| 4  | The phone should have 2 x 1GE ports, one for the LAN connection and the other for connecting to PC/laptop.  |  |
| 5  | Corporate directory and Lightweight Directory Access Protocol (LDAP) integration.   |  |
| 6  | Ready access to missed, received or placed calls (plus intercom history and directories).   |  |
| 7  | The phone should support QoS mechanism through 802.1p/q.  |  |
| 8  | IP address Assignment by DHCP or statically configured  |  |
| 9  | Hands-free operation with full-duplex speaker-phone   |  |
| 10 | The phone should support XML based services and applications.   |  |
| 11 | The phone should have a distinct LED indicator for message waiting.   |  |
| 12 | Should have keys for specific functionalities such as – voicemail, directories, settings, transfer, speakerphone, mute on/off, headset etc            |  |
| 13 | Media Encryption (SRTP) using AES   |  |
| 14 | Signalling Encryption (TLS) using AES   |  |
| 15 | 802.1x support  |  |
| 16 | Encryption of Configuration Files   |  |
| 17 | The phone should have the ability to register to call control server from outside of the enterprise with or without VPN.                              |  |
| 18 | The phone should support IPv4 and IPv6 from day one.  |  |
| 19 | The phone should support backlit indicators for the audio path keys (handset, headset, and speakerphone), select key, line keys, and message waiting. |  |
| 20 | Should support following audio codec - G.711a, G.711u, G.729a, G.722, iSAC, Internet Low Bitrate Codec (iLBC)   |  |
| 21 | The phone should have RJ9 headset port to connect any standards based headset. The phone should also have a separate headset key                      |  |
| 22 | The phone should support mounting against a wall  |  |
| 23 | The phone should support at least 100 entries for call history i.e. missed, received, placed etc.   |  |
| 24 | Should support busy lamp indicator (BLF) to indicate the presence   |  |
| 25 | Should support boss-secretary feature, so that secretary can answer calls on behalf of Manager  |  |
| 26 | The handset should be hearing aid-compatible  |  |

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| 27 | The phone should support the following features at a minimum: <ol style="list-style-type: none"> <li>a. Call forward</li> <li>b. Call pickup</li> <li>c. Call waiting</li> <li>d. Callback</li> <li>e. Call park</li> <li>f. Conference</li> <li>g. Extension Mobility</li> <li>h. Auto answer</li> <li>i. Auto-detection of headset</li> <li>j. Immediate Divert</li> <li>k. Music on hold (MoH)</li> <li>l. SIP URI dialing</li> <li>m. URL Dialing</li> <li>n. Message waiting indicator (MWI)</li> <li>o. Personal directory</li> <li>p. Forced Authorization Code (Account/FAC)</li> <li>q. Call history lists</li> </ol> |  |
|----|--|--|

| <b>Top Level IP Phone Cisco 8875/Equivalent</b> |   |                   |
|---|---|-------------------|
| <b>Sr. No.</b>                                  | <b>Technical Specifications</b>   | <b>Compliance</b> |
|   |   | <b>Yes/No</b>     |
| 1   | The phone should have 1024 × 600 high resolution 7-inch LED touch screen with coloured display                                      |                   |
| 2   | The phone should support Power over Ethernet IEEE 802.3af class 1/2/3/4 and should also have AC power adapter option                |                   |
| 3   | The phone should have 2 x 10/100/1000BASE-T Ethernet network, one for the LAN connection and the other for connecting to PC/laptop. |                   |
| 4   | Ready access to missed, received or placed calls (plus intercom history and directories).   |                   |
| 5   | The phone should support QoS mechanism through 802.1p/q.  |                   |
| 6   | The phone should support Wi-Fi 802.11a/b/g/n/ac, 2.4 GHz/5 GHz dual bands.  |                   |
| 7   | The phone should provide user the flexibility while using the headset i.e. RJ-9, USB-C, USB-A, 3.5mm AUX                            |                   |
| 8   | The phone should have atleast 2 multi-purpose USB ports that could be used for charging mobile phones, connecting USB headsets.     |                   |
| 9   | IP address Assignment by DHCP or statically configured  |                   |

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| 10 | Hands-free operation with full-duplex speaker-phone   |  |
| 11 | The phone should be a SIP based Phone i.e session Initiation protocol (SIP) supported   |  |
| 12 | The phone should support XML based services and applications.   |  |
| 13 | The phone should have a distinct LED indicator for message waiting.   |  |
| 14 | Should have keys for specific functionalities such as – voicemail, directories, settings, transfer, speakerphone, mute on/off, headset etc  |  |
| 15 | Media Encryption (SRTP)   |  |
| 16 | Signalling Encryption (TLS)   |  |
| 17 | 802.1x support  |  |
| 18 | Encryption of Configuration Files   |  |
| 19 | The phone should have the ability to register to call control server over an internet link with or without VPN.   |  |
| 20 | The phone should support IPv4 and IPv6 from day1.   |  |
| 21 | The phone should support backlit indicators for the audio path keys (handset, headset, and speakerphone), Home key, and message waiting.  |  |
| 22 | Should support following audio codec - G.711a, G.711u, G.729a, iSAC, Internet Low Bitrate Codec (iLBC), OPUS  |  |
| 23 | The phone should also have a separate headset key   |  |
| 24 | Should have a built-in auto-focus camera with 1080p30 resolution (encode & decode). The camera should have a shutter to open/close camera. Should support standards based video protocol H.264. The camera should have 70° horizontal field of view, 45° vertical field of view |  |
| 25 | Should support self-view video, picture in picture (pip) with adjustable positions of pip.  |  |
| 26 | Should support Bluetooth (v4.2 LE) for handsfree earphones  |  |
| 27 | The phone should support call history i.e. missed, received, placed etc.  |  |
| 28 | The handset should be hearing aid-compatible  |  |

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| 29 | The phone should support the following features at a minimum: <ol style="list-style-type: none"> <li>a. Call forward</li> <li>b. Call pickup</li> <li>c. Call waiting</li> <li>d. Call hold/resume</li> <li>e. Call park</li> <li>f. Conference</li> <li>g. Privacy</li> <li>h. Barge</li> <li>i. Speed Dial</li> <li>j. Do not Disturb</li> <li>k. Music on hold (MoH)</li> <li>l. SIP URI dialing</li> <li>m. URL Dialing</li> <li>n. Message waiting indicator</li> <li>o. Personal directory</li> <li>p. Favourates</li> <li>q. Call history lists</li> </ol> |  |
|----|---|--|

| <b>Executive Level IP Phone Cisco DeskPro/Equivalent</b> |  |                   |
|--|--|-------------------|
| <b>Sr. No.</b>   | <b>Technical Specifications</b>  | <b>Compliance</b> |
|  |  | <b>Yes/No</b>     |
| <b>1</b>   | <b>General</b>   |                   |
| 1.1  | Should be an integrated system with at least 26 inch or higher 4K LED/LCD/TFT screen, 4K Camera, Mics and speakers for wide band audio output. The Codec should be a part of the unit. Bluetooth headset should also be included from day 1 in solution. |                   |
| 1.2  | It should be possible to use camera, microphone and speakers with any SW client (without using units Codec Functionalities)  |                   |
| 1.3  | LED/LCD/TFT screen should be a touch screen to provide a touch interface to the user.  |                   |
| 1.4  | Must support IPv4 and IPv6 from day one.   |                   |
| 1.5  | The display should work as PC/Laptop Display when not in a call, and should allow working on PC and Attending calls simultaneously.  |                   |
| 1.6  | Must have the following touch buttons for ease of use <ol style="list-style-type: none"> <li>1. Mute/Unmute</li> <li>2. Volume Increase/Decrease</li> </ol>  |                   |

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| 2    | <b>Video Standards</b>  |  |
| 2.1  | Should support minimum H.264  |  |
| 2.2  | System should support H.323 and SIP protocol.   |  |
| 2.3  | System must support desktop sharing H.323 and SIP calls   |  |
| 2.4  | System should support Video stream upto Full HD 1080p30 and Content stream upto 4K 2160p15  |  |
| 2.5  | System must have ability to send and receive two live simultaneous video sources in a single call.  |  |
| 2.6  | System must support layout control for video and presentation on a single LED/LCD screen.   |  |
| 2.7  | Should Touch forwarding capabilities via USB - C  |  |
| 2.8  | Should have HDMI input to connect PC/ Laptop directly to the Video Conferencing System and display a resolution upto 3840 x 2160p60 (4kp60)   |  |
| 2.9  | Should also have USB-C Display port with resolution upto 3840 x 2160p60 (4kp60)   |  |
| 2.10 | The user must be able to toggle between the Laptop/PC mode and the Video Conferencing mode at a push of button/icon.                          |  |
| 2.11 | Must have a HD output via a HDMI output port (for future support to connect to external display)  |  |
| 2.12 | System must support H.239 and BFCP for resolutions upto 1080p   |  |
| 2.13 | The unit should support<br>Internal microphone array for speech, USB headset, Bluetooth headset   |  |
| 2.14 | The unit should support<br>Integrated High-quality speakers with directional audio<br>Analog headphone output, USB headset, Bluetooth headset |  |
| 2.15 | System should support Wireless Content Sharing and allow sharing content from PC/Laptop   |  |
| 2.16 | Should support firewall traversal solution using the H.460.18 and H.460.19 protocol   |  |
| 2.17 | Audio System : The system should have two stereo front speakers with inbuilt microphones, wideband speakers.                                  |  |
| 2.18 | G.722, G.711, AAC-LD or better  |  |
| 3    | <b>Other Features</b>   |  |
| 3.1  | Noise Reduction/Echo Cancellation, Automatic Gain control   |  |
| 3.2  | Upto 6 Mbps Point to Point  |  |
| 3.3  | The Unit should support inbuilt 1+4 HD Multisite by adding a License key in future.   |  |
| 3.4  | 1 x LAN /Ethernet--10/100/1000  |  |

|          |   |  |
|----------|---|--|
| 3.5      | 1 x LAN /Ethernet--10/100/1000 to connect a PC (i.e. built in switch)   |  |
| 3.6      | Must support 802.11a/b/g/n/ac 2.4 GHz and 5 GHz   |  |
| 3.7      | Must support Bluetooth 3.0 for connecting Bluetooth headsets  |  |
| 3.8      | Must support Standard based Packet loss recovery algorithm to handle packet loss.                                     |  |
| 3.9      | Must support QOS  |  |
| 3.10     | Must' support URI Dialling  |  |
| 3.11     | Must support SIP and H.323  |  |
| <b>4</b> | <b>Security Features</b>  |  |
| 4.1      | Should have password protected system menu  |  |
| 4.2      | Encryption of video call: ITU-T standards based Encryption of the video call using Advanced Encryption Standard (AES) |  |
| 4.3      | Call should be encrypted end-to-end on IP calls   |  |
| <b>5</b> | <b>Camera</b>   |  |
| 5.1      | Should be 4K Ultra HD camera with privacy shutter   |  |
| 5.2      | 70 degrees horizontal Field of View   |  |
| 5.3      | 55 digress vertical field of view   |  |
| 5.4      | Automatic focus, brightness and white balance   |  |
| 5.5      | Camera On LED indicator   |  |
| 5.6      | Automatic tilt adjustment   |  |
| <b>6</b> | <b>Directory Services</b>   |  |
| 6.1      | Should support Local and Global directories   |  |
| 6.2      | Should support LDAP and H.350 protocols for directory transfer.   |  |

**TECHNICAL SPECIFICATIONS FOR RACEWAYS**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**MAKES: OBO/MK/LEGRAND**

Supply of Trapezoidal duct, one-compartment, for use in cement screeds and under false floors.

The under floor duct for “in screed” system shall be of “UPVC” in combination of single, double or triple runs in compliance with the relevant sections of standard EN 50085 & DIN VDE 0634. The under floor UPVC ducts shall be of trapezoidal shape for better load withstand capacity and closed box type construction. The UPVC under floor ducts shall have to be provided with required rigidity with a standard loading capacity of 750N according to VDE 0634 (before screed laying) and shall prevent the seepage of concrete and screed water.

The single UPVC ducts shall have dimension of 90 x 35 mm or 60 x 25 mm as required and mentioned on the drawings and standard length of the duct shall be of 3 mtrs. Single, double or triple runs of ducts

need to be used to accommodate different types of cables - Power, Data & Telecommunication. Suitable Coupler of similar trapezoidal shape shall be used to connect the standard lengths of the ducts in screed covered system. Single or multiple runs of UPVC ducts need to be secured to the structural slab by means of fastening clamps of similar trapezoidal shape. The vertical riser bends should be used as well for quick entry of cables in the under floor system.

The UPVC under floor ducts shall be made up of Lead free, non-flame propagating grade Poly vinyl chloride material as per EN 50085-2-1 and shall be ROHS compliant. The UPVC ducts shall have smooth surface finish without sharp edges and Burrs. The UPVC ducting shall have IP 40 Protection against access to hazardous parts.

#### JUNCTION BOX

Underfloor junction box for PVC ducts in heights of 25 mm and 35 mm raceways. Under floor Junction boxes shall be robust in its construction with a base plate and side walls manufactured from 1.5 mm thick (+ or - 0.1 mm tolerance) galvanized sheet steel. The base box bodies shall be made from galvanized sheet steel with a zinc coating in accordance with EN 10327 DX51D + Z275-N-A-C.

Junctions or Junction Boxes with open sides without knock outs shall not be acceptable.

Height of the under floor junction boxes shall be 60 mm as minimum and shall have to be provided with four corner pillars for height adjustment from 60 to 70 mm for first fix installation.

The Trap and frame of Junction outlets shall be manufactured from GI in line with the specifications detailed above and shall be of two or three piece construction – Trap, Frame and floor covering protection flange where ever required. The frame shall be fitted with the floor covering protection flange of 10 mm all around for protection of the cut edges of the floor finishing material – carpet or ceramic tiles where ever require. The entire three piece GI trap and frame shall be powder coated colour matched to the floor finish material as per architect's choice. GI powder coated trap and frame shall have to be 2 mm thick with an additional 3mm thick GI powder coated load plate completely supported by the frame for ensuring maximum rigidity and providing adequate load bearing capacity. The junction outlet boxes shall be able to withstand a load of 1.5KN conforming to EN 50085.

Junction outlet trap and frames need to be fixed on the height adjusting corner pillars and load plate shall be easily removable for installation / easy access to the wiring contained within.

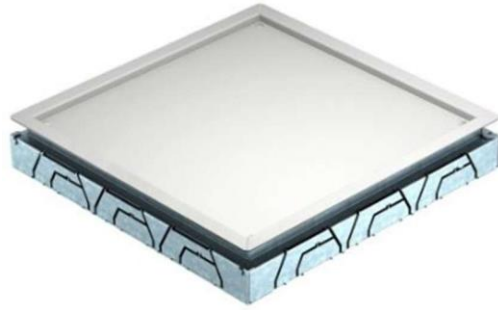
Junction outlet boxes shall be substantially dimensioned to eliminate congestion and provide ample working space within. Junction boxes shall be supplied with cross over bridges for segregation of power, data and telecommunication cables if necessary. The trap of Junction outlets shall be with a



standard 10 mm recess for ceramic tiles to accommodate various ceramic tile floor coverings.



Raceway



Junction Box



Coupler



Fixing Bracket

## TECHNICAL SPECIFICATIONS FOR PERIMETER SECURITY SYSTEMS:

**(For all below mentioned 5 products OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

### Design Brief:

The proposed below systems are applicable to automated parking floors from basement, 1<sup>st</sup> to 13<sup>th</sup> floors

a. All below mentioned systems will seamlessly work between themselves as independent system but will also share information with the building centralized systems

The automated parking floors will be also be protected by the following additional systems

### **1. Intelligent Addressable Fire Alarm (MAF Required. Same make as the building)**

1 loop expandable to 2 loop Intelligent Addressable fire alarm in one with the technical specifications as mentioned above this will be used for the addressable heat sensing cable system installed to monitor each parking slot. This fire panel should be on the same protocol as the building Fire Alarm System and should be integrated with the Automated parking BMS and the building BMS system

### **2. Line Type Heat Detector Sensing Cable –Intelligent Addressable (MAF Required. Same make as the building)**

For monitoring of **each and every individual parking slot** for basement+ 13 podium automated parking floors (total 98+455=553 nos.) The hermetically sealed sensor cable contains small hybrid circuits (sensor) which, to be placed at every 4 or 5 meters intervals to ensure that **each and every parking slot will have their individual Heat Detector** . The hybrids, which contain an integrated circuit with a defined address and a semiconductor temperature sensor, are electrically connected by a flat flexible cable. All the data from sensor element encapsulated in sensor cable is processed in the microprocessor-based controller having important LED indications and seamlessly integrate with the above Fire Alarm Panel communication protocol.

The total length of the system may be up to a minimum of 350 meters x 2 runs meters or 99 + 99 sensors whichever is earlier per controller.

### **3. ULTRASONIC RODENT REPELLENT SYSTEM (MAF Required. Same make as the building)**

Each **individual parking slot** to be protected by 1 no. ultrasonic rodent repellent transducer with on each floor to protect the cars from rodent menace **for basement+ 13 podium automated parking floors (total 98+455=553 nos.)**. Approx each floor will require 40 transducers and 2 nos. master controller with 128X64 Graphic LCD DISPLAY which will be networked and connected to centralized software for better management. No looping of transducers.

**Please refer the matrix for detailed floor wise break-up and tender technical specifications**

### **1. UNDER VEHICLE SCANNING SYSTEM (UVSS) (MAF required)**

**MAKES: GATEKEEPER(USA)-IVUS+ILPR+MULTI ANGLE IVOD/ VEHANT-NUVOSCAN-3D/SECUSCAN(GERMANY)-PERMANENT SYSTEM WITH HEAVY DUTY COVER**

Design Brief:

2 nos. are required since there are 2 set of entry/exit gates for the building

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

This will be the first defense to the building and will be installed before the entry gate to scan the underside of all cars which entry the premises. A brief about UVSS and the detailed technical specifications

As part of the solution, any incoming vehicle should drive into the Premise, once the traffic light is green. Traffic cones etc. needs to be installed to ensure that the vehicles pass in-line over the scanner with chassis in the middle/over the scanner.



Once the traffic light is green, the vehicle passes over a Ground loop. Ground loop is terminated into the junction box. The Ground loop triggers a Driver



camera, the multi-purpose camera (LicensePlate + vehicle overview image) and also activates the UVSS scanner.

This Driver camera takes image of Driver (with window glass retracted) and Multi-Functional camera takes TWO images (1) The vehicle overview



image & (2) The License plate image. This data (driver image, license plate and vehicle image) are sent to Terminal PC for further processing.

When the Vehicle (car, vans, truck and bus) driven over the Ground loop, the UVSS was also activated (along with 2 light rails) and was waiting for the vehicle to pass over the scanner. [In case, the vehicle stops over the scanner for 10 secs, the system performance does not get affected].



Once the vehicle passes over the scanner (max. speed 56kph), the Gigabit area scan camera takes TWO - images of the incoming vehicle at an angle of 60 degrees. These images taken at 300 fps are sent to PC for processing. These Two images at forward & backward angles, are stitched together to act as 3D virtual image, with the help of software. Images are in monochrome to facilitate automatic detection, which works on PC contrast. Colored images are not advisable for automatic detection. E.g.: X-Rays are monochrome. Also, vehicle chassis are not in color.

## SOFTWARE

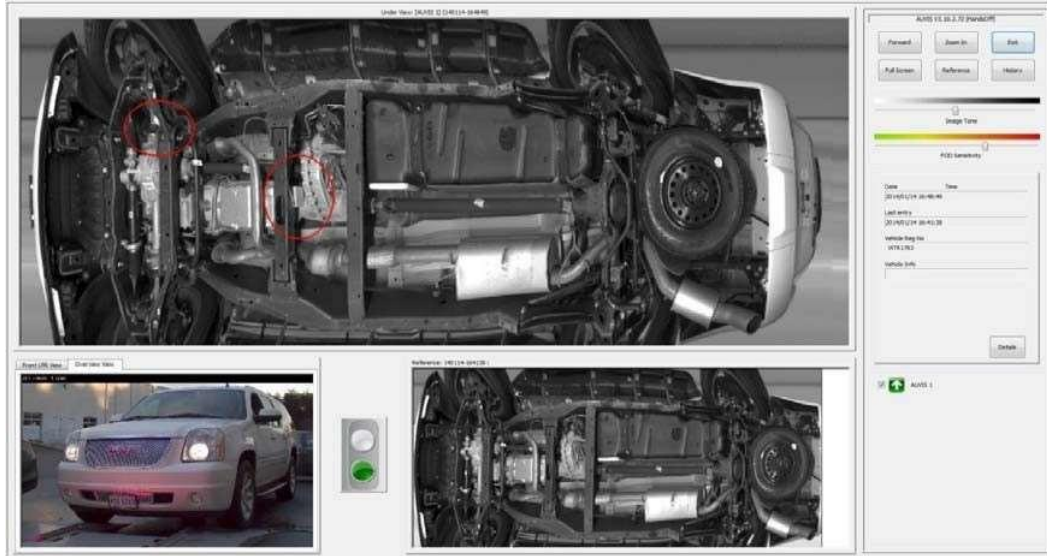
The terminal PC has all the required software to process images from Driver cam, multi-functional camera and scanner (two) images. Gatekeeper system is based on Automatic Detection Technology without human element.

Gatekeeper's system converts vehicle undercarriage digital images into computer files that are matched to a database of known safe vehicle images. A reference image is pulled from database for comparison based on, 1:1 feature – which enables image retrieval with reference to Number plate and 1: N feature, which facilitates image retrieval with reference to the chassis model. When a difference between the reference image and new scanned image is identified by the system it automatically places a red ring around the difference i.e. explosive or change to undercarriage etc. and activates an audio and/or visual alarm to alert the operator of the threat.

The Driver image and License Plate Image are auto cropped for display and also the vehicle image is processed for display. Each such scanned data is stored as a file in database.

The software compiles all the information from the scanner, the driver camera & the Multi-

Functional Camera and displays it on the operator terminal PC, for a quick inspection of incoming vehicle, license plate and the driver. The PC SSD is fast and takes 2-4 secs time for



processing once the vehicle clears the scanner area. The PC has 1 TB SSD which can store up to 1 Million scanned images for date availability and retrieval.

### OTHER FEATURES:

A watch list in software helps in alerting when the license plates entered in the list, are detected by the Multi-Functional camera (LPR).

Each vehicle entry into premise has its details recorded, which includes license plate, undercarriage image and vehicle image. If a license plate number of a recorded vehicle is used by another vehicle make and model, then the system alerts the same, automatically.

### PERFORMANCE SPECIFICATIONS-

System Description - The UVSS shall capture clear images of the underside of the vehicle at 2 different angles – 60 degrees to the front and 60 degrees to the back. Once captured the software shall automatically detect any foreign object within 4 seconds and automatically place a red ring around the foreign object enabling the guard

to process the vehicle quickly and effectively, achieving all of the required security functionality of Automatic Foreign Object Detection (AFOD).

### UVSS System Performance

The system must be capable of automatically identifying a reference image of the same or similar vehicle for automatic comparison in the system database, based solely on the vehicles undercarriage characteristics and not by way of a license plate or RFID tag or any other vehicle identifier.

The system must be capable of automatically identifying any change or difference between a newly scanned vehicle's undercarriage and the undercarriage of the reference image of the same or similar vehicle without the intervention of a system operator and regardless of the vehicle speed up to 35 kph.

All changes or differences identified by the system must be automatically highlighted by the system on the system monitor without operator intervention. The system must do the comparison, not the operator.

The system must produce two composite images of the complete undercarriage of a vehicle and not be sensitive to speed up to 35 kph. Of the two contemporaneous views, one must look forward at ~60° and one backward at ~60° from the one area scan camera. Single images with a 90-degree viewing angle are specifically non-qualifying technologies

The system must be capable of identifying each vehicle's make and model based solely on the vehicles undercarriage image and/or plate number.

The scanner must contain an Area Scan camera capable of operating at a minimum of 200 frames per second.

The Area Scan Image Processing technology must allow images to be normalized or displayed with minimal distortion, regardless of the speed of the vehicles up to 35 kph. Running video and line scan camera technologies are specifically non-qualifying technologies

The Scanner should be Monochrome only. Color scanners are non-qualified because, Color scanning reduces contrast that computers rely on to assist in identifying change and also undercarriages (chassis) are mainly grey, so no use of color scanning as it adds nothing to automatic inspection systems and it reduces performance,

instead.

The system allows for a vehicle to stop on top of the scanner for up to 10 seconds without changing the quality of the undercarriage images or the system's ability to identify any change to the undercarriage.

The scanner shall be IP68 rated (International Protection Rating).

Vehicle make and model of all cars shall be automatically detected and identified.

The embedded vault must be made of hot dipped galvanized steel and include access holes for cable conduit and drain piping. The vault lid must be a minimum of 20mm thick to protect the scanner and light rails and be capable of being affixed to the vault via counter sunk bolts.

The system must be capable of processing a vehicle within 3-4 seconds of the vehicle clearing the embedded scanner.

The system must contain a self-cleaning water sprayer to wash the system down on a preset time basis or as required by the operator.

The under-vehicle scanners shall provide a centralized server solution where there are multiple under vehicle scanners.

The system shall have an automatic license plate camera that is fully integrated with the automatic under vehicle inspection system with a 98% probability of detection and shall read English styled characters and numbers

The system shall be provided with Scene image capture and License plate capture facility, using ONE camera

The System shall be provided with Traffic Lights.

#### **UVSS SYSTEM SOFTWARE**

The system must contain software that allows for digital stitching of a vehicle in continuous motion to create consistent high-resolution digital images regardless of vehicle speed up to 35 kph.

The system must contain software that includes digital image algorithms that will allow the system to automatically match a scanned vehicle undercarriage image with the same or similar vehicle undercarriage image contained in the system database without the use of a license platerreader or RFID.

The system must contain software that will automatically detect foreign objects or changes to a vehicle undercarriage and be capable of providing both visual and audible alerts on the operator terminal.

The system must contain software that provides a bi-directional, contemporaneous dual inspection view (forward and backward) of a vehicle undercarriage.

The system must contain Windows SQL database software.

The system must contain software that provides for remote access and servicing via the Internet from anywhere in the world.

The system must contain software that provides for a “Watch List” and the ability to check a license plate against a vehicle undercarriage and alert when the two don’t match or have changed.

The system must contain software that allows for the system GUI and soft keyboard to be changed to any language.

#### UVSS SYSTEM PHYSICAL PROPERTIES

Top Plate: ~1240mm long x 1140 meters wide x 20mm thick.

Vault: ~1370 mm long x 1140 mm wide x 160 mm deep

Environmental:

IP68 Rated.

Scanner:

Dimensions: 70 cm wide x 12 cm high x 1-meter-long, 1 piece

Weight: 14 kg (approx.)

Power Source: 110 – 230 VAC 50/60 Hz

Environmental: Sealed unit to protect against heat, dust, water and vibration.

Temperature range: -35c to 70c

Humidity range: 0 to 98% relative, non-condensing

Viewing Angle/s: Two high resolution images at 60° angles (one forward and one backward looking)

Scanning Camera:

Gigabit Area Scan camera operating at a minimum of 300 FPS

Undercarriage illumination: 2 x 102cm strip of High Performance programmable LEDs- matched to scanner optimal light wavelength.

#### UVSS System Performance Properties

Max Vehicle Length: Not less than 25 meters’ standard

Vehicle Width: Not less than 2.75 meters’ standard

Vehicle Weight: Not less than 30-ton axel weight



Max Vehicle Speed: 35 kph

Operational Range: 100 meters stand off from embedded scanning unit to remote operator terminal with CAT6

cable - 15 KM with Fiber Optic or Wireless options.

Vehicle License Plate: Automatic plate reader with manual operator plate number input if required.

Networking: System must be able to operate in either a standalone or networked environment and be capable of operating a Distributed Database.

System Maintenance: The system must be designed for fast, simple replacement of components and diagnostics through remote access and control via secure socket Internet connection to facilitate efficient operational time availability.

System Manuals: The system must come complete with assembly/installation and operating manuals.

## 2. CANTILEVER AUTOMATED GATE TECHNICAL SPECIFICATION

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**MAKES: GUNNEBO/CHEMEY/A1 FENCE/MECHATRONICS/HERAS**

### **Design Brief:**

Since we have 2 sets of entry/exit gates we will require 4 nos. in total

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

### **Gate Specifications**

|                                 |   |   |
|---------------------------------|---|---|
| <b>Gate Type</b>                | - | <u>Automated Cantilever Gate</u>              |
| <b>Clear opening</b>            | - | 6.6.m ( O/O)                                  |
| <b>Gate Height</b>              | - | 2.2 m (From GL to top of Gate Frame)          |
| <b>Infill</b>                   | - | 358   |
| <b>Material of Construction</b> | - | Mild Steel pipes which are hot dip galvanized |
| <b>Finish of Gate</b>           | - | TPC Coated Gate                               |

**Mounting type of gate** - Base Plate  
**Mounted RAL Shade of Gate** - Green 6005/As per Client/Architect/Consultant

**Gate Frame**

**Section Type of Frame & Gate Brace** - Square Hollow Section (SHS) **Section**

**Dimensions of Gate Frame** - SHS 120x80mm ( Top & bottom) **Section Dimensions**

**of Gate Frame** - SHS 80x80mm ( Side)

**Section Thickness Gate Frame & Gate Brace** - 3mm+/- 10%

**No. of Parts in Gate Height** - 1

**No. of Parts in Gate Length** - 1

**No. of Vertical Braces** - 3 Per Frame ( SHS 40 x 40x 2)

**Material of Construction** - Mild Steel pipes which are hot dip galvanized

**Coating** - Hot dip galvanized with min 350 GSM coating as per IS 4736

**Finish** - Thermoplastic powder coating ,The welded panels are subsequently treated in a 7 tank pretreatment process and then coated in an automated controlled booth. The whole process is verified and approved by Axalta. Coating thickness of min 200 Microns is achieved in powder coat .

**Colour** - Green 6005

**Coating Standard** - EN 10245-1/ IS 13871

**Coating Life** - Thermoplastic coating will withstand 1440 Hours of salt spray test. (Type Test Certificate from a competent authority will be provided along with material) **Coating make** - Axalta or equivalent

**Gate Post**

**Section Type of Gate Post** - Square Hollow Section (SHS) **Section**

**Dimensions of Gate Post** - SHS 80x80mm **Section Thickness**

**Gate Post** - 3mm+/- 10%

**Gate post type** - Inverted U shaped post

**Material of Construction** - Mild Steel pipes which are hot dip galvanized.

**Coating** - Hot dip galvanized with min 350 GSM coating as per IS 4736

**Finish** - Thermoplastic powder coating ,The welded panels are subsequently treated in a 7 tank pretreatment process and then coated in an automated controlled booth. The whole process is verified and approved by Axalta . Coating thickness of min 200 Microns is achieved in powder coat .

**Colour** - Green 6005

**Coating Standard** - EN 10245-1/ IS 13871

**Coating Life** - Powder coating will withstand 1440 Hours of salt spray test. (Type Test Certificate from a competent authority will be provided along with material)

**Coating make** - Axalta or equivalent

**Gate Infill - 358**

**Gate Infill - 358 weld mesh**

**Mesh Size** - 12.7 mm X 76.2mm

**Mesh Wire** - Minimum Mass of Zinc Coating 40 GSM

**Wire Dia before coating.** - 4 mm (+/- 0.06mm)

**Tensile Strength of wire** - Min 550 N/sq.mm

**Coating Standard** - EN 10245-1/ IS 13871

**Coating Life** - Powder coating will withstand 1440 Hours of salt spray test. (Type Test Certificate from a competent authority will be provided along with material)

**Coating make** - Axalta or equivalent

**Colour** - Green 6005/As per Client/Architect/Consultant

**Imported Accessories**

GALVANISED TRACK - 6 M - 2 nos

Hanger for cantilever gate with steel rollers mounted on ball bearings – 2 nos

GI End guide - required for resting the gate. One each on either end of the gate - 2 nos

End wheel - required for resting the gate. One each on either end of the gate - 2 nos

UPPER GUIDE - SCREW-TYPE MANTION - 1nos

**Gate automation:**

**Input voltage** - 90V– 240V AC  $\pm 10\%$ , 50Hz

**Motor voltage** - 12V DC

**Motor power supply** - Battery-driven (standard capacity - 12V 5Ah)

**Operator push force:**

**Gate Force Rated** - 17 kgs

**Gate mass** - maximum 500kg

**Gate speed** - 22 m/min

**Operations in standby with standard battery Half day** - 150 cycles

**Full day** - 55 cycles

**Collision sensing** - Electronic

**3. TECHNICAL SPECIFICATIONS FOR GATE BOOM BARRIER (OEM MAF required)**

**MAKES: MAGNETIC-ACCESS-L/KABA(ELKA)-P 5000/FAAC-B680H/AUTOMATIC-BL 229/SKIDATA-BARRIER.GATE**

**Design Brief:**

Since there are 2 set of entry exit gates we will require 8 nos. of 3 to 3.5 meters boom barrier as site requirement and 2 each at one gate each.

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

The need of security is imperative right from the first contact at the premises entry. This can be proving very important as its not only the user but also the vehicle that enters.

The boom barriers will help us to monitor and control the movement of a vehicle, or a person by extension through proper authorization. This will help better control of traffic at entrance and exit positions, convenience & enhanced security 24/7

A vehicle access barrier shall mean a rising boom barrier that shall open in case of an impulse with the use of a valid smart card. The barrier shall close either after the vehicle has passed or after an adjustable hold-open time in case the vehicle chooses not to pass through. Appropriate sensors shall be used for this purpose. It shall meet the following specifications.

Vehicles arriving at the premises will be stopped at the gate. Authorized person/visitor or vehicle will be given access based on his registered privilege through access control or manual register. The barrier will open and the car will be given entry. The car passes the barrier safely as it is monitored by loop detector and safety beam and then barrier closes again. The process will happen every time a new vehicle enters or exit the premises

3 Mtr length boom barriers on either sides of the entry gate and exit gate put together in total 4 nos. Also the entrance to the basement will be monitored and controlled by a boom barrier. The overall scheme will have simple UHF parking readers and UHF tags on the authorized vehicles for ease of parking vehicles.

The security team at the entry/exit will have button operation for open/close of all boom barriers for better management. The same will be integrated with the UVSS system, Automatic Bollards for smooth parking in designated spaces in the building compound or the parking basement.

| SR. No. | Item        | Description                         |
|---------|-------------|-------------------------------------|
| 1       | Application | Outdoor                             |
| 2       | IP Rating   | 54                                  |
| 3       | Housing     | Barrier Housing Unit: Powder Coated |

|    |                                  |   |
|----|----------------------------------|---|
|    |                                  | Boom: Powder Coated White RAL 9010 with Red reflective strips.  |
| 4  | Housing Dimension                | Modular   |
| 5  | Housing Material Of Construction | All Aluminium Housing with Base frame in SS-304 for high protection against corrosion.  |
| 6  | Protection                       | All Housing and internal parts will be rust & corrosion free metals or alloys of high strength with suitable Epoxy coating as applicable.   |
| 7  | Housing Dimension (W X D X H)    | 315mm X 360mm X 915mm approximately   |
| 8  | Boom Specifications              | The Booms shall be extruded aluminium with octagonal profile (straight/articulated) 100mm. X 55mm. X 1.6 mm. shall be the structure of the profile/ Alternatively the boom may also be offered as extruded aluminum with round profile of dia 74 mm X 1.4 mm . 8 /10 meter booms may be supplied as two pieces joined together .The extension dimensions shall match the main boom length as per manufacturers design . |
| 9  | Intelligence                     | The barrier shall use a Blockable DC High Torque Drive in combination with CAN bus communication standard interfaced Controller. It shall offer LCD Display & Graphic User Interface for easy control setting. Possibility for integration via standard user interfaces.  |
| 10 | Digital Inputs                   | Minimum 8   |
| 11 | Digital Outputs                  | Minimum 4   |
| 12 | RelayOutputs                     | At least 6  |
| 13 | Compliance & Safety              | Compliance to CE.<br>Adherence to Safety Requirements of the EMC Directive 2004/108/EC,<br>Low Voltage Directive 2006/95/EC and<br>The basic requirements of the Machinery Directive 2006/42/EC   |
| 14 | Power Supply                     | 230+/- 10% VAC, 50 Hz.  |
| 15 | Maximum Power Consumption        | Not More than 100 watts   |
| 16 | Opening & Closing Time           | 1.3 seconds for Boom Length up to 3.5 Meters<br>4 seconds for Boom Length Between 3.5 to 6 Meters   |
| 17 | Operating Temperature            | -30 Degree Celsius to + 50 Degree Celsius   |

|    |                         |   |
|----|-------------------------|---|
| 18 | Safety                  | S/W for Detection of Presence of Vehicle in Loop or in the path of Infrared Safety Sensors available. Loops or Sensors to be used to prevent barriers from closing on the vehicle.                                      |
| 19 | Duty Cycle              | 100%  |
| 20 | Integration             | Shall function in integration with Smart cards based access control systems etc.<br><b>Should have provision to connect the Automatic Bollard Interface Circuit in case of an Intruder Vehicle hits the Barrier Arm</b> |
| 21 | Performance Requirement | MCBF- 10 Mil Cycles<br>MTBF- 50,000 Hours<br>MTTR- 30 Minutes   |
| 22 | Certificates Required   | TUV certificate For Opening & Closing time<br>ISO Certificate of the Company<br>Certification for Ingress Protection<br>EMC Test report   |

**4. K4 RATED AUTOMATIC BOLLARDS FOR ENTRY GATES (OEM MAF required)**

**MAKES: FAAC-JS48-HA/GUNNEBO(ELKOSTA)M30/P1/ ATG ACCESS-SP1200/AUTOMATIC-RB M50\_1200/PILOMAT-M30/1200**

**Design Brief:**

**i. Under Vehicle Scanning System**

a. To be installed at the 2 entrance gates, total 2 nos.

**ii. Cantilever Technology MS Gate and Gate Automation**

a. To be installed for entry and exit gates of 6 to 6.5 mts as per site, total 4 nos.

**iii. Boom Barriers**

a. 2 nos. of 3 to 3.5 mts (as per site requirement) boom barriers to be installed for each entry and exit gates. So total 4 X 2 = 8 nos.

b. 1 no. will be installed for the basement entrance

**iv. Automatic Bollards**

a. 4 nos. of K4 automatic bollards as 1 set to be installed at 2 entry gates- total 2 sets.

Since there are 2 set of entry gates we will require 8 nos. of automatic retractable bollards 4nos. at each entry gate.

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

A set of 4 nos. Automatic retractable hydraulic bollards will be installed after the UVSS, Cantilever technology MS powder coated automated gates and boom barriers and should deter any incoming vehicles to cross or gain access without proper authorization and help protect the premises from any potential threat. Looking at the importance of the building we have proposed 3 sets of bollards at entry and exit gates

They will be operated on a command by authorized personnel or through automatic commands and should simply be lowered to enable vehicles to circulate freely and can be integrated with long range readers & with the proposed access control system.

A Single bollard should employ a cylinder with a Minimum height 800mm off ground, having diameter 275mm, made of SJ235JR EN 10219 steel (Minimum thickness of 12,5mm), with surface treatment in anti-corrosive cataphoresis and polyester powder painted, or of stainless steel AISI 316L (with Minimum thickness 12mm), with satin finishing for the rash environments.

The support structure should be in reinforced steel and the bollard and the support structure drop into a pit unit that sits in the foundation for easy installation. All internal fixing frames for cables, sensors, etc., are made of stainless steel, to prevent corrosion.

The protection rate of the hydraulic unit must be of Minimum IP67.

Bollard speed on normal duty: Rising Time 8s / Lowering Time 4,5s.

Cylinder above ground is visible on all environment conditions, having a 55mm high reflecting strip all around the cylinder itself, as well as LED lights that flash when bollard moves and stay permanently ON when upraised.

These Bollard systems of Two Numbers should be designed to stop a vehicle weighing 6.800 kg, running at 50Km / hour and having capability to adsorb at least an energy of 673.000 Joules as defined in accordance to ASTM F2656-07 standards.

The above performance is obtained in installations, realised according to the supplied manual.

Hydraulic drive unit should be integrated into the bollard cylinder and consists of a pump unit, powered by an electric motor (voltage 230AC) able to grant suitable operation.

In case of power failure while the bollard is upraised, the cylinder remains in position. A

mechanical valve to lower manually the cylinder is accessible with dedicated key on the cylinder head, but protected by an anti-burglar armored lock. Hydraulic unit should be supplied with a “Gentle Stop” function to slow down the movement in the last 3cm of the opening (lowering) movement to reduce the stress of the impact.

#### INSTALLATION COMPONENTS

For ease of installations, these bollards should be installed in a dedicated modular pit complete with counter-frame.

#### CONTROL BOARD

It's supplied with 230VAC voltage – 50/60Hz. It's Equipped with a built-in dual loop detector and includes programmable logic and provides all commands for normal operation. To link the bollard and the control board, a 16+1 conductors -min 1,5mm section- cable shall be employed.

#### OPERATING TEMPERATURE AND WEATHER CONDITIONS:

Bollard shall be fully operational within following conditions:

Operating temperature -15 °C / +55 °C

Operating temperature with heater (accessory) -25 °C / +55 °C

| Features                         | Parameter  |
|----------------------------------|--|
| Drive                            | Hydraulic unit   |
| Cylinder height from ground [mm] | 800-1000   |
| Cylinder diameter [mm]           | 275  |
| Cylinder material                | Steel SJ235JR EN 10219<br>(12,5mm thick)                                   |
| Cylinder surface                 | Cataphoresis and polyester powder painted<br>Dark grey metallized RAL 7021 |
| Head                             | Aluminum RAL 9006  |
| Rising time [s]                  | ~8   |
| Lowering time [s]                | ~4,5   |
| Emergency automatic lowering     | YES  |
| Emergency lowering time [s]      | ~2   |
| Safety pressure switch           | YES  |
| Emergency manual lowering        | Accessible by key (armored lock)   |
| Gentle Stop function             | YES  |
| Power supply                     | 230V ~ 50(60Hz)  |
| Max power consumption [W]        | 575  |
| Hydraulic unit protection Index  | IP67   |
| Suggested Usage                  | Intensive  |



|  |   |
|--|---|
| Reflective strip height [mm]                         | 55  |
| Reflective strip colour                              | Orange  |
| Impact resistance [J]                                | 85.000  |
| Break-in resistance in single unit configuration [J] | 287.000   |
| Break-in resistance in two units configuration [J]   | (673.000J)  |
| Total weight [kg]                                    | 220   |
| Pit weight [kg]                                      | 60  |
| Bollard weight [kg]                                  | 160   |
| Operating temperature                                | -15 °C / +55 °C   |
| Operating temperature with heater (accessory)        | -25 °C / +55 °C   |
| Underground product dimensions WxDxH [mm]            | 560 x 560 x 1.220   |
| Required excavation dimensions WxDxH [mm]            | 1.000 x 1.000 x 1.540   |
| Supply cable   | 1.5 sq mm, Shielded   |
| Max cable length [m]                                 | • 50 to 100   |
| Resistance Force: Break-in: 673.000 J according to:  | PAS 68: Impact test specifications for vehicle security barrier systems<br>IWA 14-1: Vehicle Security Barriers<br>1: Performance requirement, vehicle impact test method and performance rating<br>ASTM F2656: Standard Test Method for Vehicle Crash Testing of Perimeter Barriers |

**TECHNICAL SPECIFICATIONS FOR FOLLOWING SYSTEMS FOR INDEPENDENT DELUGE FIRE PROTECTION SYSTEM FOR AUTOMATED PARKING SYSTEM IN PODIUM FLOORS 1<sup>ST</sup> TO 13<sup>TH</sup>**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**Design Brief:**

The proposed below systems are applicable to automated parking floors from basement, 1<sup>st</sup> to 13<sup>th</sup> floors

a. All below mentioned systems will seamlessly work between themselves as independent system but will also share information with the building centralized systems

The automated parking floors will be also be protected by the following additional systems

**1. Intelligent Addressable Fire Alarm (MAF Required. Same make as the building)**

1 loop expandable to 2 loop Intelligent Addressable fire alarm in one with the technical specifications as mentioned above this will be used for the addressable heat sensing cable system installed to monitor each parking slot. This fire panel should be on the same protocol as the building Fire Alarm System and should be integrated with the Automated parking BMS and the building BMS system

**2. Line Type Heat Detector Sensing Cable –Intelligent Addressable (MAF Required. Same make as the building)**

For monitoring of **each and every individual parking slot** for basement+ 13 podium automated parking floors (total 98+455=553 nos.) The hermetically sealed sensor cable contains small hybrid circuits (sensor) which, to be placed at every 4 or 5 meters intervals to ensure that **each and every parking slot will have their individual Heat Detector**. The hybrids, which contain an integrated circuit with a defined address and a semiconductor temperature sensor, are electrically connected by a flat flexible cable. All the data from sensor element encapsulated in sensor cable is processed in the microprocessor-based controller having important LED indications and seamlessly integrate with the above Fire Alarm Panel communication protocol.

The total length of the system may be up to a minimum of 350 meters x 2 runs meters or 99 + 99 sensors whichever is earlier per controller.

**3. ULTRASONIC RODENT REPELLENT SYSTEM (MAF Required. Same make as the building)**

Each **individual parking slot** to be protected by 1 no. ultrasonic rodent repellent transducer with on each floor to protect the cars from rodent menace **for basement+ 13 podium automated parking floors (total 98+455=553 nos.)**. Approx each floor will require 40 transducers and 2 nos. master controller with 128X64 Graphic LCD DISPLAY which will be networked and connected to centralized software for better management. No looping of transducers.

**Please refer the matrix for detailed floor wise break-up and tender technical specifications**

**4. Building Management System (MAF Required. Same make as the building)**

Latest Version Server-Client BMS Software as specified for real-time processing of all IO points being mapped into the system by TCP/IP PLC/DDC Controllers and Protocol Integrators for monitoring of valves and sensor monitoring of the deluge fire protection system including the above Fire Alarm, Heat Sensing cable and Ultrasonic rodent repellent. Please consider minimum **1000 software tags** as per the make to ensure complete monitoring and control of the system. The same system has to seamlessly integrate in the building BMS.

The 32 bit ddc controller panels should have necessary IO and Modbus/bacnet port capacity to the complete requirements for basement + 13 automated parking podium floors.

**DDC Panel specifications:**

DDC Controller 32 bit dual/single core multifunction processor having min 600 MHz upto 1.2 GHz Processor, internal flash memory of minimum 64Mb upto 1 Gb for programming process applications and data storage, programming Files, 3D flash, min.1 USB 3.0 port, 24 V DC power supply, with MS Enclosure IP40 rated and required accessories. The DDC controller having non-proprietary web server(Internet Explorer, Google Chrome) providing data of the entire connected systems and diagnostics and health status. The DDC/PLC shall have LED display/indicators showing Running status, Error status, IO module status. The DDC/PLC shall be certified with Achilles Level 2 Certification/equivalent for protection from cyberattack. The backplate should be 100% wired with necessary transformer, SMPS power supply, 5A socket & small light and tamperproof door and lock. (Minimum base IO of 28-32. Universal Input/Outputs will maximum the usage with 20% spare capacity)

**TECHNICAL SPECIFICATIONS FOR AV SYSTEMS**

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

**MAKES: AS MENTIONED IN TENDER LIST OF MAKES**

**Design Brief:**

**AUDIO-VISUAL SYSTEMS**

a. These systems are applicable for the occupied floors on Ground, 14<sup>th</sup> to 19<sup>th</sup> floor and following areas

1. 18 Pax Conference Rooms

2. 10 Pax Conference Rooms
3. Meeting Cubicles
4. Deputy Chief Engineer Cabins
5. Executive Engineers Cabin

**b. Please refer the matrix for detailed floor wise break-up and tender technical specifications**

MCGM MTL has estimated quantities and areas where a comprehensive and simple AV systems as per their functional requirements. The bidder shall quote for the complete AV systems for the 18 Pax and 10 Pax Conference Rooms, Meeting Cubicals, Deputy Chief Engineers, Executive Engineers for their office at Worli, Mumbai. The scope includes positioning of various AV components, integration with other facilities, cable routing for optimum performance keeping aesthetics of the Conference Room in mind with the items requisitioned. Any technical deviations for items or its accessories required for complete features and functionality shall be clearly specified and quoted.

- 1 The items quoted shall meet or exceed the technical and functional requirement specified.
- 2 Make & Model of the item quoted against each line item is required to be clearly mentioned by the bidder.
- 3 MAF (Manufacturer Authorisation Form) is compulsory from OEM's to ensure technical and configuration certification and after sales service and warranty support
4. Bidder shall ensure completeness, correctness w.r.t. specifications of the item before delivery of item at site. Bidder is liable to replace the item/items in case if required to comply with the intent of the scope of work.
7. Installation, Commissioning & Testing of all the items supplied shall be carried out as per the detail functional requirements, technical specifications and instruction of Engineer-In-Charge (EIC).
8. On site Training and Documentations as per the details given in the technical specifications and OEM manuals to be arranged by Bidder.
9. Bidders shall quote the items rates inclusive of minimum three year onsite comprehensive warranty.

10. Bidder should have enough technically certified technicians/engineers to carry out such a large setup over a long period of execution.

A good audio-visual setup will greatly enhance collaboration and productivity in conference rooms. With the right AV solutions, team members will be able to communicate effectively, share ideas, and make decisions in real-time. Video conferencing setup allows remote teams to participate in meetings and discussions as if they were physically present in the room saving time and energy.

**All above panels will seamlessly integrate with the Building Management System over Modbus/Bacnet protocols and comply with the tender makes and specifications.**

**Include all necessary items required to make the system complete and working at all times**

**(A) 18 Pax Conference Rooms**

- Conference Room will have a 85” display with ceiling tile microphone for speech reinforcement during VC & ceiling speakers for audio reinforcement.
- A user can connect his laptop and get access of ceiling microphone & speakers via USB enabling to place a VC call via Laptop.
- The room will be fully automated enabling control of all room devices via IPAd & touch panel.

**Estimated Qty:**

| <b><u>SR. No.</u></b> | <b><u>Description</u></b>                                       | <b><u>Qty</u></b> |
|-----------------------|---|-------------------|
| 1.                    | 2. 85” 4k Professional Display                                  | 1                 |
| 3.                    | 4. Heavy-Duty Full Motion TV wall Mount for above display<br>5. | 1                 |
| 6.                    | 7. 20X Optical Zoom FHD camera                                  | 1                 |
| 8.                    | 9. Ceiling Tile Microphone                                      | 2                 |
| 10.                   | 11. 90W PoE++ power supply kit for Tile Microphone              | 2                 |
| 12.                   | 13. Surface Mount Kit for Tile Microphone                       | 2                 |
| 14.                   | 15. Digital Signal Processor                                    | 1                 |
| 16.                   | 17. 4 Channel Power Amplifier                                   | 1                 |
| 18.                   | 19. Ceiling Speakers  | 3 Pairs           |

|     |   |   |
|-----|---|---|
| 20. | 21. Cable Cubby with 2 x Universal Power,1 x USB-A Mobile Charger,1 x USB-C Mobile Charger,1 x Type C USB 3.2 Gen 1,2 x CAT 6 Network/RJ-45 | 2 |
| 22. | 23. 4X2 UC Switcher   | 1 |
| 24. | 25. Under desk Mounting plate for above Switcher  | 1 |
| 26. | 27. Power Supply for above switcher   | 1 |
| 28. | 29. 2 metre USB Type C cable for 100W/5A PD Charging  | 2 |
| 30. | 31. 10 metre Active Extension cable   | 2 |
| 32. | 33. 2 metre USB Type C cable  | 2 |
| 34. | 35. High-Speed HDMI Cable10.70m   | 1 |
| 36. | 37. Control Processor   | 1 |
| 38. | 39. App for Touch Panel   | 1 |
| 40. | 41. Ipad with 10.2"   | 1 |
| 42. | 43. Wall mount kit with charging for Apple iPad   | 1 |
| 44. | 45. Wired Table top Touch Panel   | 1 |
| 46. | 47. 4 Channel Universal Dimmer  | 1 |
| 48. | 49. Wireless Router   | 1 |
| 50. | 51. Wireless keypad , 7 button keypad   | 2 |
| 52. | 53. 4-channel ON/OFF relay based switching  | 1 |
| 54. | 55. 2 Channel DALI Module with 128 addresses  | 1 |
| 56. | 57. Wireless communication module to communicate between Controller & Keypads   | 1 |
| 58. | 59. Interface between above controllers & automation processor  | 1 |
| 60. | 61. Lighting & Ballast in Client Scope  | 1 |
| 62. | 63. 8 port Gigabit PoE Smart Switch   | 1 |
| 64. | 65. AV Equipment rack   | 1 |
| 66. | 67. Cables connectors and accessories   | 1 |
| 68. | 69. Installation and Commissioning Charges  | 1 |
| 70. | 71. Programming Charges   | 1 |

**Technical Specification:**

**1. 85" 4K UHD Display: (MAF Required)  
 Make: LG/Samsung/Christie**

| Parameter                             | Technical Specifications   | Compliance (Yes/No) |
|---------------------------------------|--|---------------------|
| Panel Technology                      | IPS  |                     |
| Display Size - Diagonal (inches)      | Min. 85" or more   |                     |
| Resolution                            | 3840 X 2160 (UHD)  |                     |
| Native Contrast Ratio                 | 4000:1 or higher   |                     |
| Glass Haze                            | 2%   |                     |
| Response Time (G to G)                | 6ms or lower   |                     |
| Brightness (Typ.) in Nits             | 350 Nits or higher   |                     |
| Operation Hours (Hours / Days)        | 24/7   |                     |
| Input / Output Ports                  | <b>VIDEO INPUT:</b> HDMI X 2 nos.<br><b>USB INPUT:</b> USB X 2 nos |                     |
| Communication port                    | RS232C, RJ45   |                     |
| Power Supply Requirement              | AC 100-240V~, 50/60Hz  |                     |
| Max Power consumption (W/h)           | 198W Max or less   |                     |
| Power Consumption in Sleep & Off mode | 0.5W or less   |                     |
| Typical Power consumption (W/h)       | 130W or Lower  |                     |
| Operating Temperature                 | 0°C~ 40°C or better  |                     |
| OEM Warranty                          | 3 Years by default OEM Warranty                                    |                     |

**2. Mounting Bracket for 85" Display )  
 Make: Lumi/B-tech/Chief**

| Parameter     | Technical Specifications                                  | Compliance (Yes/No) |
|---------------|---|---------------------|
| Type          | Swivel wall mount   |                     |
| Compatibility | Must be suggested brand by OEM As per the Weight Capacity |                     |
| Colour        | Black   |                     |

**3 Camera: (MAF Required)**  
**Makes: Lumens/Clearone/Aver**

| Parameter              | Technical Specifications  | Compliance (Yes/No) |
|------------------------|---|---------------------|
| Video System           | HD: 1080p60,1080p50,1080i60,1080i50<br>1080p30,1080p25,720p60,720p50,720p30<br>720p25   |                     |
| SENSOR                 | 1/2.8 inch, CMOS  |                     |
| Effective Pixel:       | 2.07M   |                     |
| Scanning Mode          | Progressive   |                     |
| Lens                   | 20x, f4.4mm – 88.5mm, f1.8 – f2.8   |                     |
| Optical Zoom           | 20x   |                     |
| Digital Zoom           | 16x   |                     |
| Focus Mode             | Auto Focus  |                     |
| H & V FLIP             | Supported   |                     |
| INPUT/OUTPUT INTERFACE | HD Output: 1 x HDMI: Version 1.3<br>Network Interface: 1 x RJ45: 10M/100M Ethernet Interface<br>Audio Interface:<br>1-Ch 3.5mm Audio Interface, Line In<br>1-Ch 3.5mm Audio Interface, Mic In<br>1-Ch 3.5mm Audio Interface, Line Out<br>USB: 1 x USB 3.0: type B female jack, 1 x USB 2.0: type A female jack<br>Communication: 1 x RS232 In: 8-Pin Min din, Max distance: 30M, Protocols: VISCA/Pelco-D/Pelco-P 1 x RS232 Out: 8- |                     |



|                                    |   |  |
|------------------------------------|---|--|
|                                    | Pin Min din, Max distance: 30M, Protocols: VISCA network use Only, 1 x RS485: Share with RS232 Out, Max distance: 1200M, Protocols: VISCA/Pelco-D/Pelco-P |  |
| <b>Power Supply Requirement</b>    | JEITA type (DC In 12V)  |  |
| <b>Max Power consumption (W/h)</b> | 12W (Max)   |  |
| <b>Operating Temperature</b>       | -10°C – 40°C (14°F - 104°F)   |  |
| <b>Storage Temperature</b>         | -40°C – 60°C (-40°F - 140°F)  |  |
| <b>OEM Warranty</b>                | 3 Years by default OEM Warranty   |  |

3. Ceiling Tile Microphone (MAF Required)

- Makes: ClearOne/Sennheiser/Shure

| Parameter                                  | Technical Specifications   | Compliance (Yes/No) |
|--|--|---------------------|
| <b>Type of Microphone</b>                  | Beamforming mic array technology   |                     |
| <b>True Frequency Invariant Beamformer</b> | Gain Response is unvarying across frequency  |                     |
| <b>Beam widths</b>                         | 35°, 45° and 55° with Frequency Invariance or better   |                     |
| <b>Beamforming Range</b>                   | 100 Hz to 20 KHz or better   |                     |
| <b>Dynamic Range</b>                       | 20 Hz to 20 kHz, > 70 dB or better   |                     |
| <b>Number of Beams</b>                     | Up to 12 Room Patterns: Full Circle/Square, Rectangular, Semi-Circle/Classroom, Custom Beams   |                     |
| <b>Coverage Sizes</b>                      | Customizable coverage patterns starting at 5 ft x 5 ft (25 sq ft area) circular coverage at a mounting height of 7 ft to a maximum coverage of 64 ft x 64 ft (4096 sq ft area) circular coverage at a mounting height of 20 ft |                     |
| <b>Configuration</b>                       | 1) Acoustic Echo Cancellation (AEC) on/off   |                     |

|                              |   |  |
|------------------------------|---|--|
|                              | 2) Noise Cancellation (NC) on/off. Range: 6 to 25 dB depth.<br>3) Automatic Level Control (ALC) on/off.<br>4) Automatic Gain Control (AGC). |  |
| <b>Network Interfaces</b>    | 1 LAN /Ethernet Dante Based with PoE++ power  |  |
| <b>Thermal</b>               | 270 BTU/HR at Max power   |  |
| <b>Operating Temperature</b> | 14 °F/-10 °C to 104 °F/40 °C ambient temperature  |  |
| <b>Compatibility with</b>    | Any Soft Client applications such as Zoom, MS Team, Google Meet, Webex and etc.   |  |
| <b>OEM Warranty</b>          | 3 Years by default OEM Warranty   |  |

- 
- 4. Surface Mount Kit
  - Makes: ClearOne/Sennheiser/Shure

| Parameter               | Technical Specifications                          | Compliance (Yes/No) |
|-------------------------|---|---------------------|
| <b>Product Category</b> | Ceiling mount kit                                 |                     |
| <b>Compatibility</b>    | Compatible & suitable for Ceiling Tile Microphone |                     |
| <b>OEM Warranty</b>     | 3 Years by default OEM Warranty                   |                     |

**6. Digital Signal Processor (MAF Required)**  
 Makes: Xilica/Biamp/Clearone

| Parameter  | Technical Specifications  | Compliance (Yes/No) |
|--|---|---------------------|
| <b>Mic/Line Inputs with AEC and Noise Cancellation</b> | 12 Nos with wide band 20Hz -22KHz Distributed Acoustic Echo Cancellation. This system shall not be a floating point DSP.      |                     |
| <b>Line Outputs</b>                                    | 8 Nos   |                     |
| <b>Input Scalability</b>                               | Shall be able Possible to Expand Multiple Units for connecting more no. of microphones  |                     |
| <b>Mix Minus Digital Expansion Bus</b>                 | Mix Minus Full Duplex 64 Channel Bi Directional bus to support a min of 150ft distance in addition to Dante, Cobranet or AVB. |                     |

|                                 |   |  |
|---------------------------------|---|--|
| <b>Network Audio Features</b>   | Shall be able to upgrade to support Network audio protocols such as Dante, CobraNet ,AVB without changing the hardware. unit in 2 Channel Bidirectional USB audio |  |
| <b>USB Audio</b>                | Built in 2 Channel Bidirectional USB audio  |  |
| <b>Auto Mixer Features Type</b> | First Mic priority based to avoid false gating and avoid tunneling sound and also shall be able to enable or disable this functionality                           |  |
| <b>PA Adaptive</b>              | To avoid false gating of microphone for audio signals routed via speakers   |  |
| <b>Adaptive Ambient</b>         | System shall be able to monitor the ambient sound changes and set the Gating Parameters automatically.  |  |
| <b>Off Attenuation Setting</b>  | User Editable Off Attn Setting Required   |  |
| <b>Noise Cancellation</b>       | Shall support 25 dB Noise cancellation depth  |  |
| <b>Hold Time Setting</b>        | User Editable Hold Time Setting Required  |  |
| <b>LAN and PC Connections</b>   | 1 No RJ 45 PC and LAN Ethernet Connectivity   |  |
| <b>RS 232</b>                   | 1 No x DB9 Connectivity for RS232 Connectivity  |  |
| <b>Built-in GPIO Ports</b>      | 4 Nos GPIO Ports to run external general purpose inputs and outputs for Logic Control   |  |
| <b>Macro Recorder</b>           | Shall be able to create Macros using Recorder as well as Command Lines  |  |
| <b>HTTP Agent</b>               | Internal Webserver to support any java supported browser to be used for control functionality   |  |
| <b>OEM Warranty</b>             | 3 Years by default  |  |

**7. Powered Amplifier (MAF Required)**  
**Make; Xilica/QSC/Clearone**

| Parameter             | Technical Specifications   | Compliance (Yes/No) |
|-----------------------|--|---------------------|
| <b>Amplifier Type</b> | Should be 4 channel amplifier, each channel at 60 watts, class D amplifier |                     |
| <b>Speaker Output</b> | 4 ohm/8 ohm, 70V/100V constant voltage output                              |                     |

|                          |   |  |
|--------------------------|---|--|
| <b>Wattage</b>           | 2*120 W output in bridged<br>4*60 watts@ sensitivity in 4/8 ohm 70V and 100 V |  |
| <b>Input Sensitivity</b> | 20hz to 22Khz @0dBu   |  |
| <b>Rack Size</b>         | Half Rack   |  |
| <b>OEM Warranty</b>      | 3 Years by default  |  |

**8. Ceiling Speaker (MAF Required)**  
 Make: ; Xilica/QSC/Clearone

| Parameter              | Technical Specifications   | Compliance (Yes/No) |
|------------------------|--|---------------------|
| <b>Speaker Type</b>    | Enclosure Material and Finish • ABS, White<br>• Grille: White, magnetic attachment to enclosure<br>Dimensions and Weight • Diameter x height: 235 x 160 mm • Hole cut diameter: 205 mm • 4.85 lbs (2.2 kg) |                     |
| <b>Frequency Range</b> | 50Hz to 20kHz (-10dB).<br>, 107 degrees (-6dB at 10kHz). Sensitivity >91dB (at 1m).  |                     |
| <b>Power</b>           | • 100 V: 7.5 W, 15 W, 30 W, selectable • 70 V: 3.8 W, 7.5 W, 15 W, 30W, selectable • 8 Ω: 60 W   |                     |
| <b>Compliance with</b> | CE, RoHS   |                     |
| <b>OEM Warranty</b>    | 3 Years by default OEM Warranty  |                     |

**9 .Cable Cubby (MAF Required)**  
 Make: AH Mayer/Logic/Kramer

| Parameter           | Technical Specifications  | Compliance (Yes/No) |
|---------------------|---|---------------------|
| <b>Connectivity</b> | 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 2 x HDMI 2.1V, 1 x Type A USB 3.2 Gen 1, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 |                     |
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty   |                     |

9. Switcher (MAF Required)

- Make: Crestron/Extron/Lightware

| Parameter                 | Technical Specifications   | Compliance (Yes/No) |
|---------------------------|--|---------------------|
| <b>Support</b>            | The switcher shall support HDMI 2.0 signal formats   |                     |
| <b>Input/Output</b>       | It should have two HDMI 2.0 along with two USB 3.1 USB type B port & two full-featured USB-C 3.1 Gen 1 input ports and two HDMI 2.0 output port. |                     |
| <b>USB-C Connectivity</b> | It should support USB-C input connectivity for 4K Video, Audio, Data, and Power over a single USB-C connection                                   |                     |
| <b>USB-C Charging</b>     | It should support charging via USB-C up to 100W  |                     |
|                           | The switcher shall provide independent switching of the four input signals.  |                     |
| <b>Audio Output</b>       | The switcher shall have a balanced analogue audio output port for stereo audio deembedding.  |                     |
| <b>Format Support</b>     | The switcher shall support the following signal formats: 7.1 HDMI embedded audio, Dolby TrueHD, and DTS-HD Master Audio 7.1 formats.             |                     |
| <b>USB Complaint</b>      | The switcher shall be USB 3.1 Gen 1, USB 2.0, USB 1.1 compliant  |                     |
| <b>HDCP Complaint</b>     | The switcher shall be HDCP 2.2 compliant.  |                     |
| <b>HDCP Encryption</b>    | Supports the HDMI content with HDCP encryption.  |                     |
| <b>Resolution</b>         | The switcher supports video content and all standard resolutions and frequencies as specified under HDMI up to 4K UHD @60Hz RGB 4:4:4.           |                     |
| <b>Volume Control</b>     | The switcher shall provide adjustable volume on an analogue output port.   |                     |
| <b>EDID Management</b>    | The switcher shall support EDID management for customizable EDID tables.   |                     |

|                            |  |  |
|----------------------------|--|--|
| <b>EDID Resolutions</b>    | The switcher should be able to store a minimum of 100 EDID resolutions.  |  |
| <b>Control Port</b>        | The switcher shall provide a bi-directional RS-232, Ethernet and GPIO port for control.  |  |
| <b>Network</b>             | The switcher shall have multiple Ethernet network configurations fitting various corporate network topologies and IT security standards.                           |  |
| <b>Security Support</b>    | It should support SSH, SSL, and HTTPS for IT security.   |  |
| <b>Sensor Connectivity</b> | . It should have an Occupancy sensor connection (with a 24V power supply)  |  |
| <b>USB Support</b>         | The switcher shall support multiple USB 3.1 Gen 1 (Type A) connectivity for any type of USB devices (Camera, speakerphone, touch monitor, USB-HID devices etc....) |  |
| <b>OEM Warranty</b>        | 3 Years by default OEM Warranty  |  |

10. USB C CABLE (MAF Required) Make: Crestron/Lightware/Extron

| Parameter                 | Technical Specifications                   | Compliance (Yes/No) |
|---------------------------|--|---------------------|
| <b>Connectors</b>         | 2 x USB Full-Featured Type-C™ plug         |                     |
| <b>Maximum Data Speed</b> | 20Gbps (10Gbps/lane)                       |                     |
| <b>Maximum Current</b>    | 5 A  |                     |
| <b>Compatibility</b>      | Compatible with DisplayPort Alternate Mode |                     |
| <b>Pin coating</b>        | Gold-plated                                |                     |
| <b>Length</b>             | 2m   |                     |
| <b>OEM Warranty</b>       | 3 Years by default OEM Warranty            |                     |

11. USB Active Extension Cable (MAF Required)

- Make: Crestron/Lightware/Extron

| Parameter         | Technical Specifications               | Compliance (Yes/No) |
|-------------------|--|---------------------|
| <b>Connectors</b> | 1x USB 3.0 A Male, 1x USB 3.0 A Female |                     |

|                               |                                 |  |
|-------------------------------|---------------------------------|--|
| <b>Maximum Data Speed</b>     | USB 3.0/USB 3.1 Gen 1-5 Gbps    |  |
| <b>Extension Cable Length</b> | 10 m                            |  |
| <b>Jacket Material</b>        | PVC, Black                      |  |
| <b>OEM Warranty</b>           | 3 Years by default OEM Warranty |  |

**12. USB C CABLE (MAF Required)**

- Make: Crestron/Lightware/Extron

| <b>Parameter</b>          | <b>Technical Specifications</b>            | <b>Compliance (Yes/No)</b> |
|---------------------------|--|----------------------------|
| <b>Connectors</b>         | 2 xUSB Full-Featured Type-C™ plug          |                            |
| <b>Maximum Data Speed</b> | 10Gbps (10Gbps/lane)                       |                            |
| <b>Maximum Current</b>    | 3 A  |                            |
| <b>Compatibility</b>      | Compatible with DisplayPort Alternate Mode |                            |
| <b>Pin coating</b>        | Gold-plated                                |                            |
| <b>Length</b>             | 2m   |                            |
| <b>OEM Warranty</b>       | 3 Years by default OEM Warranty            |                            |

**13. HDMI CABLE (MAF Required) Make: Crestron/Lightware/Extron**

| <b>Parameter</b> | <b>Technical Specifications</b>  | <b>Compliance (Yes/No)</b> |
|------------------|--|----------------------------|
| <b>VIDEO</b>     | Max Resolution for 3–15ft (.9–4.6m) lengths: 4K@60Hz (4:4:4)<br>Max Resolution for 25–35ft (7.6–10.7m) lengths: 4K@60 (4:2:0)<br>Max Resolution for 50ft (15.2m) lengths: 1080p<br>Max Data Rate for 3–15ft (.9–4.6m) lengths: 18 Gbps<br>Max Data Rate for 25–35ft (7.6–10.7m) lengths: 8.91 Gbps |                            |

|                     |   |  |
|---------------------|---|--|
| <b>AUDIO</b>        | Supported Audio Formats: Dolby Digital Plus™, Dolby TrueHD™, DTS–HD Master Audio™, DVD Audio, SA–CD   |  |
| <b>PHYSICAL</b>     | HDMI Source: On a male HDMI type A, 24K gold–plated K–Lock connector<br>HDMI Display: On a male HDMI type A, 24K gold–plated K–Lock connector |  |
| <b>CONDUCTORS</b>   | Material: Tinned Copper/Bare Copper 3–35ft (.9–10.7m) lengths: 28AWG (7/0.127)<br>50ft (15.2m) lengths: 26AWG (7/0.160)                       |  |
| <b>OEM Warranty</b> | <b>3 Years by default OEM Warranty</b>  |  |

**14. Control Processor (MAF Required)**

- Makes: Crestron/Extron/AMX

| <b>Parameter</b>            | <b>Technical Specifications</b>   | <b>Compliance (Yes/No)</b> |
|-----------------------------|---|----------------------------|
| <b>Memory</b>               | Memory Card: 8 GB SD, NVRAM: 1 MB, DDRAM: 512 MB, Note: Supports external USB Solid State Drives  |                            |
| <b>Power Consumption</b>    | Active Power Consumption: 4.2 W   |                            |
| <b>RS-232/422/485 Ports</b> | Min. X1 No. 1 nos. 10-position 3.5mm Screw Terminal, NetLinx Port 1, XON/XOFF (transmit on / transmit off), CTS/RTS (clear to send/ready to send), 300 - 115,200 baud |                            |
| <b>RS-232 Port</b>          | Min. x3 Nos. 2-position 3.5mm Screw Terminal, NetLinx Ports 2-4, XON/XOFF (transmit on / transmit off), CTS/RTS (clear to send/ready to send), 300 - 115,200 baud     |                            |



|                             |   |  |
|-----------------------------|---|--|
| <b>Serial Indicator</b>     | Min. x4 nos. sets of LEDs (red/yellow) indicate when serial Ports 1 - 4 are transmitting and receiving data   |  |
| <b>IR/Serial</b>            | Min. x4 nos. 2-position 3.5mm Screw Terminal, 8 IR Transmit / 1-way Serial ports, 8 IR/Serial data signals can be generated simultaneously  |  |
| <b>IR/Serial Indicators</b> | (2) LEDs (red) indicate when each of the IR/Serial ports (11-14) are transmitting control data  |  |
| <b>I/O Channels</b>         | (4) One 6-position 3.5mm Screw Terminal, 4-channel binary I/O port for contact closure with each input being capable of voltage sensing, Channels 1-4   |  |
| <b>I/O Indicator</b>        | Min. x4 nos. LEDs (yellow) indicate each of the I/O channels (1-8) are active   |  |
| <b>Relays</b>               | Min. x4 nos. One 8-position 3.5 mm Screw Terminal, (4) single-pole, single-throw relays, Channels 1-4, Each relay can switch up to 24 VDC or 28 VAC @ 1 A, each relay is independently controlled |  |
| <b>Relay Indicators</b>     | Min. x4 nos. LEDs (red) indicate when each of the relay channels (1-4) are active (closed)  |  |
| <b>OEM Warranty</b>         | 3 Years by default OEM Warranty   |  |

**15. Touch Panel application license**

- Make: Crestron/Extron/AMX

| <b>Parameter</b>      | <b>Technical Specifications</b>                           | <b>Compliance (Yes/No)</b> |
|-----------------------|---|----------------------------|
| <b>App Control</b>    | Launch installed applications directly from Touch Control |                            |
| <b>Multi-Profiles</b> | Dynamically and instantly change connection profiles      |                            |
| <b>OEM Warranty</b>   | 3 Years by default OEM Warranty                           |                            |

**16. Wireless touch Panel with configurable GUI interface**

- Make: Apple/Equivalent

| Parameter           | Technical Specifications  | Compliance (Yes/No) |
|---------------------|---|---------------------|
| Retina Display Size | 25.91 cm / 10.2-inch (diagonal) LED-backlit multi-Touch display with IPS technology |                     |
| Brightness          | Minimum 500 nits  |                     |
| Resolution          | 2160x1620-pixel resolution at 264 pixels per inch (ppi)                             |                     |
| Capacity            | Minimum 64GB  |                     |
| OEM Warranty        | 3 Years by default OEM Warranty   |                     |

#### 17. Docking Station for Ipad

- Makes: IPort/Crestron/Extron

| Parameter                  | Technical Specifications   | Compliance (Yes/No) |
|----------------------------|--|---------------------|
| Charge Case & Stand system | Slim case that docks and charges iPad wirelessly wallmount                 |                     |
| Orientations               | portrait or landscape with magnets that align charging pins automatically. |                     |
| OEM Warranty               | 3 Years by default OEM Warranty  |                     |

#### 19. Wi-Fi Router

Makes: Juniper/Cisco/Aruba

| Parameter                  | Technical Specifications                      | Compliance (Yes/No) |
|----------------------------|---|---------------------|
| Gigabit Ethernet WAN Port  | Minimum 1x 10/100/1000                        |                     |
| Gigabit Ethernet LAN Ports | Minimum 4x 10/100/1000                        |                     |
| Supports                   | WPA, WPA2, and the latest WPA3 Wi-Fi Security |                     |
| OEM Warranty               | 3 Years by default OEM Warranty               |                     |

**20. Wireless Keypad (MAF Require)**

**Make: Lutron/Crestron**

| Parameter                   | Technical Specifications  | Compliance (Yes/No) |
|-----------------------------|---|---------------------|
| <b>Button Configuration</b> | 7 button configuration including dedicated Raise/Lower button in true wireless form     |                     |
| <b>Battery Life</b>         | Battery operated with minimum 8 years battery life                                      |                     |
| <b>Communication</b>        | Communicating to LMS modules and systems on wireless RF protocol within 1 GHz bandwidth |                     |
| <b>OEM Warranty</b>         | 3 Years by default OEM Warranty   |                     |

**21. Relay Controller (MAF Require)**

**Makes: Lutron/Crestron**

| Parameter            | Technical Specifications           | Compliance (Yes/No) |
|----------------------|------------------------------------|---------------------|
| <b>Configuration</b> | Minimum 4 Channel in single module |                     |
| <b>Load</b>          | 5A Total Load                      |                     |
| <b>OEM Warranty</b>  | 3 Years by default OEM Warranty    |                     |

**22. Dali Controller (MAF Require)**

**Makes: Lutron/Crestron**

| Parameter | Technical Specifications | Compliance (Yes/No) |
|-----------|--------------------------|---------------------|
|           |                          |                     |

|                           |   |  |
|---------------------------|---|--|
| <b>Configuration</b>      | DALI control module should have minimum 2 links of DALI with each link capable of addressing 64 DALI address and configurable to 64 groups within the same link |  |
| <b>Load Compatibility</b> | Any type of DALI load like static dim, tunable control drivers like DT6/DT8 can be configured on the same link  |  |
| <b>OEM Warranty</b>       | 3 Years by default OEM Warranty   |  |

**23. Wireless Gateway (MAF Require)**

**Makes: Lutron/Crestron**

| <b>Parameter</b>     | <b>Technical Specifications</b>  | <b>Compliance (Yes/No)</b> |
|----------------------|--|----------------------------|
| <b>Configuration</b> | Wireless gateway operating on less than 1 Ghz Rf capable of connecting to minimum 5 wireless keypads |                            |
| <b>OEM Warranty</b>  | 3 Years by default OEM Warranty  |                            |

**24. Central Control Interface (MAF Require)**

**Makes: Lutron/Crestron**

| <b>Parameter</b>     | <b>Technical Specifications</b>  | <b>Compliance (Yes/No)</b> |
|----------------------|--|----------------------------|
| <b>Configuration</b> | Central control interface should be able to integrate with AV automation device on API for seamless connection |                            |
| <b>OEM Warranty</b>  | 3 Years by default OEM Warranty  |                            |

**25. Require Cables & Connectors and other Accessories.**

| Parameter   | Technical Specifications    | Compliance (Yes/No) |
|---|-----------------------------|---------------------|
| All the Cables and Connectors required to complete the project as per the site conditions | As Per Industrial Standards |                     |

.....

**(B) 12 PAX Meeting Room AV System Description:**

- 12 PAX room will have a 65" display with all in one sound bar (in-built mic & camera) enabling user to connect his laptop & place a VC call or do a wired presentation.

**Estimated Qty:**

| SR. No. | Description   | Qty |
|---------|---|-----|
| 1.      | 72. 65" 4k Display  | 1   |
| 2.      | 73. Heavy-Duty Full Motion TV wall Mount for above display<br>74.   | 1   |
| 3.      | 75. High-quality video soundbar with inbuilt mic & Camera   | 1   |
| 4.      | 76. Cable Cubby with 2 x Universal Power,1 x USB-A Mobile Charger,1 x USB-C Mobile Charger,1 x Type C USB 3.2 Gen 1,2 x CAT 6 Network/RJ-45 | 1   |
| 5.      | 77. 10 metre Active Extension cable   | 1   |
| 6.      | 78. High-Speed HDMI Cable10.70m   | 1   |
| 7.      | 79. Cables connectors and accessories   | 1   |
| 8.      | 80. Installation and Commissioning Charges  | 1   |

**Technical Specification:**

- 65" 4K UHD Display: (MAF Required)**  
**Make: LG/Samsung/Christie**

| Parameter        | Technical Specifications | Compliance (Yes/No) |
|------------------|--------------------------|---------------------|
| Panel Technology | IPS                      |                     |

|  |  |  |
|--|--|--|
| <b>Display Size - Diagonal (inches)</b>          | Min. 65" or more   |  |
| <b>Resolution</b>                                | 3840 X 2160 (UHD)  |  |
| <b>Native Contrast Ratio</b>                     | 4000:1 or higher   |  |
| <b>Glass Haze</b>                                | 2%   |  |
| <b>Response Time (G to G)</b>                    | 6ms or lower   |  |
| <b>Brightness (Typ.) in Nits</b>                 | 350 Nits or higher   |  |
| <b>Operation Hours (Hours / Days)</b>            | 24/7   |  |
| <b>Input / Output Ports</b>                      | <b>VIDEO INPUT:</b> HDMI X 2 nos.<br><b>USB INPUT:</b> USB X 2 nos |  |
| <b>Communication port</b>                        | RS232C, RJ45   |  |
| <b>Power Supply Requirement</b>                  | AC 100-240V~, 50/60Hz  |  |
| <b>Max Power consumption (W/h)</b>               | 198W Max or less   |  |
| <b>Power Consumption in Sleep &amp; Off mode</b> | 0.5W or less   |  |
| <b>Typical Power consumption (W/h)</b>           | 130W or Lower  |  |
| <b>Operating Temperature</b>                     | 0°C~ 40°C or better  |  |
| <b>OEM Warranty</b>                              | 3 Years by default OEM Warranty                                    |  |

**2. Mounting Bracket for 65" Display**  
**Makes: Lumi/B-tech/Chief**

| <b>Parameter</b>     | <b>Technical Specifications</b>                           | <b>Compliance (Yes/No)</b> |
|----------------------|---|----------------------------|
| <b>Type</b>          | Swivel wall mount   |                            |
| <b>Compatibility</b> | Must be suggested brand by OEM As per the Weight Capacity |                            |
| <b>Colour</b>        | Black   |                            |

**3 Cable Cubby (MAF Required)**

Makes: AH Mayer/Logic/Kramer

| Parameter           | Technical Specifications  | Compliance (Yes/No) |
|---------------------|---|---------------------|
| <b>Connectivity</b> | 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 2 x HDMI 2.1V, 1 x Type A USB 3.2 Gen 1, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 |                     |
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty   |                     |

3. All In One Soundbar: (MAF Required)

- Makes: Lumen/Sony/ Clearone

| Parameter                       | Technical Specifications   | Compliance (Yes/No) |
|---------------------------------|--|---------------------|
| <b>CAMERA</b>                   | Auto Framing, automatically frames meeting participants. Max Resolution:4Kp30 • People Tracking: Automatically tracks the active speaker,4K HD Camera, 4x digitalzoo |                     |
| <b>VideoFormats</b>             | 4K30fps,1080p30fps, 720p30fps, etc.  |                     |
| <b>Scanning Mode</b>            | Progressive Scanning   |                     |
| <b>Lens: Focus</b>              | f=2.1mm, HFOV: 110°  |                     |
| <b>Minimal Illumination</b>     | 50 lux   |                     |
| <b>White Balance</b>            | Auto / Manual /One push  |                     |
| <b>Horizontal Angle of View</b> | 110°   |                     |
| <b>Electronic Pan Tilt Zoom</b> | 4x   |                     |
| <b>Microphone</b>               | Four Element MicrophoneArray · Acoustic EchoCancellation · Automatic Noise Reduction · Automatic Gain Control · Pickup Distance: 16 feet                             |                     |
| <b>Speaker</b>                  | Output Power: 20   |                     |
| <b>COMPATIBILITY</b>            | Operating Systems: Windows 10, macOS   |                     |
| <b>INPUT/OUTPUT INTERFACE</b>   | • USB interface: 1xUSB 3.0: Type B, female • 1 x Powerinterface • Security lock slot   |                     |
| <b>OEM Warranty</b>             | 3 Years by default OEM Warranty  |                     |

4. USB Active Extension Cable (MAF Required)

- Makes: Crestron/Lightware/Extron

| Parameter              | Technical Specifications               | Compliance (Yes/No) |
|------------------------|--|---------------------|
| Connectors             | 1x USB 3.0 A Male, 1x USB 3.0 A Female |                     |
| Maximum Data Speed     | USB 3.0/USB 3.1 Gen 1-5 Gbps           |                     |
| Extension Cable Length | 10 m                                   |                     |
| Jacket Material        | PVC, Black                             |                     |
| OEM Warranty           | 3 Years by default OEM Warranty        |                     |

5. HDMI CABLE (MAF Required) Make: Crestron/Lightware/Extron

| Parameter       | Technical Specifications  | Compliance (Yes/No) |
|-----------------|---|---------------------|
| <b>VIDEO</b>    | Max Resolution for 3–15ft (.9–4.6m) lengths: 4K@60Hz (4:4:4)<br>Max Resolution for 25–35ft (7.6–10.7m) lengths: 4K@60 (4:2:0)<br>Max Resolution for 50ft (15.2m) lengths: 1080p<br>Max Data Rate for 3–15ft (.9–4.6m) lengths: 18 Gbps<br>Max Data Rate for 25–35ft (7.6–10.7m) lengths: 8.91 Gbps<br>Max Data Rate for 50ft (15.2m) lengths: 4.95Gbps<br>Supported Color Spaces: RGB, YCbCr, xvYCC, Adobe sRGB, sYCC601, BT.2020<br>HDMI Compliance: HDR, HDCP 2.2, EDID and CEC |                     |
| <b>AUDIO</b>    | Supported Audio Formats: Dolby Digital Plus™, Dolby TrueHD™, DTS–HD Master Audio™, DVD Audio, SA–CD   |                     |
| <b>PHYSICAL</b> | HDMI Source: On a male HDMI type A, 24K gold–plated K–Lock connector  |                     |



|                     |   |  |
|---------------------|---|--|
|                     | HDMI Display: On a male HDMI type A, 24K gold-plated K-Lock connector   |  |
| <b>CONDUCTORS</b>   | Material: Tinned Copper/Bare Copper 3-35ft (.9-10.7m) lengths: 28AWG (7/0.127)<br>50ft (15.2m) lengths: 26AWG (7/0.160) |  |
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty   |  |

**(C) Meeting Cubical:**

- Meeting Cubical will have a 55" display with all in one sound bar (in-built mic & camera) enabling user to connect his laptop & place a VC call or do a wired presentation.

**Estimated Qty:**

| <b>SR. No.</b> | <b>Description</b>  | <b>Qty</b> |
|----------------|---|------------|
| 1.             | 81. 55" 4k Display  | 1          |
| 2.             | 82. Heavy-Duty Full Motion TV wall Mount for above display  | 1          |
| 3.             | 83. High-quality video soundbar with inbuilt mic & Camera   | 1          |
| 4.             | 84. Cable Cubby with 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 | 1          |
| 5.             | 85. 10 metre Active Extension cable   | 1          |
| 6.             | 86. High-Speed HDMI Cable 10.70m  | 1          |
| 7.             | 87. Cables connectors and accessories   | 1          |
| 8.             | 88. Installation and Commissioning Charges  | 1          |

**Technical Specification:**

- 55" 4K UHD Display: (MAF Required)**  
Makes: LG/Samsung/Christie

| <b>Parameter</b>        | <b>Technical Specifications</b> | <b>Compliance (Yes/No)</b> |
|-------------------------|---------------------------------|----------------------------|
| <b>Panel Technology</b> | IPS                             |                            |

|  |  |  |
|--|--|--|
| <b>Display Size - Diagonal (inches)</b>          | Min. 55" or more   |  |
| <b>Resolution</b>                                | 3840 X 2160 (UHD)  |  |
| <b>Native Contrast Ratio</b>                     | 4000:1 or higher   |  |
| <b>Glass Haze</b>                                | 2%   |  |
| <b>Response Time (G to G)</b>                    | 6ms or lower   |  |
| <b>Brightness (Typ.) in Nits</b>                 | 350 Nits or higher   |  |
| <b>Operation Hours (Hours / Days)</b>            | 24/7   |  |
| <b>Input / Output Ports</b>                      | <b>VIDEO INPUT:</b> HDMI X 2 nos.<br><b>USB INPUT:</b> USB X 2 nos |  |
| <b>Communication port</b>                        | RS232C, RJ45   |  |
| <b>Power Supply Requirement</b>                  | AC 100-240V~, 50/60Hz  |  |
| <b>Max Power consumption (W/h)</b>               | 198W Max or less   |  |
| <b>Power Consumption in Sleep &amp; Off mode</b> | 0.5W or less   |  |
| <b>Typical Power consumption (W/h)</b>           | 130W or Lower  |  |
| <b>Operating Temperature</b>                     | 0°C~ 40°C or better  |  |
| <b>OEM Warranty</b>                              | 3 Years by default OEM Warranty                                    |  |

**2. Mounting Bracket for 55" Display**  
 Makes: Lumi/B-tech/Chief

| Parameter            | Technical Specifications                                  | Compliance (Yes/No) |
|----------------------|---|---------------------|
| <b>Type</b>          | Swivel wall mount   |                     |
| <b>Compatibility</b> | Must be suggested brand by OEM As per the Weight Capacity |                     |
| <b>Colour</b>        | Black   |                     |

**3 .Cable Cubby (MAF Required)**  
 Makes: AH Mayer/Logic/Kramer

| Parameter           | Technical Specifications  | Compliance (Yes/No) |
|---------------------|---|---------------------|
| <b>Connectivity</b> | 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 2 x HDMI 2.1V, 1 x Type A USB 3.2 Gen 1, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 |                     |
| <b>OEM Warranty</b> | 4 Years by default OEM Warranty   |                     |

3. All In One Soundbar: (MAF Required)

- Makes: Lumen/Sony/ Clearone

| Parameter                | Technical Specifications   | Compliance (Yes/No) |
|--------------------------|--|---------------------|
| CAMERA                   | Auto Framing, automatically frames meeting participants.<br>Max Resolution: 4Kp30<br>People Tracking: Automatically tracks the active speaker, 4K HD Camera, 4x digitalzoo |                     |
| Video Formats            | 4K30fps, 1080p30fps, 720p30fps, etc.   |                     |
| Scanning Mode            | Progressive Scanning   |                     |
| Lens: Focus              | f=2.1mm, HFOV: 110°  |                     |
| Minimal Illumination     | 50 lux   |                     |
| White Balance            | Auto / Manual / One push   |                     |
| Horizontal Angle of View | 110°   |                     |
| Electronic Pan Tilt Zoom | 4x   |                     |
| Microphone               | Four Element Microphone Array<br>· Acoustic Echo Cancellation<br>· Automatic Noise Reduction<br>· Automatic Gain Control<br>· Pickup Distance: 16 feet                     |                     |
| Speaker                  | Output Power: 20   |                     |
| COMPATIBILITY            | Operating Systems: Windows 10, macOS   |                     |
| INPUT/OUTPUT INTERFACE   | <ul style="list-style-type: none"> <li>• USB interface: 1xUSB 3.0: Type B, female</li> <li>• 1 x Power interface</li> <li>• Security lock slot</li> </ul>                  |                     |

|                     |                                 |  |
|---------------------|---------------------------------|--|
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty |  |
|---------------------|---------------------------------|--|

4. USB Active Extension Cable (MAF Required)

- Makes: Crestron/Lightware/Extron

| Parameter                     | Technical Specifications               | Compliance (Yes/No) |
|-------------------------------|--|---------------------|
| <b>Connectors</b>             | 1x USB 3.0 A Male, 1x USB 3.0 A Female |                     |
| <b>Maximum Data Speed</b>     | USB 3.0/USB 3.1 Gen 1-5 Gbps           |                     |
| <b>Extension Cable Length</b> | 10 m                                   |                     |
| <b>Jacket Material</b>        | PVC, Black                             |                     |
| <b>OEM Warranty</b>           | 3 Years by default OEM Warranty        |                     |

5. HDMI CABLE (MAF Required)

- Makes: Crestron/Lightware/Extron

| Parameter    | Technical Specifications   | Compliance (Yes/No) |
|--------------|--|---------------------|
| <b>VIDEO</b> | Max Resolution for 3–15ft (.9–4.6m) lengths: 4K@60Hz (4:4:4)<br>Max Resolution for 25–35ft (7.6–10.7m) lengths: 4K@60 (4:2:0)<br>Max Resolution for 50ft (15.2m) lengths: 1080p<br>Max Data Rate for 3–15ft (.9–4.6m) lengths: 18 Gbps<br>Max Data Rate for 25–35ft (7.6–10.7m) lengths: 8.91 Gbps<br>Max Data Rate for 50ft (15.2m) lengths: 4.95Gbps<br>Supported Color Spaces: RGB, YCbCr, xvYCC, Adobe sRGB, sYCC601, BT.2020<br>HDMI Compliance: HDR,HDCP 2.2, EDID and CEC |                     |
| <b>AUDIO</b> | Supported Audio Formats: Dolby Digital Plus™, Dolby TrueHD™, DTS–HD MasterAudio™, DVD Audio, SA–CD   |                     |

|                     |   |  |
|---------------------|---|--|
| <b>PHYSICAL</b>     | HDMI Source: On a male HDMI type A, 24K gold-plated K-Lock connector<br>HDMI Display: On a male HDMI type A, 24K gold-plated K-Lock connector |  |
| <b>CONDUCTORS</b>   | Material: Tinned Copper/Bare Copper 3-35ft (.9-10.7m) lengths: 28AWG (7/0.127)<br>50ft (15.2m) lengths: 26AWG (7/0.160)                       |  |
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty   |  |

**(D) Deputy Chief Engineer Cabin AV System Description**

Deputy Chief Engineer Cabin will have a 65" display with all in one sound bar (in-built mic & camera) enabling user to connect his laptop & place a VC call or do a wired presentation.

**Estimated Qty:**

| <b><u>SR. No.</u></b> | <b><u>Description</u></b>   | <b><u>Qty</u></b> |
|-----------------------|---|-------------------|
| 1.                    | 65" 4k Display  | 1                 |
| 2.                    | Heavy-Duty Full Motion TV wall Mount for above display  | 1                 |
| 3.                    | High-quality video soundbar with inbuilt mic & Camera   | 1                 |
| 4.                    | Cable Cubby with 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 | 1                 |
| 5.                    | 10 metre Active Extension cable   | 1                 |
| 6.                    | High-Speed HDMI Cable 10.70m  | 1                 |
| 7.                    | Cables connectors and accessories   | 1                 |
| 8.                    | Installation and Commissioning Charges  | 1                 |

**Technical Specification:**

**1. 65" 4K UHD Display: (MAF Required)**  
**Makes: LG/Samsung/Christie**

| Parameter                             | Technical Specifications   | Compliance (Yes/No) |
|---------------------------------------|--|---------------------|
| Panel Technology                      | IPS  |                     |
| Display Size - Diagonal (inches)      | Min. 65" or more   |                     |
| Resolution                            | 3840 X 2160 (UHD)  |                     |
| Native Contrast Ratio                 | 4000:1 or higher   |                     |
| Glass Haze                            | 2%   |                     |
| Response Time (G to G)                | 6ms or lower   |                     |
| Brightness (Typ.) in Nits             | 350 Nits or higher   |                     |
| Operation Hours (Hours / Days)        | 24/7   |                     |
| Input / Output Ports                  | <b>VIDEO INPUT:</b> HDMI X 2 nos.<br><b>USB INPUT:</b> USB X 2 nos |                     |
| Communication port                    | RS232C, RJ45   |                     |
| Power Supply Requirement              | AC 100-240V~, 50/60Hz  |                     |
| Max Power consumption (W/h)           | 198W Max or less   |                     |
| Power Consumption in Sleep & Off mode | 0.5W or less   |                     |
| Typical Power consumption (W/h)       | 130W or Lower  |                     |
| Operating Temperature                 | 0°C~ 40°C or better  |                     |
| OEM Warranty                          | 2 Years by default OEM Warranty                                    |                     |

1. Mounting Bracket for 65" Display Makes: Lumi/B-tech/Chief

| Parameter     | Technical Specifications                                  | Compliance (Yes/No) |
|---------------|---|---------------------|
| Type          | Swivel wall mount   |                     |
| Compatibility | Must be suggested brand by OEM As per the Weight Capacity |                     |
| Colour        | Black   |                     |

2. Cable Cubby (MAF Required)

Makes: AH Mayer/Logic/Kramer

| Parameter           | Technical Specifications  | Compliance (Yes/No) |
|---------------------|---|---------------------|
| <b>Connectivity</b> | 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 2 x HDMI 2.1V, 1 x Type A USB 3.2 Gen 1, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 |                     |
| <b>OEM Warranty</b> | 5 Years by default OEM Warranty   |                     |

3. All In One Soundbar: (MAF Required)

- Makes: Lumen/Sony/ Clearone

| Parameter                       | Technical Specifications   | Compliance (Yes/No) |
|---------------------------------|--|---------------------|
| <b>CAMERA</b>                   | Auto Framing, automatically frames meeting participants.<br>Max Resolution:4Kp30<br>People Tracking: Automatically tracks the active speaker,4K HD Camera, 4x digital zoom |                     |
| <b>Video Formats</b>            | 4K30fps,1080p30fps, 720p30fps, etc.  |                     |
| <b>Scanning Mode</b>            | Progressive Scanning   |                     |
| <b>Lens: Focus</b>              | f=2.1mm, HFOV: 110°  |                     |
| <b>Minimal Illumination</b>     | 50 lux   |                     |
| <b>White Balance</b>            | Auto / Manual /One push  |                     |
| <b>Horizontal Angle of View</b> | 110°   |                     |
| <b>Electronic Pan Tilt Zoom</b> | 4x   |                     |
| <b>Microphone</b>               | Four Element Microphone Array · Acoustic Echo Cancellation · Automatic Noise Reduction · Automatic Gain Control · Pickup Distance: 16 feet                                 |                     |
| <b>Speaker</b>                  | Output Power: 20   |                     |
| <b>COMPATIBILITY</b>            | Operating Systems: Windows 10, macOS   |                     |
| <b>INPUT/OUTPUT INTERFACE</b>   | <ul style="list-style-type: none"> <li>• USB interface: 1xUSB 3.0: Type B, female</li> <li>• 1 x Power interface</li> </ul>  |                     |

|                     |                                 |  |
|---------------------|---------------------------------|--|
|                     | • Security lock slot            |  |
| <b>OEM Warranty</b> | 3 Years by default OEM Warranty |  |

4. USB Active Extension Cable (MAF Required)
- Makes: Crestron/Lightware/Extron

| Parameter                     | Technical Specifications               | Compliance (Yes/No) |
|-------------------------------|--|---------------------|
| <b>Connectors</b>             | 1x USB 3.0 A Male, 1x USB 3.0 A Female |                     |
| <b>Maximum Data Speed</b>     | USB 3.0/USB 3.1 Gen 1-5 Gbps           |                     |
| <b>Extension Cable Length</b> | 10 m                                   |                     |
| <b>Jacket Material</b>        | PVC, Black                             |                     |
| <b>OEM Warranty</b>           | 3 Years by default OEM Warranty        |                     |

5. HDMI CABLE (MAF Required) Make: Crestron/Lightware/Extron

| Parameter    | Technical Specifications  | Compliance (Yes/No) |
|--------------|---|---------------------|
| <b>VIDEO</b> | Max Resolution for 3–15ft (.9–4.6m) lengths: 4K@60Hz (4:4:4)<br>Max Resolution for 25–35ft (7.6–10.7m) lengths: 4K@60 (4:2:0)<br>Max Resolution for 50ft (15.2m) lengths: 1080p<br>Max Data Rate for 3–15ft (.9–4.6m) lengths: 18 Gbps<br>Max Data Rate for 25–35ft (7.6–10.7m) lengths: 8.91 Gbps<br>Max Data Rate for 50ft (15.2m) lengths: 4.95Gbps<br>Supported Color Spaces: RGB, YCbCr, xvYCC, Adobe sRGB, sYCC601, BT.2020<br>HDMI Compliance: HDR, HDCP 2.2, EDID and CEC |                     |



|                     |   |  |
|---------------------|---|--|
| <b>AUDIO</b>        | Supported Audio Formats: Dolby Digital Plus™, Dolby TrueHD™, DTS–HD Master Audio™, DVD Audio, SA–CD   |  |
| <b>PHYSICAL</b>     | HDMI Source: On a male HDMI type A, 24K gold–plated K–Lock connector<br>HDMI Display: On a male HDMI type A, 24K gold–plated K–Lock connector |  |
| <b>CONDUCTORS</b>   | Material: Tinned Copper/Bare Copper<br>3–35ft (.9–10.7m) lengths: 28AWG (7/0.127)<br>50ft (15.2m) lengths: 26AWG (7/0.160)                    |  |
| <b>OEM Warranty</b> | <b>3 Years by default OEM Warranty</b>  |  |

**(E) Executive Engineer Cabin AV System Description**

- Executive Engineer will have a 65” display with HDMI cable to do a wired presentation.

**Estimated Qty:**

| <b><u>SR. No.</u></b> | <b><u>Description</u></b>   | <b><u>Qty</u></b> |
|-----------------------|---|-------------------|
| 1.                    | 65” 4k Display  | 1                 |
| 2.                    | Heavy-Duty Full Motion TV wall Mount for above display  | 1                 |
| 3.                    | Cable Cubby with 2 x Universal Power,1 x USB-A Mobile Charger,1 x USB-C Mobile Charger,1 x Type C USB 3.2 Gen 1,2 x CAT 6 Network/RJ-45 | 1                 |
| 4.                    | 10 metre Active Extension cable   | 1                 |
| 5.                    | High–Speed HDMI Cable10.70m   | 1                 |
| 6.                    | Cables connectors and accessories   | 1                 |
| 7.                    | Installation and Commissioning Charges  | 1                 |

**1. 65” 4K UHD Display: (MAF Required)**  
**Make: LG/Samsung/Christie**

| <b>Parameter</b>                        | <b>Technical Specifications</b> | <b>Compliance (Yes/No)</b> |
|---|---------------------------------|----------------------------|
| <b>Panel Technology</b>                 | IPS                             |                            |
| <b>Display Size - Diagonal (inches)</b> | Min. 65" or more                |                            |

|  |  |  |
|--|--|--|
| <b>Resolution</b>                                | 3840 X 2160 (UHD)  |  |
| <b>Native Contrast Ratio</b>                     | 4000:1 or higher   |  |
| <b>Glass Haze</b>                                | 2%   |  |
| <b>Response Time (G to G)</b>                    | 6ms or lower   |  |
| <b>Brightness (Typ.) in Nits</b>                 | 350 Nits or higher   |  |
| <b>Operation Hours (Hours / Days)</b>            | 24/7   |  |
| <b>Input / Output Ports</b>                      | <b>VIDEO INPUT:</b> HDMI X 2 nos.<br><b>USB INPUT:</b> USB X 2 nos |  |
| <b>Communication port</b>                        | RS232C, RJ45   |  |
| <b>Power Supply Requirement</b>                  | AC 100-240V~, 50/60Hz  |  |
| <b>Max Power consumption (W/h)</b>               | 198W Max or less   |  |
| <b>Power Consumption in Sleep &amp; Off mode</b> | 0.5W or less   |  |
| <b>Typical Power consumption (W/h)</b>           | 130W or Lower  |  |
| <b>Operating Temperature</b>                     | 0°C~ 40°C or better  |  |
| <b>OEM Warranty</b>                              | 3 Years by default OEM Warranty                                    |  |

**2. Mounting Bracket for 65" Display**  
**Makes: Lumi/B-tech/Chief**

| <b>Parameter</b>     | <b>Technical Specifications</b>                           | <b>Compliance (Yes/No)</b> |
|----------------------|---|----------------------------|
| <b>Type</b>          | Swivel wall mount   |                            |
| <b>Compatibility</b> | Must be suggested brand by OEM As per the Weight Capacity |                            |
| <b>Colour</b>        | Black   |                            |

**3 Cable Cubby (MAF Required)**  
**Make: AH Mayer/Logic/Kramer**

| <b>Parameter</b> | <b>Technical Specifications</b> | <b>Compliance (Yes/No)</b> |
|------------------|---------------------------------|----------------------------|
|                  |                                 |                            |

|                     |   |  |
|---------------------|---|--|
| <b>Connectivity</b> | 2 x Universal Power, 1 x USB-A Mobile Charger, 1 x USB-C Mobile Charger, 2 x HDMI 2.1V, 1 x Type A USB 3.2 Gen 1, 1 x Type C USB 3.2 Gen 1, 2 x CAT 6 Network/RJ-45 |  |
| <b>OEM Warranty</b> | 5 Years by default OEM Warranty   |  |

**4. USB Active Extension Cable (MAF Required)**

**Make: Crestron/Lightware/Extron**

| Parameter                     | Technical Specifications               | Compliance (Yes/No) |
|-------------------------------|--|---------------------|
| <b>Connectors</b>             | 1x USB 3.0 A Male, 1x USB 3.0 A Female |                     |
| <b>Maximum Data Speed</b>     | USB 3.0/USB 3.1 Gen 1-5 Gbps           |                     |
| <b>Extension Cable Length</b> | 10 m                                   |                     |
| <b>Jacket Material</b>        | PVC, Black                             |                     |
| <b>OEM Warranty</b>           | 3 Years by default OEM Warranty        |                     |

**5. HDMI CABLE (MAF Required)**

**Makes: Crestron/Lightware/Extron**

| Parameter    | Technical Specifications   | Compliance (Yes/No) |
|--------------|--|---------------------|
| <b>VIDEO</b> | Max Resolution for 3–15ft (.9–4.6m) lengths: 4K@60Hz (4:4:4)<br>Max Resolution for 25–35ft (7.6–10.7m) lengths: 4K@60 (4:2:0)<br>Max Resolution for 50ft (15.2m) lengths: 1080p<br>Max Data Rate for 3–15ft (.9–4.6m) lengths: 18 Gbps<br>Max Data Rate for 25–35ft (7.6–10.7m) lengths: 8.91 Gbps<br>Max Data Rate for 50ft (15.2m) lengths: 4.95Gbps |                     |

|                     |   |  |
|---------------------|---|--|
|                     | Supported Color Spaces: RGB, YCbCr, xvYCC, Adobe sRGB, sYCC601, BT.2020<br>HDMI Compliance: HDR, HDCP 2.2, EDID and CEC                       |  |
| <b>AUDIO</b>        | Supported Audio Formats: Dolby Digital Plus™, Dolby TrueHD™, DTS–HD Master Audio™, DVD Audio, SA–CD   |  |
| <b>PHYSICAL</b>     | HDMI Source: On a male HDMI type A, 24K gold–plated K–Lock connector<br>HDMI Display: On a male HDMI type A, 24K gold–plated K–Lock connector |  |
| <b>CONDUCTORS</b>   | Material: Tinned Copper/Bare Copper<br>3–35ft (.9–10.7m) lengths: 28AWG (7/0.127)<br>50ft (15.2m) lengths: 26AWG (7/0.160)                    |  |
| <b>OEM Warranty</b> | <b>3 Years by default OEM Warranty</b>  |  |

#### TECHNICAL SPECIFICATIONS FOR EXTRA LOW VOLTAGE SIGNAL CABLES

**(OEM MAF Manufacturers Authorization Form to be submitted in technical bid to ensure complete technical configuration, proposed model certification and after sales service support for following years)**

1. Fire Alarm, PA Gas Suppression, Aspiration, Water leak detection : 2C X 1.5 Fire Survival armoured cables as per specifications
2. Access Control System: 2C/4C/8C 1 sq mm LSZH Armoured Cables as per specifications
3. Ultrasonic Rodent Repellent: 2C 0.5 sq mm LSZH Armoured Cables as per specifications
4. BMS system: 2C/4C/6C 1 sq mm LSZH Armoured Cables as per specifications
5. IT Cable: CAT6 flexible and 6 Core Multi Mode Armoured Fibre Cable

| <b>2Core x 1.5 sq.mm, ATC Conductor, Unshielded, Armoured, LSZH Fire Survival Cable</b> |  |  |
|---|--|--|
| <b>Sr. No.</b>  | <b>Particulars</b>                                       | <b>2C x 1.5</b>                          |
| 1   | Name of Manufacturer                                     |  |
| 2   | Product Number   |  |
| 3   | Type of Cable  | LSZH Fire Survival, Unshielded, Armoured |
| 4   | No. of Elements x size in mm <sup>2</sup>                | 2C x 1.5                                 |
| 5   | General Reference Standard                               | BS EN 50288-7                            |
| 6   | Voltage Rating   | 600/1000 V                               |
| <b>7</b>  | <b>Conductor</b>   |  |
| 7.1   | Nominal Cross Section Area (in sq.mm)                    | 1.5                                      |
| 7.2   | Type of Conductor  | Annealed Tinned Copper                   |
| 7.3   | Conductor Material                                       | Copper - Multistranded                   |
| 7.4   | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)      | 12.2                                     |
| 7.5   | Fire Resistance Material over Conductor                  | Mica Taping                              |
| 8   | Fire Performance Circuit Integrity test as per BS:6387   | 950°C for 2 Hours                        |
| <b>9</b>  | <b>Insulation</b>  |  |
| 9.1   | Insulation Material                                      | Cross Linked LSZH compound               |
| 9.2   | Nominal Thickness / Minimum Thickness of Insulation (mm) | 0.60/0.44                                |
| 9.3   | Core / Pair Identification                               | As per Standard                          |
| 9.4   | Laying Up  | Twisted Core                             |
| 10  | Woven Glass Fibre Tape for Additional Fire Resistance    | 30% Overlap over laid up Core            |
| <b>11</b>   | <b>Shielding</b>   |  |
| 11.1  | Material   | NA                                       |
| 11.2  | Coverage   | NA                                       |
| 11.3  | Overlap  | NA                                       |
| 11.4  | Drain Wire   | NA                                       |
| <b>12</b>   | <b>Innersheath</b>                                       |  |
| 12.1  | Material   | LSZH compound                            |
| 12.2  | Minimum thickness (mm)                                   | 0.3                                      |
| 12.3  | Electrical Barrier                                       | Polyester Tape                           |
| <b>13</b>   | <b>Armouring</b>   |  |
| 13.1  | Material   | Galvanized Steel                         |
| 13.2  | Type of Armouring  | Round Wire                               |
| 13.3  | Nominal size of Armouring                                | 0.9 mm Soft Wire over 95% coverage       |

|           |  |  |
|-----------|--|--|
| <b>14</b> | <b>Outersheath</b>   |  |
| 14.1      | Material   | LSZH compound                            |
| 14.2      | Nominal Thickness / Minimum Thickness of Outer Sheath (mm)           | 1.24                                     |
| 14.3      | Outer Sheath Colour  | Red                                      |
| <b>15</b> | Approx Overall Diameter of the Cable (mm)                            | 12.70 ± 2.0 mm                           |
| <b>16</b> | <b>FRLS Properties (for FRLS cable only)</b>                         |  |
| 16.1      | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2      | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3      | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4      | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5      | Flammability Test  | As per IS 1554 Part 1                    |
| <b>17</b> | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1      | Halogen Acid Gas Emission  | <0.5                                     |
| <b>18</b> | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 90 Deg. C                                |
| <b>19</b> | Maximum Conductor Temperature during Short Circuit (°C)              | 250 Deg. C                               |
| <b>20</b> | Mutual Capacitance (nf/km)   | <150                                     |
| <b>21</b> | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| <b>22</b> | Dielectric Strength for 1 minute (H.V Test in kV)                    | 2 kV                                     |
| <b>23</b> | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1      | In Ground at 30°C (A)  | 18 Amp.                                  |
| 23.2      | In Air at 40°C (A)   | 14 Amp.                                  |
| <b>24</b> | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| <b>25</b> | Maximum Tensile Strength for Cables Pulled with Stocking (Newtons)   | 9 x D <sup>2</sup> (D is cable OD in mm) |
| <b>26</b> | Printing & Sequential Marking  | As per Standard                          |

| <b>2Core x 0.5 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>2C x 0.50</b>                    |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 2C x 0.5                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 0.5                                 |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Flexible                   |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 40.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness / Minimum Thickness of Insulation (mm)   | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Brown                               |
| 15   | Approx overall diameter of the cable (mm)                  | 9.50 ± 2.0 mm                       |

|      |  |  |
|------|--|--|
| 16   | <b>FRLS Properties (for FRLS cable only)</b>                         |  |
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D-2863           |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D-2843           |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC-60754- 1          |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 5 Amp.                                   |
| 23.2 | In Air at 40°C (A)   | 4 Amp.                                   |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |



| <b>2Core x 1.5 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>2C x 1.5</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 2C x 1.5                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1.5                                 |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 12.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Brown                               |
| 15   | Approx Overall Diameter of the Cable (mm)                  | 10.80 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |                                       |
|------|--|---------------------------------------|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D-2863        |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863 |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D-2843        |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754-1       |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                 |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |                                       |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                  |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                             |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                             |
| 20   | Mutual Capacitance (nf/km)   | <150                                  |
| 21   | VOLUME RESISTIVITY @ room tem ( $\Omega/cm$ )                        | $1 \times 10^{13}$                    |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                  |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |                                       |
| 23.1 | In Ground at 30°C (A)  | 18 Amp.                               |
| 23.2 | In Air at 40°C (A)   | 14 Amp.                               |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)   |
| 25   | Maximum Tensile Strength for Cables Pulled with Stocking (Newtons)   | $9 \times D^2$ (D is cable OD in mm)  |
| 26   | Printing & Sequential Marking  | As per Standard                       |

| <b>2Core x 1.0 sq.mm, Twisted, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|---|--|-------------------------------------|
| <b>Sr. No.</b>  | <b>Particulars</b>   | <b>2C x 1.0</b>                     |
| 1   | Name of Manufacturer                                       |                                     |
| 2   | Product Number   |                                     |
| 3   | Type of Cable  | Shielded, Armoured, LSZH            |
| 4   | No. of Elements x size in mm <sup>2</sup>                  | 2C x 1.0                            |
| 5   | General Reference Standard                                 | BS EN 50288-7                       |
| 6   | Voltage Rating   | 600/1000 V                          |
| 7   | <b>Conductor</b>   |                                     |
| 7.1   | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2   | Type of Conductor  | Annealed Tinned Copper              |
| 7.3   | Conductor Material   | Copper - Multistranded              |
| 7.4   | Shape of Conductor   | Standard Circular                   |
| 7.5   | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8   | <b>Insulation</b>  |                                     |
| 8.1   | Insulation Material  | PVC                                 |
| 8.2   | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3   | Core / Pair Identification                                 | As per Standard                     |
| 9   | Laying Up  | Twisted Core                        |
| 10  | <b>Shielding</b>   |                                     |
| 10.1  | Material   | Aluminium Mylar Tape                |
| 10.2  | Coverage   | 100%                                |
| 10.3  | Overlap  | 30%                                 |
| 10.4  | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11  | <b>Innersheath</b>   |                                     |
| 11.1  | Material   | Extruded PVC                        |
| 11.2  | Minimum thickness (mm)                                     | 0.3                                 |
| 12  | Electrical Barrier   | Polyester Tape                      |
| 13  | <b>Armouring</b>   |                                     |
| 13.1  | Material   | Galvanized Steel                    |
| 13.2  | Type of Armouring  | Round Wire                          |
| 13.3  | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14  | <b>Outersheath</b>   |                                     |
| 14.1  | Material   | LSZH compound                       |
| 14.2  | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3  | Outer Sheath Colour  | Grey                                |
| 15  | Approx overall diameter of the cable (mm)                  | 10.30 ± 2.0 mm                      |
| 16  | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |

| <b>4Core x 1.0 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>4C x 1.0</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 4C x 1.0                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Grey                                |
| 15   | Approx overall diameter of the cable (mm)                  | 11.30 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |

| <b>8Core x 1.0 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>8C x 1.0</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 8C x 1.0                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Grey                                |
| 15   | Approx overall diameter of the cable (mm)                  | 13.70 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |



| <b>2Core x 1.0 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>2C x 1.0</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 2C x 1.0                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Blue                                |
| 15   | Approx overall diameter of the cable (mm)                  | 10.30 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |

| <b>4Core x 1.0 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>4C x 1.0</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 4C x 1.0                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Blue                                |
| 15   | Approx overall diameter of the cable (mm)                  | 11.30 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |

| <b>6Core x 1.0 sq.mm, Shielded, Armoured, Outer LSZH Cable</b> |  |                                     |
|--|--|-------------------------------------|
| <b>Sr. No.</b>   | <b>Particulars</b>   | <b>6C x 1.0</b>                     |
| 1  | Name of Manufacturer                                       |                                     |
| 2  | Product Number   |                                     |
| 3  | Type of Cable  | Shielded, Armoured, LSZH            |
| 4  | No. of Elements x size in mm <sup>2</sup>                  | 6C x 1.0                            |
| 5  | General Reference Standard                                 | BS EN 50288-7                       |
| 6  | Voltage Rating   | 600/1000 V                          |
| 7  | <b>Conductor</b>   |                                     |
| 7.1  | Nominal Cross Section Area (in sq.mm)                      | 1                                   |
| 7.2  | Type of Conductor  | Annealed Tinned Copper              |
| 7.3  | Conductor Material   | Copper - Multistranded              |
| 7.4  | Shape of Conductor   | Standard Circular                   |
| 7.5  | Maximum D.C. Resistance of Conductor at 20°C (Ω/km)        | 18.2                                |
| 8  | <b>Insulation</b>  |                                     |
| 8.1  | Insulation Material  | PVC                                 |
| 8.2  | Nominal Thickness of Insulation (mm)                       | 0.60 ± 0.16 mm                      |
| 8.3  | Core / Pair Identification                                 | As per Standard                     |
| 9  | Laying Up  | Twisted Core                        |
| 10   | <b>Shielding</b>   |                                     |
| 10.1   | Material   | Aluminium Mylar Tape                |
| 10.2   | Coverage   | 100%                                |
| 10.3   | Overlap  | 30%                                 |
| 10.4   | Drain Wire   | 0.5 mm <sup>2</sup> , Tinned Copper |
| 11   | <b>Innersheath</b>   |                                     |
| 11.1   | Material   | Extruded PVC                        |
| 11.2   | Minimum thickness (mm)                                     | 0.3                                 |
| 12   | Electrical Barrier   | Polyester Tape                      |
| 13   | <b>Armouring</b>   |                                     |
| 13.1   | Material   | Galvanized Steel                    |
| 13.2   | Type of Armouring  | Round Wire                          |
| 13.3   | Nominal size of Armouring (mm)                             | 0.9                                 |
| 14   | <b>Outersheath</b>   |                                     |
| 14.1   | Material   | LSZH compound                       |
| 14.2   | Nominal Thickness / Minimum Thickness of Outer Sheath (mm) | 1.24                                |
| 14.3   | Outer Sheath Colour  | Blue                                |
| 15   | Approx overall diameter of the cable (mm)                  | 12.85 ± 2.0 mm                      |
| 16   | <b>FRLS Properties (for FRLS cable only)</b>               |                                     |

|      |  |  |
|------|--|--|
| 16.1 | Oxygen Index   | Minimum 29% as per ASTM D- 2863          |
| 16.2 | Temperature Index  | Minimum 250 Deg.C as per ASTM D- 2863    |
| 16.3 | Smoke Density Rating   | Maximum 60% as per ASTM D- 2843          |
| 16.4 | Acid Gas Generation  | Maximum 20% as per IEC- 60754- 1         |
| 16.5 | Flammability Test  | As per IS 1554 Part 1                    |
| 17   | <b>LSZH / ZHFR Properties (for LSZH cable only)</b>                  |  |
| 17.1 | Halogen Acid Gas Emission  | <0.5                                     |
| 18   | Maximum Conductor Temperature Under Normal Operating Conditions (°C) | 70 Deg. C                                |
| 19   | Maximum Conductor Temperature during Short Circuit (°C)              | 70 Deg. C                                |
| 20   | Mutual Capacitance (nf/km)   | <150                                     |
| 21   | VOLUME RESISTIVITY @ room tem (Ω/cm)                                 | 1 x 10 <sup>13</sup>                     |
| 22   | Dielectric Strength for 1 minute (H.V Test in kV)                    | 1 kV                                     |
| 23   | <b>Continuous Current Carrying Capacities</b>                        |  |
| 23.1 | In Ground at 30°C (A)  | 13 Amp.                                  |
| 23.2 | In Air at 40°C (A)   | 11 Amp.                                  |
| 24   | Minimum Bending Radius   | 14 - 16 PCD (Pitch Circle Diameter)      |
| 25   | Cable pulled with Stocking (Newtons)                                 | 9 x D <sup>2</sup> (D is cable OD in mm) |
| 26   | Printing & Sequential Marking  | As per Standard                          |

**TENDER LIST OF MAKES**

| <b>SR. NO.</b> | <b>ITEM DESCRIPTION</b>         | <b>APPROVED MAKES</b>                  |
|----------------|---------------------------------|--|
| 1              | FIRE ALARM SYSTEM               | SIMPLEX/SHRACKSIEMENS/ESSER/AUTRONICA  |
| 2              | CENTRAL FIRE DISPLAY            | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 3              | REPEATER PANEL                  | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 4              | FIRE GUI SOFTWARE               | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 5              | MULTISENSOR DETECTORS           | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 6              | MODULES/HOOTERS/<br>STROBES     | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 7              | MANUAL CALL POINT               | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 8              | BEAM DETECTORS                  | SIMPLEX/SHRACK/SIEMENS/ESSER/AUTRONICA |
| 9              | PA SYSTEM MASTER<br>CONTROLLER  | BOSE/SCHRACK/JBL/TOA/COMMEND           |
| 10             | PA CLASS-D POWER<br>AMPLIFIER   | BOSE/SCHRACK/JBL/TOA/COMMEND           |
| 11             | PA CONSOLE                      | BOSE/SCHRACK/JBL/TOA/COMMEND           |
| 12             | SPEAKERS                        | BOSE/SCHRACK/JBL/TOA/COMMEND           |
| 13             | MUSIC PLAYER                    | SONY/YAMAHA/JBL/BOSE                   |
| 14             | IG541 GAS SUPPRESSION<br>SYSTEM | TYCO/SIEMENS/KIDDE                     |
| 15             | IG541 GAS CYLINDERS             | TYCO/SIEMENS/KIDDE                     |
| 16             | IG541 GAS                       | TYCO/SIEMENS/KIDDE                     |
| 17             | FLEXIBLE DISCHARGE HOSE         | TYCO/SIEMENS/KIDDE                     |
| 18             | ELECTRIC ACTUATORS              | TYCO/SIEMENS/KIDDE                     |
| 19             | MANUAL ACTUATORS                | TYCO/SIEMENS/KIDDE                     |
| 20             | PNEUMATIC ACTUATORS             | TYCO/SIEMENS/KIDDE                     |
| 21             | DISCHARGE PRESSURE<br>SWITCH    | TYCO/SIEMENS/KIDDE                     |
| 22             | NOZZLES                         | TYCO/SIEMENS/KIDDE                     |

|    |  |                                 |
|----|--|---------------------------------|
| 23 | BLEED VALVES                               | TYCO/SIEMENS/KIDDE              |
| 24 | PRESSURE GAUGE                             | TYCO/SIEMENS/KIDDE              |
| 25 | SCH 40; ASTM A106 GR B,<br>GLAVANIZED PIPE | TATA/JINDAL/ESSAR               |
| 26 | WARNING SIGNS                              | TYCO/SIEMENS/KIDDE              |
| 27 | GAS RELEASE MODULES                        | TYCO/SIEMENS/KIDDE              |
| 28 | ABORT STATIONS                             | TYCO/SIEMENS/KIDDE              |
| 29 | ASPIRATION PANEL                           | XTRALIS/SIEMENS/SHRACK-SECUTRON |
| 30 | ASPIRATION PANEL PIPE &<br>ACCESSORIES     | ASTRAL/PRECISION/BEC            |
| 31 | SMPS POWER SUPPLY                          | POWERTEC/ACE/ELITE/KELTRONICS   |
| 32 | ULTRASONIC RODENT<br>REPELLENT SYSTEM      | VARNA/STAR/MASER/C-SYSTEMS      |
| 33 | TRANSDUCERS                                | VARNA/STAR/MASER/C-SYSTEMS      |
| 34 | DIGITAL WATER LEAK<br>DETECTION PANEL      | C-SYSTEM/ELSA/TTK/PERMA         |
| 35 | DIGITAL WATER LEAK CABLE                   | C-SYSTEM/ELSA/TTK/PERMA         |
| 36 | SENSOR INTERFACE MODULE                    | C-SYSTEM/ELSA/TTK/PERMA         |
| 37 | CLIPS/LABELS ACCESSORIES                   | C-SYSTEM/ELSA/TTK/PERMA         |
| 38 | IP BASED CCTV SYSTEM                       | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 39 | VMS SOFTWARE                               | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 40 | 32 CHANNEL NVR                             | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 41 | INDOOR DOME CAMERA                         | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 42 | OUTDOOR BULLET CAMERAS                     | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 43 | OUTDOOR PTZ CAMERAS                        | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 44 | VMS SERVERS/<br>WORKSTATION                | HP/DELL/LENOVO                  |
| 45 | 55" VIDEO WALL                             | LG/SAMSUNG/BARCO/CHRISTIE       |
| 46 | JOYSTICK                                   | PELCO/VIVOTEK/AXIS/AVIGILON     |
| 47 | CAMERA MOUNTING POLES                      | JINDAL/TATA/ESSAR               |



|    |                                   |   |
|----|-----------------------------------|---|
| 48 | ACCESS CONTROL SOFTWARE           | HID//LENEL/MERCURY/HONEYWELL-PROWATCH   |
| 49 | POE BASED 2 READER CONTROLLER     | HID//LENEL/MERCURY/HONEYWELL-PROWATCH   |
| 50 | OSDP CARD READER                  | HID SIGNO/LENEL/HONEYWELL   |
| 51 | OSDP BIOMETRIC FACE READER        | HID SIGNO/LENEL/HONEYWELL   |
| 52 | RFID READERS                      | NEDAP/HID/ALLEGION  |
| 53 | RFID TAGS                         | NEDAP/HID/ALLEGION  |
| 54 | ELECTROMAGNETIC LOCKS             | TRIMEC/ EBELCO/BELL/ASSA ABLOY  |
| 55 | MAGNETIC CONTACTS                 | TRIMEC/ EBELCO/BELL/ASSA ABLOY  |
| 56 | EMERGENCY BREAK GLASS             | TRIMEC/ EBELCO/BELL/ASSA ABLOY  |
| 57 | MIFARE SMART CARDS                | HID/SENTRY/HONEYWELL/LENEL  |
| 58 | SMART LOCKER SYSTEMS              | FONZEL/SMARTBOX/ VECOS/ELOCKER  |
| 59 | SMART LOCKER SOFTWARE             | FONZEL/SMARTBOX/ VECOS/ELOCKER  |
| 60 | WALK THROUGH METAL DETECTOR       | SMITH(CEIA)-HI-PE PLUS/GARRETT-PD 6500I<br>RAPISCAN-ORION 900M                        |
| 61 | HAND HELD METAL DETECTORS         | SMITH(CEIA)-HI-PE PLUS/GARRETT-PD 6500I<br>RAPISCAN-ORION 900M                        |
| 62 | X-RAY BAGGAGE SCANNERS (HANDHELD) | SMITH-6040C/LIEDOS-ACX 6.4/RAPISCAN-ORION 920 CX                                      |
| 63 | X-RAY BAGGAGE SCANNERS (FREIGHT)  | SMITH-100100T/LIEDOS-PX™ 10.10-MV/RAPISCAN-628 XR                                     |
| 64 | SWING BARRIERS                    | KABA-ARGUS/MAGNETIC-MPW-112/BOONEDAM-LIFELINE<br>SPEEDLANE/ GUNNEBO-SPEEDSTILE FLS EV |
| 65 | P-GATE                            | KABA/MAGNETIC/BOONEDAM/ GUNNEBO   |
| 66 | BMS SOFTWARE                      | SCHNEIDER/TRIDIUM/SIEMENS/PCVUE/BECKHOFF/ENLITE                                       |
| 67 | NETWORK CONTROLLERS               | SCHNEIDER/TRIDIUM/SIEMENS//BECKHOFF/ENLITE  |
| 68 | DDC CONTROLLERS                   | SCHNEIDER/TRIDIUM/SIEMENS/BECKHOFF/ENLITE   |
| 69 | ALL SENSORS                       | GREYSTONE/SONTAY/ BAPI/VAISLA   |
| 70 | WIRELESS SENSORS GATEWAY          | SENSEGIZ/MONNIT/INNOMAINT   |

|    |                                    |                           |
|----|------------------------------------|---------------------------|
| 71 | WIRELESS SENSORS                   | SENSEGIZ/MONNIT/INNOMAINT |
| 72 | ENTERPRISE ROUTER                  | ARUBA/CISCO/JUNIPER       |
| 73 | FIREWALL                           | ARUBA/CISCO/JUNIPER       |
| 74 | NETWORK ACCESS CONTROL             | ARUBA/CISCO/JUNIPER       |
| 75 | MANAGED CORE SWITCH (48 PORTS SFP) | ARUBA/CISCO/JUNIPER       |
| 76 | MANAGED L2 POE SWITCH (48 PORTS)   | ARUBA/CISCO/JUNIPER       |
| 77 | MANAGED L2 POE SWITCH (24 PORTS)   | ARUBA/CISCO/JUNIPER       |
| 78 | 10G SFP MODULES                    | ARUBA/CISCO/JUNIPER       |
| 79 | WIRELESS CONTROLLER                | ARUBA/CISCO/JUNIPER       |
| 80 | WIRELESS ACCESS POINTS             | ARUBA/CISCO/JUNIPER       |
| 81 | IP PBX                             | ARUBA/CISCO/JUNIPER       |
| 82 | VOICE GATEWAY 4 PRI                | ARUBA/CISCO/JUNIPER       |
| 83 | IP PHONES                          | ARUBA/CISCO/AVAYA         |
| 84 | FLEXIBLE CAT6 CABLE                | SIEMON/SYSTIMAX/PANDUIT   |
| 85 | ARMOURED FIBRE CABLE               | SIEMON/SYSTIMAX/PANDUIT   |
| 86 | PATCH PANELS                       | SIEMON/SYSTIMAX/PANDUIT   |
| 87 | LIU                                | SIEMON/SYSTIMAX/PANDUIT   |
| 88 | CAT6 PATCH CORDS                   | SIEMON/SYSTIMAX/PANDUIT   |
| 89 | FIBRE PATCH CORDS                  | SIEMON/SYSTIMAX/PANDUIT   |
| 90 | PIGTAILS                           | SIEMON/SYSTIMAX/PANDUIT   |
| 91 | IO MODULES                         | SIEMON/SYSTIMAX/PANDUIT   |
| 92 | FACE PLATES                        | SIEMON/SYSTIMAX/PANDUIT   |
| 93 | UNDERFLOOR PVC DUCTS               | OBO/MK/LEGRAND            |
| 94 | PRE GALVANISED JUNCTION BOXES      | OBO/MK/LEGRAND            |
| 95 | GI CONDUITS                        | VIMCO/ BEC/ AKG/SUPREME   |
| 96 | RACKS                              | APC/RITTAL/NETRACK        |

|     |  |  |
|-----|--|--|
| 97  | CANTILEVER MS GATE AND GATE AUTOMATION | GUNNEBO/CHEMEY/A1 FENCE/MECHATRONICS/HERAS   |
| 98  | BOOM BARRIERS                          | MAGNETIC-ACCESS-L/KABA(ELKA)-P 5000/FAAC-B680HAUTOMATIC-BL 229/SKIDATA-BARRIER.GATE                                    |
| 99  | UNDER VEHICLE SECURITY SYSTEM          | GATEKEEPER(USA)-IVUS+ILPR+MULTI ANGLE IVOD/VEHANT-NUVOSCAN-3D/SECUSCAN(GERMANY)-PERMANENT SYSTEM WITH HEAVY DUTY COVER |
| 100 | K4 RATED AUTOMATIC BOLLARDS            | FAAC-JS48-HA/GUNNEBO(ELKOSTA)M30/P1/ ATG ACCESS-SP1200/AUTOMATIC-RB M50_1200/PILOMAT-M30/1200                          |
| 101 | ARMOURED LV SIGNAL CABLES              | CALLIPLAST/RR CABLE/ POLYCAB/KEI   |
| 102 | LASER PRINTERS                         | HP/CANON/BROTHER   |
| 103 | HDPE PIPES                             | ALEX/DARSHAN/SHREE POLYMER   |
| 104 | AV DISPLAYS                            | LG/SAMSUNG/BARCO/CHRISTIE  |
| 105 | DISPLAY MOUNTING BRACKETS              | LUMI/B-TECH/CHIEF  |
| 106 | 20X PTZ CAMERA                         | LUMENS/CLEARONE/AVER   |
| 107 | CEILING TILE MICROPHONE                | SENNHEISER/SHURE / CLEARONE  |
| 108 | POE INJECTORS                          | SENNHEISER/SHURE / CLEARONE  |
| 109 | MOUNTING KIT                           | SENNHEISER/SHURE / CLEARONE  |
| 110 | DSP                                    | XILICA/BIAMP/CLEARONE  |
| 111 | POWER AMPLIFIERS                       | XILICA/QSC/CLEARONE  |
| 112 | CEILING SPEAKERS                       | XILICA/QSC/CLEARONE  |
| 113 | CABLE CUBBY                            | A.H.MEYER/LOGIC/KRAMER   |
| 114 | SWITCHER                               | CRESTRON/EXTRON/LIGHTWARE  |
| 115 | USB C CABLE                            | CRESTRON/EXTRON/LIGHTWARE  |
| 116 | USB ACTIVE EXTENSION CABLE             | CRESTRON/EXTRON/LIGHTWARE  |
| 117 | HDMI CABLE                             | CRESTRON/EXTRON/LIGHTWARE  |
| 118 | CONTROL PROCESSOR                      | CRESTRON/EXTRON/AMX  |
| 119 | 10.1 TOUCH PANEL                       | CRESTRON/EXTRON/AMX  |

|     |                             |                           |
|-----|-----------------------------|---------------------------|
| 120 | WIRELESS TOUCH PANEL        | APPLE/EQUIVALENT          |
| 121 | DOCKING STATION FOR IPAD    | IPOINT/CRESTRON/EXTRON    |
| 122 | WIFI ROUTER                 | CISCO/ARUBA/JUPITER       |
| 123 | WIRELESS KEYPAD             | LUTRON/CRESTRON           |
| 124 | 4 CHANNEL SWITCHING MODULE  | LUTRON/CRESTRON           |
| 125 | 2 CHANNEL DALI MODULE       | LUTRON/CRESTRON           |
| 126 | ATHENA PROCESSOR            | LUTRON/CRESTRON           |
| 127 | ALL IN ONE SOUND BAR        | LUMEN/SONY/ CLEARONE      |
| 128 | HEAT DETECTOR SENSING CABLE | AP SENSING/SHRACK/SIEMENS |

**IBMS IO SUMMARY.**

This is a indicative IO summary and the IO counts on the hard and soft points can increase during or after the tender process based on site requirements. In order to fulfill this, you are requested to **considered 20% spare capacity in all hardware and software** to meet overall IBMS requirements of the building

| Sr. No.   | Description                            | Qty      | AI         | AO       | DI        | DO       | Qty | Remarks             |
|-----------|--|----------|------------|----------|-----------|----------|-----|---------------------|
| <b>I</b>  | <b>Other Sensors</b>                   |          |            |          |           |          |     |                     |
| 1         | Outside Air CO2+temp+RH Sensor         |          | 3          |          |           |          | 1   | Outdoor Temp/RH/CO2 |
| 2         | Indoor Air CO2+temp+RH Sensor          |          | 192        |          |           |          | 64  | Indoor Temp/RH/CO2  |
|           | <b>Total</b>                           |          | <b>195</b> | <b>0</b> | <b>0</b>  | <b>0</b> |     |                     |
| <b>II</b> | <b>Plumbing</b>                        | <b>3</b> |            |          |           |          |     |                     |
|           | Tank Level Monitoring (Low, Med, High) |          |            |          | 9         |          |     |                     |
|           | Sub-Total                              |          |            | <b>0</b> | <b>9</b>  | <b>0</b> |     |                     |
|           | Spare - 20%                            |          | 0          | 0        | 2         | 0        |     |                     |
|           | <b>Total with Spare</b>                |          | <b>0</b>   | <b>0</b> | <b>11</b> | <b>0</b> |     |                     |

|            |  |          |          |          |            |           |  |  |
|------------|--|----------|----------|----------|------------|-----------|--|--|
|            |  |          |          |          |            |           |  |  |
| <b>III</b> | <b>Fire Fighting</b>                     | <b>5</b> |          |          |            |           |  |  |
|            | Pump Run Status Monitoring               |          |          |          | 5          |           |  |  |
|            | Pump Trip Status Monitoring              |          |          |          | 5          |           |  |  |
|            | Pump Auto/Manual Status Monitoring       |          |          |          | 5          |           |  |  |
|            | Header Monitoring every floor 5 branches |          |          |          | 140        |           |  |  |
|            | Sub-Total                                |          |          | <b>0</b> | <b>155</b> | <b>0</b>  |  |  |
|            | Spare - 20%                              |          | 0        | 0        | 31         | 0         |  |  |
|            | <b>Total with Spare</b>                  |          | <b>0</b> | <b>0</b> | <b>186</b> | <b>0</b>  |  |  |
|            |  |          |          |          |            |           |  |  |
| <b>IV</b>  | <b>Pressurisation Fans for Lifts</b>     | <b>9</b> |          |          |            |           |  |  |
|            | Fan On/Off Command                       |          |          |          |            | 9         |  |  |
|            | Fan On/Off Status                        |          |          |          | 9          |           |  |  |
|            | Fan Trip Status                          |          |          |          | 9          |           |  |  |
|            | Fan Auto/Manual Status                   |          |          |          | 9          |           |  |  |
|            | Sub-Total                                |          | <b>0</b> | <b>0</b> | <b>27</b>  | <b>9</b>  |  |  |
|            | Spare - 20%                              |          | 0        | 0        | 5          | 2         |  |  |
|            | <b>Total with Spare</b>                  |          | <b>0</b> | <b>0</b> | <b>32</b>  | <b>11</b> |  |  |
|            |  |          |          |          |            |           |  |  |
| <b>V</b>   | <b>Pressurisation Fans for Staircase</b> | <b>5</b> |          |          |            |           |  |  |
|            | Fan On/Off Command                       |          |          |          |            | 5         |  |  |
|            | Fan On/Off Status                        |          |          |          | 5          |           |  |  |
|            | Fan Trip Status                          |          |          |          | 5          |           |  |  |

|           |   |           |            |           |            |           |    |                    |
|-----------|---|-----------|------------|-----------|------------|-----------|----|--------------------|
|           | Fan Auto/Manual Status                  |           |            |           | 5          |           |    |                    |
|           | Sub-Total                               |           | 0          | 0         | 15         | 5         |    |                    |
|           | Spare - 20%                             |           | 0          | 0         | 3          | 1         |    |                    |
|           | <b>Total with Spare</b>                 |           | <b>0</b>   | <b>0</b>  | <b>18</b>  | <b>6</b>  |    |                    |
|           |   |           |            |           |            |           |    |                    |
| <b>VI</b> | <b>Treated Fresh Air Unit</b>           | <b>16</b> |            |           |            |           |    |                    |
|           | TFA On/Off Command                      |           |            |           |            | 16        |    |                    |
|           | TFA Run Status                          |           |            |           | 16         |           | 16 | DP Switch          |
|           | TFA Trip Status                         |           |            |           | 16         |           |    |                    |
|           | TFA Auto/Manual Status                  |           |            |           | 16         |           |    |                    |
|           | VFD Speed Modulation Command            |           |            | 16        |            |           |    |                    |
|           | VFD Speed Modulation Feedback           |           | 16         |           |            |           |    |                    |
|           | DPT for VFD Modulation                  |           | 16         |           |            |           |    |                    |
|           | DP Switch for Filter Status             |           |            |           | 16         |           | 16 | DP Switch          |
|           | Duct Temp/RH/CO2 Sensor for Return Air  |           | 48         |           |            |           | 16 | temp/Rh/CO2 Sensor |
|           | Chilled Water Valve Modulation Command  |           |            | 16        |            |           |    |                    |
|           | Chilled Water Valve Modulation Feedback |           | 16         |           |            |           |    |                    |
|           | TFA Limit Switch Status                 |           |            |           | 16         |           |    |                    |
|           | Fire Input Signal                       |           |            |           | 16         |           |    |                    |
|           | <b>Sub-Total</b>                        |           | <b>96</b>  | <b>32</b> | <b>96</b>  | <b>16</b> |    |                    |
|           | Spare - 20%                             |           | 19         | 6         | 19         | 3         |    |                    |
|           | <b>Total with Spare</b>                 |           | <b>115</b> | <b>38</b> | <b>115</b> | <b>19</b> |    |                    |

|             |   |           |            |                   |                     |           |          |                                |
|-------------|---|-----------|------------|-------------------|---------------------|-----------|----------|--------------------------------|
|             |   |           |            |                   |                     |           |          |                                |
| <b>VIII</b> | <b>LT Panel</b>   | <b>17</b> |            |                   |                     |           | <b>1</b> |                                |
| 1           | on/off Status   |           |            |                   | 32                  |           |          |                                |
| 2           | Auto/Manual Status  |           |            |                   | 32                  |           |          |                                |
|             | <b>Total</b>  |           | <b>0</b>   | <b>0</b>          | <b>64</b>           | <b>0</b>  |          |                                |
|             |   |           |            |                   |                     |           |          |                                |
| <b>IX</b>   | <b>Gas Suppression System</b>   | <b>75</b> |            |                   |                     |           | 21       | IG-541 cylinders               |
| a           | Cylinder Low Pressure Monitoring (looped through 1 no. Fire Monitor Module) |           |            |                   | 75                  |           |          |                                |
| b           | Discharge Pressure Switch (looped through 1 no. Fire Monitor Module)        |           |            |                   | 75                  |           |          |                                |
|             | <b>Total</b>  |           | <b>0</b>   | <b>0</b>          | <b>150</b>          | <b>0</b>  |          |                                |
|             | <b>TOTAL HARD IO's</b>  |           | <b>310</b> | <b>38</b>         | <b>608</b>          | <b>47</b> |          | <b>1003</b>                    |
|             |   |           |            |                   |                     |           |          |                                |
| <b>VII</b>  | <b>Third Party Integration</b>  |           | <b>Qty</b> | <b>Per Device</b> | <b>Total Points</b> |           |          | <b>Remarks</b>                 |
| 1           | Fire Alarm System   |           | 2          | 2000              | 4000                |           |          | Modbus-Bacnet MSTP/IP Protocol |
| 2           | PA System   |           | 2          | 5                 | 10                  |           |          | Modbus-Bacnet MSTP/IP Protocol |
| 3           | Basement Ventilation System   |           | 1          | 100               | 100                 |           |          | Modbus-Bacnet MSTP/IP Protocol |
| 4           | Rodent Repellent  |           | 54         | 5                 | 270                 |           |          | Modbus-Bacnet MSTP/IP Protocol |
| 5           | Aspiration Panels   |           | 20         | 5                 | 100                 |           |          | Modbus-Bacnet MSTP/IP Protocol |
| 6           | Water Leak Detection  |           | 17         | 10                | 170                 |           |          | Modbus-Bacnet MSTP/IP Protocol |

|    |                                     |  |    |     |     |  |  |                                   |
|----|-------------------------------------|--|----|-----|-----|--|--|-----------------------------------|
| 7  | Smart Lockers                       |  | 4  | 150 | 600 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 8  | CCTV VMS Integration                |  | 1  | 550 | 550 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 9  | Access Software<br>Integration      |  | 1  | 500 | 500 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 10 | UVSS Integration                    |  | 2  | 20  | 40  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 11 | Automatic Bollards<br>Integration   |  | 2  | 20  | 40  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 12 | Boom Barriers                       |  | 9  | 5   | 45  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 13 | Swing Barriers                      |  | 14 | 5   | 70  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 14 | Gate Automation                     |  | 4  | 5   | 20  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 15 | WTMD                                |  | 4  | 5   | 20  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 16 | X Ray Baggage<br>Scanners           |  | 4  | 5   | 20  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 17 | DG Set                              |  | 4  | 20  | 80  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 18 | UPS                                 |  | 34 | 20  | 680 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 19 | Utility Energy Meters               |  | 13 | 12  | 156 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 20 | DG Set Energy Meters                |  | 13 | 12  | 156 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 21 | LT Energy Meters                    |  | 17 | 5   | 85  |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 22 | Smart Lockers                       |  | 4  | 150 | 600 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 23 | Automatic Parking<br>Dousing System |  | 1  | 300 | 300 |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |



MATERIAL TESTING LAB WORLI MUMBAI ELV + IT + IBMS + AV + AUTOMATIC PARKING ELV SYSTEMS  
 DESIGN NOTES, DESIGN BRIEF REPORT & TECHNICAL SPECIFICATIONS

|    |  |  |    |    |              |  |  |                                   |
|----|--|--|----|----|--------------|--|--|-----------------------------------|
| 24 | Water Treatment Plant                    |  | 1  | 40 | 40           |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 25 | Sewage Treatment Plant                   |  | 1  | 40 | 40           |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 26 | Transformer                              |  | 2  | 10 | 20           |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 27 | BMS Water Meters                         |  | 4  | 5  | 20           |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 28 | Material Testing Lab Equipment's         |  | 42 | 25 | 1050         |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 29 | Elevators and Lifts                      |  | 12 | 20 | 240          |  |  | Modbus-Bacnet<br>MSTP/IP Protocol |
| 30 | IOT Sensors Gateway Router               |  | 17 | 25 | 425          |  |  | MQTT                              |
|    | <b>TOTAL SOFT IO POINTS</b>              |  |    |    | <b>10447</b> |  |  |                                   |
|    | 20% spare capacity for soft points       |  |    |    | <b>2089</b>  |  |  |                                   |
|    | <b>FINAL TOTAL SOFT + HARD IO POINTS</b> |  |    |    | <b>13539</b> |  |  |                                   |