

## GENERAL TECHNICAL SPECIFICATIONS FOR ELECTRIC WORKS

### 1. L. T. PANELS / P.C.C. / M.C.C. –

#### 1.1 TYPE OF PANEL:

All the PCC's / PDB's / MCC's shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz.

The PCC's / MCC's shall be designed to withstand the and heaviest condition at site, with minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.

Should conform to Indian Electricity Act and rules (till last amendment) & approved as per FIA norms.

#### APPLICABLE IS STANDARDS

METERS (MEASURING) FOR ANALOG METERS	IS:1248-1958
INSTALLATION AND MAINTENANCE OF SWITCH GEARS	IS:3072-1975
H.D. AIR BREAKER, SWITCH GEARS AND FUSES FOR VOLTAGE NOT EXCEEDING 1000 VOLTS	IS:4047-1977
SELECTION, INSTALLATION AND MAINTENANCE OF FUSES UP TO 650 VOLTS	IS:8106-1966
GENERAL REQUIREMENTS FOR SWITCH GEAR AND GEAR FOR VOLTAGE NOT EXCEEDING 1000 VOLTS	IS:4237-1967
DEGREE OF PROTECTION PROVIDED BY ENCLOSURES FOR LV S/GEARS	IS:2147-1962
INSULATED CONDUCTOR RATING	IS:8084-1972
ENCLOSED DISTRIBUTION FUSE BOARDS AND CUT-OUTS FOR VOLTAGE NOT EXCEEDING 1000 VOLTS	IS:2675-1983
FUSE WIRE USED IN RE-WEARABLE TYPE ELECTRIC FUSES UP TO 650 VOLTS	IS:9926-1981
CONDUCTOR FOR INSULATED ELECTRIC CABLES AND FLEXIBLE CORDS	IS:8130
SHUNT CAPACITORS FOR POWER SYSTEMS	IS:2834-1954
HRC CARTRIDGE FUSES AND LINKS UP TO 660 VOLTS	IS:2208

HRC FUSES HAVING RUPTURING CAPACITY OF 50 KA	IS:9224
AC ELECTRICITY METERS: PART – 1 GENERAL REQUIREMENTS AND TESTS	IS:772 PART 1
DIRECT ACTING ELECTRICAL INDICATING INSTRUMENTS	IS:1248
CURRENT TRANSFORMERS	IS:2705
ELECTRICAL RELAYS FOR POWER SYSTEMS PROTECTION	IS:3231
PHOSPHATE TREATMENT OF IRON AND STEEL FOR PROTECTION AGAINST CORROSION	IS:3618
GUIDE FOR MARKING OF INSULATED CONDUCTOR	IS:5578
CODE OF PRACTICE OF PHOSPHATING OF IRON AND STEEL	IS:6005
FACTORY BUILT ASSEMBLIES OF SWITCHGEAR AND CONTROL-GEAR FOR VOLTAGES UPTO AND INCLUDING 1000V AC AND 1200V DC.	IS:8623
GUIDE FOR UNIFORM SYSTEM MARKING AND IDENTIFICATION OF CONDUCTORS AND APPARATUS TERMINALS	IS:11353
LOW VOLTAGE FUSES IS:13703	
LV SWITCHGEAR AND CONTROL GEAR (PART 1 TO PART 5)	IS:13947
STRUCTURE CONSTRUCTION (IP-54)	IS:2147
MINIATURE CIRCUIT BREAKER (MCB)	BS:3871PART-1 1965 IS:8825 (1996)
FUSE	IS:2000-1962
AIR CIRCUIT BREAKER	IS:2516 PART 1,2,3
CONTACTORS	IS:2959 & BS:775
DIGITAL METER	IS:13779
ELECTRICAL POWER & CONTROL WIRING CONNECTION WIRING INSIDE THE MODULE FOR POWER, CONTROL PROTECTION	IS:694 & IS:8130
DANGER NOTICE PLATE	IS:2551-1982 & IS:5-1978

MCCB IEC 60439-2 /

IS:8623-2

SFU

IS:13947 (PART-3) & IEC 60947-3

ELCB

BS 3871 & 4293, IS., CEE 27

## 1.1 STRUCTURE :

- ✓ The PCCs, MCCs & PDBs shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation, front operated and floor mounting type.
- ✓ CRCA sheet steel used in the construction of PCCs / MCCs / PDBs shall be 2 mm thick for structure, 1.6 mm thick for doors, covers shrouds and 3 mm thick for gland plate and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.
- ✓ The PCCs / MCCs / PDBs shall be totally enclosed, completely dust and vermin proof and degree of protection being no less than IP-54 confirming to IS 2147. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasketed with neoprene gaskets and shall be lockable.
- ✓ All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screw shall enter into holes taped into an adequate thickness of metal or provided with bolts and nuts. Self-threading screws shall not be used in the construction of PCCs / MCCs / PDBs.
- ✓ A base channel of 75 mm x 75 mm x 5 mm or as per the weight of the panel shall be provided at the bottom.
- ✓ PCCs / MCCs / PDBs shall be arranged in multi-tier formation. The PCCs / MCCs / PDBs shall be of adequate size to facilitate enough space for maintenance and cooling. The size of the PCCs / MCCs / PDBs shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component does not attain temperature more than 40 degree Celsius. Openings shall provide for natural ventilation, but the said openings shall be screened with fine weld mesh.
- ✓ Knockout holes of appropriate size and number shall be provided in the PCCs / MCCs / PDBs in conformity with number, and size of incoming and outgoing conduits / cables.
- ✓ Alternatively the PCCs / MCCs / PDBs shall provided with removable sheet plates at top and bottom to drill holes for cable / conduit entry at site.

- ✓ The PCCs / MCCs / PDBs shall be designed to facilitate easy inspection, maintenance and repair.
- ✓ The PCCs / MCCs / PDBs shall be sufficiently rugged in design and shall support the equipment without distortion under normal and short circuit condition they shall be suitable braced for short circuit duty .

## **1.2 PROTECTION CLASS:**

All the indoor PCCs / MCCs / PDBs shall have protection class of IP - 54.

## **1.3 POWDER COATING:**

All sheet steel material shall undergo seven-tank process after all the necessary shearing and other mechanical works are completed. After the seven-tank process powder coating treatment shall be adopted using powder of reputed make. After the powder coating is complete welding in the panel or any sort of shearing, bending or cutting activity shall not be done. The colour shall be Siemens Grey 631

## **1.4 CIRCUIT COMPARTMENT:**

Each circuit breaker and switch fuse units shall be housed in separate compartments and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with the breaker / switch fuse units in ON and OFF position. Safety interlocks shall be provided for non-opening of the door when the breaker is in ON position. The door shall not form integral part of the draw out position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tiers in a vertical section.

## **1.5 INSTRUMENT COMPARTMENT :**

Separate and adequate compartment shall be provided for accommodating instruments, indicating lamp, control contactors, relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, switch fuse units, bus bars and connections.

## **1.6 BUSBARS :**

The busbar shall be air insulated and made high quality, high conductivity, high strength copper and as per relevant IS code. The busbar shall be for three phases and neutral system with separate neutral and earth bar. The busbar and interconnection between busbar and various components shall be of high conductivity, hard drawn, electrolytic copper. The busbar shall be of rectangular cross section designed to withstand full load current for phase busbar and full rated current for neutral busbar and shall be extensible type on either side. The busbar shall be rated for the frame size of the main

incoming breaker. The busbar shall have uniform cross section through out the length. Ratio of 1 sqmm = 1.2 A shall be adopted for tinned copper bus bars.

The busbar and interconnection shall be insulated with heat shrinkable PVC sleeves and be colour coded in red, Yellow, Blue and Black to identify the three phases and neutral of the system. The busbar shall be supported on unbreakable, non hygroscopic DMC insulated supports at sufficiently close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 50 KA RMS symmetrical for one second and a peak short circuit withstand of 105 KA minimum.

The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm thick FRC sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearances between the busbar are maintained as per below.

Between phases : 27 mm min.

Between phases and neutral : 25 mm min.

Between phases and earth : 25 mm min.

Between neutral and earth : 23 mm min.

All busbar connection shall be done by drilling holes in busbars and connecting by chromium plated bolt and nuts. Additional cross section of busbar shall be provided in all PCCs / MCCs / PDBs to cover-up the holes drilled in the busbars. Spring and flat washers shall be used for tightening the bolts.

All connection between busbar and circuit breaker / switches and between circuit breaker/ switches and cable terminals shall be through solid copper strips of proper size to carry full rated current. These strips shall be insulated with insulating strips.

## **1.7 ELECTRICAL POWER & CONTROL WIRING CONNECTION :**

Terminal for both incoming and outgoing cable shall be suitable for 1100 volts grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder less sockets for the cable size as indicated on the appended drawing for the PCCs, MCCs, PDBs.

Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.

Both control and power terminals shall be properly shrouded.

10% spare terminal shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block so that not more than one outgoing wire connected per terminal.

Terminal strip for power and control shall preferably be separated from each other by suitable barriers of enclosures.

Wiring inside the module for power, control protection and instrument etc. shall be done with use of 1100 V conforming to IS 694 and IS 8130. Power wiring inside the starter module shall be rated for full current rating of contactor, but not less than 4 sq mm cross section area. For current transformer circuits, 2.5 sq mm-copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq mm copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solder less sockets at the ends before connections are made to the terminals.

Control power for the motor starter module shall be taken from the respective module switchgear outgoing from R phase and Neutral. Control wiring shall have control fuse (HRC type).

Particular care shall be taken to ensure neat and orderly laying of the wiring. Identification ferrules shall be tagged to all the wire termination for ease of identification and to facilitate and testing.

"CUPAL" washers shall be used for all copper and aluminum connections. Final wiring diagram of the PCC, MCC, PDB power and control circuit with ferrules number shall be submitted along with the PCC/MCC/PDB as one of the documents.

### **1.8 TERMINALS :**

The outgoing terminals and neural link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformer for instrument metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming and outgoing cables to internal components connection of the distribution board is permitted. Only one conductor may be connected in one terminal.

### **1.9 WIREWAYS :**

A horizontal PVC wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

### **1.10 CABLE COMPARTMENT:**

Cable compartment of adequate size shall be provided in the PCCs, MCCs, and PDBS for easy termination of all incoming and outgoing cables entering from top. Adequate support shall be provided in the cable compartment.

### **1.11 EARTHING :**

Copper earth busbar of minimum 25 mm x 6 mm size shall be provided in the PCCs, MCCs, PDBS for the entire length of panel. As per the rating of the main busbars the size of earthing busbar shall be decided. The framework of the PCCs, MCCs, PDBs shall be connected to this earth busbar. Provisions shall be made for connection from earth

busbar to the main earthing bar coming from the earth pit on both sides of the PCCs, MCCs, PDBs.

The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp and the clamp shall be ultimately bounded with the earth bar.

### **1.12 LABELS:**

Engraved Aluminium sheet labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

### **1.13 NAME PLATE :**

A name plate with panel designation in bold letter shall be fixed at top of the central in panel. A separate name plate giving feeder details shall be provided for each feeder module door.

Inside the feeder compartment, the electrical component, equipments, accessories like switchgear, contactor, lamp, relays etc. shall suitably be identified by providing stickers. Engraved nameplates shall be of Aluminium strip of black colour and silver letters format.

Nameplate shall be fastened by counter sunk screws / riveted and not by adhesives.

### **1.14 DANGER NOTICE PLATE :**

The danger plate shall be affixed in a permanent manner on operating side of the panel.

The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

The danger notice plate in general shall meet to requirements of local inspecting authorities.

Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made from minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.

The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of IS : 2551-1982.

The said letter, the figure and the sign of skull and bones be painted in single red colour as per IS: 5-1978.

The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.

The danger notice plate, if possible, be of ISI certification mark.

### **1.16 INTERNAL COMPONENTS:**

The PCC / MCC / PDB shall be equipped complete with all type of required number of air circuit breakers, switch fuse unit, contactor, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbar, cable boxes, cable glands etc. and all the necessary internal connections /wiring as required and as indicated on relevant drawings. Components necessary for proper complete functioning of the PCC / MCC / PDB but not indicated on the drawings shall be supplied and installed on the PCC / MCC / PDB.

All part of the PCC / MCC/ PDB carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at any part of the PCC / MCC / PDB.

All units of the same rating and specifications shall be fully interchangeable.

### **1.17 INSPECTIONS / TESTING:**

Each equipment should inspect and witness by client & consultant.

The PCC / MCC / PDB shall be inspected and checked as per inspection manual of the PCC / MCC / PDB manufacturer.

Various electrical components and accessories of the PCC / MCC / PDB shall be checked as per drawing for the respective PCC / MCC / PDB.

The PCC / MCC / PDB shall be checked for rigid mounting, earthing connections, proper rating and size of components, internal wiring, etc.

All mechanical fasteners and electrical connections shall be checked and tightened before installation.

#### **Type test:**

Type test certificates for all switchgears shall be provided.

#### **Routine Test:**

Prior to dispatch of the PCC / MCC / PDB following tests shall be carried out.



a) Mechanical endurance test shall be carried out by closing and opening of all the ACB's, MCB's switches etc.

b) Over voltage and Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in ON position. Similar test shall be carried out keeping the isolating switch in closed position.

c) All the interlocks, controls and tripping mechanism of the switchgears shall be tested for their proper functioning.

d) High voltage test, Continuity test, Control circuit test shall be carried out.

### **1.18 L. T. SWITCHGEARS:**

#### **1.18.1 GENERAL:**

The type, size, and rating of the components shall be as indicated on the relevant single line diagrams.

#### **1.18.2 MINIATURE CIRCUIT BREAKER (MCB):**

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS: 3871 (Part-I) 1965 and IS: 8825 (1996). The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a faulty current.

The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCB's shall be tested and certified as per Indian Standard, prior to Installation.

#### **1.18.3 FUSE:**

Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with IS : 2000-1962 and having rupturing capacity of not less than 35 MVA at 415 Volts.

#### **1.18.4 AIR CIRCUIT BREAKER:**

The ACB shall meet with IS : 2516 part I, II and III. Each pole of the ACB's shall be equipped with and over current, earth fault and short circuit release. The ACB's shall be

equipped with under voltage trip only on those used as main incomer of all sources, bus coupler and inter connector. The trip devices shall be direct acting.

Disconnecting devices of approved type shall be provided to facilitate the removal of the circuit breakers from the housing for test and maintenance purpose.

The ACB's shall have an arc-quenching device on each pole. The ACB's shall have auxiliary contacts for signaling, interlocking etc. The ACB's shall have slow close facilities for checking contact operation and contact gap adjustment.

All contacts subject to arcing shall be tipped with arc resisting material. Main contacts shall be silver plated, multi-finger and spring-loaded type. Facilities shall be provided to isolate the circuit breaker for inspection purpose.

Interlocks shall be provided to:

Prevent the breaker from being isolated unless it is in the "OFF" position.

Prevent the breaker from being racked in to the service position unless it is in the "OFF" position.

Prevent the breaker from being accidentally pulled completely "OFF" the guide rail. Safety shutters of insulating material shall be provided to prevent access to all live contacts, when the breaker is in the inspection position or completely withdrawn. Facilities shall be provided for earthing the circuit breaker.

Air circuit breaker shall be capable of clearing the maximum fault current, which can occur.

The breaker plates shall have an ON-OFF indicators, spring charge indicators, provision to padlock manual handle and provision to lock draw-out mechanism. Electrically operated breaker shall have provision for emergency manual closing by inserting a tool through the fuse plate. A control isolating switch shall be provided on the fuse plate to isolate the supply to the charging motor.

#### **1.18.5 MOULDED CASE CIRCUIT BREAKER:**

The MCCB shall be air break type and having quick make quick break with trip free operating mechanism.

Housing of the MCCB shall be of heat resistant and flame retardant insulating material. Operating handle of the MCCB shall be in front and clearly indicate ON / OFF / TRIP positions.

The electrical contact of the circuit breaker shall be of high conducting non-deteriorating silver alloy contacts.

The MCCB shall be provided with microprocessor based trip units. All the releases shall operate on common trip busbar so that in case of operation of any one of the releases

in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided.

The MCCB whenever called for in the drawings shall provide an earth fault relay.

The MCCB shall provide two sets of extra auxiliary contacts with connections for additional controls at future date.

#### **1.18.6 CONTACTORS:**

The contactor shall meet with the requirements of IS: 2959 and BS: 775.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC 3 and shall be suitable for minimum class II intermittent duty.

If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

#### **1.18.7 TRIVECTOR:**

Flush mount 96 x 96 x 80 mm load manager type Enercon EM 6400 or equivalent meter of accuracy class 1 as per IS 13779 shall be provided. The meter shall be accurate on distorted waveforms; simultaneous sampling of voltage and amperes shall be done. It shall have low burden on PT and CT shall have bright display, shall view 3 parameters together shall have auto scaling from kilo to mega to giga units, shall have programmable CT, PT ratios with built in phase analyser. Auto scrolling shall be programmable as per user choice and communication with PC; PLC DCS shall be possible through RS 485 serial port. It shall be dust proof, tamper proof with data import export option and 10 years back up of integrated data.

Parameters to be monitored shall be Frequency, Line to line and average and line to neutral and average voltage, phase wise and average current, phase wise and total KVA, KW and P.F. reading and KWH monitoring.

User programmable facility for delta 2e and star 3e measurement, C.T. and P.T. ratios, sliding window auto sync. And auto scrolling of parameters shall be available.

Sensing shall be 3 phase, 4 wire measuring True RMS with voltage input range of 110 to 415 V nominal and current input of 5 amps or 1 amps as per field configuration. Current range shall be from 50 mA to 7.5 A and burden on PT or CT shall be app 0.2 VA.

Accuracy for kW / kWh shall be as per IS 1377 / CBIP88 and for all other parameters shall be +/- 0.5% of full scale + 0.5% of reading + 1 digit. Digital readout shall be of 3 rows of 4 digits each (12.5 mm size) with 7 segments bright red LED. Input frequency shall be 50Hz / 60Hz +/- 5%. Power factor range shall be 0.5 lag – unit – 0.8 lead.

Resolution for power parameters shall be for 4 digits and energy parameters shall be 8 digits. Display update shall be at every 15 seconds for demand parameters and 1 sec for other parameters. Display sequence shall be parameter followed by value.

Temperature range shall be 0-50°C and humidity <95% non-condensing.

#### **1.18.8 CURRENT TRANSFORMER:**

Where called for, CT's shall provide for current measuring. Each phase shall be provided with separate CT of class I accuracy and VA burden as shown in SLD for operation of associated metering and controls. Current transformer shall be in accordance with IS: 2705 - 1964 as amended up to date.

#### **1.18.9 PUSH BUTTON:**

The push button unit shall comprise of the contact element, a fixing holder, and push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. Continuous current rating. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.

#### **1.18.10 INDICATING LAMP:**

The push button unit shall comprise of the contact element, a fixing holder, and push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. Continuous current rating. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip. Push button shall be of self-glowing type with LED lamp.

Indicating Lamp shall be LED type and shall supplied complete with translucent covers to diffuse the lamp light. Indicating lamps shall be part of push buttons.

Colour shade for the indicating lamps shall be as below:

ON indicating lamp : Green

OFF indicating lamp : Red

TRIP indicating lamp : Amber

PHASE indicating lamp : Red, Yellow, and Blue.

## 1.1 KV GRADE L.T. CABLES AND CABLE TERMINATION:

### A. SPECIFICATIONS

#### L. T. XLPE CABLE:

##### GENERAL:

- The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in the original drums with manufacturer's name, size and type clearly written on the drums.
- All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.
- The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.
- The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

##### CONDUCTOR:

Uncoated, annealed copper / aluminum, of high conductivity, upto 4 mm<sup>2</sup> size the conductor shall be solid and above 4 mm<sup>2</sup> the conductors shall be concentrically stranded as per IEC : 228.

##### INSULATION :

Cross link polyethylene (XLPE) extruded insulation rated at 70°C.

##### CORE IDENTIFICATION:

Two core : Red and Black  
Three core : Red, Yellow and Blue  
Four core : Red, Yellow, Blue and Black  
Single core : Green, Yellow for earthing.  
Black shall always be used for neutral.

##### ASSEMBLY:

Two, three or four insulated conductors shall be laid up, filled with non-hygroscopic material and covered with an additional layer of thermoplastic material.

##### ARMOUR:

Galvanised steel flat strip / round strips applied helically in single layers complete with covering the assembly of cores.  
For cable size upto 10 sq mm : Armour of 1.4 mm dia G.I. round wire

For cable size above 10 sq mm : Armour of 4 mm wide 0.8 mm thick GI strip

**SHEATH:**

ST -2 PVC along with polypropylene fillers to be provided.

Inner sheath shall be extruded type and shall be compatible with the insulation provided for the cables.

Outer sheath shall be of an extruded type layer of suitable PVC material compatible with the specified ambient temp. of 50°C and operating temperature of cables. The sheath shall be resistant to water, ultra violet radiation, fungus, termite and rodent attacks. The colour of outer sheath shall be black.

Sequential length marking along with size and other standard parameters shall be required at every 1.0 mtr on the outer sheath.

**TESTING:**

Finished cable tests at manufacturers works : The finished cables shall be tested at manufacturer's works for all the routine tests for all the length and size of cables to be delivered at site and the certificate for the same shall be furnished to client. If required the cables shall be tested in presence of the client's representative.

Voltage test : Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for duration of 5 minutes.

Conductor resistance test : The D.C. resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20°C to check the compliance with the values specified in the Is 8130 – 1976.

Cable tests before and after laying cables at site :

Insulation resistance test between phases, phase to neutral and phase to earth.

Continuity test of all the phases, neutral and earth continuity conductor.

Earth resistance test of all the phases and neutral.

All the tests shall be carried out in accordance with the relevant IS code of practise and Indian Electricity Rules. The vendor shall provide necessary instruments, equipments and labour for conducting the above tests and shall bear all the expenses in connection with such tests. All tests shall be carried out in the presence of client and the results shall be prescribed in forms and submitted.

**CABLE MARKING:**

The outer sheath shall be legibly embossed at every meter with following legend :

ELECTRIC CABLE: 1100 V, SIZE: \_\_\_ C X \_\_\_ MM<sup>2</sup> with Manufacturers name, year of manufacturing and ISI symbol.

**SEALING DRUMMING AND PACKING:**

After tests at manufacturer's works, both ends of the cables shall be sealed to prevent the ingress of moisture during transportation and storage.

Cable shall be supplied in length of 500 mtrs or as required in non-returnable drums of sufficiently sturdy construction.

Cables of more than 250 meters shall also be supplied in non-returnable drums. The spindle hole shall be minimum 110 mm in diameter.

Each drum shall bear on the outside flange, legibly and indelibly in the English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type, and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

**CABLE TERMINATION:**

Cable terminations shall be made with aluminium crimped type solder less lugs for all aluminium cables and stud type terminals. For copper cables copper crimped solder less lugs shall be used.

Crimping shall be done with the help of hydraulically operated crimping tool. For joints where by cable is with aluminium conductor and bus bars are aluminium, bimetallic lugs shall be used with compound. CUPAL type of washers shall be used.

Crimping tool shall be used for crimping any size of cable.

**CABLE GLANDS:**

Cable glands shall be of brass single compression type. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations.

**FERRULES:**

Ferrules shall be of self-sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.

**CABLE JOINTS:**

Kit type joint shall be done and filled with insulating compound. The joint should be for 1.1 KV grade insulation.

**B. WORKMANSHIP**

Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the CLIENT AND/OR ITS ARCHITECT before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.

Cables shall be laid on walls, cable trays, inside shafts or trenches. Saddling or support for the cable shall not be more than 500 mm apart. Plastic identification tags shall be provided at every 30 m.

Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.

In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc unless marked on drawing by architect / consultant. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points.

All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. Cable termination for conductors up to 4 sq.mm. may be insertion type and all higher sizes shall have compression type lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armouring shall be earthed at both ends.

In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry watertight.

Testing: MV cables shall be tested upon installation with a 500V Meggar and the following readings established:

Continuity on all phases.

Insulation Resistance.

between conductors.

all conductors and ground.



All test readings shall be recorded and shall form part of the completion documentation.

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.

Format for cable testing certificate:

a. Drum no. from which cable is taken :

b. Cable from \_\_\_\_\_ to \_\_\_\_\_

c. Length of run of this cable \_\_\_\_\_ mtr

d. Insulation resistance test

between core 1 to earth \_\_\_\_\_mega-ohm

between core 2 to earth \_\_\_\_\_mega-ohm

between core 3 to earth \_\_\_\_\_mega-ohm

between core 1 to core 2 \_\_\_\_\_mega-ohm

between core 2 to core 3 \_\_\_\_\_mega-ohm

between core 1 to core 3 \_\_\_\_\_mega-ohm

duration used :

e. High voltage test : Voltage Duration

between core and earth

between individual cores

### **C. MODE OF MEASUREMENT**

The cables shall be measured in rmt and terminations on unit basis.

## **DISTRIBUTION BOARDS:**

### **A. SPECIFICATIONS**

Distribution boards shall be fabricated from 14 gauge M.S. sheet or shall be readymade as specified in the make of material list. It shall be of double door type with hinged (lockable if required) door suitable for recessed mounting in wall. Distribution boards shall be powder coated with 7-tank process application.

The distribution boards shall be provided with phase barriers, wiring channels to accommodate wires and individual per phase neutral links. There shall be separate or individual earth link as per requirement. Proper arrangement shall be made for mounting of MCB's and other accessories.

Distribution boards shall meet with the requirements of IS 2675 and marking arrangement of bus bars shall be in accordance with I.S. standards.

Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° C over the ambient. Each board shall have two separate earthing terminals.

Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. One earthing terminal for single phase and two terminals for 3 phase DB's shall be provided with an earth strip connecting the studs and the outgoing ECU earth bar.

The top and the bottom faces of the D.B. shall be provided for conduit entry of minimum 1" dia. The faces if asked shall be kept detachable.

All outgoing feeders shall terminate on a terminal strip which in turn is interconnected to the MCB/Fuse base by means of insulated single conductor copper wires as follows  
Up to 15 A 2.5 sq.mm. 40 A 10 sq.mm.  
25 A 4.0 sq.mm. 63 A 16 sq.mm.  
32 A 6.0 sq.mm.

Each DB shall have indicating lamps preferably neon type denoting power availability in the board after the switch indicating lamps shall be complete with fuses.

### **MINIATURE CIRCUIT BREAKERS (MCB) :**

MCB's shall have quick make and break non-welding self-wiping silver alloy contacts for 10 KA short circuit both on the manual and automatic operation. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism. In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Breakers must conform to BS 3871 with facility for locking in OFF position. Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sq.mm. Aluminium or 2.5 sq.mm. Copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

### **RCCB / ELCB**

The RCCB should suffice all the requirements of IS as per code IS - 12640 - 1988. The RCA should be current operated and not on line voltage.

The RCCB should ensure mainly the following functions:

- i) Measurement of the fault current value.
- ii) Comparison of the fault current with a reference value.
- iii) The RCCB should have a toroidal transformer with the main conductors of primary (P - N) which check the sum of the current close to zero.
- iv) All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant.
- v) It should be truly current operated.
- vi) It should operate on core balance toroidal transformer.
- vii) Its accuracy should be  $\pm 5 \%$ .
- viii) It should operate even in case of neutral failure.
- ix) It should trip at a present leakage current within 100 mA
- x) Its enclosure should be as per IP 30.
- xi) Its mechanical operation life should be more than 20,000 operations.
- xii) It should provide full protection as envisaged by IE rules - 61-A, 71 - ee, 73 - ee, 1985 and also rule 50 of IE rule 1956.
- xiii) It should conform to all national and international standards like IS: 8828-1993, IS: 12640-1988, BS 4293 - 1983, CEE 27 (International commission Rules for the approved of electrical equipment).

## **B. WORKMANSHIP**

The D.B. shall be properly grouted in the wall in concealed manner taking care that the powder coating is not scratched and dents are not formed on the D.B. The MCBs and ELCBs. In the distribution boards shall be fixed as per the circuit details provided. All the wires terminating in the MCBs and the ELCBs shall be lugged for proper contact and ferrules depicting the circuit nos shall be provided. D.B.s mounted in concealed manner shall have a groove around it so as to save the finish of the plaster and colour during future opening of the door. The distribution boards shall have circuit chart tagged on the door for future maintenance. Danger notice plates shall be fitted to the distribution boards with screws and not stuck so as to assure its presence for a longer duration.

**C. MODE OF MEASUREMENT**

The distribution boards shall be measured in nos and the MCBs and ELCBs shall be measured in nos separately.

## **INTERNAL WIRING**

### **A. SPECIFICATIONS**

#### **RIGID PVC AND FLEXIBLE PVC FRLS LHSFT CONDUITS:**

All conduits shall be rigid PVC alloy low in halogens pipe having minimum wall thickness of medium gauge 1.6 to 2.0 approved by F.I.A. & I.S.I. and shall conform to IS 9537 part 3 and complying with fire safety standards classification V-0. The temperature stability shall be from -20°C - +80°C and also shall be UV stabilised.

Up to 38 mm diameter in slab - minimum 1.8 mm. wall thickness.

Up to 38 mm diameter in floor - minimum 2.0 mm. wall thickness.

Above 40 mm. diameter - minimum 2.2 mm. wall thickness.

Flexible conduits shall be formed from a continuous length of spirally wound interlocked steel strip with a fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

#### **ACCESSORIES:**

PVC conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs etc. shall be specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS: 2667-1964 and IS: 3857-1966. All fitting associated with galvanized conduit shall also be galvanized.

#### **WIRES:**

All wires shall be single core multi-strand/ flexible copper or single strand Copper ( if specified in BOQ), PVC insulated **FRLS** grade as per IS: 694 and shall be 660 V\1100 V. All wires shall be colour coded as follows:

#### **Phase Colour of wire**

R Red

Y Yellow

B Blue

N Black

Earth Green (insulated)

Control (If any) Grey

All off wires Same as Phase wire

#### **SWITCHES & SOCKETS:**

Switches shall be modular type with silver-coated contacts. Sockets shall be 5 pins with switch and plate type cover. Combination of multiple switch units and sockets should be used to minimize the switch boxes.

For heavy duty, metal clad sockets with M.C.B / Isolator mounted in a galvanized steel box shall be provided.

**SWITCH PLATE AND BOX:**

Plates of the same make, as that of switches shall be used with the modular range. Also M.S. boxes shall be taken as switch boxes.

**B. WORKMANSHIP**

The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 25 mm diameter unless otherwise indicated or approved. Size of wires shall not be less than 1.0 sq.mm. Copper or 2.5 sq.mm. Aluminium.

Nominal Dia of wires (mm)	Nominal Cross sec. Area (mm <sup>2</sup> )	20 mm		25 mm		32 mm		38 mm	
		S	B	S	B	S	B	S	B
1/2.40	1.50	4	3	8	6	15	9	--	--
1/1.80	2.50	4	2	6	4	10	8	--	--
1/2.24	4.00	2	2	4	3	8	6	--	--
1/2.80	6.00	1	--	4	3	6	6	--	--
1/3.55	10.00	1	--	3	2	5	4	6	5

S - runs of conduits which have distance not exceeding 4.25 m. between draw boxes & which do not deflect from the straight by an angle more than 15 degree.

B - runs of conduits, which deflect, from the straight by more than 15°. Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 300 mm distance between telephones, TV & Computer piping.

Separate conduits/raceways shall be used for :

Normal lights and 5 A 3 pin sockets on lighting circuit.

Separate conduit shall be laid from D.B. to switch board.

Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.

Emergency lighting.

Telephones.

Fire alarm system.

Public address system & Music system.

For all other voltages higher or lower than 230 V.

T.V. Antenna.

Water level guard.

Computer Wiring

Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.

Conduits run on surfaces shall be supported on metal 12 mm. thick G.I. pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building.

Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.

Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but the building Contractor will do final finish.

Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the CLIENT AND/OR ITS ARCHITECT, before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete suitable fish wires shall be drawn in all conduits before they are embedded.

Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement. Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be

spaced at not more than 12 meters apart or two 90° solid bends or equal. All junction and switch boxes shall be covered by 6 mm clear plate. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.

Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.

An insulated earth wire of copper rated capacity shall be run in each conduit.

#### Lighting & Power Wiring :

All final branch circuits for lighting and appliances shall be single conductor/ stranded/ flexible wires run inside conduits. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes. Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.

All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.

Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the CLIENT AND/OR ITS ARCHITECT'S approval.

Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.



Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 2.5 sq.mm. copper shall be used. Every conductor shall be provided with identification ferrules at both ends matching the drawings.

Testing: the entire installation shall be tested for :  
Insulation resistance.  
Earth continuity.  
Polarity of single pole switches.

General: All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium gauge) & with 650v / 1100v grade PVC insulated flexible copper conductor wire. The switches should be modular with moulded cover plates, blank plates for outlet boxes. The accessories, connectors, sockets, should be fixed with brass chrome / cadmium plated machine screw. For fan points the rates should be with hum - free type 300 W regulators as required to complete the point wiring. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place. All the looping shall be done only in the switchboard and outlet points. The size of the wire shall be as per the specification. Colour code shall be strictly followed.

The size of wires shall as follow :

25-32 Amp. metal clad points:

Phase / Neutral	6.0 mm <sup>2</sup>
Earth	4.0 m m <sup>2</sup>

20 Amp. outlet points :

Phase / Neutral	4.0 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

Two nos. of 15 Amps. socket outlet connected in parallel from DB to first outlet

Phase / Neutral	4.0 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

from first outlet to second outlet.

Phase / Neutral	2.5 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

Light, fans, exhaust fan, 5 Amp. On board plug point, two way light points, bell point etc from switch to outlet.

Phase / Neutral	1.5 m m <sup>2</sup>
-----------------	----------------------

Earth	1.0 m m <sup>2</sup>
From D.B. to switch board – lighting / 5 A socket etc – i.e. circuit mains part of point wiring	
Phase / Neutral	2.5 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

15/20 Amps. Socket outlet for AC (Single Phase/Three Phase) / Geyser	
Phase / Neutral	4.0 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

15/20 Amps. Socket outlet for appliances or looped from sockets with 4 sq mm ckt.	
Phase / Neutral	2.5 m m <sup>2</sup>
Earth	2.5 m m <sup>2</sup>

Separate pipes shall be laid for off wires and circuit mains.

Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.

Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit mains.

Mains for lighting and on board plug points shall be of one-size higher wires than those used in off.

**The point definition shall be conducting and wiring from D.B. to S.B. and there from to final outlet point including switches and accessories, junction boxes, fan boxes, zarri work with cement –sand etc of approved make.**

## **6. LIGHT FIXTURES**

### **A. SPECIFICATIONS**

Light fixtures as mentioned in the BOQ with the catalogue nos and makes shall be installed. The fixtures shall be complete with ballast and shall be prewired by the manufacturer.

Fans of the approved makes and size shown in the drawing shall be used and install in the hook type M.S. box used by the CLIENT.

### **B. WORKMANSHIP**

The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures

### **C. MODE OF MEASUREMENT**

The unit rate shall be considered for fitting one fixture. The rate shall include following All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable.

Supplying and fixing Ball and socket joints wherever required.

Earthing of fittings.

Electrical connections to fittings/fans from the junction box/ceiling rose.

Installation and interconnection of Electronic regulators for ceiling fans.

Supplying and fixing 300 mm. GI down rod for ceiling fans.

## 7. EARTHING

### 1.0 Specification

#### 1.1 Chemical Earthing Earth Rod

The Earth Rod shall be mentioned in earthing schematic. Length of copper bonded steel rod shall be 10 feet.

The minimum copper bonding thickness is 250 microns.

Copper bonding on the steel rod is through Nickel interface.

Gives lowest possible resistance to ground also resist to corrosion.

It shall be molecularly bonded with copper to high strength steel cores.

The life of the earth rod shall be minimum 20 years.

Earth resistance of  $< 3\Omega$  shall be achieved at farthest point for normal earthing &  $< 1\Omega$  shall be achieved at farthest point for clean earthing.

#### **Ground enhancing material**

Necessary amount of GEM shall be used as soil tests as per site requirement & approval engineers.

#### **Earth strips / wires**

The earthing conductor (protective conductor from earth electrode up to the main earthing terminal/earth bus, as the case may be) shall be of copper / Al. of at least 98% conductivity confirming to I.S. 3043, and in the form of wire or strip as specified.

The size & material of earthing conductor and nos. of earth pits are as specified in drg. Though contractor shall confirm the same as per local CEIG dept. requirements & any changes required for the same is within scope of contractor.

#### **Shop drawings / execution**

The contractor shall be responsible to prepare shop drawings for routes of complete system along with necessary calculations before execution for approvals along with location of pits as per site condition. The drawings given by consultant are indicative and it shall be contractor's responsibility to achieve the necessary values for earthing. Contractor shall also incorporate necessary requirements as per local codes / approving authorities.

Following activities shall be carried out for the earthing station  
Minimum 3 mtr. centre to centre distance between two earth pits.  
The bore should be minimum 10ft deep.

All earth pits of same category shall be interlinked with insulated cable.

The earth conductors (Cu. / Al.) inside the building shall be properly clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level or as per site condition as approved by engineer.

The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

For termination / connectors for the earth strip / wires; factory fabricated connectors shall be used. Braising and other local means for joining shall be not carried out. The connectors shall be tested as per BS EN 50164 : 2000.

### **1.2 Mode of Measurement**

Earthing stations shall be measured in units whereas earthing strips and wires shall be measured in rmt.

## **8. TELEPHONE, COMPUTER & IT SYSTEM**

### **A. SPECIFICATIONS**

#### TELEPHONE CABLES AND WIRES:

The type of cables and the services shall be as follows:

Indoor – Multipair PVC sheath armoured / un-armoured as specified 0.6 mm tin Cu. Cable.

Outside -- Multipair PVC sheath armoured / jelly filled as specified 0.6 mm tin Cu. Cable. All multi core cables and wires shall be of tinned copper conductor of not less than 0.6 mm dia and shall be colour coded twisted pairs with rip cord.

The conductor resistance shall be less than 150 ohms per KM and the insulation resistance between the conductors not less than 50 mega ohms and the nominal capacitance of about 0.1 microfarad per kilometre.

Cables laid under ground or locations subject to dampness and flooding shall be filled with polyethylene compound and shall have sufficient protection against moisture and water ingress.

All armoring shall be of galvanized steel wires and protected against corrosion by an outer sheath of PVC in the case of indoor cables and polyethylene in the case of outdoor cables. Outer sheathing must be fire retarding and anti-termite.

All un-armoured single core cables and inner sheath of armoured cables shall be provided with ripcord.

#### TELEPHONE TAG BLOCKS:

The telephone tag blocks shall be suitable for the multi core telephone cables and shall have two terminal blocks, cross connect type. All incoming and outgoing cables shall be terminated on separate terminal blocks and termination shall be silver soldered. The cross connecting jumpers shall be insulated wires of same diameter and screw connected.

The tag blocks shall be mounted inside fabricated sheet steel boxes with removable hinged covers and shall be fully accessible. The enclosure shall be painted with 2 coats of red oxide and stove enamelled.

#### TELEPHONE OUTLET SOCKET:

Telephone outlet socket shall be of the same make as that of the switches and accessories. The outlet sockets shall consist of 2 A 2 Pair polyethene connector in M.S.I / PVC boxes with switch plate of the same make as that of switches and telephone

socket. The telephone outlet socket unless and otherwise specified shall be jack type and not pin type.

**COMPUTER WIRES :**

The computer wires shall be of 4 pair enhanced Cat 6 category and shall be of the makes as specified in the tender. The wires used shall be as per the specifications laid down by AVAYA for the certification of the network installed.

**COMPUTER DATA OUTLET SOCKETS:**

The computer sockets shall be of e Cat 6 category and of the make specified in the tender. The sockets shall be installed in the plates of the modular switches range to be used. The sockets shall be crimped using crimping tool with the Cat 6 wire. Computer socket shall be tested with required tools and take certificate for authorized agency.

**For clean room application the plates shall be of SS 316 with no sharp edges.**

**FLOOR RACEWAY:**

Floor raceway of hot dip galvanised / aluminium sheet of 14 g / 2.0 mm shall be used and the dimensions for the same shall be as per the BOQ. The raceways shall be as per the make specified in the tender. The raceways shall be free of any sort of welding edges or other sharp edges to protect cutting of wires during pulling. The raceways shall be laid with use of junction boxes fabricated from 14 g hot dip GI as per drawing.

## **PABX SYSTEM :**

### **Features Required or Not**

Technology	PCM TDM
KTS Support	Yes
ISDN BRI & PRI	Yes
E & M Support	Yes
E1 Support	Yes
Hybrid technology	Yes
External Caller ID display console and Key phone	on Yes
External Music	Yes
Paging Port	Yes
Conference facility	Yes-8 Party
Memory Storage	32 MB Secure Digital (SD) RAM
DISA Card	Yes. 4 Port. 64 different messages.
8 minutes storage	
DOSA Feature	Yes
VoIP	Yes. Open Industry standard
System connectivity V.	24 Port and USB Port built in on system
Range of Key phone	Yes
Auto Redial on Key Phones	Yes
Back Lit Key Phones	Yes
USB/Comp.	connectivity on
Key phones	Digital-XDP. Also USB
No. of keys on Key Phones	9 to 37 keys
DSS Connectivity	60 keys
Supports PC Console	Yes
OHCA on Key Phone	Yes
Jog Dialer/Navigator Keys	4 Navigator Keys
Absence messages	Yes. On Key phones and also simple phones
Incoming call routing based on caller ID	Yes
Two way recording of external call	Yes
Personal greeting to external caller	Yes
MS Outlook integration	Yes
POP UP of incoming caller	Yes
WEB Site/URL integration	Yes
Call details/log of incoming callers	Yes
Tenant Facility	Yes
System modes	3. Day, night and lunch
Appointment reminders	Yes
19 inch variants	Yes

### **B. WORKMANSHIP**

All cables shall be on cable racks and neatly stitched together.

The connection at the tag blocks shall be silver soldered so as to achieve minimum contact resistance.



The final branch connections with single pair cables in conduits and the maximum number of cables in each conduit shall be as follows:

Conduit	diameter	Max. No. of cables
Inch	mm.	
3/4"	20	2 Nos. single pair
1"	25	6 Nos. single pair
1 1/4"	32	12 Nos. single pair
1 1/2"	40	18 Nos. single pair

The tag blocks shall be mounted inside fabricated sheet steel boxes with removable hinged covers and shall be fully accessible. The enclosure shall be painted with 2 coats of red oxide and stove enameled.

**1. DETAILS OF SERVICES:**

2.

**End to End IT Infrastructure at NII Rajkot office for**

- LAN Connectivity
- Voice connectivity
- VC / Meeting Room LAN & display connectivity

**UTP CABLE INSTALLATION GUIDELINES**

1. The Contractor shall be certified Structured Cabling Vendor in order that the final installation be certified in accordance with the Vendors warranty requirements.

2. The contractor is responsible for the provision of all tools required to fulfill his installation obligations in accordance with task at hand at his cost. This includes specialist tools such as drills Machine, Impact Tools, Pliers, Cutters, Tool Punch, and Hammer etc.

3. All cable reels are to be visually inspected for damage incurred during shipping and transit prior to installation.

4. Cable and connecting components found to be damaged or defective prior and during the installation process are to be brought to the Notice of respective person immediately & returned back it to respective Person.

5. It is expected that installed products be capable of supporting voice and data communications applications as per Standards.

6. Contractor has to ensure that Field Team have got full Understanding of the BOM & verify the supplied material as per Part No. / Qty etc.

7. Contractor is responsible for Identification of Each Node Location ( Be it Data / Voice ) with respect to Height from the Finish Floor Level. / Distance from the Corner of the wall etc. & to Mark physically on site in presence of the customer's representative

8. To finalize the encasing raceway type at different pathways e.g. PVC cap on casing inside the rooms & PVC Pipes in the Passages / Corridors / below False Flooring / above false ceiling etc. with the customer's representative.

9. To finalize the feruling scheme keeping in mind the customer's feedback so as to easily identify all the cables at the rack side. The scheme should be short as far as possible & self-explanatory.

10. To Check for the Farthest Node Location Cable Length. It should not exceed 90.00 Meters Length. To check for the Cable Path inside the Furniture if in case.

11. To measure the cable lengths for all the Nodes from Node to Rack Location. Keep additional cable inside the Rack for routing & Termination.

12. Cable being pulled in should be handled by no less than 2 individuals at all times in order to avoid damage to the cable by means of kinks, twisting along its own axis, getting snagged etc. It is recommended that 3 installers co-operate in the pulling in of any given cable run, 1 on each end and another in the middle or positioned near any obstructions to feed slack and thus avoid undue stress on the cable.

13. Care should be taken not to score conductors during the removal of the outer insulating sleeve of the cable when preparing to terminate pairs.

14. Cable bends are to be kept to 25mm at minimum at all times (installed).

15. During the installation process, installers are required to visually inspect cable and connecting hardware components for damage. If such damage is found, e.g. tears in the outer jacket of the cable, severe kinks as identified by white/grey bands of discoloration on cable jacket, these components are to be replaced immediately.

16. No more than 13mm of wire may be exposed for the purposes of termination.

17. All cabling shall be clearly feruled at both ends to the rear of the point of termination no more than 100mm from such a termination point.

18. All patch panel ports and workstation outlets shall be clearly labeled by means of appropriately secured printed labels (hand written labels are not acceptable). All patch and workstation outlet cables shall be clearly labeled by means of an appropriately secured printed label.

19. Where support structures are used, such structures are to provide support at a maximum of 1.5 meters along the length of the run as to avoid cable tension as a result of the cumulative weight of such cable acting upon itself at the next point of support.

20. The surface of such support structures e.g. Cable hangers will not pose a risk of damaging cable due to sharp edges or angular surfaces which would act against the symmetry of wire pairs within the cable or a risk to installers e.g. Cuts.

21. Cable ties are to be used at set intervals of 300mm for all cable bundles thus presenting a uniform appearance.

22. Under no circumstances shall any cable/s hang unsupported, vertical runs are to be supported are no greater than 300mm intervals.

23. Where purpose-installed conduits are to be used for structured cabling, such conduits may never be filled beyond 40% of capacity and should bend at a radius of no less than 6 times the outside diameter of such conduit, nor shall more than two 90 degree bends along the total span of such a conduit.

24. Cable may be laid adjacent to sources of interference such as 240V electrical branch circuits with a minimum separation of 1 foot. At no point may data cabling cross the path of any power or broadband cable, fluorescent lighting unit (where suspension is used as a means of separation) at an angle less or greater than 90 degrees.

25. The installer is to ensure that electrostatic devices such as photocopiers and sources of radiation such as x-ray devices, radio transmitters, their antennae and associated broadband cables are to be avoided when routing cable.

26. To ensure maximum efficiency for all installation projects, well-trained field installers should understand the fundamental techniques necessary for handling high performance cabling.

27. The first step in the process is cutting the proper length of cabling and ensuring that you have adequate margin for attaching the connectors without creating problems by leaving excess cabling at the termination point. Typically, it's a good practice to leave approximately 18 inches of cabling at the wall outlet. The amount of cabling at the wiring cabinet end will depend on the specific installation requirements, but you should typically leave only enough slack to fit neatly within the wire management structure.

28. When cutting the cable it's important to use snips that provide a good clean cut every time. The tool should also be ergonomically suited for repeated usage without undue fatigue or stress to the user. The use of a blade with a serrated edge can help keep the cabling jacket from slipping along the blade face during the cutting process. When using snips equipped with a smooth blade you run the risk of cutting yourself while trying to hold the cabling in place for a clean cut. Another important feature to look for in a good snip is an elongated handle, which allows you to easily exert the needed pressure using the palm of the hand rather than your fingers.

#### **4 CONTRACTOR'S SCOPE OF SUPPLY**

4.1 This is complete requirements for LAN infrastructure at new office for LAN, Voice, and VGA cabling, Vendor has to ensure:

- Own end to end activities for complete IT infrastructure
- Installation of new LAN , Voice & all cabling

4.2 All the materials, equipment, appliances or other things of whatsoever nature required in or about the execution of the work, whether of temporary or permanent nature shall be provided by the Contractor.

4.3 Before starting of work at site, Contractor shall himself familiarize for the work having obtained approval/clearance from client. Vendor need to identify risks for the sites before starting activity.

4.4 Without limiting the generality thereon, Contractor shall do all work necessary at each of the job which is complete in all respect with site restoration.

4.5 Before Starting of Job, Contractor shall ensure that tool box talk & Site specific Risk Assessment with Work In charge and identified work related site specific risk assessment is done at every location. Contractor has to attend the safety training provided by CLIENT HSSE Team.

4.6 Contractor is required to validate the BOQ and its related details so that there are no deviations in the project (In terms of specifications mismatch, functionality, objective of the project)

4.7 Contractor shall carry out the route survey for any activity he will provide diagrams to owner for Approval of routes before carrying out activity.

**4.8 Contractor shall Lay / connect the Cables as per attached Sheet of Structure Cabling Standards.**

4.9 Needless to mention that all cables should be routed via proper Casing/ piping/ Raceways only, and Quality of the Material should be the best and Precision make (MMS Quality) wherever is possible.

4.10 Contractor shall take care of office Interior, while laying cables

4.11 Contractor shall ensure fill up all holes/ Partitions, cementing work, which they have done during execution of project. And they need to take permission before doing any civil work as per client procedure and policy.

4.12 Contractor shall ensure detailed documentation for Individual sites like patching details, Raceway layouts, Diagrams, numbering, Cable length, Test reports, numbering etc.

4.13 Contractor shall check the connectivity through AMP testing methodology & provide test certification.

All the cables need to be tagged

- i. 1. Underlying power and LAN cables need to be tagged with ferule at both the ends and also at 10 mtr internal.

- ii. 2. Jack Panel patch cords need to be tagged separately / differently at both the ends.
- iii. 3. Cable coding has to be different for LAN, Voice, UPS Power and RAO power
- iv. 4. Vendor will need to provide LAN cabling diagram separately along with the tagging clearly mentioned
- f. There should be individual MCB for each category power socket to ensure that maintenance can be done on specific category of sockets without disturbing other categories
- g. 6 sets of One RJ45 LAN points also to be provided along with 15 Amp plug point across the server four walls
- h. Separate earthing for server room
- i. provision for at least 1 additional Jack panel for Data and one for Voice just below the respective panels
- j. Server room fire control system should be separate
- k. Vendor need to install piping for FM200 based cylinders along with portable fire extinguishing cylinders within the server room
- l. The false flooring height vs door vs stairs to the DC need to be considered to ensure that there is minimum risk and maximum convenience
- m. The racks needs to be installed in the rear end to allow free space in front for maintenance and equipment handling
- n. The ceiling also should be with the water seepage protection
- o. Server room entry should be with a fire retardant door of 1200mm with a small glass window
- p. The Power cabling and Network cabling should be terminating in separate corners to facilitate maintenance of both simultaneously
- q. Server room CCTV has to be true High Definition 1920 x 1080 with IR and clear identification within server room
- r. The Rack should have a power strip (of 15 amp multi plug x 10 power points) on one side and another power strip (of 15 amp multi plug x 10 power points)

s. Patch cord for racks should be of adequate length to connect between both racks from under the floor routing only and not across the rack in open

## **B. General**

a. There should be double space in the duct to accommodate more cables or facilitate maintenance

b. Should be able to accommodate 2 LAN points, two multi point 5 amp plugs, 1 HDMI port and one RCA with Audio and Video jacks in straight strip and not congested box shape.

c. Conduit should be able to allow up to three HDMI cables up to the projector along with 2 RCA cables (1 from table and another from VC)

d. UPS cabling in the server room, users PC, printers and common printers will be done by the contractor

e. All LAN cabling will be done by the contractor as per the specifications provided above

f. A testing report for all the patch cords should be submitted to client.

g. The Racks, UPS, EPABX, Fire system, Lights, CCTV, Power points, Lan points will be done by the contractor as per the specifications provided above

h. The cabling duct will be consolidated however with partition for LAN, Power and Voice to prevent electronic interference across. It should be easily maintainable duct considering future expansion

i. All patch cords have to be factory crimped and lockable; Min 2 mtr patch cords to be considered for server room and for end-user 1.5 mtr can be considered. 20% surplus cable should be provided. The patch cord specifications (Speed+Capacity) have to match the LAN cabling

j. All LAN cabling and patch cords should fully comply and support the PoE (Power over Ethernet)

k. Ceiling LAN points 4 corners, 4 middle of the walls and 1 in the center of the ceiling = total 9 LAN points along with 5A UPS point

l. Music box Should have 2 fans for inlet and 2 fans for outlet

m. VC Glass box also to be provided by vendor same as installed in Ahmedabad location

n. For common printers The provision should be for full floor height printers along with 2 wooden trays installed in that area to facilitate paper keeping

#### **Color scheme for structure cabling**

- ✓ Data cabling & I/O – Black color
- ✓ Voice cabling & I/O – Yellow color
- ✓ Server Primary cable – Red color
- ✓ Server secondary cable – Blue color

**Copper Cable Testing, Certification, and Warranty The contractor shall test the entire network cabling system after installation. After installation, all cables shall be tested and certified for performance at their transmission level:-i.e.- CAT6E**

- ✓ Cabling should support the data signal across distance it runs in premises without any data loss or corruption.
- ✓ Any cable run that does not pass each and every criterion shall not be accepted.
- ✓ The contractor shall provide a report of all circuits that were successfully tested as part of the acceptance criteria.
- ✓ Product Warranty and System Assurance Warranty of 25 years for this structured cabling system shall be provided.

#### **Documentation**

- The contractor shall provide complete documentation and diagrams for all the cabling and the patch panels
  - All raceway diagrams must be published as part of documentation
  - The contractor shall provide detail patching details as per CLIENT format
  - Vendor has to follow documentation for CLIENT HSSE work permit
  - All drawings have to be available in Auto cad, Visio and PDF

# **CONVENTIONAL FIRE ALARM SYSTEM**

## **THE SPECIFICATION COVERS GENERAL REQUIREMENTS OF MICROPROCESSOR BASED FIRE ALARM CONTROL AND INDICATING EQUIPMENT.**

The Fire detection system shall comprise of a central unit, connected by two wires to field devices. Including fire detection devices, alarm devices and control devices, located throughout the protected building area. The control unit shall continuously monitor the status of all sensing devices, and initiate action when a fire or smoke, Heat condition is present.

The alarm management shall be field configurable from the control panel via a key pad to enable the system and to permit future changes. This configuration shall be maintained under power failure conditions.

The Fire alarm panel shall be designed to communicate with the sensors and field devices. It shall be a microprocessor based unit, and shall incorporate all hardware and software to enable it to make decisions upon information received from sensors, and operate appropriate outputs to initiate required alarm and signals. The panel shall comply with IS 2189 code of practice. The control unit shall have a front panel comprising of indicating LED's, control keyboard, and LCD display.

The panel shall have 20x4 characters LCD monitoring & programming setup through menu option.

Alarm and Fault signaling and its annunciation shall be capable of zone wise by means of LED and LCD display. The panel shall be capable to do and indicate the zone wise disablement. The LCD message shall have priority when there is multiple even persists; Alarm should have higher priority than Fault. However, it must be possible to view all other events currently in the system, including, alarm, fault and disable.

The visual indications must be arranged so that the different warning are clearly distinguished.(i.e. amber for fault, red for alarm) The internal audible signal device may be the same for all alarms, but either tone variation shall be used to differentiate the signals. Outputs shall be provided for audible alarms, control functions and remote repeater.

The panel shall have number of zones as required by site conditions (tenderer shall specify the number of zones). The zones must be fully field programmable to permit sensors to be allocated to any zone. Each zone shall be identified by a 40 character text label displaying on the LCD display. This shall be field programmable. The panel must provide facilities for the operator to inspect the zoning configuration, and inhibit, or activate devices. Facilities must be provided for identifying all active and inhibited Zones and all connected zone types. Event Logging for Fire and Fault is available in the panel with 70 counts with date and time.

### **Panel Indicators**

All visual indicators shall be LED's and no incandescent lamps are to be used.



The following LED's must be provided:

Zone wise Fire  
Zone wise Open  
Zone wise Short  
Zone wise Isolate  
System ON.  
AC Power ON.  
Battery ON.  
Charger ON  
Low Battery  
Hooter Fault.  
Auxiliary isolate  
Silenced.

### **Panel Displays**

The LCD text display must be able to simultaneously display a minimum of the following information in each display mode.

Zone Display Mode:

- Type of alarm (Fire / Fault)
- Alarm count
- Total number of alarms
- 40 Character location message

### **Panel Controls**

The panel is to incorporate a keyboard with the following functions:

Alphanumeric keyboard  
System reset button  
silence alarm button  
Menu button  
Enter button  
Left / Right Arrow button

The panel shall have potential free contact form C relay ( 2 for fire and 1 for fault)

**Optionals:** zone wise Relay & zone wise Sounder, MODBUS Convertor, TCP/IP module, CMS Software provided based on requirement. Repeater panel provision is available in the panel.

### **Technical Specifications:**

#### **Power**

- 220-240 VAC, 50 Hz.
- Wire size: 1.5 Sq. mm with 600V insulation

#### **Battery (Lead Acid only)**

- Charging Voltage: 27.9 VDC.
- Charging Capacity: 7 Amp Hour Battery Max.
- System Quiescent Current: 50mA + (4.2mA per zone)

#### **Initiating Device Circuits (Zone Circuit)**

- All zones are Class B wiring supervisory
- Normal Operating Voltage: Nominal 24 VDC
- Alarm Current: 20 -35mA threshold
- Short Circuit Current: 40mA Maximum
- Loop resistance: 50 ohms Maximum
- End-Of-Line Resistor: 4.7K, 1/4watt
- Standby Current: 6.8mA (2.4mA for Detectors)

#### **Notification Appliance Circuits (Sounder/Hooter Circuit)**

- Class B wiring Supervisory
- Operating Nominal Voltage: 24 VDC
- Hooter (NACs) output: 0.5A
- End-Of-Line Resistor: 4.7K, 1/4watt

#### **Remote Outputs**

- Fire Contact (C, NO, NC): 220v AC @ 0.5A/30v DC@ 1A
- Fault Contact (C, NO, NC): 220v AC @ 0.5A /30v DC@ 1A (Optional)

#### **24 VDC Power For remote devices**

- Operating Voltage: 24VDC, 500mA Max.

#### **Manual Call Point**

The Manual Call Point shall be Conventional type to define the location.

Activation of Manual Call Point shall initiate operation of the alarm detection circuit.

The manual station shall have normally open fire alarm and annunciator contacts and these contacts shall close on activation.

- The Manual Call Point shall be with a breakable front glass.
- The housing for the switch could be mild steel / fire resistant plastic.
- The switch rating shall be for minimum 1 amp.
- There shall be a 5 mm RED LED to glow if the Call Button is activated.
- The cable termination in the call button shall be with 6A rated terminals.
- It shall be compatible with all type of conventional to the panel.

#### **Repeater Panel:**

Repeater panel shows the same indications of all main panels. The repeater panel which give's all main panels' information in one single repeater panel is located in the security room.

The repeater panel will support 128 zones of various zone panels the main panel zones not exceed more than 128 zones to monitor in a single location.

#### **Photoelectric Smoke Detector:**

This conventional detectors are designed to work with all conventional Panel. These detectors are low profile and have dual LED's for 360O visual indication. The LED's are blinking in normal operating condition whereas the steady state indicates fire status. It has an unique protocol chamber designed to sense smoke produced by wide range of sources of combustion. The detectors sensitivity can be programmed via FACP. It has a

unique drift compensation feature where in detector adjusts its normal reference based on environment conditions.

□ **Features:**

- UL listed.
- Dual LED's for 360 visibility.
- Advanced detection and communication protocol.
- Easy installation and maintenance.
- Sleek low-profile housing design.
- Regular 100mm base.

□ **Electrical Specifications:**

- Operating Voltage : 9 ~ 33V DC
- Operating Temperature : -10 C to 37.8 C
- Humidity : 0 - 95% RH, non-condensing
- Reset Voltage : less than 1V
- Start-Up Current : 120  $\mu$ A.
  
- Alarm Current : 40 mA.(Max).
- Remote Output : 15mA maximum open collector
- Smoke Sensitivity :  $(1.96 \pm 0.76)$  % / ft
- Air Velocity : 0 - 4000 fpm.

□ **Mechanical Specifications:**

- Height : 46 mm with base
- Diameter : 100 mm dia
- Weight : 130g with base
- IP Rating : IP – 42

### **Heat Detector:**

This conventional detectors are designed to work with all conventional Panel. These detectors are low profile and have dual LED's for 360O visual indication. The LED's are blinking in normal operating condition whereas the steady state indicates fire status. The detector is a fixed cum rate of rise heat detector using a thermistor. These detectors will raise an alarm when the detector reaches 59O (Fixed) or when the change in temperature exceeds the rate of rise of 11O C / min.

□ **Features:**

- UL listed.
- Dual LED's for 360 visibility.
- Advanced detection and communication protocol.
- Easy installation and maintenance.
- Sleek low-profile housing design.
- Regular 100mm base.

□ **Electrical Specifications:**

- Operating Voltage : 9 ~ 33V DC
- Reset Voltage : less than 1V
- Start-Up Current : 120  $\mu$ A.
- Alarm Current : 40 mA (Max)

- o Remote Output : 15 mA maximum open collector
- o Thermal Rating : 59 OC (138 OF)
- o Rate of Raise of Temp : 11.1OC / min (20OF/min)
- o Smoke Sensitivity : (1.9 ± 0.76) % / ft
- o Air Velocity : 0 - 4000 fpm.
- o Operating Temperature : -10 OC to 37.8 OC
- o Humidity : 0 - 95% RH, non-condensing
- **Mechanical Specifications:**
- o Height : 46 mm with base
- o Diameter : 100 mm dia
- o Weight : 130g with base
- o IP Rating : IP - 42

### **Multi Detector:**

This conventional detectors are designed to work with all conventional Panel. These detectors are low profile and have dual LED's for 360OC visual indication. The LED's are blinking in normal operating condition whereas the steady state indicates fire status. The detector is a fixed cum rate of rise heat detector using a thermistor. These detectors will raise an alarm when the detector reaches 59 OC (Fixed) or when the change in temperature exceeds the rate of rise of 11 OC / min.

#### □ **Features:**

- o UL listed.
- o Dual LED's for 360 visibility.
- o Advanced detection and communication protocol.
- o Easy installation and maintenance.
- o Sleek low-profile housing design.
- o Regular 100mm base.

#### □ **Electrical Specifications:**

- o Operating Voltage : 9 ~ 33V DC
- o Reset Voltage : less than 1V
- o Start-Up Current : 120 µA.
- o Alarm Current : 40 mA (Max)
- o Remote Output : 15 mA maximum open collector
- o Thermal Rating : 59OC (138 OF)
- o Rate of Raise of Temp : 11.1 OC / min (20 OF/min)
- o Smoke Sensitivity : (1.9 ± 0.76) % / ft
- o Air Velocity : 0 - 4000 fpm.
- o Operating Temperature : -10 OC to 37.8 OC
- o Humidity : 0 - 95% RH, non-condensing

#### □ **Mechanical Specifications:**

- o Height : 46 mm with base
- o Diameter : 100 mm dia
- o Weight : 130g with base
- o IP Rating : IP - 42

### **Mini Horn:**

Mini horn sounders are designed to simplify installations to provide primary and secondary for fire and security applications. These are ideal where smaller notifications devices is desired. The horns can be flush / ceiling mounted with / without back box.

□ **Features:**

- Slim and Sleek
- Wall or Ceiling mountable
- Mini Horn with BackBox
- 24VDC Operation
- They are used in Fire, Burglar & Emergency Alarm System.

□ **Electrical Specifications:**

- Operating Voltage : 24V DC
- Operating Current : 40mA
- Sound Level : 85dB@1m
- Operating Temperature : 0 - 49° C / 32-120° F.
- Sounder Type : Piezo Electric Type
- Tone Type : Fire Engine Siren
- Material : ABS Plastic
- Colour : Red
- Dimensions : 96 H mm X 76 L mm X 28 D mm
- Back Box : 95 H mm X 75 L mm X 58 D mm
- Mounting Type : Surface / Flush Mount

# IP BASED CC TV SYSTEM

## DESCRIPTION IN GENERAL

The CCTV Vendor shall supply, install and commission a IP Camera based CCTV system with the objective shall be to provide High degree of Electronic surveillance system to **Index B office at Gandhinagar.**

The purpose is to monitor & supervise the entire area for security purposes, as well as the record and inform officials on unwanted, untoward incidents. It is also essential to have recorded images to be stored at least for 60 days of all critical area's to facilitate investigations of a reported case.

The Hardware required for the System including servers, workstations, monitors, networking components, cables, connectors, conduits, power supplies etc. will be in vendor's scope.

***Should the Bidder need IT or Networking hardware more than what is budgeted for and provided for in the tender, then the Bidder needs to inform the tender committee / Consultants in writing on the same along with the Tender BID and include the same in his bid price.***

***Any additions to the Takeoff Quantities given in the tender, if required by the Bidder at the tender Stage will need to be spelt out by the Bidder at the time of the Bid itself.***

*It is expected that the Bidder provides a system configuration wherein Main Directory shall be loaded on one of the Primary Server hardware provided.*

*It is expected that the Bidder provides a system configuration wherein Main Directory shall be loaded on Server hardware provided.*

Strategically placed video surveillance cameras shall enhance security by providing continuous monitoring of all parts of the premises.

A. All equipment and materials used shall be standard components that are regularly manufactured and used in the system.

B. All systems and components shall have been thoroughly tested and proven in actual use.

## APPLICABLE STANDARDS

Original Equipment Manufacturer Standard

## APPROVALS

All the cameras should be

A. CE Compliant and

B. UL Listed and

C. FCCB

## SPECIFIC REQUIREMENTS:-

- All the vendors must attach the point by point compliance for below specification in their technical bid. **Offers without the compliance will not be considered.**

- The product described in this specification is (IP) based Digital Video Management (DVM) System.
- The proposed solution shall not require proprietary computer, server, network or storage hardware.
- The proposed system shall be of a manufacturer with as minimum of five (5) years of experience and offerings in the IP network video software market, the letter stating the same should be submitted by the manufacturer.
- The DVM database and video storage shall be based on SQL Server 2005 or better
  - a) Failover directory should be a basic feature of the DVM all the related licenses should be included in offer.
  - b) Failover recording capabilities shall be a basic feature of the DVM and should be included in offer.
  - c) Redundant recording capabilities shall be a basic feature of the DVM and should be provided if required.
- The DVM system shall be based on the latest in software programming technology Microsoft .NET frame work or better.
- The DVM approved IP cameras shall provide the ability to be powered by power over Ethernet (PoE) 802.3af option.
- The DVM shall be able to support all cameras at the up to 25 frames and full resolution as per camera specifications.
- The DVM should support any of the following Video Analytics Features selected outdoor cameras.
  - a) Trip wire detection
  - b) Loitering detection
  - c) Stolen object detection
  - d) Object left detection
  - e) Operator selected object tracking
- The DVM video storage shall be capable of storing video for a period of 30 days available for on line access – the license provided with the Tender Offer shall be for unlimited storage capability.
- The DVM Storage solution shall be as minimum set at RAID-5 configuration
  - a) Storage system shall be of Direct Attached Storage (DAS) systems Network Attached Storage (NAS) systems and / or Storage Area Network (SAN) Systems.
- The DVM shall be based on high quality Dual MPEG-4/H.264 IP cameras. JPEG, MJPEG, Wavelet, or any other image based video compression will not be

considered as approved equal due to the high network bandwidth associated with these types of digital video compression.

- Each Camera shall provide dual video streaming technology providing independent settings per stream.
  - a) A viewing stream of up to 25 fps and 720p video resolution and a recording stream of up to 25fps and upto 720p video resolution as per client / consultants Briefing on the same.
  - b) The system shall be flexible and allow bandwidth selection between 64Kb to 4Mb per stream.
  - c) When both the viewing stream and the recording stream are set at the same FPS and resolution the camera shall send on the network a single multicast stream this shall help reduce network bandwidth.
- The DVM shall have a capacity to switch and control all the current cameras. It should be expandable to unlimited cameras in future.
- The system shall allow the recording, live monitoring, playback of archived video audio, and data simultaneously.
- The DVM shall provide file export tool for export the native video format with all video protections (e.g. watermark, encryption) and the ability to play this video on a standard computer.
- The native file format video player shall show the status of the video authentication as available with the original file format.
- The IP Based DVM shall provide file export tool for export of single frames of video in J-PEG and BMP file formats and for export of motion video files in AVI file format for transport and playback on computers utilizing a Windows environment.
- The Client shall provide the required computers for the DVM client and servers, these computers shall be of the most current state of the art technology available at the time of installation and as minimum shall be better than the minimum requirements specified by DVM system manufacturer as well as tender specifications.

#### **AA. DIGITAL VIDEO MANAGEMENT SERVER SOFTWARE.**

- The DVM software shall consist of an MS-SQL 2005 or better based Main and failover Directory Database Server, Archive Server for audio and video, Failover recording, Digital Virtual Matrix, Incident Reports, Alarm Management, reporting tools and Watchdog modules. All the related software licenses should be the part of the offered system.
- The DVM Server shall maintain a catalog of settings for all the client, servers, and IP cameras in the system



- a) The DVM shall enable the client to dynamically create connections between any camera on the digital monitors (audio, video, serial ports and digital I/Os)
- b) The DVM shall provide the client seamless operation of all cameras available in the system regardless of the actual connection to different archive servers.
- c) The DVM shall detect signal loss and have the capability to alert the systems administrator
- The DVM Archive Server shall offer the capability to be installed multiple servers software on multiple Computer Servers to enable distributed archiving architecture on the LAN or WAN.
- The DVM Archive Server, for video and audio, shall support and manage (90) camera connections from IP cameras each at 25FPS PAL and 4CIF/VGA resolution (704x576PAL) and (120) cameras at 25FPS PAL and 2CIF resolution (352x288 PAL), 170 cameras at 25FPS and CIF resolution.
- The DVM shall be able to set each camera frame rate, bit rate and resolution independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.
- The DVM shall utilize multicast network communication for video monitoring.
- Unicast based equipment will not be considered as an approved equal for alternate system.
- The DVM shall be a software based solution, and shall not require proprietary hardware for video and audio recording servers.
- The DVM shall have a built-in Digital Video Matrix Switcher functionality without the need of any additional software license.
  - a) The Virtual Matrix Switch shall provide a full matrix operation of IP video to digital (computer) screens or analog monitors using Decoders.
  - b) The Virtual Matrix Switch shall have the capability of creating camera sequences with the following functionalities:
- The DVM shall support web based clients connecting to the DVM system via the Internet.
- The DVM shall support a built-in Watchdog module
  - a) The Watchdog shall monitor operation of all services and automatically restart them if they are malfunctioning.
  - b) The Watchdog shall be responsible for restarting the application or in a last resort restart the server in case of malfunction of software components.

- The DVM shall be based on a true open architecture that allow for use of nonproprietary PC and storage hardware that shall not limit the storage capacity and shall allow for gradual upgrades of recording capacity.
- The DVM Server shall be of the most recent computer technology and shall cover the DVM requirements.
  - i. To provide an advanced and reliable system the operating system shall be Windows 2003- Server level (Win XP pro will not be considered as approved equal) or higher.
- The DVM shall provide alarm dry contact interfaces to allow for any alarm input initiating any action in the DVM system.  
The DVM shall transmit dry contact information over the IP Digital Transmission Network.
- The DVM shall provide a serial interface for alarm input to allow for any alarm input initiating any action in the DVM system.
  - The DVM shall transmit alarm serial information over the IP Digital Transmission Network.
- The DVM Shall support full duplex audio communication and transmission signals over the IP Digital Transmission Network without the need of any additional license.
- The DVM shall provide a reporting utility for tracking but not limited to the following options. Video and images shall be stored with reports for documenting events.
  - a) Alarms, Incidents, Operator logs, Service requests
  - b) The Email Alert should be generated in responds to alarms triggered in DVM software and sends out email alerts to a preconfigured list of recipients.
  - c) It should be possible to export the settings of various entities within the DVM i.e Archiver, Directory, cameras etc.. It should be possible to print these reports.
  - d) It should be possible to get reports on past events by querying the audit databases. It should allow the search by User Logon, Entity Configuration, Incident, Alarm, Application Failure, and Equipment Failure.
  - e) It should prove the tool to create the case document which should include Archive Video, Photos, Text and other file attachments.
- The DVM shall provide alarm management module without the need of any additional license.

- a) The alarm management shall be able to set any monitor or groups of monitors to automatically display cameras in response to alarm inputs.
- b) The alarm management shall be able to reset automatically or manually alarmed video.
- c) The alarm management shall allow for multiple modes of alarm handling capability, these modes to be programmed within the same system.
- The DVM shall have support an Internet Gateway server application without the need of any additional license
  - a) The Internet Gateway server shall allow clients to view good quality video streams from remote locations, over the internet, over firewall and proxies
  - b) The Internet Gateway server shall manipulate the video data to adjust the video stream type and properties to the connection type
  - c) The Internet Gateway server shall support all video stream types, including live, archive, instant replay, video sequences, and video on alarm.
  - d) The Internet Gateway server shall have only one TCP port exposed to the internet, thus masking the video servers, encoders and cameras from direct connections coming from external networks.
  - e) The Internet Gateway server, in collaboration with the Gateway server, shall provide remote users full functionality in a transparent way; the remote user will use the system normally despite the fact that the connection goes through the Internet Gateway.

## **BB. DVM CLIENT**

- The DVM client shall consist of Administrator Tool application, a Monitoring application, remote monitoring application.
- The DVM client shall perform the following applications simultaneously without interfering with any of the Archive Server operations (Recording, Alarms, etc.):
  - a) Live display of cameras
  - b) Play Live audio
  - c) Broadcast audio to remote locations
  - d) Live display of camera sequences
  - e) Live display of stitched and/or panoramic camera views
  - f) Playback of archived video and audio
  - g) Playback of stitched and/or panoramic camera clips
  - h) Retrieval of archived video and audio
  - i) Instant Replay of live video and audio
  - j) Instant Replay of stitched and/or panoramic camera clips
  - k) Use of graphical controls (maps)

- l) Configuration of system settings
- m) Execution of system macros.

- The DVM client applications shall support any form of IP network connectivity, including: LAN, WAN, VPN, Internet, and Wireless
- The DVM client applications shall support IP Multicast (UDP) and Unicast (UDP) video and audio streaming.
- The DVM client applications shall automatically adapt to the network topology and use the best available method to receive streaming video.
- The DVM client applications shall provide an authentication mechanism, which verifies the validity of the user.

#### **DVM Client Monitor Application :**

- The Client Monitor application shall allow for live monitoring of video and audio.
- The Monitor shall enable view of 1 to 25 video tiles simultaneously on a single SVGA (1 024x768) monitor at 30fps per camera.
- The Monitor shall enable view of up to 25 video tiles simultaneously on a single monitor and shall provide the ability to connect up to four (4) monitors to a single computer supporting multiple SVGA (1 024x768) monitor outputs.
- The IP Based DVM Shall provide as minimum on each of the VGA monitors independently the following tile views:

Full screen, Quad, 3x3, 4x4, 5x5, 1 + 9 (One large and 9 small view), 1+11 (One large and 11 small view), 1+12 (One large center tile and 12 small view), 1+15 (One large and 15 small view), And more

- The Client monitor shall enable playback of audio independently from video. The monitor shall enable the user to work with multiple Audio layouts containing collections of microphones, speakers and audio clips.
- The Client monitor shall enable playback of audio mixed from both live and archived audio sources, allowing the user to control the volume of each source independently as well as mute them or record them manually.
- The Client monitor application shall enable broadcast of audio from the user workstation to multiple speaker or other audio out resources simultaneously. This shall be available using a simple microphone connected to the user workstations sound card.
- The DVM Monitor application shall allow operators to view an instant replay of any camera or audio input (microphone).

- The operator shall be able to define the amount of time he wishes to go back from a predefined list or through a custom setup period.
- The operator shall be able to control the playback with play, pause, forward, and speed buttons.
- The DVM Monitor application shall allow operators to add bookmarks to recorded clips of video or audio
- The operator shall be able to choose and trigger an action from a list of available actions included but are not limited to:
  - View camera in a video tile
  - View camera on a Decoder (analog monitor)
  - View Map or procedure in a video file
  - Starting/stopping PTZ pattern
  - Go to PTZ Preset
  - Sending alert messages
  - Send/receive messages through a serial data stream
- The DVM Monitor application shall display all cameras attached to the system regardless of their physical location on the network.
- The DVM Monitor application shall display all camera sequences created in the system.
- The DVM Monitor application shall allow for unlimited cameras sequences, which can be run independently of each other on either digital monitor tiles or analog CCTV monitors.
- The DVM Monitor application shall allow operators to control (Pause/Play, skip forwards, skip backwards) Camera Sequences, without affecting other operators' ability to view and control the same sequence.
- The DVM Monitor application shall display all cameras, sequences and analog monitors in a logical tree.
- The DVM Monitor application operator shall be able to drag and drop a camera from a tree of available cameras into any video tile or an analog monitor icon for live viewing.
- The DVM Monitor application operator shall be able to drag and drop a camera sequence from a tree of cameras into any video tile or an analog monitor icon for live viewing.
- The DVM Monitor application shall support Graphical Site Representation (Maps) functionality, where digital maps are used to represent the physical location of cameras and other devices throughout facility.

- The DVM Maps shall have the ability to contain hyperlinks to create a hierarchy of interlinked maps.
- The DVM Maps shall be able to import maps from any graphical software supporting BMP, JPEG and/or GIF image formats.
- The DVM Monitor application operator shall be able to drag and drop a camera from a map into a video tile for live viewing.
- The operator shall be able to click on an icon in a map to initiate PTZ camera preset, run PTZ pattern, view camera in an analog monitor or send an I/O stream.
- The DVM Monitor application shall support the procedure functionality, where procedures can be triggered to appear during a certain event and can be used to provide detail written or verbal instructions to the operator as to the actions to be taken.
- The DVM Monitor application shall support digital zoom on a fixed camera's live and recorded video streams
- The DVM client shall provide the following video analytics alarm options:
  - a) Trigger alarms or events to draw the user attention
  - b) Provide a meaningful text description of the event.
  - c) Provide OSD graphics to depict the analytics event, including the participating objects, event location, motion directions and more.
  - d) Provide the above OSD graphics on live video, archived video and JPEG images
  - e) Support automatic tagging/book-marking of analytics events
  - f) Support search of analytics events history.
- The Client Workstation shall have dual redundant 1 G (1000Mb) network interface and shall operate on 100/1000 Ethernet networked and shall be of the most current technology available by a major brand name manufacturer of computers and servers.
- The DVM Monitor application shall provide management and control over the system using a standard PC, mouse, keyboard and CCTV Joystick controller. The vendors should provide joystick controller as an integrated part of each client workstation.
- The DVM client shall be able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including cameras of various manufacturers' brands, including their PTZ functionalities (i.e.: one keyboard manufacturer controls other manufacturer's dome or vice-versa).
- The DVM client shall allow for a CCTV keyboard to be attachable directly to the PC running the DVM client application via its serial port.

- The DVM client CCTV Keyboard Interface shall provide full PTZ control.
- The operator shall be able to control pan-tilt-zoom, iris, focus, dome relays and dome patterns
- The DVM client software shall allow the operator to access the PTZ configuration menus with no need of additional hardware.
- This shall prioritize which operator has control over a camera vs another operator trying to control the same camera at the same time.
- The DVM client CCTV Keyboard Interface shall provide full video matrix operations

#### **D ALARM MANAGEMENT**

- The IP based DVM shall provide alarm management and reporting module
- The IP based DVM shall notify a user on any alarm set in the system
- The DVM user shall be able to support multiple alarms
- The DVM system administrator shall be able to set for each user the maximum alarms to be viewed at one time
- The DVM user shall be able to forward alarms to other users
- The DVM alarm management shall keep audit trail of all alarm and operators related operations in a separated database.
- The DVM alarm database shall provide multi time schedule support and shall be able to save the alarm database for different period of time as the recorded video schedule.

#### **Hardware Compliance IP Based Dome Cameras**

IP Based Dome Cameras shall have following feature:

- 1/3" CCD/CMOS, Progressive Scan
- HD 720P, Dual H.264 streaming, 25 FPS, 3mm-9mm varifocal lens,0.05 lux Colour,Tamper detection, 3D Noise reduction, PoE & standard 12VDC/24VAC power input,
- Automatic Gain Control, BLC, White balance: On/Off
- Manual pan/tilt adjustment up to 360/180 deg
- S/N Ratio: >50dbs
- Compression: Dual stream H.264 and/or MPEG-4 user configurable (One H.264 for recording and one MPEG-4 for live view or any desired combination), ISO standard.
- Unicast and Multicast support
- Frame Rate : Adjustable 1-25FPS for PALs
  - Resolution: Adjustable from 320 x 240 to 640 x 480 or better, with capability of streaming 640 x 480 @ 25FPS and configurable compression to H.264 or MPEG4 independently for both streams.
- Bandwidth : 64Kbps to 6Mbps
- Built-in Multi-zone motion detection

Unicast, Multicast, RTP, TCP, UDP, HTTP, IGMP, ICMP, DHCP, DNS  
Flash memory for upgrade of video codec and application firmware over the network through web access.

- ❖ 10/100 Base-T Auto sensing, Half/Full Duplex (RJ45)
- ❖ 2 potential free alarm inputs, 1 Relay out
- ❖ Power : 802.3af class 3 PoE and 12VDC/24VAC auto sensing
- ❖ Operating Temp: 0° C to 50° C
- ❖ Mount: Surface
- ❖ Humidity : 90% (Non-condensing)
- ❖ UL and CE and FCC

### High Configuration Client Workstation

- The SVMS computer Client shall be of Dell, HP or IBM make. Cases where the DVM OEM directly supplies the Server shall be acceptable on approval from Consultant / Client.
- The SVMS client shall be of the most recent computer technology and shall cover the SVMS minimum requirements.
- i7 Processor , 2.66GHz,12M, 6.4GT/s, 4 x 4 GB or more of RAM, Microsoft® Windows XP PRO SP2 with Windows 7 Business License
- 60 GB 10 KRPM 3 Gbps HD for OS.
- Windows 7 64bit,DVD/RW, Joystick controller, Two NVS 315 or higher version,1024MB DDR3or better; DVI Graphics Card to support 4 multiplexed Monitors on One CCTV Client.
- With different content possibility on each of the monitor i.e Multiplexed, Alarm, Maps, sequence or any combination. Also Support Drag-n-drop of images by using connected mouse device.
- Network Interface Card - 10/100/1000 MB
- DVD-R/W
- Min 2 Year Next Business Day On Site Hardware Warranty from OEM

### TESTING & COMMISSIONING

Sr No	Description	Visual	Test Readings	Documentation
1	All cables are tested for continuity, insulation, resistance etc.	√	√	
2	System installation proper as per drawing		√	
3	Carry out visual checks on all cameras, cables, camera housing etc., to ensure they are clean and		√	



	free from any mechanical damage		
4	Check for proper termination & feruling	√	
5	Check input A/C supply voltage	√	
6	Check Input supply DC voltage at every camera.	√	
7	Check all cameras' signal on monitor. Also check for clarity, sharpness of the picture.	√	
8	Check PTZ controls of PTZ camera	√	
9	Check recording / playback FRAME RATE	√	√
10	Check server software & client software is installed without any bugs.	√	√
11	Set programming of all cameras through software.	√	√
12	Check remote viewing of cameras on internet/WAN	√	

## DOCUMENTATION

The CCTV system contractor, upon completion of the commissioning activity, shall hand over the system to the customer.

At the time of hand over, the contractor shall provide the customer with the following documentation:

- 1 Copy of detailed report
- 2 Component and equipment list
- 3 Product description sheets
- 4 System design drawing(s)
- 5 System schematic diagram(s)
- 6 System operating manual

## HANDOVER

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s), illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, maintenance operations and procedures shall be included in the manual.

## TRAINING

### General

The contractor shall provide the customer with details of the training required by personnel to operate and maintain the CCTV system.

The Contractor and the customer shall jointly agree the number of staff to attend the training courses.

## MAINTENANCE

Routine maintenance should be carried out in accordance with customer's requirements. All performance checks undertaken should be recorded in the system log book.

As a minimum, the following performance checks must be undertaken on each maintenance visit.

Remove dust and dirt from the camera enclosures (Inside & outside) exterior using a soft brush or a lint cloth. A solvent which is harmless to the finishes of metal and plastic may be applied to more stubborn stains.

Examine the exterior of the enclosure for any signs of damage or loose cable glands and rectify any faults found.

Remove any dust or dirt from the interior of the camera & DVR using a soft brush or a vacuum cleaner.

Examine the printed circuit boards for signs of over heating, dry joints and/or damaged tracks

## **PUBLIC ADDRESS SYSTEM**

### **GENERAL SYSTEM REQUIREMENTS:**

The voice alarm system shall be the integrated solution for BGM and EVAC. The voice alarm system shall be designed for public address and emergency evacuation. All the essential EVAC functionality – such as system supervision, spare amplifier switching, loudspeaker line surveillance, digital message management and a fireman's panel interface – shall be combined.

The system shall provide for emergency call (EMG), business call and BGM audio, up to 60 zones, 8 call stations and two remote control panels.

The voice alarm system shall be a one channel/two channel system. It shall be compatible with BGM sources and 100 V booster amplifiers. It shall be capable of connecting to EVAC compliant loudspeakers and accessories for an integrated public address and voice alarm solution.

The system shall be fully IEC 60849 compliant.

It shall have full system supervision, loudspeaker line impedance supervision, a supervised emergency microphone on the front panel and a supervised message manager for at least 200 pre-recorded messages and chimes.

It shall be possible to merge messages to allow even more flexible use of pre-recorded announcements and evacuation messages. It shall be possible for each message to have any length within the total available capacity.

The memory shall have a capacity of 16 MB. It shall be possible to upload from a PC via USB into the memory, after which the unit shall operate without PC connection.

The standard WAV-format shall be used for the messages and sample rates of 8kHz up to 24kHz with 16-bit word length (linear PCM) shall be supported.

Volume override relay contacts shall be provided for each zone separately for overriding local loudspeaker volume controls. All current override schemes shall be supported (3-wire and 4-wire override schemes i.e. standard 24V and failsafe). Upon a call or an activated trigger input these contacts shall be activated for the appropriate zones, together with an additional voltage free contact (Call Active) for control purposes.

A 24Vdc output shall be available to supply power to external relays, so no external power supply shall be required for that purpose. A LED VU-meter shall allow for monitoring of the master output.

The maximum allowed total cable length between the controller and the last router in the chain shall be 1000 meters.

The maximum allowed total cable length between the controller and the last call station in the chain shall be 1000 meters.

The maximum allowed total cable length between the controller and the RC panel shall be 1000 meters.

The controller and each connected router shall have 12 trigger inputs to start business and emergency messages. Each shall be configurable for a message consisting of a sequence of up to 8 wave files.

It shall be possible for wave files to be used in different combinations with other messages, optimizing flexibility and used storage space.

The messages shall be merge able to allow even more flexible use of pre-recorded announcements and evacuation messages. The system will be configured for 24 zones, expandable to up to 60 zones using additional six zone routers. Up to 8 call stations shall be connectable. Interconnections shall be made using standard RJ45 connectors and CAT5 cable.

It shall be possible to connect 1000 watts booster amplifier per router. The audio output shall use standard analog audio 100 V line switching for full compatibility with public address equipment and EVAC-compliant loudspeakers. The system shall be configured using DIP switches for basic functionality and a PC for more advanced functions. It shall be possible to specify 16 priority levels.

A built-in 240 W booster amplifier shall provide the power for the emergency call channel and BGM. It shall be possible to add additional booster amplifiers as spare, to provide two-channel operation or if the total power requirement exceeds 240 W (maximum 1000 W per 6 zones).

The maximum/rated output power of the internal booster shall be 360 W / 240 W. max mains inrush current shall be 8A @ 230 Vac / 16A @ 115 Vac

All control equipments should operate on Mains voltage which will be either 230Vac or 115Vac,  $\pm 15\%$ , 50 / 60Hz (selectable)

The power supply voltage range shall be 18 – 24V with a current consumption of less than 50 mA.

Power consumption of the Central Control Unit shall not exceed 600 Watts, and that of the Matrix shall not exceed 50Watts.

In case of Power failure Battery backup facility should be available and the battery voltage shall be 24Vdc, +20% / -10%.

The nominal sensitivity shall be 85 dB SPL (gain preset 0dB).

The nominal output level shall be 700 mV.

The maximum allowable sound pressure level shall be 110 dBSPL.

The microphone shall have a limiter. The distortion shall be less than 0.6% at maximum input.

The equivalent input noise level shall be no more than 30 dB SPL. The frequency range shall be 100Hz – 16kHz.

The speech filter shall be a 315 Hz, high-pass, 6 dB/oct filter. The output impedance shall be 200 Ohms. The stem length with microphone shall be 390 mm.

All low level connections and volume override shall be on MC1,5/XX-ST-3,5 type connector blocks.

All high level connections except mains shall be on MSTB 2,5 /XX-ST.

The input contact shall have supervision based on a series and parallel resistor.

All control equipments shall be rack mountable with removable rack mounts. The matrix shall be not higher than 2U. The controller shall be not higher than 3U. The rack mounting kit shall be included.

The operating temperature range shall be -10°C to +55°C. The storage temperature range shall be -40°C to +70°C.

The system shall comply to the following standards:

EVAC compliance acc. to IEC 60849

EMC emission acc. to EN 55103-1

EMC immunity acc. to EN 55103-2

Safety acc. to EN 60065

#### CENTRAL CONTROL UNIT SPECIFICATION

- As the basis of the voice alarm system, the Central control unit shall have all the essential functionality for compliance with IEC 60849 standard, including full system supervision, loudspeaker line impedance supervision, a supervised emergency microphone on the front panel and a supervised message manager.
- Frequency response shall be 60 Hz – 18 kHz (+1/-3 dB, @ -10 dB ref. rated output. The distortion shall not exceed 1% at the rated output, 1 kHz.
- Control unit shall have tone controls to allow for adjustment of the BGM sound.
- It shall have separate bass and treble controls.
- The controller shall have two BGM source inputs and a mic/line input with configurable priority, speech filter, phantom power and selectable VOX activation.
- It shall be possible to select 16 priority levels for microphone, call stations and trigger inputs for optimum system flexibility. It shall have two connectors to

connect call stations. It shall have 12 input triggers with 6 supervised trigger inputs.

- Furthermore it shall have one record output on cinch connectors.
- The trigger outputs shall be on floating relays with a rating of 250V @ 7A.
- The controller shall have an emergency active relay, a fault relay and two general purpose relays, for control purposes. The fault relay shall be failsafe.
- The output section shall have six transformer-isolated 100 V constant voltage outputs for driving 100 V-loudspeakers in six separate zones.
- All zones shall be individually selectable from the front panel and the BGM output level in each zone shall be individually settable in 6 steps.
- The BGM output shall be connected to the 70V line, thus it shall be possible to connect a total load of 480 Watts in a two channel system combined with a 480 Watt booster.
- The output of the booster shall be also available as a separate output on 100V and 70 V. A separate 100 V Call Only output shall be provided for addressing an area where BGM is not required but where evacuation announcements are. Six configurable volume override output contacts shall be available for overriding local volume controls during priority calls. A LED VU-meter shall monitor the output.

**MATRIX SPECIFICATION:**

- The Matrix shall be an expansion unit adding 6 zones as well as 12 input- and 8 output contacts to the voice alarm system.
- It shall be able to use the booster built in the central control unit.
- It shall provide outputs and inputs for one or two boosters in a multi amplifier for one- or two-channel system.
- It shall provide dual channel operation for calls and BGM simultaneously to a maximum of six different zones, using two booster amplifiers.
- Also single channel operation shall be possible with only one booster.
- The matrix shall have a set of relays for zone-switching the power amplifier output(s) to different loudspeaker groups.
- Each of the zones shall be switched between the call channel (upon call-station selection or all-call microphone or emergency activation), the BGM channel (upon front panel selection), or off.

- The zone power handling capacity of the matrix shall be 1000 Watts.
- The router shall also have 12 input triggers. 6 triggers shall be supervised for EMG purposes.

#### **PAGING STATION SPECIFICATION:**

1. The 6-zone paging station shall be a stylish high quality call station with a stable metal base, a flexible microphone stem and a unidirectional condenser microphone.
2. It shall be intended for making calls to selected zones.
3. The special design shall allow for neatly flush mounting in desk tops.
4. Using dip switches on the bottom of the call station, the call station ID shall be selectable. The call station shall have selectable gain, speech filter and limiter for improved intelligibility.
5. On each call station it shall be possible to select 6 zones with the possibility to connect a paging station keypad to increase the number of zones or zone groups that can be selected.
6. It shall have LED indications for zone selection, fault and emergency state.
7. The call station extension shall provide seven additional zone and zone group keys
8. On each paging station shall be possible to select 6 zones with the possibility to connect up to 8 call station keypads to increase the number of zones or zone groups that can be selected. Selected zones are indicated with LEDs on the call station, three additional LEDs give visible feedback on the active state of the microphone and the system. Green indicates microphone active, amber indicates that the system has detected a fault (IEC 80649) and red indicates that the system shall be in the emergency state.

#### **LOUD SPEAKER CEILING MOUNT:**

Recess mount speaker with metal grill, designed in accordance with IEC268-5 Power handling capacity standards. CE conformity. Safety according to EN60065. Ball-proof according to DIN 18032-3. Complete with metal fire dome, with following specifications:

- Maximum power : 9 watts
- RMS: 6 watts. Tappings at 6/3/1.5w
- SPL: 99dB
- At 6w/1watt (1kHz at 1 mtr)
- Rated impedance: 1667 ohm
- 2 pole push-in terminal block

#### **SURFACE MOUNT SPEAKER:**

1. Suitable for speech and music reproduction. Metal enclosure designed to mount on surface or for recess mount. Conforming to CE and safety according to EN60065 and Evacuation compliance to BS5839-8 complete with back box with following specifications:

2. Maximum power: 9 watts
3. RMS: 6 watts with tapping at 6/3/1.5/0.75 watts.
4. SPL: 102dB at 6 watts /1w (1kHz, 1mtr)
5. Frequency: 150 Hz to 20kHz.
6. Impedance: 1667 ohm with 3 pole screw connector.

#### **AMPLIFIER:**

7. 19 inch rack mounting 2U high metal housing with dual priority switching.
8. Inputs for 100 volts slave operation.
9. Level controls for input 1 and 2.
10. 240 watts RMS
11. Frequency range: 50Hz to 20kHz
12. Distortion: <1% at rated output power, 1kHz
13. Inputs and outputs available at 100volts.
14. Direct output : 100 volts / 70 volts and 8 ohm.
15. Operation: 230 volts AC and 24VDC

#### **BGM SOURCE:**

16.  Back ground music source consisting of DVD/CD/MP3 player with USB input and a separate FM player.
17.  Simultaneous operation of player and FM set

#### **CORE CABLE**

18. 2 core 1 Sq mm Multi Stranded Overall PVC Cable of any Standard Make
19. This will be laid in the Pre-laid Conduits

#### **VOLUME CONTROL SWITCH**

- 12/36/100 watts 100 volts volume control with over ride relay.



- Suitable for 3 and 4 wire system.
- Continuous rotating system
- Self-extinguishing according to UL 94
- Safety according to EN60065 certification
- Five attenuation steps
- Frequency response: 50Hz to 20kHz
- Consumption: 20mA at 24VDC
- Mounts on MK switch panel

### Technical Specification – AV System

#### Wall mount Speaker:

##### 6W Wall mount speaker with 6/3W taps

Parameters	Values
Rated power	6 W
Power taps @ 100V	6 W / 3 W
Sound pressure level at 6W/1W (1kHz,1m)	96 dB / 88 dB
Frequency range (-10dB)	110 Hz -13 kHz
Rated impedance	1.7 k $\Omega$ / 3.3 k $\Omega$
Connection	Cable
Dimensions (W x H x D)	260 x180 x 120 mm
Weight	1.08 kg
Color	White (RAL 9010)
Weight of Magnet	115 g

#### Ceiling mount speaker:

##### 6W Ceiling speaker with metal grille and 6/3W taps

Parameters	Values
Max power	9W
Rated power	6W
Power taps @ 100V	6W / 3W
Sound pressure level at 6W/1W (4kHz,1m)	98 dB / 90 dB
Frequency range (-10dB)	80 Hz -20 kHz
Dispersion angle (1kHz/-6dB)	160°
Rated input voltage	100 V / 70 V
Rated impedance	1.7 k $\Omega$ / 3.3 k $\Omega$
Connection	Push terminal
Dimensions( $\Phi$ x H)	$\Phi$ 180mm x 55 mm
Hole cut-out size	150 mm
Size of speaker	5"
Weight	0.6 kg
Color	White (RAL 9010)
Weight of Magnet	93 g

#### Amplifier:

The amplifier is highly compact Class-D mixer amplifier solution featuring with

integrated audio source, 5 zone selectors, volume control of each input, equalizer and 5 zone paging station. With precise understanding of the needs of simple applications, this not only provides stable performance of Class-D amplifier, but also increases value from the utilization of each function.

#### **Features**

- 3-level priority with mute function
- Advanced protection system includes current limiting, over current and thermal protection
- 7 band graphic equalizer
- Extendable by adding audio mixer and power amplifier with LINK and PRE-AMP  
Compact size and light weight
- 5-zone remote paging microphone
- Telephone paging input and dry contact of chime

#### **Wireless Hand Held System:**

- Handheld wireless Mic : Including one Receiver and one uni directional Dynamic Handheld Microphone- Receiving System: automatic-switching diversity Receiver
- Image rejection: 55 dB nominal, 50 dB minimum Signal-to-noise ratio: >100 dB at 40 kHz deviation (A-weighted), maximum modulation 40 kHz
- Total harmonic distortion: <1% (+/- 10 kHz deviation at 1 kHz)
- Sensitivity: 20 dBuV (S/N 60 dB at 5 kHz deviation, IEC-weighted)

#### **Transmitter Unit :**

- Number of Channels 10 total
- Frequency Stability  $\pm 0.005\%$ , Phase Lock Loop frequency control
- Modulation Mode FM
- Normal Deviation  $\pm 5$  kHz
- Operating Range 300' typical
- Operating Temperature Range 41° F (5° C) to 113° F (45° C)
- Frequency Response 100 Hz to 15 kHz

### **Wireless Lapel System:**

Receiver and Body Transmitter pack : True diversity UHF Wireless system with one receiver and Beltpack Unipack Transmitter- Receiving System: automatic-switching diversity Receiver Image rejection: 55 dB nominal, 50 dB minimum Signal-to-noise ratio: >100 dB at 40 kHz deviation (A-weighted), maximum modulation 40 kHz Total harmonic distortion: <1% (+/- 10 kHz deviation at 1 kHz) Sensitivity: 20 dBuV (S/N 60 dB at 5 kHz deviation, IEC-weighted) Transmitter Pack-Tone Lock™ tone squelch system fights interference Compatible with the Wireless Essentials® range. Quick slide Power button is great for easy access with 10 selectable channels available to choice from.  
RF Power Output: 10 mW Lavalier microphone:  
Element: Condenser, Polar Pattern: Cardioid, Cable: 55 inch (1.4 m), terminated for use with body-pack transmitters, Accessories Furnished: Clothing clip; windscreen.

### **Wireless Headset Mic:**

Element: Fixed-charge back plate, permanently polarized condenser  
Polar pattern: Cardioid  
Frequency response: 100-13,000 Hz  
Low frequency roll-off: 80 Hz, 18 dB/octave  
Open circuit sensitivity: Phantom: -51 dB (2.8 mV) re 1V at 1 Pa, Battery: -53 dB (2.2 mV) re 1V at 1 Pa  
Impedance: Phantom: 200 ohms, Battery: 270 ohms  
Maximum input sound level: Phantom: 132 dB SPL, 1 kHz at 1% T.H.D., Battery: 121 dB SPL, 1 kHz at 1% T.H.D.  
Dynamic range (typical) : Phantom: 96 dB, 1 kHz at Max SPL, Battery: 85 dB, 1 kHz at Max SPL  
Signal-to-noise ratio: 58 dB, 1 kHz at 1 Pa  
Phantom power requirements: 11-52V DC, 2 mA typical  
Battery type : 1.5V AA/UM3  
Battery current / life : 0.4 mA / 2000 hours typical (alkaline)  
Switch: Off, on-flat, on-roll-off  
Weight: Microphone: 60 g (2.1 oz) , Power module: 139 g (4.9 oz)  
Dimensions: Microphone: 20.4 mm (0.80") diameter, Power module: 84.0 mm (3.31") H x 63.0 mm (2.48") W x 22.0 mm (0.87") D, Headset: 120.0 mm (4.72") nominal at widest point, 80.5 mm (3.17") flexible boom  
Output connector: Power module: Integral 3-pin XLRM-type  
Cable: 1.4 m (4.6') long (permanently attached to microphone), 2.8 mm (0.11") diameter, 2-conductor shielded cable with TA3Ftype connector

### **Projector:**

Display system	3LCD system
Light output	4000 lm
Power Consumption	APP.377 W
Resolution	WUXGA
Nativ Aspect Ratio	16:10
Zoom	Manual
Zoom ratio	x 1.45

Lens shift	V	
Max.range	NA	
H		
Max.range	NA	
Light Source	mercury lamp base	
Life	<b>5000 h</b>	
Operating angle	NA	
Portrait Mode	NA	
Other	Edge Blending	NA
Features	Option Lens slot	NA
Crisp Lens	NO	
Picture By Picture	NO	
HDBaseT	YES	
Instant On/Off	NO	
Constant Brightness mode	YES	
Extended mode	NO	

### Speech mic:

- Element:** Dynamic
- Polar Pattern:** Hypercardioid
- Frequency Response:** 40-16,000 Hz
- Open Circuit Sensitivity:** 55 dB (1.7 mV) re 1V at 1 Pa
- Impedance:** 300 ohms
- Weight:** 270 g

**Dimensions:** 170.0 mm long, 48 mm diameter

**Output Connector:** Integral 3-pin XLRM-type

**Accessories:** stand clamp for 5/8" threaded stands; 5/8" to 3/8" threaded

adapter; soft protective pouch .

### Charger for Wireless Transmitters:

This two-bay recharging station provides power to recharge NiMH batteries in two handheld transmitters and/or transmitters in any combination. Maintenance charging prevents battery self-discharge until the transmitter is removed from charger. The charger draws power from a standard wall socket.

- NiMH batteries are charged within the transmitters
- Versatile unit charges handheld transmitters and/or transmitters (in any combination)
- Built-in safety feature monitors cell voltage and automatically turns off the unit if problems are detected
- Automatic shut-off if alkaline (non-rechargeable) batteries are installed
- Automatic shut-off if damaged batteries are installed
- Maintenance charging prevents battery self-discharge until the transmitter is removed from charger

**Shotgun Mic:**

- Element: Fixed-charge back plate, permanently polarized condenser
- Polar Pattern: Line + gradient
- Frequency Response: 40-20,000 Hz
- Low Frequency Roll Off: 80 Hz, 12 dB/octave
- Open Circuit Sensitivity: Phantom: -38 dB (12.5 mV) re 1V at 1 Pa Battery: 39 dB (11.2 mV) re 1V at 1 Pa
- Impedance: Phantom: 250 ohms Battery: 300 ohms
- Maximum Input Sound Level: Phantom: 132 dB SPL, 1 kHz at 1% T.H.D. Battery: 120 dB SPL, 1 kHz at 1% T.H.D.
- Dynamic Range: Phantom: 110 dB, 1 kHz at Max SPL Battery: 98 dB, 1 kHz at Max SPL
- Signal to Noise Ratio: 72 dB, 1 kHz at 1 Pa
- Phantom Power Requirements: 11-52V DC, 2 mA typical
- Battery Type: 1.5V AA/UM3
- Battery Current Life: 0.4 mA / 1200 hours typical (alkaline)
- Switch: Flat, roll-off
- Weight: 170 g (6.0 oz)
- Dimensions: 369.0 mm (14.53") long, 21.0 mm (0.83") diameter
- Output Connector: Integral 3-pin XLRM-type
- Accessories: stand clamp for 5/8"-27 threaded stands; 5/8"-27 to 3/8"-16 threaded adapter; windscreen; battery; protective carrying case

**FACTORY ACCEPTANCE TEST FOR ALL BOUGHT OUT ITEMS:**

Client, his consultant and their authorized representative shall have the right to inspect and test or get inspected and tested the goods at the works of the Seller or its sub suppliers any time during manufacture and prior to dispatch and to inspect within a reasonable time after arrival of goods at the ultimate destination and during and after erection, testing and commissioning. The goods shall not be deemed accepted until

after the said inspection, testing and commissioning and signing of the Acceptance Certificate. Failure to make any inspection of or payment for or acceptance of goods shall in no way impair client right to reject non-conforming goods or to avail itself of any other remedies to which client may be entitled, notwithstanding client knowledge of the nonconformity, its substantiality in the case of its discovery. In the event of failure of Seller to remove the rejected goods within the time allowed, client shall have the right to dispose of the same at the seller's risk and cost. During the time the rejected goods lie with client awaiting removal by the seller, they will so lie at the seller's risk. All goods rejected by client after receipt at the destination shall be removed by the seller within a reasonable time allowed by client, not exceeding 30 (thirty) days at seller's expense and risk.

The Seller will permit client Inspectors, Consultant and their authorized representatives free access during normal working hours to his works, godown, storage or loading spot etc. and will give them all necessary assistance to perform their task including free use of all accessories, testing and control instruments. The seller shall ensure that the same facilities are granted by his sub-suppliers.

Unless specifically stated to the contrary in the order, all expenses relevant to the preparation and performance of testing, inspection and preparation of any test reports or certificates shall be borne by the Seller EXCEPT for the salaries, fees, traveling, lodging and boarding expense of the Consultant's / client's representatives. However, if the visit duration of PDA / client's representatives is extended for the reasons not attributable to PDA / client, the cost of the extended period of visit shall be borne by the seller.

The sellers shall carry out tests related to performance tests as described in the specifications and specified in the order. All such performance tests shall be at supplier costs. Supplier shall also provide all the tests certificates and documents as demanded by the Inspector for his satisfaction that the order has been executed as per PO specifications. All such certificates, documents in original shall be submitted to the Client before dispatch of material. The goods shall be dispatched from suppliers shop only after written confirmation from clients / or its authorized representative.

**The contractor shall consider all cost towards inspection of goods by consultant / EIC at factory / manufacturers works prior to shipping for 2 persons. (Travelling (Air / 1st AC) / stay etc complete)**

#### **SAFETY CODE**

1. Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground, or from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra labour shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handhold shall be provided on the Ladder and the ladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical).
2. Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a rung ladder shall in

no case be less than 30 cm. for ladders upto and including 3 meters in length. For longer ladders this width shall be increased atleast 6 mm. for each additional 30 cm. of length. Uniform step spacing shall not exceed 30 cm.

1. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites shall so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lightest to protect public from accidents and shall be bound to bear expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.
2. Demolition: Before any demolition work is commenced and also during the process of the work: -
  - a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
  - b) No electric cable or apparatus, which is liable to be a source of danger over a cable or apparatus used by operator, shall remain electrically charged.
  - c) All practical steps shall be taken to prevent danger to persons employed, from risk or fire or explosion or flooding. No floor, roof, or other part of a building shall be so overloaded with debris or any materials as to render it unsafe.
3. All necessary personal safety equipment as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use; and the contractor shall take adequate steps to ensure proper use of equipment by those concerned.
  - a) Those engaged in handling any material, which is injurious to eyes, shall be provided with protective goggles.
  - b) Those engaged in welding works shall be provided with welder's protective-shields.
  - c) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
  - d) The contractor shall not employ male or female labour below the age of 18 years.
4. When work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

5. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following:
  - a) i. These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good repair and in good working order.
  - iii. Every rope used in hoisting or lowering materials or as a means suspension shall be of durable quality and adequate strength, and free from patent defects.
  - b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in charge of any hoisting machine including any scaffold winch or give signals to operator.
  - c) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.
  - d) In case of a departmental machine, safe working load shall be notified by the Engineer-in-charge. As regards contractor's machines the contractor shall notify safe working load of each machine to the Engineer-in-charge whenever he brings it to site work and get it verified by the Engineer-in-charge.
6. Motors gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards; hoisting appliances shall be provided with such means as will reduce to the minimum risk of accidental decent of load adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats working apparel such as gloves, sleeves and boots as may be necessary, shall be provided. Workers shall not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.
7. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of work.
8. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named therein by the contractor.



9. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the contractor shall be open to inspection by the Engineer-in-charge or his representatives and the Inspecting Officers.
10. Notwithstanding the above conditions 1 to 14 the contractor is not exempted from the operation of any other Act or Rule in force.
11. If the height at which the contractor is working is more than 12 feet then the staff should wear safety helmet and tie himself with softy belt, client/ architect have all right to ask the contractor to stop wire if the safety condition are not fulfilled.

### **AS BUILT DRAWINGS / SHOP DRAWINGS**

Contractor shall make all necessary shop drawings indicating conduit / cable tray routes / quantities / sizes; cable schedule, circuiting details etc complete before starting the works and get approval of consultant / EIC.

At the completion of the works and before issue of the certificate of virtual completion, the contractor shall submit to the consultant 4 sets (HARD AND SOFT FORMAT) of layout drawings drawn at approved scale indicating the complete wiring system as installed.

These drawings must provide the following minimum information :

- Run and size of conduits, inspections, junction and pull boxes.
- Size of conductors in the conduits.
- Location and rating of sockets and switches controlling the light and power outlets.
- Location and details of distribution boards, mains, switches, switchgear, main panel and other particulars.
- A complete wiring diagram, as installed and schematic drawings showing all connections in the complete electrical system.
- Location of outlets, junction boxes, sizes of various conduits for telephones.
- Location of all earthing stations, routes, sizes of all earthing conductors, manholes, layout of earth link strips, etc.
- H. Layout and particulars of all cables.
  - Necessary drawings with prints for approvals from local / govt. authorities.
- Above indicates the general requirement. However, contractor must include all information desired by the client and Architects/Consultants in the final as built documents. Guidance for the preparation of as built document shall be had from the consultant.

### **11. MANUFACTURER'S INSTRUCTIONS**

Where manufacturer's have furnished specific instructions, relating to the materials used in this job for covering, paints etc which are not specifically mentioned in this documents, manufacturer's instructions shall be followed.

### **12. GUARANTEE**

At the close of the work and before issue of the final certificate of virtual completion. The contractor shall furnish written guarantee indemnifying the Architect/Consultant against defective materials and workmanship for a period as mentioned in the

schedule of fiscal aspects. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to client the following :

- A. Any defective work or material supplied by the Contractor.
- B. Any material or equipment damage or destroyed as a result of defective workmanship by the Contractor.

### **13. SAFETY OF MATERIAL**

The Contractor shall provide proper and adequate storage facilities to protect all materials and equipment, including those issued by the owner against damage from any cause whatsoever.

### **14. COMPLETION CERTIFICATE**

On completion of the Electrical Installation a certificate shall be furnished by the Contractor counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the local authority. The contractor shall be responsible for getting the Electrical installation inspected and approved by the local authorities concerned.

### **15. ENGINEER AND FOREMAN**

The Contractor shall employ a competent fully licensed, qualified full time electrical Engineer and foreman to direct the work of Electrical Installation in accordance with drawings and specification. The foreman shall be available full time on site to receive instruction from Architect/Consultant or his nominee in the day to day activities throughout the duration of the contract the foreman shall correlate the progress of work in connection with all relevant requirements of the supply authorities.

### **16. LIAISONING WITH LOCAL SUPPLY COMPANY**

The contractor shall be responsible for all the Liaisoning work with the supply company. However, all the technical assistance required for the same may be furnished by the consultant. The contractor has to fill the necessary forms and submit test reports so as to ensure that the supply is available in time. The contractor shall prepare necessary drawings for the approval of the concerned government departments and has to get the necessary permissions for supply and D.G. sets etc.

### **17. SPECIFICATIONS AND SCHEDULE**

The specification and schedule of rates shall be considered as part of this contract and any work or materials shown on schedule and not called for in this specifications or vice versa shall be executed as if specially called for in both. The drawings indicate the extent and general arrangement of the fixtures, controlling switches, wiring system etc. and are essentially diagrammatic. The drawing indicates the points of termination of conduit runs and are suggestive of the routes to be followed.

### **18. SUPERVISION**

Supervision shall be by a competent person experienced in the nature of the work to be undertaken. This person shall be available on site for the full period of works. The

Engineer may demand at any time during the contract the replacement of the contractors personnel who fails to satisfy this requirement of competent.

## **19. TOOLS AND EQUIPMENTS**

The Contractor shall provide all necessary Jointing Equipment, tools, Portable power tools, test equipment etc which will be required to carry out the Electrical work. All the zarri work, except in unavoidable circumstances, shall be done with a zarri cutter. This includes all heavy duty equipments such as Cranes, lorries, etc. for site delivery and fixing.

The contractor must have minimum following instruments :

- 1) 1000 / 500 V Meggar.
- 2) Clip on meter.
- 3) Earth tester.
- 4) Lux meter.
- 5) Zarri Cutter.
- 6) Multi Meter.
- 7) Drill machine upto 25 mm dia.
- 8) Ladders suitable for 30 ft. and above.
- 9) All safety equipments like helmet, safety rope etc.
- 10) Complete set of spanners, screw drivers etc.

## **20. SITE STORAGE**

The contractor shall be responsible for the safe storage of materials on site. This includes ensuring that all equipment is handed to the client in sound undamaged order.

The Contractor shall be responsible for safe storage of materials on site, and liable for their replacement. The Contractor would be required to maintain a watch man on site and shall remain Contractors Choice.

## **21. SPARES**

The Contractor shall prepare a schedule of manufactures recommended for spares for one year maintenance.

## **22. OPERATING AND MAINTENANCE MANUALS**

The Contractor shall furnish two sets of operating manuals which shall include services maintenance instructions and circuit diagram for each item of equipment.

## **23. SITE CONDITIONS**

The Contractor shall take all necessary action to acquaint himself fully with site conditions. Any conditions at tendering stage will not be accepted.

After the contract is awarded the Contractor shall acquaint himself fully with existing services and obtain all necessary information to avoid any damage to the services during excavation etc.

## **24. LABELS AND NOTICES**

On all switchgear identification name plates shall be fitted these will identify the substation and/ or out going ways. The labels shall be made on indestructible non deteriorating material with lettering engraved in black or white background except where otherwise specified. Fixing shall be by means of rivets or screws in addition to any

adhesive. all labels shall be English/Hindi /mother language as directed by the Consultant. All pillars and mini feeder pillars in addition to identification labels shall have each way identified by a label to the same specification fitted in the feeder pillar. An indestructible "Danger 415 volts" plates should be fitted externally with a double flush danger signal. The letters to be 12 MM height minimum in signal red.

In addition each distribution board shall have a typed chart detailing particulars of the circuits controlled which shall be fixed to the inside of the door. The details shall include the circuit load, description, the type and rating of the protection device, and the cable size. A sheet of transparent rigid plastic shall be used to completely cover the chart to prevent damage.

## **25. PACKING AND RECEIPT OF MATERIAL**

The contractor shall take every possible measure including appropriately strong packing, proper supervision of loading and off loading and proper transportation by the most suitable route to ensure the safe delivery to site of plant and equipment. The Contractor shall keep at site up-to-date record of all materials received and fully annotated with details of the carrier and condition of equipment on arrival.

## **26. RECORDING OF WORK**

The contractor shall keep a diary and a set of drawing recording the progress of the works and details of all instruction received. These shall be available for the consultant upon request. The contractor's site representative will submit a written report every two weeks outlining the progress of the work including work completed to date. The review of the work completed and the bar chart submitted shall be done weekly and the difference in the two shall be submitted to be Consultant specifying the reasons for the difference.

On completion of work the contractor has to submit detailed reconciliation statement of all electrical materials. The loss of material shall be recovered at prevailing market rate for the material supplied by the client or other agency.

The contractor shall take permission from the employer before he takes all the unused material from the site on completion of work.

## **27. MARKING OUT**

Routes and positions of systems, and positions of all electrical equipment shall be marked out by the contractor and approved by the Engineer before such items are installed.

These items shall be installed in the positions shown on the drawings, but reasonable variations may be made on site with the consent of Engineer.

## **28. FIXING**

Screws fixing brick concrete or similar materials which necessitate plugging shall be made using steel woodscrews into plugs in rotary drilled holes.

Items of switch fuse gear, cable racks and trays etc. shall be fixed using corrosion resistant steel bolts fitted with expanding collars, e.g. 'Anchor Fastner' set into rotary

drilled holes of the correct size all such bolts shall be provided with one number wide flange washer and one heavy spring washer.

## Approved Makes

SR NO.	ITEM DESCRIPTION	MAKES
	<b>Electrical</b>	
1	Rigid PVC FRLS LHSFT Conduit 1.6-1.8 mm wall thickness ISI & FIA Approved	Nehir, Precision.
2	Accessories for conduit	same as above.
3	Flexible Wire	RR, Finolex, Polycab.
4	Switch	MK- Blenz, Legrand - Marious, or Equivalent
5	MCB & Distribution Board	Schneider Acti-9, Legrand, Indo Asian – Opti pro
6	Data Wire	Tyco AMP, Molex,
7	Telephone Wire	RR, Polycab, Deltron, Finolex
8	Cable (PVC Armoured cable)	RR, Acab, Finolex, Polycab
9	HRC Fuses	Schneider Acti-9, Legrand, Siemens
10	MCBs	Schneider Acti-9, Legrand, Siemens, Indo Asian
11	Re-wirable Porcelain Fuse	CPL, KEW
12	Connector	Connectwell, Elmex
13	ELCB/ ELMCB	Schneider Acti-9, Legrand, Seimens, Indo Asian
14	Capacitor (APP / Heavy duty type)	L&T, Epcos, Legrand
15	Relay	Alstom, ABB, EE
16	MCCB	Schneider, Siemens, L & T, Legrand □ range of MCCBs as per specs
17	Meter (Digital)	Conzerv, SEMS, Elmeasure
18	PVC tape	Steel grip, Anchor
19	Glands Double Compression type	Cosmos, comet, Polycab
20	Cable Lugs	Dowells, 3-D, Polycab
21	GI Raceway & Floor Junction Box	MK, Legrand
22	Earthing	Ashlok, Earth rite,
23	Light Fixture	Havells, Crompton, Philips
24	Exhaust Fan	Bajaj, Crompton
25	Ceiling Fan/ wall Fan	Bajaj, Crompton
26	Telephone tag Box	Krone
27	LT Panel	Shiv Shakti, Shakti Vijay, Shubhdra, A.D.
28	Patch Panel	Tyco or Equivalent
29	Rack	President or Equivalent
30	Button holder, Angle holder, ceiling rose	Anchor or ISI Approval make
31	Heavy pipes should be 6 kg/sq.cm.	Jyoti, Astral, Supreme
	<b>CCTV System</b>	
1	Cameras	Bosch /GE/ Samsung/Honeywell / Panasonic
2	Software	Bosch /GE/ Samsung /Honeywell / Panasonic
3	Monitor	Viewsonic / Samsung / LG / Panasonic
	<b>PA SYSTEM</b>	

1	Speakers	Bosch / Bose / ATIES / JBL
2	Amplifier	Bosch / Bose / ATIES / JBL
3	Control Station	Bosch / Bose / ATIES
	<b>FIRE ALARM SYSTEM</b>	
1	Fire Alarm Panel	Honeywell / Ravel/ GST/ Agni Controls
2	Photo Electric Smoke Detector	Honeywell / Ravel/ GST/ Agni Controls
3	Heat Detector	Honeywell / Ravel/ GST/ Agni Controls
4	Multi Criteria Smoke Detector	Honeywell / Ravel/ GST/ Agni Controls
5	Break Glass Unit	Honeywell / Ravel/ GST/ Agni Controls
6	Sounder	Honeywell / Ravel/ GST/ Agni Controls
	<b>Other item</b>	
1	Projector	Sony, Panasonic, Epson
2	Motorised Projection Screen	Link / Whirlwind/ Sommer /Euro Cable or Equivalent
3	Electronic bell	As make as switch make