

**Scope of Electrical work, Technical specifications and Other conditions for  
Electrical work.**

**1. Technical Speciation's and Other Conditions of Contract:**

**1.1 Pre-delivery tests for materials by RITES/RDSO**

All individual items of the schedule each costing more than 5.00 Lakhs should be inspected and certified by RITES/RDSO. Test certificates /inspection certificates shall be submitted to the office of Engineer-In charge prior to delivery of the materials at site. The cost of this provision is deemed to be included in the quoted rates of each individual items forming part of the schedule. Any financial claim by the contractor in this regard will not be entertained by the Railways.

The following materials are exempted for RITES/ RDSO /Third party inspection:

Material required for electrification of buildings: Point wiring items including switches, ceiling rose, PVC Round block/plates, Gang boxes (Metal/PVC), ferules, plug points and Tops, Fan regulators, Bulb holders, Switches and blinds, All sizes of conduit (PVC/Metal) pipes including casing and capping, calling bells, MCB distribution boards, MCB's, RCCB's, PVC Wires/Group of wires of different sizes etc.

**2. Cable trench for cable laying:**

Earth work for Excavation in all soils for cable trenches depth as advised by Engineer In charge as per site condition, the bottom of trench is leveled and sharp edges of rock, laying the cable and refilling the trench with earth after positioning the cable markers, and remaining well stages to bring the surface in level with original surface.

Route indicators should be provided for every 50 mtr and also at each curve, change of direction irrespective of distance with size of cable with direction and Jointing Indicators to be provided in every joint.

## **2.1 Laying of cable in trench, refilling and consolidation:**

If two separate feeders are to be laid in the same trench horizontal interval spacing is advisable in order to reduce the effect of mutual heating and also ensure that a fault occurring on one cable will not damage the adjacent one.

Collection of Cables from Gatishakti store, Hubballi to site is under contractors scope including loading, unloading and transporting and return of excess cable to store.

## **2.2 Trenchless Cable trench for cable laying:**

Trenchless cutting technology by adopting Horizontal drilling method (will be applied where ever normal earth excavation is not possible as per instruction of Engineer In charge. The Nominal diameter (outer dia) of HDPE should not be less than (External dia of 90.9 mm). HDPE should confirm the IS 494(1995) or latest. The material grade should not be less than PE 80 and class should not be less than PN 6.

3. PVC insulated copper wire conforming to IS: 694 of 1990 or its latest edition for working voltage up to and including 1100 volts with ISI Mark.
- 3.1 Point wiring exceeds above 5 mtrs distance of Running meter and also exceeds 5 mtrs distance of average running meters in Total points will be paid by Railways for the length of wire and pipe as a New NS item.
- 3.2 The provision of blank / dummy plates in modular boxes in contractors scope.
- 3.3 SPN/TPN Double door distribution Boards should be minimum IP:54 protection or more, Mechanical impact strength not less than IK 09, Isolated neutral Bar, Door earthing & cement spill protector. MCB's with suitable enclosure shall conform to IS 8828-1996 second revision or latest. All MCBs should be 'C' Curve type or Higher.
4. SPECIFICATION FOR MCB  
MCB's should be C curve or higher with suitable enclosure shall confirm to IS 8828-1996 second revision or latest.
5. All LED fitting should conform to the specifications enclosed in Annexure-A.

6. The BLDC Ceiling fan should conform to the specifications enclosed in Annexure-B.
7. The Ring Main Unit (RMU) should conform to the specifications enclosed in Annexure-C
8. Highmast should conform to the specifications enclosed in Annexure-D
9. LED sign should conform to the specifications enclosed in Annexure-E
10. Water coolers should conform to the specifications enclosed in Annexure-F.
11. Backlit LED name scope includes Supply & fixing of laser cutting poly acrylic box type channel letters made out of heavy quality aluminum powder coated sheet with trim cap imported MC 3mm thick acrylic sheet with front fascia in 3mm acrylic and 65mm box raising in 3mm poly acrylic sheet. LED modules fixed inside the letter shall be water proof and water proof power supply shall be fixed in the back portion of the for ENGLISH, HINDI & Regional Language letters. Backlit LED Railway station Name Board Design to be submitted before starting of the work & written approval should be obtained before supply of material.

## 12. Technical specification for Pole mounted Battery charger to be supplied

- Input voltage: 230 V, Single phase AC supply,
- Out put voltage: 110 V DC Supply with 35 Amps Rate current,
- Charging current range: 7 to 40 Amps (With 3 way current selector switch)
- Output voltage range: 110 to 120 V DC,
- Class of insulation: E
- Cooling: Natural air Cooling,
- Overall efficiency: 75 at 110V, 35 Amps,
- List of components of Pole mounted battery charger.

<u>S.No,</u>	<u>Description</u>	<u>Capacity/Rating</u>
1	AC MCB Main ON	25 A
2	DC MCB-Out put	50 A
3	Neon Light Mains on Indication	230 V
4	Transformer with Tapping	4.5 KVA
5	Choke Transformer-Filter Choke	30 A
6	Switch 1 P 3 WY ON & OFF Rotary Switch	63 A
7	D 1, D 2 Bridge Diode Body anode	70 A,1200 V
8	D3,D4 Bridge diode body anode	70 A,1200 V
9	R1-R4 Resistor	150 Ohm, ½ Watt
10	C1-C4 Capacitor	01 MF/200 V
11	C5 Filter capacitor	1000 MF/200 V
12	R5,R6 Bleeder Resistor Wire wound	400m 150 W

### 13. Earthing requirements:

- a) Perforated steel galvanized pipe of 'C' class of 40 mm dia and 4.5 metre long shall be erected in an earth pit and the earth wire used shall be of GI strip of size 25 mm x 3 mm for HT and 8 SWG GI wire for LT with suitable clamping of size not less than 25 x 3 mm on to the terminal structure and embedded in concrete for raising to the top of terminal structure. Both ends of the GI strip/GI wire should be fixed with GI bolts, nuts and spring washer. Earthing pit and cover shall be as per drawing enclosed. Earth box shall be painted with black paint above the ground level duly marked with earth values. The earth pit shall be filled with alternate layers of charcoal and salt each of thickness 150mm and 200 mm surrounding the pipe. 8 SWG GI earth wire shall be used for earthing single pole structure. In the ground GI wire shall be buried at a depth of 0.5m and connected to the earth terminal. Supply of GI pipe and all accessories for earthing including GI flat and GI wire is included in the scope of work for earthing arrangements.
- b) Earthing shall be provided for all the equipment's installed as per Indian standard code or practice No. IS: 3043/1966 and in conformity with I.S. Rules and to the satisfaction of the site Engineer.
- c) The earthing inter connections shall be made with 8 SWG GI wire.
- d) The earth electrodes can be inter-connected for effective earthing and also when resistance to earth of an earth electrode is high, as directed by the Engineer at site.
- e) The earth continuity/wires shall be rigidly fixed to the respective earth terminals in the equipment by shape of M.S. Cadmium plated bolt and nuts with washer and shall be properly connected with electrodes at the earth pits as detailed.
- f) The individual earth resistance value of the earth pits should be as per following table :-

Center	Earth Value (Max)
Power Station	0.5 ohm
Substation major	1.0 ohm
Substation minor	2.0 ohm
Distribution transformer	5.0 ohm
Transmission line	10 ohm
Single isolate earth pit	5 ohm
Earthing mesh	0.5

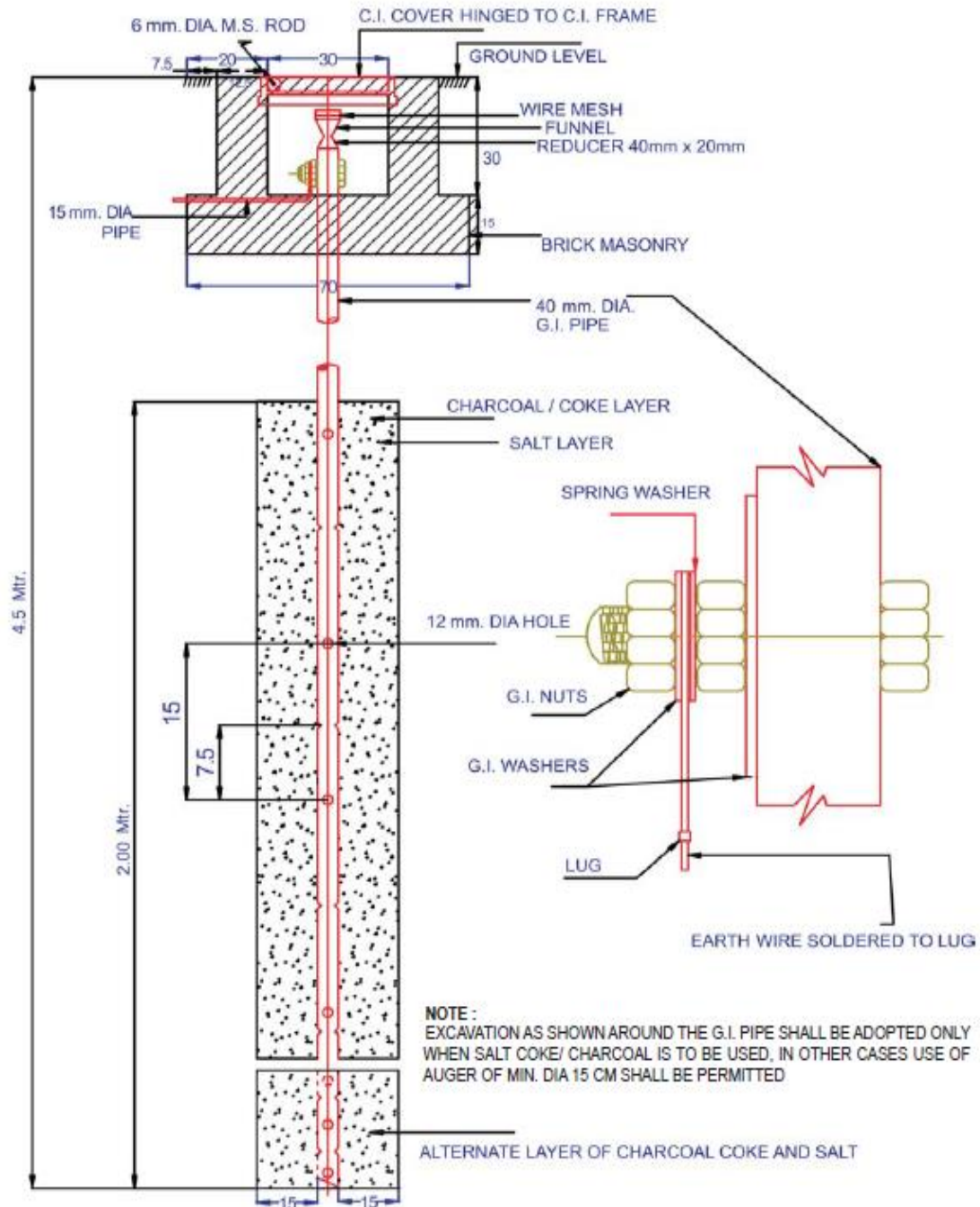
- g) The earth pit No., earth resistance value and date of measurement shall be legibly painted / stenciled on the earth pit

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## Method of Pipe Earthing

[Clause 8.4.1.1(i)]

NOT TO SCALE



ALL DIMENSIONS ARE IN CM (OTHER DIMENSIONS SHOWN)

#### **14. Specification of 20 HP Monoblock Centrifugal Pump:**

Rating : 20 HP, 3 phase 415V

Speed : 1450 RPM or more

Maximum Head : 10-56 meters or more.

Discharge : 20-66 LPS or more.

IP Protection : IP44 or more

Insulation class : B or more

Accessories : Base frame, coupling, coupling head, PCC foundation as per manufacturer's design and foundation bolts, Foot valve-01 No, Non return valve-01 No and sluice valve -01 No etc. & all other accessories as per IS:1520:1980.

#### **15. Specification of VFD Drive Suitable to Control 2 Nos of 20 HP Pumps:**

Rating : 20 HP/15 KW, heavy duty 33 A rated 6 pulse Variable frequency drive.

Rated Voltage: 380 to 480V Three-phase (-15%/+10%)

Overload Capacity : HD - 150% for 1min; ND - 120% for 1min

DC Reactor : Built-in to reduce the harmonics

Control Method : V/F, Sensor less Vector Control, Slip Compensation

Frequency Control Range : 0.01 to 400Hz (minimum) for V/F, 0 to 120Hz for Sensor less Vector Control

Output Frequency Resolution: 0.01Hz

Communication : Built-in RS485 Modbus RTU

Drive should have Flying-start function

Drive must have Peer-to-Peer function embedded: I/O can be shared among master and slave drives.

(RS485 wiring required).

Drive must have inbuilt User sequence function (PLC Logic)

VFD should have Features : Multi keypad, peer-to-peer communication to share I/Os, user sequence, inbuilt PID, no motor detection, auto tuning, KEB, DI/DO ON-OFF delay, torque control, torque boost, DC braking, fire mode, flux braking, 2nd motor, frequency jump, slip compensation

VFD should have protection for : Under load trip, low voltage trip, phase loss trip, no motor trip, exterior brake trip, safety input error, IO board trip inverter overload warning, lost command warning, overheat Trip, encoder trip, DBR %ED warning.

VFD should have below Alarm: Command Loss trip, overload, inverter overload, fan operation, resistance braking, Nos. of corrections on rotor auto tuning.

Drive must have Safety function: The safety input function meets EN ISO 13849-1 Pld and EN 61508 SIL2 (EN60204-1, stop category 0) or equivalent IS specification.

Safety I/P: 2, complying with EN ISO 13849-1 Pld and EN61508SIL2 [EN60204-1, stop category 0]

PCB Protection: Conformal Coating complying to IEC 60721-3-3 class 3C2

Application humidity: Below relative humidity 90% RH (no condensation)

VFD should have proper cooling arrangement with cooling fan

### **13. VFD Panel specification:**

VFD panel should have the provision of VFD/DOL bypass option between motor1 and motor 2 selection option in VFD mode.

Rating : 20 HP

Rated Voltage: 380 to 480V Three-phase (-15%/+10%), 50/60Hz (-5/+5%).

Protection class : IP 54 or more.

Panel sheet thickness not less than 2 mm with CRCA sheet and powder coated with Siemens gray color with Separate Neutral and Earth bus/links to be provided and all hinged doors to be earthed.

Incomer : MCCB with rotary handled and spreader as per type 2 co-ordination.

Rating : 63A with short circuit protection.

Contractor : Panel should have 1 No VFD input contactor AC3 rated as per rating.

Panel should have 2 Nos VFD output contactor AC3 RATED for motor 1 and motor 2 selections as per rating.

Panel should have 1 No DOL contactor AC3 rated with OLR as per type 2 coordination.

Panel should have multi-function meter (V, A, F, P, PF METER).

Panel should have indication lamp for R, Y, B drive RUN, TRIP.

Panel should have ON/OFF push button and speed POT to control the VFD.

Panel should have provision to select the motor 1 or motor 2 in VFD Mode

The scope of Erection, Testing commissioning centrifugal monoblock pump set includes fixing of all supplied items control panel, erection of pipe, non-return valve, wiring, & all other miscellaneous items required up to delivery of pump



# **TECHNICAL SPECIFICATION FOR LED TYPE (INDOOR/OUTDOOR) LIGHT FITTINGS**

## 1. General requirements of LED type (INDOOR/OUTDOOR) light fittings:

1	LED make	NICHIA/OSRAM/SEOUL/PHILIPS LUMILEDS/CREE/LEDNIUM/ AVAGO
2	Type of LED	High power, SMD (Surface Mounting Device) LED
3	Lumen output / Efficiency	> 100 lumens/Watt
4	Lumen Output at fitting level/ Efficiency	> 75 Lumens/Watt
5	LED life	> 50,000 burning hours
6	Depreciation	30 %max. after 50,000 burning hours
7	Color Rendering Index (CRI)	> 75
8	Nominal voltage	220 V AC
9	Input operating voltage	105-295 V AC
10	Power factor	> 0.9
11	Protections	
	i. Surge protection	1.5 kV for 50 Micro seconds
	ii. Over voltage protection	300 V AC for 2 minutes
	iii. High Voltage protection	1.72 kV AC for 1 minute
	iv. Insulation resistance	Minimum 2 mega ohms with 500 V megger
12	Driver type	Constant current driver with short circuit protection
13	Driver components	Industrial grade only
14	THD	< 20 %
15	Efficiency of driver Electronic	Efficiency of driver > 85 %
16	Construction of Housing	Pressure die cast aluminum or CRCA or Extruded aluminum
17	Finishing	Powder coated/anodized
18	Lamp cover	Toughened glass of min 0.8 mm thickness of sufficient strength or high transmittance efficiency (min.90 %) Acrylic diffuser as per need of fitting.
19	Secondary optics	Polycarbonate reflector/polycarbonate lence
20	Mounting	Indoor: Suitable for surface/Recessed/hung type Outdoor: Suitable for Existing pole etc.
21	Ingress protection	IP 65 – Outdoor, IP 20 – Indoor.

## 2. NOTE

- a) Supplied luminaries shall conform to BIS:16107 or IEC:62722 and LEDs to BIS:16103 or IEC:62717.
- b) LED luminaries shall also conform to LM-79 ( For Quoted fitting) and LM-80 for LEDs used.
- c) Firm have to submit LM-80 & LM-79 test certificates from National/International accredited laboratory and OEM certificate for compliance of BIS/IEC before supply of material against each schedule item.
- d) Firms have to submit warranty certificate for 5 (five) years along with supply.

**Annexure-B****TECHNICAL SPECIFICATIONS FOR ENERGY EFFICIENT BRUSHLESS DC MOTOR (BLDC) CEILING FAN:**

S.N.	Description	Requirement
1	Sweep	1200 mm
2	BEE rating	5 star
3	Rated power	28 W maximum
4	Operating Voltage	140-290 V Single phase AC
5	Frequency	48-52 Hz
6	Air-Delivery	220 M3/Min
7	Harmonic Distortion	5 % Max
8	Speed Control	Smart Remote (IR) Control with Three steps (minimum) or Regulator suitable for BLDC fan control.
9	Blade Thickness	1.1 mm
10	Blade material	Aluminum
11	Bearing	Double Ball bearing
12	Down Rod Size (Without Shackle)	300 mm
13	Shank & Shackle Thickness	2 mm (Minimum)
14	Canopy	2 Nos
15	Color	Standard White
16	Warranty	5 Years
17	IS specifications	(a) IS: 616/2010 for safety requirement for electronic equipment. B) IS:374/2019 performance test for Air Delivery as per Cl. No. 10.3 of specification.
18	Test report	The firm Has to submit type test report from Government accredited test labs like NABL certified/CPRI etc.

**1. TECHNICAL SPECIFICATION FOR 4 WAY RING MAIN UNIT (RMU)**  
**(OUT DOOR TYPE)**

For the purpose of convenience this specification is divided into Five parts viz.

Part 1: Scope, General information.

Part 2: Specification for the HT side ring main unit and circuit breakers.

Part 3: Bill of Material for RMU.

Part-4. Technical specification for RMU.

**PART-1 : SCOPE AND GENERAL INFORMATION**

**1.0 SCOPE**

The specification covers design, manufacture, supply of 4 Way 11kV RMU CCVV+Me, extensible type (2x LBS, 2x VCM+1Me), with FRTU complete with all accessories. Any incidental item, whether or not explicitly brought in the schedule, drawing (or) this specification but is / are required to complement the functional requirements of the RMU and are statutorily to be provided as per codes and manuals and are deemed to be forming the scope of supply along with the RMU. The RMU with all the major equipment's such as Load break switches, VCB/SF-6 HT breaker, FRTU, shall be of either ABB/Siemens/Schneider/L&T make or of any other standard make mentioned in list of approval makes which is conforming to the specifications enclosed along with tender document.

**1.1 SYSTEM DETAILS:** The RMU shall be designed to work on an 11kV, three-phase 50 Hz AC system of supply.

**1.2 CONSTITUENT OF RMU**

The entire RMU shall consist of Two number of HT load break switches, Two numbers of SF6 insulated VCB copper busbar, FRTU , accessories for interlocking and copper bus bar for metering panel isolation.

**1.3 SITE CONDITION**

The equipment covered under this specification is for outdoor installation and should be suitable for use at the site at South Western Railway, Hubli, Karnataka state for the prevailing climatic conditions. Approximate figures are as under

a) TEMPERATURE: The reference ambient temperature is to be taken as 38 °C as per IS 9676.

- i) Maximum ambient air temp : 40°C
- ii) Maximum daily average ambient temp : 34°C

b) RELATIVE HUMIDITY

- i) Maximum : 90%
- ii) Minimum : 10%
  
- c) Average Annual rainfall : 750 cm
- d) Average no of rainy days/annum : 150
- e) Average no of thunderstorm days/annum : 60
- f) Altitude : Not exceeding 50 m
- g) Rainy months : Jun to Oct
- h) Wind pressure : 195kg/m<sup>2</sup> up to 30m

The atmosphere is heavily polluted, laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during monsoon periods. All equipment's shall be designed to withstand seismic forces, corresponding to an acceleration of 0.1g.

## 1.4 DRAWINGS AND DOCUMENTS

The tenderer shall furnish technical details of various equipment's as per details attached at the end of this specification. The tenderer shall furnish details of any deviation from this specification clearly while participating in the tender. The tenderers shall also enclose necessary drawings Viz. General arrangement, internal arrangement of components, Plinth, Schematic diagram etc. and technical leaflets.

## 1.5 COMPLIANCE TO STANDARDS

- 1.5.1 All equipment and material shall be designed manufactured and tested in accordance with IEC 62271-200 or relevant IS standard.
- 1.5.2 Equipment and material confirming to any other standard, which ensures equal or better quality may be accepted. In such case, copies of English version of the standard adopted shall be submitted.
- 1.5.3 The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to date relevant IS code of practice and Indian electricity act. In

addition other rules and regulations applicable to the work shall be followed. In case any discrepancy the most stringent and restrictive one shall be binding.

**1.6 Earthing :** All the current free metallic parts of the equipment in the RMU shall be connected to the framework. High conductivity, electrolytic copper strips of adequate cross section duly painted with green or black colour shall be used for earthing purpose. Two earthing terminals shall be provided on the framework at suitable locations for connecting system earthing. The earthing strip shall run in flush with the platform and shall not be projected out. Two separate and distinguished earthing shall be provided for the neutral point earthing, for each transformer sufficient numbers of individual earths are to be provided to each sub-station as per relevant IS / IEC specification

### **1.7 Safety and Fire Hazard**

1.7.1. The RMU is going to be erected in the vicinity of people moving areas. It is therefore utmost important that the RMU is protected against any internal faults developed in the high voltage switchgear. An arrangement inside the pre-fabricated sub-station shall be made in such a way that the internal arc shall not come out of the sub-station causing fire hazards and unsafe for personnel moving around.

1.7.2 The standard danger boards shall be provided on HT compartment doors. These shall be made in Aluminium with white letters engraved on red background. The letters shall be sized in such a way that they will be visible from a distance.

### **1.8 Technical Literature:**

- i) Two copies of Operating, Instruction & Maintenance manual along with the detailed drawings and schematic diagram covering the mechanical & electrical portion [electrical circuit and wiring diagram of power & control circuits] of the machine should be supplied free of cost along with the equipment. The manuals shall be updated with incorporation of test data after performance tests are carried out at site.
- ii) Manual and catalogue giving part list number of each component and assembly drawings shall also be provided with the machine in two copies free of cost. The manufacturer or tenderer will clearly indicate the guideline for trouble shooting of the machine.

**1.9 Labels:-** All HT panel shall be clearly labelled as required indicating their purpose where ever necessary and "ON" and "OFF" lettered on brass, ivory, enamel iron or other suitable materials.

**1.10** The contractor shall provide all as laid / as erected drawings general arrangement drawing and other details such data obtained during type and routine tests. Authenticated copy of type test certificate and original certificate of routine test clearly indicating the serial number of equipment / accessories shall be submitted. Any modification / alteration / corrections pointed out by the Electrical Inspector shall be carried out both at site as well as in drawing. A soft copy of the drawings in a CD / DVD shall also be supplied.

**1.11 Training:**

- i) Training shall be provided by the contractor for a minimum of 6 staffs for operating & maintenance at manufacturers end or at site or at both ends after the RMU is installed and successfully commissioned.
- ii) Training should also be given to the minimum of 6 staff along with detailed circuitry of electrical & electronics for further maintenance.

**1.12 Foundation :**

Foundation drawings, earthing and trench requirements as per site conditions to be submitted by contractor for approval.

**1.13 Proving Test:**

RMU performance shall be demonstrated by the contractor or his agent after Successful commissioning at the work site for a period of 24 hrs.

- (i) The Tenderer arrange for persons from manufacture in case of Not OEM and OEM should arrange for Engineer for overlooking/ the installation & commissioning and testing process.
- (ii) The Tenderer should bring Engineer from OEM for Relay co-ordination or in case of OEM, OEM should assist in Relay co-ordination after installation and commissioning.

**1.14 Warranty:**

- i) The tenderer shall guarantee the performance of the equipment against faulty/inadequate design, construction and workmanship, manufacturing and material defect. The warranty period should be for a period of 12 months from the date of successful commissioning of the RMU.
- ii) This warranty shall expire after 12 (Twelve) months, except in respect of complaints, defects and/or claims notified to the contractor before the expiry of the warranty period.

- ii) During the Warranty period the tenderer's liability in respect of any complaint defect shall be execution of repairs, replacement of defective parts and re-commissioning free of any charges, to the extent that such replacement or repairs are attributable to or arise from faulty workmanship or design or material in the manufacture of the equipment/stores and/or negligence in any manner and also in the event of failure of the equipment to perform as intended.
- iv) All replacement and repairs that the Railway shall call upon the contractor to deliver or perform under this warranty shall be delivered and performed by the contractor immediately. The total period taken for the attention will be counted for extension to the warranty period. Further, in case where any replacement of the component takes place to the machine during the warranty period, the provision of this warranty clause shall apply to that component to replace or renew until the expiration of 12 (Twelve) months from the date of such replacement is carried out by the tenderer. This extended period shall hereinafter be referred to as "EXTENDED WARRANTY PERIOD".
- v) For the faithful fulfillment of the obligations of the warranty contemplated in this clause and for the due and faithful fulfillment of the contract as a whole, the contractor shall furnish a Warranty Bond.

#### **1.15 Packing & Delivery:**

- i) The tenderer will be fully responsible for any damages during packing, transit of the sub-station as to ensure that the stores are not damaged.
- ii) The equipment will be securely packed for safe transportation and will be consigned at firm's risk. The consignment has to be insured by the tenderer at his own cost, if required.
- iii) The stores should be delivered to sites indicated by Engineer in charge within Hubballi.

#### **1.16 INSPECTION: BY RITES:**

The supplier shall give at least 15 days advance intimation to the RITES to enable them to depute their representative for witnessing the routine tests on overall unitized package substation.

#### **1.19 TESTS**

Type tests and Routine tests on RMU should be conducted in accordance with IEC Standard or IS standard or latest. Manufacturers test certificates for type tests for RMU will be submitted by firm during RITES inspection and Routine tests on overall unitized package substation will be conducted in presence of RITES representative.

Manufacturers test certificates for type tests and Routine tests as per relevant IEC / IS specifications for RMU will be submitted by firm during RITES inspection.



## **PART 2 : SPECIFICATION FOR THE HT SIDE OUTDOOR TYPE RING MAIN UNIT AND CIRCUIT BREAKERS**

The RMUs shall conform in all respects to high standards of Engineering design, workmanship and latest IEC 62271-200 standards or relevant IS at the time of offer.

### **2.1 SYSTEM**

The system network is 11000 Volts, 3 phase 3 wires 50 cycles. The voltage and frequency are subject to variation as per statutory limits governed by Indian Electricity Rules 1956 with latest amendments in force.

### **2.2 GENERAL**

2.2.1 The Ring Main Unit shall be installed at 11KV Substations in Vasco-Da-Gama in which LBS can be used as incoming & outgoing/extension of Supply in case of failure and SF6 VCB used to connect transformers.

2.2.2 The type of the 11 KV circuit breaker shall be VCB enclosed in a close vessel having SF6 as insulating medium along with Load Break Isolator, Earth switch, 11kV Bus and other associated equipment's.

The extensible RMU shall consists of the following combinations of load break switches and Circuit breakers for a nominal voltage of 12 KV using SF6 gas as insulating and Vacuum as arc quenching medium.

The system shall be in such a way that the incoming supply shall be terminated in the first HT panel of first LBS, second LBS will feed the supply to next Substation & so on and one out going CB each shall be for Transformer protection.

- i) Each LBS should have on HT panel supply incoming side:
  - a) Two numbers of 11kV, 630 Amps, continuously rated fault making, load breaking switches. These units shall be triple pole, SF6 Insulated, quick break type with spring charge stored energy with hand operated mechanism & motorized control for remote operation. It shall have arrangement for terminating up to 240mm<sup>2</sup>, 11KV, 3C, XLPE incoming and outgoing feeder cables.
  - b) Two numbers 11kV, 630 Amps SF6 insulated Vacuum Circuit Breaker (For connecting to transformers), load breaking and fault breaking type fitted with three 630 Amps continuously rated insulated bus bar (suitable for SF6 environment) along with CT. It shall have arrangement for terminating up to 240 mm<sup>2</sup>, 11 KV, 3C, XLPE cables.

- ii) Right angled reusable boot for terminations (3X3 nos.)
  - iii) The load break switches and the breaker shall be housed in a SF6 gas filled, non ferrous, non ferrite stainless steel (grade SS304 or higher) tank.
- 2.2.3 The RMU shall be of single bus bar SF6 gas insulated outdoor, tropicalized and outdoor metal enclosed type. The RMU metal parts shall be painted with pure polyester powder type paint having high corrosion resistance . The overall paint layer thickness shall not be less than 75 microns. The RMU shall be suitable for installation in severe outdoor environment conditions.
- 2.2.4 The complete RMU shall be IP 54 suitable for outdoor application and type tested for weather proof at reputed national / international lab. Bidder shall submit entire type test reports for outdoor type design at the time of inspection.
- 2.2.5 All live parts except for the cable connections shall be insulated with SF6 gas. The SF6 enclosure shall be made of welded stainless steel. The gas leakage rate shall less than 0.1% per annum and no gas filling should be required at site during the product life cycle in normal operating conditions.
- 2.2.6 The cubicle shall be metal enclosed with a sheet steel of appropriate thickness and provided with a pressure relief arrangement away from operator. The high-voltage vessel shall be made up of non-magnetic stainless steel grade SS304 or higher.
- 2.2.7 Protection of personnel against internal arc is of utmost importance, since the complete RMU will be installed in public areas. It is mandatory that complete RMU (gas vessel & cable connection compartment) are required to be internal arc tests for minimum 20kA, 1sec. If any additional box is included to increase the cable termination height, RMU should be type tested for internal arc with the additional cable box.
- 2.2.8 Any accidental over pressure inside the sealed chamber shall be limited by the opening of a pressure-limiting device in the rear part of the enclosure. Gas will be released to the rear of the switchgear, away from the operator to ensure safety of the operating personnel and all the manual operations will be carried out on the front of the switchboard. The RMU must be tested for IAC (Internal Arc Classification) to ensure safety of the personnel around the RMU during Internal arc.
- 2.2.9 The Entire units of RMU shall be in a single compact metal clad, outdoor type suitable for all weather conditions. The switchgear and bus bar shall all be filled with SF6 at 0.3-0.6 bar G/IEC/IS Standards relative pressure to ensure the insulation and breaking functions. The SF6 tank must be sealed for life and shall meet the “sealed pressure system” criterion in accordance with the IEC 62271-200

standard. The RMU must be a system for which no handling of gas is required throughout the service life.

- 2.2.10 Minimize the number of tanks to reduce the interconnection and maintain the same gas pressure for all feeders. This will also help in reducing the gas pressure monitoring at SCADA level.
- 2.2.11 The enclosure for switchgear and metallic RMU housing shall have a design such that in the event of an internal arc fault, the operator shall be safe. This should be in accordance with IEC 62271-200. The outdoor RMU must be tested for internal arc fault for minimum 20 KA for 1sec for the vessel as well as the cable compartment. Internal arc venting by bottom explosion shall be flush mounted on floor; in case of Top explosion the gas coming from the vent should be at minimum 1.62m height which is more than average human height. The height of vent lesser than 1.62m height shall be risky as the humans shall be directly exposed to hot gases.
- 2.2.12 Suitable type test report for temperature rise test on the RMU shall be submitted at the time of inspection.
- 2.2.13 Each switchboard shall be identified by an appropriately sized label, which clearly indicates the functional units and their electrical characteristics.
- 2.2.14 The switchgear and switchboard shall be designed so that the position of the different devices is visible to the operator on the front of the switchboard and operations are visible as well.
- 2.2.15 The switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings, requirements clause as per relevant IS / IEC specification without any damage or deterioration of the materials.
- 2.2.16 For continuous operation at specified ratings, temperature rise of the various switchgear components shall be limited to permissible values at site conditions mentioned in this specification stipulated in the relevant IS / IEC standard or this specification.
- 2.2.17 The equipment shall be so designed that corona discharge would not occur.
- 2.2.18 The entire switching system shall be totally encapsulated. There shall be no access to exposed conductors. In accordance with the standards in effect, the switchboards shall be designed so as to prevent access to all live parts during operation without the use of tools.

### 2.3 Sulphur Hex fluoride Gas (SF6 GAS)

The SF6 gas shall comply with IEC 60376, 60376A and 60376B and shall be suitable in all respects for use in 11 KV panels under the operating conditions. The SF6 shall be tested for purity, dew point air hydrolysable fluorides and water content as per IEC 60376, 60376A and 60376B and test certificate shall be furnished to the Railways indicating all the tests as per IEC 60376 for each Lot of SF6 Gas. The stainless steel vessel shall be type tested for pressure test & the type test report for the same shall be submitted at the time of inspection.

### 2.4 STANDARDS

Unless otherwise specified elsewhere in this Specification, the RMU, Switchboard (Switchgear), Load break isolators, Instrument Transformers and other associated accessories shall conform to the latest revisions and amendments thereof of the following standards.

		<b>IEC standard</b>
<b>Switchgear</b>		IEC 62 271-1
		IEC 62 271-200
<b>Devices</b>	Circuit-breakers	IEC 62 271-100
	Disconnectors and earthing switches	IEC 62 271-102
	Switch-disconnectors	IEC 60 265-1
	Voltage detecting systems	IEC 61 243-5
<b>Degree of protection</b>	-	IEC 60 529
<b>Insulation</b>	-	IEC 60 071
<b>Instrument transformers</b>	Current transformers	IEC 60 044-1
	Voltage transformers	IEC 60 044-2
<b>Installation, erection</b>	-	IEC 61 936-1

- 2.4.1 In case of imported equipment standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable IEC / Indian standards.
- 2.4.2 The equipment shall also conform to the provisions of Indian electricity rules and other statutory regulations currently in force in the country.
- 2.4.3 In case IEC / IS standards are not available for any equipment, the relevant standards issued by BS / VDE / IEEE / NEMA or equivalent agency are applicable for any equipment.

2.4.4 In case of any contradiction between various referred standards / specifications / data sheet and statutory regulations the following order of priority shall govern

- Statutory regulations
- Codes and standards
- Tender specification
- Guaranteed technical particulars

## **2.5 RING MAIN UNIT (RMU) :**

2.5.1 The RMU enclosure must be a metallic, which shall follow an industrialized process of manufacturing. The RMU shall be of single bus bar SF6 gas insulated outdoor, tropicalized and metal enclosed type. The RMU metal parts shall be painted with pure polyester powder type paint having high corrosion resistance, the overall paint layer thickness shall not be less than 75 microns. The rating of enclosure shall be suitable for operation on three phase, three wire, 11 KV, 50 cycles, A.C. System with short-time current rating of 21 KA for 3 seconds with Panels.

2.5.2 RMU must be suitable for all operations from panel front including cable access & termination. Rear & side operating or cable access shall not be acceptable.

2.5.3 The SF6 gas insulated switchgear housing shall have an over pressure relief device vented to the rear side of the equipment. An operating mimic diagram shall be provided on the front side of RMU.

2.5.4 It is necessary to fit an absorption material in the tank to absorb the moisture from the SF6 gas to regenerate the SF6 gas following arc interruption. The SF6 insulating medium shall be constantly monitored via a temperature compensating gas pressure indicator offering a simple indication. Alternatively ready for service indicator offering simple indication for GO-NO GO shall be provided. All the combination of the RMUs should have the required SF6 insulation by providing necessary gas chamber capacity.

## **2.6 Ring Cable switches (LOAD BREAK TYPE)**

2.6.1 The load break isolators for Incoming / Outgoing / Extension of supply must be provided and the load break isolators are fully insulated by SF6 gas. The load break isolators shall consist of 630 Amp fault making/load breaking spring assisted ring switches, each with integral fault making earth switches. The switch shall be naturally interlocked to prevent the main and earth switch being switched 'ON' at the same time. The selection of the main and earth switch is made by a lever on the facia, which is allowed to move only if the main or earth switch is in the off position. **Closing and opening operation of the Load Break**

**Switch shall be done from remote. The load break isolators shall be provided with 24VDC motor to have the facility for remote operation. It should be feasible to retrofit the motor at site.** Each load break switch shall be of the triple pole, simultaneously operated, non automatic type with quick break contacts and with integral earthing arrangement. The load break switch shall be fitted with a mechanical indicator on the panel front fascia for indicating switch ON/OFF positions.

2.6.2 The load break switches offered shall conform to IEC-62271 as amended to date. The load break switches shall be SF6 insulated, triple pole, spring assisted hand operated type with quick break contacts. SF6 gas pressure gauge shall be provided for pressure indication purpose.

- a) The operating handle shall have the three positions "ON", "OFF", and "EARTH" which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the load break switches operation shall be prevented from "ON" position to "EARTH" position or vice versa in a single operation. This can also be achieved by using separate handles.
- b) Integral cable test terminals for test plug with clear identification mark and with interlocked cover shall be provided. The interlocks shall be so arranged that, the cable test terminals will be accessible only in the "EARTH" position of the load break switches
- c) To facilitate testing of cables, it shall be possible to bring the load break switches to OFF position while the test plugs are kept inserted, but operation to ON position shall be prevented so long the cable testing is in progress.
- d) The load break switches shall be capable of breaking full load current and a fault making of 52.5 KA peak.

## **2.7 EARTHING OF ISOLATORS AND VACUUM CIRCUIT BREAKERS (EARTH SWITCH)**

Necessary arrangements shall be provided at Off Load isolators / Vacuum Circuit Breaker for selecting Earth position. Mechanical interlocking systems shall prevent the RMU function from being operated from the 'ON' to 'Earth On' position without going through the 'OFF' position.

## **2.8 VACUUM CIRCUIT BREAKER**

2.8.1 The 11KV, 630 Amps SF6 insulated VCB, shall be load breaking and fault breaking type. The VCB must be provided inside the outdoor metal clad and insulated by SF6 gas.

- 2.8.2 The Vacuum circuit breaker must be with stored energy spring in combination with 3 positions off load disconnecter with position ON-OFF-EARTH. This disconnecter shall be mechanically interlocked with the VCB position & should not be operated when the VCB is in ON condition.
- 2.8.3 **Closing and opening operation of the Circuit Breaker shall be suitable for manual handle operation and also suitable for operating from remote by using shunt trip coil. Spring charging shall be done with motorized spring operating mechanism and with manual handle. Motor shall be suitable for 24V DC supply. It should be feasible to retrofit the motor at site.** The circuit breaker shall be fitted with a mechanical indicator on the panel front fascia for indicating VCB ON/OFF positions.
- 2.8.4 Both, the circuit breaker disconnecter, spring charging mechanism and ring switches ON/OFF/EARTH shall be operated by unidirectional handle.

## 2.9 PROTECTION SYSTEM

The protection on the circuit breaker shall comprise of the following components. The circuit breaker unit fitted with 3 nos class 5P10 protection CT's, a low burden trip coil and auxiliary switch assembly allowing the use of a self-powered (No external DC or AC source required) Microprocessor based numerical IDMT protection relays 3 x over current and earth fault element shall be Definite Time type relay . Relay shall be able to communicate via a MODBUS RS-485 port.

## 2.10 OPERATION & INTERLOCKING

- 2.10.1 All operations shall be from front of the equipment via spring assisted mechanism. It shall be possible to operate the switches and circuit breaker by manual & motorized spring assisted mechanism shall ensure speed of operation of switches. Operation handle shall be considered as part of the unit and should be provided with each RMU.
- 2.10.2 Interlocks shall be designed according to IEC 62 271-200

Load break switches and earthing switches shall be fully interlocked to ensure that operation is carried out in correct sequence. Movement of operating handle against interlock shall not by any means originate, store or activate the energy mechanisms. Padlocking facility shall be provided for operation of load switch and earthing switch. Safety of operation shall be ensured by interlocks. Simultaneously, closing of the main switch and earth switch should be interlocked. These interlocks shall be integral part of the operating mechanism. The fully interlocked integral test facilities are to be provided in such a way that access to the test terminals is achieved only by removal of a cover. The manually operated handle shall be mounted in front of the load break switches and so designed that the operation is complete by one movement without any undue

stain on the operator. All mechanical interlock shall be robust so as not to give any way during normal operation. The tripping of breaker unit should be provided with push button or manual operating lever.

Following Standard interlocks shall be provided in the RMU

- Three-position switch: disconnecting/load disconnecting function versus earthing
- Circuit-breaker panel: circuit-breaker versus three-position disconnect
- Cable compartment: only accessible with “feeder earthed”
- Locking devices for three-position switch

## **2.11 CABLE BUSHINGS**

The units shall be fitted with the standardized bushings that comply with EN 50181 (or) equivalent IS / IEC standards. All the bushings shall be at the same height at min 850mm from the gland plate and shall be protected by a cable boot tested for partial discharge of <5Pc, 95kv BIL level. All the cable bushings must be accessible from front only and site replaceable.

## **2.12 CABLE COMPARTMENT**

2.12.1 All the cable compartments shall be air insulated suitable for dry type cable terminations. The cable boxes at each of the two ring switches suitable for accepting HV cables of sizes up to 3C x 240 sq.mm and circuit breaker cable suitable up to 3C x 240 sq.mm. Necessary Right angle cable boot shall be supplied by the RMU manufacturer. Cable boot shall be tested for partial discharge of <5Pc & 95KV impulse. The cable compartments shall be tested for internal arc fault for minimum 20kA/1sec. All the cable compartments must be accessible from front only. Side and rear cable access shall not be accepted.

2.12.2 The design of the cable compartment shall be such that any type of jointing methods such as heat shrinkable/push on type/cold shrinkable type termination's can be adopted.

2.12.3 The cable compartment cover must be interlocked with the switch position in all the feeders. The cable compartment cover shall open only when the load break isolator / VCB is in earth position. This ensures the complete safety of operator accessing the cables.

## **2.13 CABLE TESTING FACILITY**

It shall be possible to test the cable without disconnecting them from the cable bushing duly sliding backing the cable boot. The access to the cable must be available only after earthing the respective feeder to ensure complete safety of the operators. To fulfill this feature the cable compartment covers shall be logically interlocked with the feeder earth switch.



## **2.14 CAPACITIVE VOLTAGE DETECTION SYSTEM**

The RMU shall be equipped with a capacitive voltage detection system (CVD) for checking voltage on the cable. There should be a facility to check the synchronization of phases with the use of external device. It shall be possible for the each of the function of the RMU to be equipped with a permanent CVD as per IEC 61243-5 to indicate voltage on the cables. Tenderer should submit type test report for the CVD confirming to IEC 61243-5 at the time of inspection.

## **2.15 EARTH FAULT PASSAGE INDICATORS (EFPI):**

These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU. Minimum one no load break switch per RMU shall be equipped with EFPI. The EFPI shall be Self sustained, continues functioning using internal battery even after the main incomer feeder has tripped. It should have an Enhanced Power Management leading more than 2000 hours of operation under fault conditions (blinking).

## **2.16 METERING PANEL**

Separate panel shall be provided for the bus metering. Metering panel shall include potential transformer  $11/\sqrt{3}/110V/\sqrt{3}$ , class 1, 50VA and multifunction meter. Multifunction meter shall be communicable type. There shall be no gap between RMU and metering panel. If any gap is provided between RMU and metering panel, then interconnection shall be STC (Sound Transmission Class) & IAC (Internal Arc Classification) tested and suitable reports shall be submitted by bidder at the time of inspection.

## **2.17 WIRING & TERMINALS:**

2.17.1 The wiring should be of high standard and should be able to withstand the tropical weather conditions. All the wiring and terminals (including take off terminals wiring for future automation, DC, Control wiring), Spare terminals shall be provided by the contractor. The wiring cable must be standard single-core non-sheathed, Core marking (ferrules), stripped with non-notching tools and fitted with end sleeves, marked in accordance with the circuit diagram with printed adhesive marking strips.

2.17.2 All wiring shall be provided with single core multistrand copper conductor wires with P.V.C insulation.

2.17.3 The wiring shall be carried out using multi-strand copper conductor super flexible PVC insulated wires of 650/1100V Grade for AC Power, DC Control and

CT circuits. Suitable colored wires shall be used for CT phase identification and ferrules shall be provided at both ends of the wires for wire identification. Connections and terminal should be able to withstand vibrations. The terminal blocks should be screw type for controls and disconnecting link type terminals for CT leads.

- 2.17.4 Flexible wires shall be used for wiring of devices on moving parts such as swinging Panels (Switch Gear) or panel doors. Panel wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals, terminal blocks and wiring gutters. The cables shall be uniformly bunched and tied by means of PVC belts and carried in a PVC carrying trough.
- 2.17.5 The position of PVC carrying trough and wires should not give any hindrance for fixing or removing relay casing, switches etc., Wire termination shall be made with solder less crimping type of tinned copper lugs. Core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted with both ends of each wire. Ferrules shall fit tightly on the wire when disconnected.
- 2.17.6 Wiring shall be done for all the contacts available in the relay and other equipment and brought out to the terminal blocks for spare contacts.
- 2.17.7 The wiring shall be in accordance to the wiring diagram for proper functioning of the connected equipment. Terminal blocks shall not be less than 650V grade.

## **2.18 SCADA FEATURES:**

### **2.18.1 REMOTE MONITORING & CONTROL OF RMUS:**

- a) The switches and breakers are to be fitted with motors for remote operation.
- b) Necessary terminals shall be provided inside the RMU for interface with FRTU and space should be available for fixing of FRTU.

### **2.18.2 The SCADA functions include**

- a) Remote control for Load Break Switches and circuit breakers
- b) Position indicator for Load Break Switches, Circuit Breakers and Earthing Switches
- c) Remote monitoring and Control of Fault indication system
- d) FPI status and reset
- e) SF6 gas pressure status
- f) There should be sufficient number of contacts for facilitating above functions and spare contacts.

## **2.19 24V DC SUPPLY:**

2.19.1 Each RMU shall be fitted with a power supply including batteries and battery charger suitable for 5x operation

2.19.2 The power supply unit shall conform to the following requirements:

- Input: 230 V AC nominal from the RMU's auxiliary power transformer allowing for possible variations from 190 to 300 V AC
- Output: Stable 24 V DC
- Batteries: 24 V DC

2.19.3 The 24 V DC batteries shall have sufficient capacity to supply power to the following devices with a nominal backup of 4 hours:

- RMU's spring-charge motors for a minimum of five (5) operations
- RMU's trip coils, close coils

## **2.20 ACCESSORIES & SPARES:**

2.20.1 The following spares and accessories shall be supplied along with the main equipments at free of costs. This shall not be included in the price schedule.

- a) Charging lever for operating load break isolators & circuit breaker of each RMU
- b) Any other spares & Tools, which are all essentially required at the time of emergency and routine maintenance.

2.20.2 Provision shall be made for padlocking the load break switches/ Circuit breaker, and the earthing switches in either open or closed position with lock & key.

## **2.21 TESTING OF EQUIPMENT & ACCESSORIES**

2.21.1 Provision for testing CTs, Relays, Breakers and Cables shall be made available. Procedure and schedule for Periodical & Annual testings of equipments, relays, etc. shall be provided by the tenderer.

2.21.2 Each type of H.V. Switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards and during manufacture and on completion.

#### 2.21.2.1 **ROUTINE TEST**

The tests shall be carried out in accordance with IS: 12729 or IEC 62271. The tests shall include but not necessarily limited to the following:

All routine tests as stipulated in the latest IEC: 62271 or IS: 12729 shall be carried out by the tenderer in the presence of RITES representative.

- i. Withstand voltage at Power Frequency for all current carrying parts including wiring.
- ii. Measurement of resistance of the main circuit.
- iii. Integral leak test for SF6 vessel.
- iv. Withstand voltage on auxiliary circuits.
- v. Operation of functional locks, interlocks, signaling devices and auxiliary devices.
- vi. Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism (primary and secondary injection).
- vii. Verification of wiring.
- viii. Visual Inspection.

Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, meter etc., as per relevant standards.

#### 2.21.2.2 **TYPE TEST**

The Tenderers should submit copies of all Type test certificate while inspection of their make in full shape as confirming to relevant IEC of latest issue obtained from domestic / international test lab.

The following tests shall be performed on a typical section of the bus assembly of each type of switchgear. Units shall be type tested in accordance with **IS: 12729 or IEC Standards 60529 and 62271. The tests shall include:-**

- a) Impulse test with breaker inside the cubicle.
- b) Temperature rise test with breaker inside the cubicle.
- c) Short Circuit test with breaker inside the breaker.
- d) Dielectric Tests.
- e) Test of apparatus i.e. circuit breaker and earthing switch.
- f) Arc Fault test.
- g) High voltage partial discharge test.
- h) Integral leak test for SF vessel

#### 2.21.3 **INSPECTION: BY RITES**

The tenderer shall give at least 15 days advance intimation to the RITES to enable them to depute their representative for witnessing the tests. The cost towards RITES inspection including transport, stay and other expenses shall be borne by the tenderer.

#### 2.21.4 **TEST CERTIFICATES**

Certified reports of all the tests carried out at the works shall be furnished in Three copies for approval of the Railway. The equipment shall be dispatched from works only after RITES inspection. Type test certificate on any equipment at the time of inspection, shall be furnished, otherwise the equipment shall have to be type tested, free of charge, to prove the design.

#### 2.21.5 **DRAWING APPROVAL**

The Contractor has to take the approval for the various drawings of the RMU unit including the protection scheme. The contractor has to provide all relay characteristics to Railways.

#### 2.21.6 **MANUAL**

The contractor has to provide the complete manual for the operation.

**PART-3 : BILL OF MATERIAL FOR RMU**

1	<b>H.T COMPARTMENT</b>	
	11 KV, 630 Amps, 21 KA for 3 sec., SF6 insulated Extensible Compact switchgear (Type CCVV+1Me) with FRTU consisting of Two Nos Electrical motor and manual handle operated spring charging mechanism Load Break Switches and Two Nos Electrical motor and manual handle operated spring charging mechanism Vacuum Circuit Breakers in SF6 insulated Stainless steel enclosure with series trip, communicable type, self powered microprocessor based numerical over current and Earth Fault (IDMT+Inst.) relay protection. Interconnection between HT switchgear and transformer shall be using 1Cx3x95 sq.mm Aluminum unarmored XLPE cable.	1 No.
	Self powered Relay shall be microprocessor based numerical with MODBUS RS485 communication port	1 No.
	Protection CT : Primary current 50 or 60 Amps, Secondary current 1/5 Amps, 2.5 VA, 5P10	3 No
	Fault Passage Indicator on minimum One Incoming LBS Module	1 No
	Manometer	1 No
	Space heater	1 No
	Thermostat	1 No
	LED Fitting, 240 V, AC for Illumination	1 No
2	<b>ENCLOSURE FOR RMU</b>	
	Outdoor type enclosure for 11 KV panel made of not less than 1.5 mm thick GI sheet enclosure (non load bearing parts) and not less than 2mm hot dip galvanized Base (load bearing parts). Degree of protection for HV compartments should be in accordance with IEC 62271-2006 or IS: 14786 or latest. Each compartment will be provided with the door & pad locking arrangement. The Compartment illumination lamp with door operated switch shall be provided.	1 Set

## **PART-4 : TECHNICAL SPECIFICATION FOR RMU:**

### **I. 11KV Bus Bar**

Sl. No.	DESCRIPTION	DETAILS
1	Type of material	Copper
2	Current Carrying Capacity	630 Amps.
3	Short time rating current for 3 Secs.	21 ka
4	Insulation of Bus bar	SF6
5	Bus bar connections	Anti-oxide grease

### **II. Parameters for Switch Gear of DT and load break isolators.**

Sl. No.	DESCRIPTION	DETAILS
1	Type	Metal enclosed
2	No of Phases	3
3	No of poles	3
4	Rated voltage	12 KV
5	Operating voltage	11 KV (+10% to - 20%)
6	Rated lightning impulse withstand voltage	Minimum 75 KV
7	Rated power frequency withstand voltage	Minimum 28 KV
8	Insulating gas	SF6
9	Rated filling level for insulation	<0.5 bar/ As Per IEC.
10	Max. permissible site altitude at the above gas pressures10 (The operating pressure has to be adjusted for greater altitudes)	≤11000m
11	Rated short time current	21KV
12	Rated short time	3 s
13	Rated peak withstand current	52.5 KA
14	Operating mechanism	Circuit breaker with stored energy mechanism
15	Rated current (Bus)	630 A
16	Rated current (breaker)	630 A
17	Circuit Breaker interrupter	VCB
18	Rated frequency	50 Hz
19	Rated operating sequence	0 – 3min- CO - 3min - CO
20	Number of mechanical/Remote operations for earthing & Ring switches & Number of mechanical / remote operations for circuit breakers	As per IEC 62271-100

### III. PRINCIPAL FEATURES:

Sl. No.	DESCRIPTION	DT Breaker
1	Circuit label	Yes
2	Mimic diagram	Yes
3	Supply voltage indication	Yes
4	Current Transformer	Yes
5	Self Powered IDMT Relay 2OC & 1 EF	Yes
6	Local / Remote Switch	Yes
7	Breaker ON/OFF indication	Yes
8	Spring Charge indication	Yes
9	Fault Tripping indication	Yes
10	Bus bar end caps	Yes
11	Whether the SF6 gas pressure gauge indicator	Yes
12	Whether the mechanism with manual for ON/OFF.	Yes
13	Whether the earth positions with arrangement for padlocking in each position and independent manual operation with mechanically operated indicator are provided	Yes

### IV. Load break switch (Isolators):

Sl. No.	DESCRIPTION	DETAILS
1	Type	SF6 load breaking and fault making
2	Rated current	630 A
3	Fault making capacity(KA peak min )	50 KA

### V. Earthing switch for 11 KV OFF Load Isolator

Sl. No.	DESCRIPTION	DETAILS
1	Rated Current	21 KA
2	Rated Short Time	3 s

### VI. Current Transformers for breaker:

Sl. No.	DESCRIPTION	DETAILS
1	CT Type	Resin cast ring core toroidal
2	CT Description	The CTs of DT breaker shall be suitable for sensing the minimum primary variable current in the order of 50 A and the secondary current for the CT is 1 / 5 A. The CT shall be housed in outside SF6 chamber for testing and Maintenance
3	Accuracy Class	Core 1: class 1 Core 2: class 5P10 protection
4	Rated Burden	2.5VA for both bores



**TECHINICAL SPECIFICATION FOR 16 MTR HIGH MAST:**

<b>1. HIGH MAST STRUCTURE :</b>		
A	Height of Mast	16 Mtr.
B	Material construction Shaft/Gussets etc.	S355 grade as per BS-EN10025:2004
C	Material construction Flange/Door stiffener.	As per IS:2062
D	No. of sections	2
E	Base Dia & Top Dia (A/F)	Base-410mm, Top-150mm
F	Plate Thickness (in mm)	Top-3 Bottom-4
G	Cross section of Mast	20 Sides polygon
H	Length of individual sections (Approx.)	Top : 5470 mm Bottom : 10980 mm
I	Length of overlap	450 mm (Approx.)
J	Type of joints	Telescopic stress fit (slip over joint system) with no circumferential weld.
K	Metal protection treatment for Mast section	Hot Dipped Galvanized (Single Dip) as per BS-EN ISO 1461
L	Thickness of galvanization (min)	75 Micron : Top 85 Micron : Bottom
M	Size of opening and door at base	1200 x 250 mm
N	Type of door	Vandal proof & weather protected
O	Locking arrangement	Padlocking arrangement in the center & 2 Nos. Allen bolt at top & bottom
P	Details of slack board inside the base compartment	Resin bonded plywood 600mm x 200 mm x 8 mm
Q	Arrangement for cable termination	TPN MCB
R	Thickness of base plate	25 mm
S	Size of anchor plate and thickness	Uniform PCD of 490 mm, 8mm
T	Details of template and thickness	Uniform PCD of 490 mm, 4mm
U	Lighting protection finial	Yes, Required. GI single spike
V	Aviation Obstruction Lights	2x100W, 230V GLS lamp with ES Cap
<b>2. DYNAMIC LOADING AS PREVAILING AT SITE :</b>		
A	Max. wind speed	50 m/s. As per IS-875-Part 3 1987
B	Max. gust speed time	3 seconds
C	Height above ground level these two factors are measured	10 Mtr.
D	Factor of safety for wind load	1.25
E	Factor of safety for material & safety of tower	1.15

<b>3. FOUNDATIONS DETAILS :</b>		
A	Type of Foundation	Open raft shallow footing RCC type.
B	Size of Foundation	PCC Bed (1:4:8)-3000x3000x100mm RCC Above PCC-2800x2800x300mm, & 1000x1000x1400mm Depth below Ground level-1500mm & above ground level 300mm.
C	Quantities	RCC (cum) - $\geq 3.75$ . PCC (cum) - $\geq 0.90$ STEEL (Kg) - $\geq 149$
D	Designed load bearing capacity	10 T per sq mtr at 2 mtr. Depth.
E	Design safety factor	$\geq 1.75$
F	Considered wind pressure (Kg/Sq mtr)	200 Kg/ Sq.Mtr as per IS-875-1987
G	Considered wind speed	50 m/s. As per IS-875-1987
H	Depth of foundation	1.5 Mtr. Below ground level
I	Number of foundation bolts	8 Nos
J	PCD of foundation bolts	490 mm
K	Type of foundation bolts	TS600 High yield tensile Cold Rolled Pitched threads.
L	Foundation Bolt diameter & length	24 mm dia, 750mm long
M	Concrete mix vibrated	M-20
N	Steel	Fe-415
<b>4. LANTERN CARRIAGE :</b>		
A	Material of construction	40NB ERW, Hot dip galvanized Class-A MS Tube
B	Diameter of carriage	535mm (ID).
C	Buffer arrangement between Carriage and Mast	PVC sleeves
D	Construction	9 Arm, Welded, 2 Sections
E	Load carrying capacity	750 Kgs.
F	Number of fittings	9 Nos. symmetrically
<b>5. WINCH :</b>		
A	No. of winch per mast	1 (SGDD Double drum)
B	Gear Ratio	53 : 1
C	Capacity (SWL)	750 Kgs.
D	No. of speed	6 pole single speed
E	Method of operation	Manual / Electrical

F	Lubrication arrangement	Self-lubricating Permanent oil bath
G	Type of lubricant	SAE 140 grade
H	Gear material	Cast Iron
I	Tested load per drum (kg)	750 Kgs. Per drum, 1500Kgs. for winch
<b>6. STAINLESS STEEL WIRE ROPE :</b>		
A	Grade	AISI 316 or better grade
B	Number of ropes	2 continuous rope
C	Construction	7/19 with central core SS
D	Centre core material	Stainless steel core
E	Diameter (mm)	6 mm
F	Thimbles & Talurit	SS Thimble, Copper Talurit
G	Breaking load capacity	2350 Kgs x2
H	Factor safety	≥ 8.5 per wire rope
<b>7. CABLE :</b>		
A	Type	5 core flexible COPPER
B	Material	EPR insulated PCP Sheathed
C	Conductor size	4 sq.mm. (copper)
D	No. of circuits per mast	One.
<b>8. POWER TOOL :</b>		
A	Model	Integral motor
B	Input supply	230/415 Volts AC 5Hz
C	Wattage/HP	≥1.5 HP
D	Number of speeds	Single speed
E	Operating speed	1440 RPM
F	Control system	Push Button
<b>9. TORQUE LIMITER :</b>		
A	Lifting capacity	Up to 700 Kgs.
B	Adjustable/Non-adjustable	Adjustable
C	Tripping device	Mechanical

**Note:**

The successful tenderer shall furnish complete specification of high mast & the following drawings:

- General arrangements drawing.
- Lighting layout & Electrical schematic.
- Foundation drawing for High Mast.
- Any other drawing considered necessary by Railways.

**THE RELEVANT STANDARDS APPLICABLE FOR HIGH MAST:**

- a) IS-875 Part-III of 1987 : Code of practice for wind and dynamic loading on structures.
- b) BS 4360 or equivalent to ASTM/DIN standard : Grade of MS plates.
- c) BS 5135 or equivalent to ASTM/DIN standard : Welding of MS Plates as material of Construction.
- d) BS 729 or equivalent to ASTM/DIN standard : Galvanizing of steel structure.
- e) Technical report No.7-1976 : Specification for high mast.
- f) IS-456 : RCC foundation.
- g) BSEN ISO 1461 of hot deep galvanizing : Metal protection treatment of mast sections.
- h) EN 19 material : Foundation Bolts.

**Technical specification for LED illuminated sign / direction boards**

1. The standard signages at Railway station to be followed as per guidelines issued by Railway Board vide letter No.[2023/SD-II/22/07/02 Dt.15/05/2023](#).
2. All LED Light fittings and its driver should be warranted for a period of 60 months from its commissioning or 72 months from the date of supply whichever is earlier and shall submit guarantee certificate from manufacturer.
3. All material shall be confirming to relevant IS, BIS, IEC etc. standards / parameters.
4. The price shall cover cost of design, manufacture, supply, loading, transportation and unloading to site, display, installation / erection, testing and commissioning of wall / hanging / floor mounting type LED illuminated sign / direction boards in Full Elliptical (FE), Half Elliptical (HE), Semi Elliptical (SE), parabolic shape as per site requirements. The display sheet shall be of unbreakable translucent polycarbonate sheet of 2 mm thickness. The text / graphics matter visibility shall not be less than 160 deg. The approved colour text and graphics shall be printed / router cut on monomeric calendared vinyl of 70-80  $\mu$ M thickness and shall be firmly pasted on display sheets. The mounting arrangement shall be hanging, wall mounting, ceiling mounting, pole mounting or floor mounting and as per site requirement. The signage shall have the integral mounting arrangements with sturdy structural frame and ACP cladding on the back side of the signage to avoid rusting and entry of dust. The LED board shall have uniform illumination with 4-8 W / sq. ft and with brightness more than ambient light. Suitable size end cap of 1.5 mm thick SS 304 / die moulded polycarbonate should be provided. The signage boards shall be confirming to as per technical specification enclosed.
5. The work covers Design, manufacture, display, installation of elegant, aesthetically appealing energy efficient LED Elliptical signages for passenger amenities areas like platforms, direction, FOB's, Service buildings, Utilities, concourse etc. of Railway Station.
6. The work which is not included in the schedule but required to complete the installation work shall be considered as the part of work and carried out by the contractor accordingly and no extra payment will be paid for that.
7. Agency shall visit the site for designing the signages, Design, model, graphics and colour scheme shall be got approved from user department before supply of LED Elliptical glow sign boards.
8. Agency shall submit the design report through professional design expert for appreciation of user department.

9. LED Elliptical Glow Sign Boards are to be provided dust environment and open space and should have proper louvers or ventilation for dissipation of heat generated by drivers / LED's.
10. The quality of the Vinyl/ Polycarbonate sheet/ anodized coating should be covered under three years warranty from the manufacturer. LED's/LED drivers shall be covered for free replacement five years warranty from the manufacturer.
11. Documentary proof of purchasing of LED/LED drivers/ Vinyl sheet/ Polycarbonate sheet from reputed approved brand shall be required to be submitted along with bill.
12. The unit prices indicated in the Schedule of quantity is inclusive of the prices for design, manufacturing, supplying of materials, multiple loading/unloading required under the particular item of schedule, storing, handling, erection testing and commissioning of installation in conformity of specification. The unit price is also inclusive of all incidental charges for transport, loading/unloading and handling of materials, commission for arranging dispatch direct from manufacturer's factory / authorized dealer / supplier and completing all necessary formalities in this respect, such as submission of forwarding notes, all insurance premium, bankers charges for bank guarantee, indemnity bonds inclusive of cost of stamps, etc. The unit prices shall include all incidental charges duties and levies including GST.

Note:-

- i. During the course of execution of above work electrical fitting, fixtures, wirings etc. needs to be removed and dismantled, shall be done by the contractor and released material shall be transported to store / scrap depot by the contractor for that no extra payment will be done. Any temporary bypass arrangement for continuity of supply if required shall also be done by the contractor under guidance of consignee.
- ii. All safety measures to be adopted during executing the work.
- iii. The work has to be carried out in Railway premises, so every precaution and safety rules shall be taken & followed by firm/contractor to protect their labours, Railway employees, passengers, materials, structures etc.

Model / Type	Full Elliptical (FE) / Half Elliptical (HE) / Semi Elliptical (SE) / Parabolic
Mounting	<p>Mounting arrangement shall be hanging, Wall mounting, Ceiling Mounting, Pole Mounting, Floor Mounting or as per site requirement. Sign Boards shall be with integrated mounting arrangement powder coated pipes to FOB/PF Structure / walls with tension rope made of SS 304 and supplied with minimum 5 meter 2.5 sq.mm FRLS multi stranded copper flexible cable as per IS: 694 with latest amendment and socket pin for connecting to power supply system. The cost of fixing of sign board with suitable clamping arrangement with SS nut, bolts, washers, square shear nut, nut-bolts, screw, T bolt, Chuck nut, shear nut or welding etc. is also included. The clamps shall be powder coated and enamel paint of approved colour.</p>
Elliptical Glow Board Frame	<p>Shall be made of Extruded Anodised hollow aluminium profile of size not less than 1.2 mm thickness and anodized to minimum 15µm thickness (Grade AC-15) in bronze &amp; silver or any other approved colour. Anodizing coating shall be as per IS: 1868 or latest amendment.</p> <p>Provide Full length square SS powder coated pipe attached to bottom cap square bracket with level adjustment provision ribbiting without welding, pass thorough top cap interlock with clamp SS pipe sliding and level adjustment provision without compromising structural strength of Elliptical Glow Board.</p> <p>Provide nylon die molded &amp; MS machine formed powder coated horizontal or vertical as per requirement heat sink bracket to hold top and bottom aluminium profile with press fit and bolting provision. Top bottom and/or side Cap as per requirement flush fixed at Profile to outer side holding all structural element together.</p>
Bracket / clamp	<p>"I" beams of size 3" - 27" / "T" beams of size 6-8" x 5", "C" beam of size 3" x 5" and round pipes 2" - 6" holding machine bended seven tank processed powder coated clamp with SS 304 nut bolts &amp; spring washers with provision of level, size and alignment adjustment. 'T', 'S' or round shaped clamp from center slot will interlock with top beam/ girder, pipe at various size with horizontal or perpendicular or tapper or slanted form with provision of beam to beam connected bracket to hold sign perpendicular or horizontal. &amp; bottom side of clamp will interlock with pipe of Elliptical Glow Board with SS nut-bolt and spring washer. High strength Round Mounting Clamp set of inner &amp; outer clamp at R 2"/3" &amp; for installation on round pipe of dia 2/3" shall be press-formed in SS 304 grade sheet of 2mm thickness, 2mm rib deep shall be formed along the periphery for additional strength, only the inner clamp shall be used with two holes</p>

	<p>shall be used for anchoring on wall. Universal mounting clamp approx. 70mm x 31mm x 22mm set consisting of sliding clamp, holding clamp, crimping lock and flexible strip shall be press-formed in SS 304 grade sheet of 1.2mm thickness. This clamp shall be slid inside the mounting channels fixed to substrates. 0.8mm strip shall be passed through this clamp and around the structure on which the sign is to be installed and crimped firmly by crimping clamp. It should fix at any structure.</p> <p>M10 Square Head Bolts SS 304 grade, 4 side chamfered shall be used for installation. M10 Hexa Head shear nuts, which are high security, anti-theft, permanent fasteners, shall be used and shall be made of SS 304.</p>
Top profile	<p>Top Profile of Elliptical Glow Board shall be made up of Aluminium Alloy (6063-T6) Extruded profile anodised to 15 <math>\mu\text{m}</math> +/- 3 <math>\mu\text{m}</math>. The profile nominal wall thickness shall be 2 mm and width approx 170 mm, 137 mm and 268 mm. The reflective metallic silver PU particle coated granules shall be provided on the internal face of the profile. The edges of the profile shall be rounded.</p> <p>The profile shall have a slot of approx 4.8 mm &amp; 7mm width on both sides to hold 2/3/4 mm thick polycarbonate sheet. The slot shall be at an angle of 80-84 degree to face firmly hold the polycarbonate sheet in elliptical and parabolic curvature. The Elliptical / Parabolic curvature of the polycarbonate sheet shall be maintained by its inherent flexural tension property. It should have circular slots for M6 self-tapping cheese head screws to fix the end caps. Along the centre line of the top of this profile there shall be a 10mm x 3mm slot for press fitting the heat sink holding brackets in place with circular slot for M6 self tapping screw should be made available. There shall also be a flat extension of 12mm to rectangular slot for additional support / fixing screws to firmly hold the heat sink holding bracket. The Total height of the central Projection should be maintained to minimize obstruction to light illumination.</p>
Bottom, top & side Profile	<p>Bottom, top and side Profile full / half of the Elliptical Glow Board shall be made of extruded anodized Aluminium Alloy hollow profile (6063-T6) having 2mm to 5mm wall thickness. It should have internal ribs with approx 1.5mm, 2.5mm thickness and 4.5mm, 4.2mm wide slot to firmly hold the polycarbonate sheet in elliptical and parabolic curvature using its flexural tension. A circular slot of dia approx. 4.5 mm at the center of profile shall be provided to fix self tapping cheese head screw for end cap.</p> <p>An extruded extension diametrically opposite to this circular slot should have approx. 10mm x 3mm slot for press fitting the heat sink holding brackets. Further flat extension of 12 mm shall be provided for</p>



	<p>screwing the bracket for additional strength &amp; fixed location.</p> <p>Total external width &amp; Height of the bottom, top &amp; side profile should be full of approx. 34mm x 48mm R 11.7mm / 42mm x 50mm, R 24.3mm / 42mm x 80mm, R16mm / 84mm x 80 mm, R16mm without compromising the strength and causing any obstruction to the light while giving maximum viewing area. The bottom corner shall have a curvature of approx. R11.7mm, 24.3mm and 16mm to appear in continuous flow of elliptical Curvature of polycarbonate sheet. This also shall add to aesthetic beauty of the whole Elliptical Glow Board.</p>
Heat Sink Holding bracket (HSH)	<p>Heat Sink Holding Bracket shall be of approx. length 184mm, 252mm, 260mm, 324mm, 397mm, 537mm, 551mm injection moulded in Nylon 6 material &amp; 1130mm, 1156mm, 861mm in MS machine formed powder coated for its strength &amp; flexibility. The bracket shall be of 'I' cross section of sizes approx. 102mm x 15mm x 10mm, 1080mm x 25mm x 5mm, 1156mm x 50mm x 5mm, 861mm x 50mm x 5mm at mid portion and it should reduce proportionately in slant at both the ends for nylon 6mm, MS 5mm. Thickness without obstructing the light and without compromising on strength.</p> <p>The 'I' cross section nylon shall have ribs for maintaining stiffness. Both the ends of HSH brackets shall have locking clasp to press fit in 10 mm x 3mm slot of top and bottom profile. The mid portion shall have offset of 14mm for nylon and 12 mm for MS.</p> <p>Central clasp shall be moulded in the Heat Sink Holding bracket to firmly hold the Heat Sink along the longitudinal axis of Elliptical Glow Board. The central clasp shall have two prong sets to hold the heat sink across its diagonal or along its sides as required. Two holes as per requirement shall be provided near the end clasps firmly.</p> <p>Two holes for nylon &amp; MS shall be provided on both sides of central clasp to fix at both profiles</p> <p>Two holes shall be provided on both sides of central clasp to fix the mid portion of bracket to strip in the event longer bracket if required</p> <p>The mid portion of HSH bracket approx. 3 mm thick x 10 mm wide aluminium strip in the event longer bracket is required or more than one Heat Sink is required for bigger size of Elliptical Glow Board.</p>
Heat Sink	<p>Heat Sink shall be 25-26 mm hollow anodized Aluminium Alloy (6063-T6) profile of 2mm thickness. Corners shall be flattened to form a square across flat to hold the heat sink diagonally. Heat sink must be press fit horizontally and diagonally from all 8 sides. All the four sides shall have dovetail of slots. Circular slots of dia 2 mm shall be provided at all four internal corners to tight fit the pins of Heat Sink connector.</p> <p>There shall be a set of three of approx 1.5mm thick ribs central of approx. 5mm height and two sides of approx. 2mm height. Provision</p>

	for maximize the surface area to aid in faster cooling as well as for additional strength to hollow square profile.
Heat sink connector	<p>Heat Sink connector shall be a moulded from polycarbonate profile of same cross sectional dimensions as that of Heat Sink. The thickness of the connector shall be approx. 5 mm.</p> <p>Two semi circular slots shall be provided on each face. Provision to pass out hot air from heatsink should be made. Four pins shall be moulded on four corners on both the faces of Heat Sink connectors to be press fitted in Heat Sink profile.</p>
Elliptical Glow Board end cap	<p>End caps full / half with elliptical and parabolic shape shall be made from injection moulded polycarbonate granules 2 mm thick / SS 304 1.2 mm thick / aluminium die casted 8 mm thick having curve on top side and internal hollow and elliptical base at bottom side with reflective internal surface. The End caps shall be perfectly opaque.</p> <p>The standard sizes are:</p> <p>170mm x 304mm x 21mm, R 511mm corner R11.7mm /</p> <p>210mm x 100mm x 20mm, R 150mm corner R 39mm /</p> <p>278mm x 130mm x 20mm, R193mm corner R39mm /</p> <p>350mm x 152mm x 20mm, R 257mm corner R 39mm /</p> <p>425mm x 175mm x 20mm, R 316mm corner R 39mm /</p> <p>563mm x 215mm x 20mm, R 449mm corner 39mm /</p> <p>210mm x 69.2mm x 20mm, R 150mm corner R 39mm /</p> <p>278mm x 84.2mm x 20mm, R 193.48mm corner R 39mm /</p> <p>350mm x 95.2mm x 20mm, R 257mm corner R 39mm /</p> <p>425mm x 106.7mm x 20mm, R 318mm corner R 39mm /</p> <p>563mm x 126.7mm x 20mm, R 449mm corner R 39mm /</p> <p>425mm x 150mm x 50mm, R 305mm corner 39mm /</p> <p>600mm x 110mm x 50mm, R 445mm corner R39mm /</p> <p>862mm x 167mm x 60mm, R 707mm corner R39mm /</p> <p>425mm x 190mm x 50mm, R 315mm corner R30mm /</p> <p>573mm x 230mm x 57mm, R 450mm corner R30mm /</p> <p>859mm x 308mm x 67mm, R 734mm corner R30mm /</p> <p>529mm x 308mm x 99mm, R 371mm Corner 40 /</p> <p>692mm x 308mm x 85mm, R 528mm corner R53mm /</p> <p>1063mm x 415mm x 126mm, R943mm corner R 80mm /</p> <p>1167mm x 353mm x 20mm, R 1062mm corner R 11.75mm /</p> <p>169mm x 915mm x 30mm, R 1246mm corner R17mm /</p> <p>342mm x 2092mm x 30mm, R 2451mm corner R 17.2mm /</p> <p>1488mm x 472mm x 30mm, R 1575mm corner R 16.3mm /</p> <p>889mm x 263mm x 25mm, R 775mm corner R 17.5mm.</p>

Note: Above size of the end cap will be utilized as per the requirement. The boards shall be such that the text & Graphics displayed on the Polycarbonate sheet held in these end caps should be completely visible even if it is viewed directly from the bottom or any direction; the text is very much legible.

Polycarbonate cap Internal face shall be cross ribbed 2mm x 3mm to increase the strength of the end cap. Eight nos. locating pins tapering towards collar of the end cap shall be provided near the internal periphery of the end cap. These pins shall firmly hold the 3mm translucent polycarbonate sheet in elliptical / parabolic curvature.

Circular cutout of dia approx. 80mm shall be provided for illuminated branding or opaque cap shall be provided in case of none branding. For branding translucent material fitting provision should provide without shadow on branding. Oblong cutout with collar shall be provided for projecting image of desired text & graphics on the floor below or opaque cap shall be provided in case of non-projecting. 2mm x 5mm Ribs approx. 20mm inside and parallel to the external periphery shall be provided for additional strength. Riser buttons shall be provided along the internal ribs to block the cutouts using opaque sheet screwed through these buttons. These buttons may also be used to mount the LED projector when required.

Projector fitting bracket shall be fix to end cap to align with oval slot.

Three nos. cap holding sockets shall be moulded at three corners of the End Cap. Two nos. locating pins shall be provided on each cap holding sockets and shall be provided at the bottom of these pins for additional strength. This pin shall locate in the top and bottom Aluminum profile.

Two tapering ribs shall be provided to cap holding brackets for additional strength.

Three through slots of approx. 17 mm x 1.5 mm shall be provided near the top of end cap for heat ventilation. Moulded Screw caps shall be provided to externally press fit in the cap holding sockets. The end cap Shall be Moulded Shatter proof opaque polycarbonate as per IS14443 or latest amended with thickness not less than 1mm and of reputed Indian make using Bayer granules.

SS 304 elliptical or parabolic cap should have approx. 20 mm vertical collar at corners of suitable dia hole to interlock with profile and structure, square bracket at bottom cap should provide to interlock vertical square structure pipe and top cap should have cut out to thoroughpass the structure pipe with the provision of ventilation.

Aluminium die Casted cap top should have curvature of R 1123-1125 mm and internal hollow with wall thickness of 6-8mm with polished and primed with metallic PU gloss lacquer coated. internal 2 nos.

	<p>cap holding socket shall be casted at both corners of cap to interlock with side profile,</p> <p>Bottom casted cap should have side curvature of - R78-79 / 112-113 mm and hollow of approx. 100 mm with internal 2 nos. cap holding socket shall be casted at both the corners of cap to interlock with side profile. Vertical rib should provide to interlock polycarbonate sheet with inner pins support should flushed with side aluminium profile. Cap should have a hole with die moulded dia approx. 12 mm grommet to pass main supply wire.</p>
Cue Beam	<p>Cue beam holding bracket die-moulded with triangular parabolic base of approx. 77mm x 68mm, 2 mm thick. Hollow cylindrical die-moulded cover of dia approx. 29mm and height 43mm attached to side legs with provision of hinge for 360 degree rotation and angle adjustment with oblong cut out of bottom cap. It should fix with bottom cap with 3 nos. holes of dia approx 3 mm.</p> <p>The Elliptical Glow Board shall have the slot for provision of Cue Beam projector wherever required with provision of cue beam holding bracket. Cue beam projector should project the given sign image and text on floor or wall from max distance with maximum brightness than ambient light.</p> <p>2 nos. Plano convex of approx. R 9.22mm, R 7.31mm and 1no. Biconvex lenses of approx. R19.8mm, R 34.1mm, should fix at given slots. Projector lens with engraved image should create maximum projection on surface The CUE BEAM should incorporate in Elliptical Glow Board.</p> <p>Technical specification of CUE BEAM Voltage - AC 110V~220V Built in LED Driver - 12 V Power - 5W Luminosity - 150~ 200LM Image Projected distance -1~ 3 meters External Dimensions approx. - Ø26mm X 76 mm</p>

Podium	<p>Elliptical shape one piece cut, top &amp; bottom 3mm thick with size approx. 1170 mm x 512 mm x 508 mm at R914mm at corner R 117mm / 1643 mm x 575 mm x 508 mm at R 1652mm at corner R 92.5mm of SS 304 with parabolic shape cut at center having dia approx 8 mm, 2 hole on top for matching with bottom cap of Elliptical Glow Board for fixing and interlocking without welding and bottom approx. 12 mm 4 hole for foundation fitting should be provided. Provide approx. 4 mm 9 holes for ventilation at top and Backside open able door system with lock &amp; key.</p> <p>SS 304 grade frame structure of size approx. 25mm x 50mm x 1.2mm square with vertical and horizontal supports covered with SS 304 sheet of 1.2mm thick with powder coated in elliptical shape machine formed matching with top of podium should provide Anchor fastener fitting provision has to be made for ground fixing.</p>
ACP Cladding	<p>Design, fabrication &amp; installation of 3mm thick exterior grade PVDF coated Aluminium composite panels (Timex, Alucobond) of having 0.5 mm thick aluminium PVDF coated sheet with specific standard colour + 3 mm core material + 0.5 mm aluminium sheet chemically treated (back sheet) bent with 5mm uniform machine grooved as per requirement, fitted on anodised aluminium/ anodized aluminium angle Primer with PU coated MS rectangular grid work. Grid for supporting ACP shall be of size approx. 38mm x 38mm x 1.5mm at a distance of Heat sink fixed in Elliptical Glow Board should accurately match Horizontally &amp; Vertically along with existing structure on site. Hardware, fixtures, brackets, anchor, fasteners of SS 304 grade etc. complete duly sealed with weathering silicon (DOW / GE) for circular columns and curved beams etc. Provision of MS clamp/ bracket for fixing with existing structure vertically, horizontally or slanted without welding and with level size alignment adjustment and interlocking provision without compromising strength and structural stability of frame should provide.</p>
Text /Graphics	<p>Shall be computer cut/printed on 80 µm Monomeric calendared Vinyl matt sheet of reputed make (Metamark / 3M) of Pantone shade 227C/165C/260C/Cool grey 8C/Black/7408C</p> <p>Note: Pantone provides a universal language of color that enables color-critical decisions through every stage of the workflow for brands and manufacturers.</p>

Led ribbon light Illumination	Ribbon light shall be of waterproof SMD 2835. The width of Ribbon light shall be 12 +/- 1mm. This shall be slide into the dovetail grooves of the heat sink & firmly pasted on all four sides of the heat sink. The light emitted from LED ribbon light should be partially reflected from the elliptical and parabolic curvature of white glossy polycarbonate sheet multiple times. Any obstruction or low brightness at the edges of the beam should be taken care of. Uniform illumination Average 4W-8W/ Sq. ft.	
LED	Linear LED of density 120 LEDs per meter of quality of proven make such as Bridgelux/ NICHIA/ SEOUL Semiconductor/ OSRAM/. OEM certificate of LED should be provided.	
	LED Wattage	0.08 W to 0.1W per LED
	LED Driver	Constant current waterproof LED driver of approved brand make Mean Well / Philips / OSRAM with separate surge protection
	LED Colour	Cool White
	Colour temperature	5500 K/6500 K
	Viewing angle	Text/Graphics/matter visibility shall not be less than 160°
	Nominal Voltage	230V, AC, 50 Hz
	Operating Voltage Range	150V-260V AC With SMPS power supply.
	Index of protection	IP 54
Sizes of Boards	The size of board shall of different sizes, as per the site requirement.	
Sign substrate	Shall be of Eco Friendly, High impact strength, shatter proof, UV resistant, Translucent, non- flammable White polycarboante solid sheet as per IS 14448 of not less than 3mm of reputed make Bayer / Lexan / Polymac. Light transmission shall be in the range of 60% - 90%. Provide U shaped 7mm x 1mm / 4mm x 1mm / 8 mm x 2mm gasket for tight holding and interlocking polycarbonate sheet in aluminum profile.	
<u>Note:</u> The successful contractor shall arrange of all equipment, tools, consumables, testing meters, Hydra scaffolding, crane, forklift etc. and other required materials for successful completion of the work. Any work not specifically mentioned, but required for successful completion of work is deemed to be included in the work. If any activity required to be included later on due to reliability and safety shall be carried out by contractor without any extra cost.		

## Annexure-F

**SPECIFICATION FOR STORAGE TYPE WATER COOLER:**

S.N	Description	Requirement
1	Type	Storage.
2	Cooling capacity	40 Ltr/Hr
3	Storage capacity	80 Ltr
4	Energy consumption	≤ 575 Watts for 40 Ltr/Hr cooling capacity
5	Power factor	≥0.85
6	IS Specification	IS:1475 latest with ISI Mark
7	Refrigerant	Eco friendly (Non CFC refrigerant)
8	Water Tank sheet material and thickness	Stainless Steel (Grade AISI 304), thickness > =0.8 mm
9	Water Tank cover and lid bottom Sheet material	Aluminium sheet
10	Water Tank cover and lid bottom Sheet Thickness	1.5mm
11	Cooler Cabinet sheet material	Stainless Steel (Grade AISI 304)
12	Cooler Cabinet sheet thickness	0.8
13	Warranty on Machine	1 (Minimum)
14	Warranty on compressor	1 year (Minimum)
15	Condenser coil	Copper
16	Condenser Fan	Propeller type (Quiet)
17	Test Report	The firm Has to submit test Report from Central Govt/NABL/CPRI/ILAC accredited lab to prove conformity to specification covering all technical requirements

## PROVISIONAL LIST OF APPROVED MAKES

S N	Item Name	Approved make
1	LT PVC insulated Single & multi –core for internal wiring	FINOLEX, UNIVERSAL, HAVELLS, INDO ASIAN, ANCHOR, V GUARD, POLYCAB
2	Cable – lugs & accessories for electrical general services.	MULTISHRINK, 3M, DOWELLS.
3	Capacitor–Fans and motors	BHEL, BHARTIA INDUSTRIES(BCH), CGL, VOLTAS, L&T (MEHR)
4	Capacitor-PF correction for electrical general services.	ABB, BHEL, L&T(MEHR).
5	ACB/MCB/MCCB for electrical general services	ABB, L&T, SIEMENS, LEGRAND, SCHNEIDER, INDOASIAN
6	LT switch gear and control gears contactors and motorstarters	ABB, CGL, L&T, SIEMENS, LEGRAND, SCHNEIDER, INDOASIAN
7	HDPE Pipe	SUDHAKAR, VARUNA, MANGALAM, RISHI, ADITYA WITH ISI MARK
8	Industrial sockets/Ray roll plug and socket	LEGRAND, INDOASIAN, SCHNEIDER, SIEMENS, STANDARD, CYCLO.
9	LED light fittings	OSRAM, BAJAJ, PHILIPS, SURYA, HAVELLS, WIPRO, CROMPTON, JAUGUAR, PANASONIC As per Railway specification.
10	Measuring instrument Analog/digital	AUTOMATIC ELECTRIC, L&T, MOTWANE, SIEMENS, TOSHNIWAL, HAVELLS, FLUKE
11	Pumps –Submersible	CGL, KIRLOSKER BROS, KSB, UNNATI PUMPS, SUGUNA with ISI mark
12	Switch fuse unit single and three phases, Change Over Switch.	ABB, CGL, GE, L&T, SIEMENS, INDO ASIAN (EON), STANDARD, BCH, SCHNEIDER, LEGRAND.
13	Timer's Electronic	ABB, BHEL, GE, L&T, SIEMENS, BCH, LEGRAND.
14	Normal type/Modular type switches, sockets, ceiling rose, bake lite lamp holder.	ANCHOR, LEADER, CONA, RIDER, ROMA, CRABTREE, SIEMENS, LEGRAND, GOLD MEDAL,



15	Transformer	Any SEB Approved with latest required star rating as per their requirement.
16	High Mast	BAJAJ, PHILIPS, GE, CROMPTON GREAVES, HAVELLS
17	Insulators	Any State Electricity Board (SEB) approved make with latest approval
18	HT DOLO FUSE	Any SEB approved make with latest approval
19	Lightning Arrestor	LAMCO, L&T/ Any SEB approved make with latest approval
20	GOS	AADITYA BIRLA INDUSTRIES, NARESH POTTERIES/ ANY SEB APPROVED MAKE WITH LATEST APPROVAL
21	Jointing kit - HT/LT	VENUS, DENSON, RAYCHEM, CABSEAL, MULTISHRINK, 3M.
22	11KV HTUG XLPE Cables	ASIAN, GLOSTER, TORRENT, POLYCAB, SBEE, HAVELLS with ISI Mark
23	1.1KV LT XLPE Cables PVC insulated	HAVELLS, RPG, SBEE, FINOLEX, POLYCAB, KEI, with ISI Mark
24	Aerial Bunched cable (HT/LT)	HAVELLS, POLYCAB, INSUCON, SBEE
25	Supply of light pipe of size 530mm soft white	SKYSHADE, RAY KONNECT, KONTACT CONSORTIUM INDIA PVT LTD
26	Microcontroller Timer control Unit	BAJAJ, PHILIPS, CROMPTON, SIEMENS, LEGRAND.
27	Solar Emergency lighting system	TATA BP SOLAR, INDOSOLAR, ALPINE ENERGY, MNRE approved
28	FRP METER BOX	SINTEX, HENSEL, SUPREME
29	VRLA 12/120AH Battery unit	AMARAJA, EXIDE, BOSCH, AMCO, HITACHI
30	Octagonal pole / Swaged pole	PHILIPS, BAJAJ, CROMPTON, ASTER, UTKARSH TUBES, JINDAL
31	MS/GI Tubular Poles	JINDAL, TATA, SURYA
32	RING MAIN UNIT(RMU) all type (Ways)	ABB, SCHNEIDER, SIEMENS, C&S, L&T
33	ON line/Off line UPS	APC, LUMINOUS, MICROTEK, NUMERIC
34	BLDC Fan	REXNORD, ATOMBERG, GORILLA, USHA, HAVELLS.
35	AC Ceiling Fan/Exhaust Fan	USHA, C&G, BAJAJ, HAVELLS,

		ALMONARD
36	Water purifier and coolers	BLUE STAR, OASIS, USHA, VOLTAS
37	Compact Sub-Station (CSS)	ABB, SCHNEIDER, SIEMENS, C&S.
38	ACSR Conductor	APAR, NALCO, VEDANTA, KHETAN, CABCON, OSWAL
39	PVC pipe for HT/LT cable/Wires Raising	SUPREME, FINOLEX, ASTRAL POLY, PRINCE PIPE
40	GI Strip 25x5mm/Wires	Any ISI make
41	Cable Trays & Accessories	Any approved make (with Prior approval)
42	Current Transformer	AUTOMATIC ELECTRIC, KAPPA, L&T, NEPTUNE
43	Potential Transformer	AUTOMATIC ELECTRIC, KAPPA, L&T, NEPTUNE
44	Digital Indicating Instruments	L&T(QUASER), SCHNEIDER(CONZERV), ABB
45	Modular plate type switch/Socket GI boxes/Fan Regulator/telephone/RJ-45/RJ- 11 modular Socket	SCHNEIDER, LEGRAND, ABB, HAVELLS, L&T, GOLD MEDAL.
46	Selector switch	L&T, KAY CEE, SIEMENS, ABB.
47	Digital Energy Meter	L&T, CONZERV, SECURE
48	APFC Relays	L&T, SCHNEIDER, SIEMENS, NEPTUNE(DUCATI)
49	Cable Gland/Lugs/Thimbles	COMMET, DOWELLS, RAYCHEM, GRIP WELL
50	Butterfly/Non-Return Valve/sluice Valve/Dual Plate Check valve/Y-strainer/Fire Man axe	KIRLOSKAR/AUDCO/ADVANCE/SANT
51	Gunmetal/Bronze Gate / Globe /Check/Ball Valves	LEADER, AUDCO, ADVANCE
52	Fire Extinguisher	CEASE FIRE, LIFEGUARD, OMEX, MINIMAX, PADMINI, SAFEX, AGNI, USHA FIRE SAFETY,
53	Contactors/ starters/Relay	SIEMENS, L&T, SCHNEIDER, ABB, GE, C&S, LEGRAND
54	Single Phase Preventer (Current Sensing)	L&T, SIEMENS, MINILEC
55	HT SF-6 Circuit Breakers/VCB	SIEMENS, ABB, CGL, L&T

56	Geysers	RACOLD, VENUS, USHA LEXUS, HAVELLS, CROMPTON, ORIENT
57	HRC fuse/Fuse switch unit	L&T, SIEMENS, HAVELLS, ABB
58	Insulation Mats	DL MILLER & CO.LTD, PREMIER POLYFILM LTD, RMG POLYVINYL INDIA LTD, JYOTI with ISI Mark
59	Change Over switch	L&T, HAVELLS, ABB, C&S.
60	Air conditioners (Split type)	VOLTAS, LG, WHIRLPOOL, BLUESTAR, CARRIER, SAMSUNG, DAIKEN, HITACHI, GODREJ
61	Solar water Heater	BOSCH, HAVELLS, HONEYWELL, RACOLD, SUDARSHAN, SIEMENS, SUPREME.
62	APFC Relay	SIEMENS, L&T, GE, ABB, SCHNEIDER
63	FIRE ALARAM SYSTEM	NOTIFIER, BOSCH, HONEYWELL, SIEMENS, GE- SECURIY
64	HT/LT PANELS	SCHNEIDER, L&T, ABB, SIEMENS, INDO ASIAN, LEGRAND, STANDARD, HAVELLS.

**NOTE: Railways reserves the right to choose any one of the makes given above, tenderer are advised to supply any one of the make, in this regard decision of Railway is final**

Raw materials of fabricated products like steel poles should be tested at approved test laboratory and certificate should be furnished by the contractor. Materials, welding, galvanizing etc. shall conform to IS specifications latest. DP test should be carried out on all the seam as per IS.3658:1999 or latest