



No. AEGCL/MD/AIIB/MORIGAONSS/2026/15

Date: 20.03.2026

**Addendum-I of the tender document Tender No:** AEGCL/MD/AIIB/Phase-II/PKG:P-II-E/2026/P-II-E

**TABLE:2 (VOLUME-1)**

SI No.	Clause No.	As Existing	As Amended	Reference to SI. No. of Response [Table 1] wherever applicable
1	Section 4 Tender forms	Tenderers can propose up to maximum of 3 (three) distinct names of reputed subcontractors/sub vendors or manufacturers	Deleted	TABLE-1(A): SI No. 8
2	Section-9 Appendix 8: Functional Guarantees	As the equipments and materials shall be acceptable only after successful testing as per requirements of the Specification and applicable Standards and Codes as referred to in the Specification, the GCC clause 38.4 shall not be applicable	As the equipments and materials shall be acceptable only after successful testing as per requirements of the Specification and applicable Standards and Codes as referred to in the Specification, the GCC clause 28.4 shall not be applicable	TABLE-1(A): SI No. 10

**Table 2: Volume-II**

***Chapter 2: Information to Bidders (ITB)***

S.No	Clause No	As Existing	As Amended	Reference to SI. No. of Response [Table 1] wherever applicable
1	Chapter 37 and 38	Tower structure and foundation design	Following line to be added: - Mult circuit tower structure and foundation design shall be provided by the Employer	
2	Chapter 13 and 23	Entire Chapter 13	Entire chapters to be replaced by new chapter Attached as Chapter 13 _TECHNICAL SPECIFICATION FOR 33 KV, 132KV, 220KV & 400 KV CVT & IVT (Annexure_Chapter-13) and Chapter 23 _TECHNICAL SPECIFICATION FOR 220kv, 132KV & 33KV CURRENT TRANSFORMERS (AIS) (Annexure_Chapter-23)	SI No. 1(Table 1B)
3	Chapter 22	Entire Chapter 22	Entire to be replaced by New chapter Attached as Chapter 22	SI No. 2(Table 1B)



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S.No	Clause No	As Existing	As Amended	Reference to Sl. No. of Response [Table 1] wherever applicable
			TECHNICAL SPECIFICATION FOR 220kV, 132kV, 66kV & 33KV CIRCUIT BREAKER (AIS) (Annexure_Chapter-22)	
4			New GTP format added Attached as Annexure A GTP Morigaon (Baghjap)	Sl No. 4(Table 1B)
5	Tower Schedule	220KV Morigaon- TSAT	Earlier published tower schedule for 220KV Morigaon TSAT Transmission line may be ignored and consider the newly published tower schedule.	
6	BOQ		Revised BOQ is uploaded.	
7	BOQ - Sr No . – 119 110V VRLA Battery 600AH	As per BOQ 110 V VRLA Battery is required, but Provided Technical Specification Consists 220 V battery & charger Specification. Please provide 110 V battery & charger Specification.	<b>CHAPTER 18: TECHNICAL SPECIFICATION FOR 110V DC BATTERY AND CHARGER is newly added which will replaced previous Annexure- CHAPTER 18</b>	Sl No. 6 (Table 1B)
8	ESIA-ESMP for Pkg-II-E:	ESIA-ESMP for Pkg-II-E link: <a href="https://docs.google.com/document/d/1cJgRnZYvTIMFX6OfImEa3-Rs1Hlyruvi/edit?usp=sharing&amp;oid=103339852801611740208&amp;rtpof=true&amp;sd=true">https://docs.google.com/document/d/1cJgRnZYvTIMFX6OfImEa3-Rs1Hlyruvi/edit?usp=sharing&amp;oid=103339852801611740208&amp;rtpof=true&amp;sd=true</a>	ESIA-ESMP for Pkg-II-E link: <a href="https://drive.google.com/file/d/1qPjmiV1L2nroXqulga-c92ILD1e6khCv/view?usp=drive_link">https://drive.google.com/file/d/1qPjmiV1L2nroXqulga-c92ILD1e6khCv/view?usp=drive_link</a>	
9	Revised BOQ (BoQ no. 9, Item 15		The scope of work involves procurement and installation of industrial grade AC's and commercial Split Acs. Please refer Annexure 19	

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## ANNEXURE-CHAPTER-13

### **CHAPTER 13: TECHNICAL SPECIFICATION FOR 33 KV, 132KV, 220KV & 400 KV CVT & IVT**

#### **13.1. SCOPE:**

13.1.1. This specification provides for the design, manufacture, assembly inspection and testing at the manufacturer's works, packing and delivery at site, erection, testing and commissioning of outdoor mounted type, single phase, oil filled, self-cooled, single unit type Inductive voltage transformers for 33 KV, 132KV & 220KV systems, & Capacitive Voltage Transformers for,132KV, 220kV & 400 KV system to be used for voltage indication, supply of potential to energy meters, relays for feeder protection in Grid Sub- stations of AEGCL, ASSAM.. In addition to the above functions the 400 KV, 220kV, 132KV CVT shall be suitable for carrier coupling.

13.1.2. The IVTs shall be complete in all respects with insulators, bimetallic connectors, fixing details etc. as described herein.

13.1.3. Bidders are required to quote for 0.2 accuracy class [metering winding] for 33 KV and 132KV IVTs & 132KV, 220kV, 400kV CVTs in the following manner.

(a)Guaranteed Technical Particulars.

(b)Technical literatures, brochures and drawings as per this specification.

(c)Type Test reports.

(d)List of orders, executed and Users' certificates with **minimum 5years of field proven experience** failing submission of the above particulars with the offer, the tender may not be considered for evaluation.

#### **13.2. Following is the list of documents constituting this Specification:**

(i) Technical Specification (TS).

(ii) Technical requirements.

#### **13.3. STANDARDS:**

13.3.1 The IVTs & CVTs shall conform in all respects to high standards of Engineering, design, workmanship and latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or material which in his judgement is not in full accordance therewith.

13.3.2. Except to the extent modified in the specifications, the IVTs & CVTs shall conform to the latest editions and the amendments of the standards listed hereunder:

Sl. No.	Standard Ref. No.	Title
01	IEC-44(4)	Instrument Transformer – measurement of PDS.
02	IEC-60	High voltage testing techniques.
03	IEC-171	Insulation co-ordination.
04	IEC-186	Voltage Transformers.
05	IEC-186(A)	Voltage Transformers (first supp. to IEC-186)
06	IEC-270	Partial discharge measurement.
07	IS-335	Insulating oil for transformers and switchgears.
08	IEC-8263	Method for RIV Test on high voltage insulators.
09	IS-2071	Method of high voltage testing.
10	IS-2099	High Voltage porcelain bushings.
11	IS-2147	Degree of protection provided by enclosures for low voltage switchgear and control.
12	IS-2165	Insulation co-ordination for equipments of 100KV and above.



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13	IS-3156 (Part-I to IV).	Voltage transformers.
14	IS-3347	Dimensions of porcelain transformer bushings.
15	IS-4146	Application guide for voltage transformers.
16	IS-5547	Application guide for Capacitor Voltage Transformers.
17	IS-9348	Coupling Capacitor & Capacitor Devices.

13.3.3 All the above along with the amendments thereof shall be read and interpreted together. However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this Technical Specification will prevail.

13.3.4. The voltage transformers with the requirements of other authoritative standards, which ensure equal or better quality than the standards, mentioned above shall also be acceptable. Where the equipment, offered by the supplier conform to other standards, salient points of difference between the standards shall be brought out in the offer. 4 (four) copies of the reference standards in English language shall be furnished along with the offer.

13.3.5. **The supplier is to furnish the standards as mentioned above from SI. 1 to 17 at their own cost, if required by the purchaser.**

**13.3.6: Accuracy specified shall be maintained at 25% of rated burden.**

## 13.4. CLIMATIC AND SERVICE CONDITIONS:

### 13.4.1 Earthquake Incidence:

The CVT/VT are to be designed to withstand earthquake of intensity, equivalent to **Minimum** 0.5g in the horizontal and 0.6g in the vertical direction.

## 13.5. INSTALLATION:

The CVT/IVT covered under this specification shall be suitable for outdoor installation without any protection from rain, dust, mist and direct rays of the sun.

## 13.6. GENERAL TECHNICAL REQUIREMENTS:

### 13.6.1. GENERAL TECHNICAL REQUIREMENTS FOR IVT:

13.6.1.1. Each IVT shall be supplied, filled with insulating oil and shall be hermetically sealed to prevent **atmospheric environment** in contact with oil, avoiding filtration and change of oil. Stainless steel diaphragm Bellow with bellow level indicator shall be provided.

13.6.1.2. Secondary Terminal Box:

13.6.1.2.1. The secondary terminals shall be brought out in a weatherproof terminal box with IP-55 **degree of protection enclosure.**

13.6.1.2.2 All secondary terminals shall be brought out in a compartment on one side of each IVT for easy access.

13.6.1.2.3. The exterior of this terminal box shall be hot dip galvanized.

13.6.1.2.4. The terminal box shall be provided with removable gland plate and glands suitable for 1100 volts grade. PVC insulated, PVC sheathed multi core of **2.5 sq.mm to 4 sq.mm** stranded copper conductor cable.

13.6.1.2.5. The terminal box shall be provided with a cover in front so as to have easy access of secondary terminals. The cover shall have a sealing/locking arrangement and shall be suitable to prevent penetration of moisture and rainwater.

13.6.1.2.6. The dimensions of the terminal box and its openings shall be adequate to enable easy access and sufficient working space for use of normal tools.

13.6.1.2.7. The terminal blocks shall be standard type and provided with ferrules indelibly marked or numbered and their identifications shall correspond to the designation on the relevant wiring diagram.



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13.6.1.2.8. Secondary wiring terminal studs shall be provided with at least three nuts, plain and spring washers. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads.

13.6.1.2.9. Primary earthing link should be provided for measurement of capacitance & di-electric dissipation factor.

13.6.1.2.10 Polarity shall be indelibly marked on each primary and secondary terminal.

13.6.1.3 The IVT shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. The method adopted for hermetic sealing shall be described in the offer.

13.6.1.4. The castings of base, collar etc. shall be die cast and tested before assembly to detect cracks and voids, if any.

13.6.1.5. The characteristics of the IVTS shall be such as to provide satisfactory performance such as voltage error and phase displacement at rated frequency shall not exceed the values as per relevant standards at any voltage between 80% and 120% of rated voltage and with burdens of between 25% and 100% of rated burden at a power factor of 0.8 lagging. The error shall be determined at the terminals of the IVT and shall include the effects of any fuses or resistors as an integral part of the IVT.

13.6.1.6. Inductive voltage transformers shall be ferro-resonance proof and adequately designed to use in HT cable circuit wherever applicable.

### **13.6.1.10. Primary Winding:**

Primary winding of the IVT will be connected phase to neutral with the neutral point solidly earthed. The arrangement for this shall be included in the scope of supply. The primary conductor shall be of adequate cross-section so that the maximum permissible current density shall not be exceeded even during short-circuit conditions. Primary Windings shall be made of Copper.

### **13.6.1.11. Secondary Winding:**

Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. The secondary conductor shall be of adequate cross section so that the maximum permissible current density shall not be exceeded even during short- circuit conditions. Secondary windings details, burden & accuracy class are mentioned in Appendix-I. Secondary windings shall be used for metering, relaying and synchronizing. Each winding shall comply requirements of both Part-II and III of up-to-date editions of IS-3156/IEC-186.

### **13.6.1.12. Core:**

Core laminations shall be of cold rolled grain-oriented silicon steel to ensure 0.2 accuracy class at both normal and over voltage. The core material, thickness of lamination, the relevant graphs showing the characteristics of the core materials shall be submitted along with the offer.

### **13.6.1.13. Tank:**

13.6.1.13.1. Both expansion chambers and tanks of the IVT shall be made of high-quality steel and shall be able to withstand full vacuum and pressure, and thermal and mechanical stresses resulting from maximum short circuit current during operation. The tanks along with all ferrous parts shall be hot-dip galvanized as per relevant standard.

13.6.1.13.2. The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. Welding in horizontal plane is to be avoided. Supplier has to obtain specific approval from the purchaser for any horizontal welding, used in the bottom tank

13.6.1.13.3. Paint inside the metallic housing shall be of anti-condensation type.

### **13.6.1.14. Porcelain Housing:**



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13.6.1.14.1. The housing shall be made up of homogeneous, vitreous porcelain of high mechanical and dielectric strength; glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface, arranged to shed away rainwater or condensed water particles (fog)

13.6.1.14.2. The bushings of the IVTS shall conform to latest edition of IS-2099. The hollow porcelain insulators shall conform to the latest edition of IS-5621

13.6.1.14.3. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength

13.6.1.14.4. The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat.

13.6.1.14.5. Cast metal and caps for the bushings shall be of high strength hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionisation.

13.6.1.14.6. End shields should be provided for distribution of stresses.

13.6.1.14.7. Corona shields for bushings, if required, should be provided.

### 13.6.1.15. Insulating Oil:

The quantity of insulating oil for the filling and the complete specification of the insulating oil shall comply in all respects with the provisions of the latest edition of IS-335. The IVTs shall be supplied filled with **new oil**.

### 13.6.1.16. Prevention of Oil Leakage and Entry of Moisture:

The supplier shall ensure that the sealing of the IVT is properly achieved. In this connection, the arrangement provided by the supplier at various locations including the following ones shall be described, supported by sectional drawings

- Locations of emergence of primary & secondary terminals.
- Interface between porcelain housing and metal tank(s).
- Cover of the secondary terminal box.
- Sealing around oil level indicator.

13.6.1.16.1. Nuts and bolts or screws used for fixation of the interfacing porcelain bushings for taking out terminals shall be provided on flanges, cemented to the bushings and not on the porcelain.

13.6.1.16.2. For gasketed joints, wherever used, **nitrite butyl rubber/Neoprene gaskets shall be used**. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

### 13.6.1.17. Fittings and Accessories:

Fittings and accessories listed below shall be supplied with each IVT. Any fitting required essential other than those listed below shall also be supplied along with each IVT.

- Oil level gauge.
- Oil filling hole and cap.
- Pressure relieving device.
- Lifting lugs.
- Phase terminal connectors.
- Tank earthing pads/terminals with necessary nuts and bolts and washers for connecting to Purchaser's strip.
- Name/Rating plate.
- H.R.C. fuse of Adequate rating
- Bellow

### 13.6.1.18. Provisions

13.6.1.18.1. Oil Level Gauge:



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An oil level gauge shall be provided to indicate the oil level in the IVT. This gauge shall be mounted in such a way that the oil level can be seen from the ground level.

### 13.6.1.18.2. Pressure Relieving Device:

Each IVT shall be provided with a pressure relieving device so as to protect bushing of the IVT even under unfavourable conditions.

### 13.6.1.18.3. Oil Drain Cock:

An oil drain cock along with a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing, if required.

13.6.1.18.4. Earthing: Metal tank of each IVT shall be provided with two separate earthing terminals for bolted connection to be provided by the Purchaser for connection to station earth-mat.

### 13.6.1.18.5. Lifting Arrangement:

The IVT shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing.

Lifting arrangement [Lifting eye] shall be positioned in such a way so as to avoid any damage to the porcelain housing or the tanks during lifting for installation/transport. Necessary string guides shall be offered which shall be of removable type.

### 13.6.1.18.6. Name Plate:

The IVT shall be provided with non-corrosive legible name plate with the information specified in relevant standards, duly engraved/punched on it.

### 13.6.1.18.7. Gasket Joint:

The manufacturer shall furnish the type of gasket used or setting methods.

### 13.6.1.18.8. Terminal Connectors:

All the IVTs shall be provided with bimetallic solder less clamp type, rigid type terminal connectors, suitable for ACSR Conductor as per site requirement. Each terminal connector shall be of universal type, suitable for both horizontal and vertical connections to the transmission line conductors/station bus bar.

13.6.1.18.8.1. Terminal Connectors shall be manufactured and tested as per IS:5561.

13.6.1.18.8.2. All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

13.6.1.18.8.3. No part of a clamp shall be less than 12mm. thick.

13.6.1.18.8.4. All ferrous parts shall be hot dip galvanized conforming to IS-2633

13.6.1.18.8.5. All current carrying parts shall be designed and manufactured to have minimum contact resistance.

13.6.1.18.8.6. Connectors shall be designed to be corona free in accordance with the requirements, stipulated in IS-5561.

13.6.1.18.9. Secondary Wiring: The Secondary wiring shall be enclosed in conduits and shall be brought to a terminal block ready for external connections. The wiring shall be of adequate cross-section and not less than 2.5 sq.mm copper wire.

13.6.1.18.10. The supplier shall supply necessary hardwares, required for connection of phase side conductor to the line terminal and the grounding strip to the grounding terminal.

13.6.1.18.11. Necessary nuts and bolts for fixing the IVTS on the supporting structures shall be in tenderer's scope of supply.

## 13.6.2. GENERAL TECHNICAL REQUIREMENTS FOR 400KV, 220KV & 132KV CAPACITIVE VOLTAGE TRANSFORMER:

13.6.2.1. The CVT shall operate satisfactorily in system with high X/R ratio. ( $T_p=100$  ms.).

13.6.2.2. The CVT transformer tanks along with top metallic shall be galvanized and painted to required shade.



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13.6.2.3. Impregnation details along with tests and checks to ensure successful completion of impregnation cycle shall be furnished for purchaser's approval.

13.6.2.4. Bellows, if used to cater for expansion of insulating oil, shall be tested in accordance with relevant standards. The details shall be subject to the approval of the purchaser.

13.6.2.5. The CVT shall be capacitor voltage type with electromagnetic units and shall be suitable for carrier coupling.

13.6.2.6. All windings of voltage transformer secondaries shall be protected by HRC cartridge type fuses.. The secondary terminals of the CVTs shall be terminated to stud type non-disconnecting terminal blocks in the individual phase secondary boxes via the fuse. Fuse ratings shall be clearly mentioned.

13.6.2.7. CVTs shall be suitable for high frequency (HF) coupling, required for power line carrier communication. The carrier signal must be prevented from flowing into potential transformer (EMU) circuit by means of a RF choke/reactor, suitable for effectively blocking the carrier signal over the entire carrier frequency range i.e. 40 to 500 KHZ. Details of the arrangement shall be furnished along with the bid. HF terminal of the CVT shall be brought out through a suitable bushing and shall be easily accessible for connection to the coupling devices of the carrier communication equipment, when utilized. The bushing shall be fully protected against rain and vermin so as to avoid the possibility of short circuits to earth. An earthing link with fastener shall be provided for HF terminal. **Test tap for Tan- delta and capacitance shall be provided.**

13.6.2.8. The electromagnetic unit, comprising compensating reactor, intermediate transformer and protective and damping devices should have a separate terminal box with all secondary terminals, brought out.

13.6.2.9. The accuracy of the windings (0.2/3P/3P) shall be maintained throughout the entire burden range preferably in the frequency range of 48 HZ to 51.5 HZ on all the three windings without any adjustment during operation. Preference will be given to such bidders who can offer for maintaining the above accuracy class in the frequency range i.e. 48 HZ to 51.5 HZ up to the above specified burden values.

13.6.2.10. Constructional Features:

13.6.2.10.1. The 400KV, 220KV & 132KV CVT shall be suitable for mounting on support structure of lattice type structures.

13.6.2.10.2. Access to secondary terminals shall be possible without any danger of access to high voltage circuit.

13.6.2.10.3. CVTs shall be hermetically sealed units.

13.6.2.10.4. **A protective surge Arrester/spark gap shall be provided to prevent break down of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor/primary winding, tuning reactor/RF choke etc. due to short circuit in transformer secondaries. Surge arrester shall be provided in the secondary winding also.**

13.6.2.10.5. The CVT secondary terminals shall be brought out into a weatherproof terminal box for ease of access. The terminal box shall have an IP rating of not less than IP 55. The terminal box shall be provided with a removable gland plate at the bottom and shall be suitable for accepting the required number of PVC insulated PVC sheathed, 10 core 2.5 mm<sup>2</sup> standard copper conductor cable.

13.6.2.10.6. All terminals shall be clearly marked to facilitate connection of secondary wiring.

13.6.2.10.7. Secondary fuses or MCBs shall be provided on or adjacent to each CVT, located such that they are accessible while the primary is live and shall be provided with labels indicating their function and their phase colours CVT secondary circuits shall be complete in themselves and shall be earthed at one point only. A separate earth link shall be provided for each secondary winding and shall be situated at the CVT. Primary earthing links should be provided.



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13.6.2.10.7. To prevent ferro resonance, suitable damping devices shall provide for connection to the transformer secondaries.

13.6.2.10.8. CVTs shall meet the requirements, given in this section of the specification.

13.6.2.10.9. The creepage and flashover distances of the high voltage insulator shall be suitable for the outdoor service conditions, specified in the schedules.

13.6.2.10.10. The bidder in the offer is to state the suitable precautions/methods, adopted during design stage of the CVT to avoid the un-desirable effects due to ferro resonance phenomena.

13.6.2.10.11. It should be stated in the bid offer regarding the steps taken in the design stage for elimination/minimization of the influence of the transient response on the behaviour of high-speed relays.

13.6.2.10.12. It shall be ensured by the bidder in the offer that the connection of carrier, frequency coupling device across the CVT will not affect the designated accuracy class of the CVT windings.

13.6.2.10.13. The capacitor divider unit shall comply to IS: 9348/1979.

13.6.2.10.14. It shall also be complied in the offer through a calculation sheet, proving that the designated accuracy class of the CVT (both metering and protection) are not affected by extreme temperatures, to be encountered in service conditions (Max. ambient temperature 50° C and minimum -0° C). The terminal connectors should be suitable for 'ACSR' Conductor as per site requirement.

### 13.7. TESTS:

#### 13.7.1 Type Tests:

The offered 33 KV, 132KV, 220kV Inductive voltage transformer 400kV, 220kV, 132KV capacitive voltage transformer should have been subjected to the following type tests in a Government approved Test Laboratory. The bidder shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years from the date of opening of the bid. For any change in the design/type already type tested and to the design/type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests/special tests without any extra cost to AEGCL in the presence of purchaser's representative at the cost of the supplier.

#### **For 33 KV, 132 KV, 220kV IVT:**

- Temperature rise test.
- Lightning Impulse Test.
- High Voltage power frequency wet withstand voltage tests.
- Determination of errors.
- IP-55 Test on secondary Terminal Box.
- RIV Test**
- Creepage distance measurement test**

N.B.: (i) The dielectric type tests should have been carried out on the **Same design and type of IVT.**

(ii) After the IVT was subjected to the dielectric tests, it should have been subjected to all routine tests as per relevant standards.

(iii) For Temperature Rise Test, the test must have been made with the appropriate rated burden, connected to each secondary winding.

#### **For 400kV, 220kV & 132kV CVT.**

Type Tests/Special Tests for 400kV, 220kV, 132kV CVT:

- Lightning Impulse voltage test on complete CVT unit.



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CIN: U40101AS2003SGC007238 GSTIN: 18AAFCA4973J9Z3

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- b) Power frequency over-voltage test on complete CVT unit.
- c) Partial discharge test.
- d) Radio interference voltage test.
- e) Corona extinction voltage test.
- f) Temperature rise test on complete CVT unit.
- g) Ferro resonance test on the complete C.V.T. unit.
- h) Transient response tests.
- i) Determination of Temperature Co-efficient test.
- j) High frequency capacitance and equivalent resistance measurement test (as per IEC-358)
- k) Stray capacitance and stray conductance test (as per IEC-358).
- l) Accuracy tests.
- m) Thermal stability test.
- n) Thermal Co-efficient test (as per IEC-358)
- o) Fast transient test.
- p) Seismic withstand test.
- q) IP-55 test on secondary Terminal Box.
- r) Magnetization and internal burden tests.
- s) Effectiveness of sealing tests.
- t) Mechanical Terminal load test on Bushing.
- u) Dielectric loss angle test (Tan Delta Test).
- v) Switching impulse withstand test
- w) Critical impulse withstand voltage of insulator housing.

- N.B: 1. The dielectric type tests should have been carried out on the same CVT.  
2. After the CVT was subjected to the dielectric tests, it should have been subjected to all routine tests as per relevant standards.  
3. The ratio errors, phase displacements before, during and after the temperature rise test on complete CVT unit should have been determined with stipulated burdens and the same should comply with the designated accuracy class for each winding of the CVT.

### 13.7.2 Routine Tests:

The following routine tests shall be conducted on each VT in the presence of Purchaser's representative for which no charges will be payable by AEGCL. No sampling is allowed.

- (a) Verification of terminal markings.
- (b) Power frequency withstand tests on primary windings/capacitor voltage divider for CVT
- (c) Partial discharge measurement for 400kV, 220kV & 132kV CVT.
- (d) Power frequency withstand tests on secondary windings/Low voltage terminal of the capacitor divider for 400kV, 220kV & 132kV CVT.
- (e) Determination of errors on complete IVT/CVT.
- (f) Measurement of Insulation resistance.
- (g) Oil leakage test.
- (h) Measurement of capacitance and dielectric dissipation factor before and after dielectric tests (as per IEC-358)
- (j) Power frequency tests on electromagnetic unit for 400kV, 220kV & 132kV CVT.
- (j) Any other test as per relevant national & international standards.
- (k) Creepage distance measurement test.

N.B.: Determination of errors shall be performed after the other tests. The standard reference VT to be used during testing for determination of ratio error and phase angle error should be of 0.05 accuracy class or better as per standard practice, presently adopted by AEGCL.

### 13.8. INSPECTION:



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13.8.1. The Purchaser shall have access at all times to the works and all other places of manufacture, where the IVTs/CVTs are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacturer of all the accessories and for conducting the necessary tests.

13.8.2. The Supplier shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangement could be made for inspection at the discretion of the Purchaser.

13.8.3. No material shall be dispatched from its manufacture unless the material has been satisfactorily inspected, tested and dispatch clearance issued. However, the Purchaser reserves the right to alter the despatch schedule attached to this Specification.

13.8.4. The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this Specification and shall not prevent subsequent rejection, if such equipments are found to be defective.

13.8.5. Clear 15 (Fifteen) days' notice shall be given to this office for deputing officer(s) for inspection. The Voltage Transformers shall be despatched only after the inspection is conducted by a representative of AEGCL and release order, issued from this office after approval of Routine Test Certificates. The shop routine test certificates in triplicate for all the Voltage Transformers along with the calibration certificates of all the meters and equipments to be used during testing (as per Annexure-B of the Specification) should be furnished along with the Inspection Offer. The Inspecting Officer will be authorised for inspection of the Voltage Transformers subject to the condition that the routine test certificates and calibration certificates of the testing equipments/meters will be found to be in order.

### 13.9. QUALITY ASSURANCE PLAN:

13.9.1. The Bidder shall invariably furnish following informations along with his offer.

- (i) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards, according to which the raw materials are tested, list of tests, normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.
- (ii) Information and copies of test certificates as in (i) above in respect of bought out items.
- (iii) List of manufacturing facilities available.
- (iv) Level of automation achieved and list of areas where manual processing exists.
- (v) List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such tests and inspection.
- (vi) Special features provided in the equipment to make it maintenance free.
- (vii) List of testing equipments, meters and test plant limitation, if any, vis-à-vis the type, acceptance and routine tests, specified in the relevant standards. These limitations shall be very clearly brought out in the offer.
- (viii) All the testing equipments, meters etc. should have been calibrated in a Government approved laboratory. The Bidder must submit the list of testing equipments and meters test as per the Technical Specification.

(ix) QAP shall include acceptance criteria against all parameters with relevant clause of standards

13.9.2. The Supplier shall within 30 days of placement of order submit the following information to the Purchaser.

- (i) List of raw materials as well as bought out accessories and the names of the materials as well as bought out accessories and the name of Sub-suppliers selected from those, furnished along with the offer.
- (ii) Type test certificates of the raw materials and bought out accessories.



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- (iii) Quality Assurance Plan (QAP) with hold points for the Purchaser's possible inspection. The QAP and hold points shall be discussed between the Purchaser and the Supplier before the QAP is finalised.

13.9.3. The Supplier shall submit the routine test certificates of bought out items and raw materials at the time of acceptance testing of the fully assembled equipment.

### 13.10. DOCUMENT:

The supplier shall furnish four sets of following drawings/documents along with his offer.

- (a) General outline and assembly drawings of the Inductive Voltage Transformers/ Capacitive Voltage Transformers.
- (b) Sectional views showing:
  - i) General constructional features.
  - ii) Materials/gaskets/sealing used.
  - iii) The insulation of the winding arrangements, method of connection of primary/ secondary winding to the primary/secondary terminals etc.
- (c) Schematic drawing.
- (d) Rating & diagram plate as per relevant IEC/ISS
- (e) Secondary Terminal Box.
- (f) Assembly Sectional view of Primary terminal/capacitor voltage divider
- (g) Assembly drawing for secondary terminal
- (h) The detailed dimensional drawing of Porcelain Housing such as ID, OD, thickness and insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.
- (i) Sectional view of pressure release device.
- (j) Drawing showing details of Oil level.
- (k) All type test reports relating to the tests as specified in Clause-8.1 of the above.
- (l) Ratio and phase angle error curves for IVTS/ CVTS
- (m) Magnetization characteristic curves such as B-H curves and Sp. Loss vs. Flux density curves for core material, used for IVT & EMU unit of CVT.
- (n) Sectional view of EMU unit of 220KV&132KV CVT.
- (o) Schematic diagram showing the working of CVT in PLCC.

### 13.11. TEST REPORTS:

- (i) Four copies of type test/special test reports shall be furnished to the Purchaser with the tender offer.
- (ii) Copies of acceptance test reports and routine test reports shall be furnished to the Purchaser. One copy will be returned, duly certified by the Purchaser and only thereafter shall the materials be despatched.
- (iii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the Purchaser.
- (iv) All test reports of tests conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when required for by the purchaser.
- (v) The necessary galvanized flanges, bolts etc. for the base of the Inductive/Capacitive Voltage Transformers shall be supplied without any extra cost to the purchaser.

### 13.12 APPENDIX – I.

#### TECHNICAL REQUIREMENTS FOR 33kV, 132kV & 220kV INDUCTIVE VOLTAGE TRANSFORMERS & 132kV, 220kV, 400kV CAPACITIVE VOLTAGE TRANSFORMER.

Sl. No	Particulars	33kV IVT	132kV IVT	220kV IVT	132kV CVT	400kV/220kV CVT



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I	II	III	IV	V	VI	VI
1	Type	Single phase, 50Hz, oil filled, self-cooled, Hermetically sealed, outdoor porcelain type.	Single phase, 50Hz, oil filled, self-cooled, Hermetically sealed, outdoor porcelain type.	Single phase, 50Hz, oil filled, self-cooled, Hermetically sealed, outdoor porcelain type.	Single phase, 50Hz, oil Filled, self-cooled, Hermetically sealed, Outdoor porcelain type.	Single phase, 50Hz, oil Filled, self-cooled, Hermetically sealed, Outdoor porcelain type.
2	Nominal system voltage.	33kV	132kV	220kV	132kV	400 kV/220kV
3	Highest system voltage.	36kV	145kV.	245kV.	145kV	420kV/245kV
4	Frequency.	50Hz± 5%	50Hz± 5%	50Hz± 5%	50Hz ± 5%	50Hz± 5%
5	System earthing.	Effectively solidly earthed	Effectively solidly earthed	Effectively solidly earthed	Effectively solidly earthed.	Effectively solidly earthed.
6	Number of phases.	3 [single phase]				
7	(i) Number of secondary windings. (ii) Purpose of windings.	3 [three] Protection & metering.				
8	Rated primary voltage.	33/1.732kV	132/1.732kV	220/1.732 kV	132/1.732kV	400/1.732 kV 220/1.732 kV
9	Rated secondary voltage.	Winding-II &III- 110/1.732V (Protection) Winding-I- 110/1.732V (Metering)	Winding-II &III- 110/1.732V (Protection) Winding-I- 110/1.732V (Metering)	Winding-II &III- 110/1.732V (Protection) Winding-I- 110/1.732V (Metering)	Winding-I- 110/1.732V Winding-II- 110/1.732V Winding-III- 110/1.732V	Winding-I- 110/1.732V Winding-II- 110/1.732V Winding-III- 110/1.732V
10	Ratio	33kV/1.732: 110V/1.732 110V/1.732	132kV/1.732: 110V/1.732 110V/1.732	220kV/1.732: 110V/1.732 110V/1.732	132kV/1.732: 110V/1.732 110V/1.732	400kV/1.732: 110V/1.732, 110V/1.732 220kV/1.732: 110V/1.732 110V/1.732
11	Rated burden.	Winding-I(M)- 50VA Winding-II(P)- 50VA Winding-III(P)- 50VA	Winding-I(M)- 50VA Winding-II(P)- 50VA Winding-III(P)- 50VA	Winding-I(M)- 50VA Winding-II(P)- 50VA Winding-III(P)- 50VA	Winding-I (M)- 50VA Winding-II (P)- 50VA Winding-III(P)- 50VA	Winding-I (M)- 50VA Winding-II (P)- 50VA Winding-III(P)50VA
12	Accuracy class	0.2/3P/3P	0.2/3P/3P	0.2/3P/3P	0.2/3P/3P	0.2/3P/3P
13	Rated voltage factor at rated frequency.	1.2 continuous. 1.5 for 30second.				
14	Temperature rise at 1.2 times the rated primary voltage, rated frequency & rated burdens.	As per IEC- 186.	As per IEC-186.	As per IEC-186.	As per IEC- 186/61869	As per IEC-186/61869



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15	Temperature rise at 1.5 times the rated primary voltage for 30 seconds, rated frequency & rated burden.	As per IEC- 186.	As per IEC-186.	As per IEC-186.	As per IEC-186/61869	As per IEC-186/61869
16	One-minute power frequency dry/wet withstand test voltage for primary winding.	70kV[rms]	275kV[rms]	460kV[rms]	275kV[rms]	650kV[rms](400kV )/ 460kV[rms](220kV)
17						
18	1.2/50 micro second impulse withstand test voltage for primary winding	170kV[peak]	650kV[peak]	1050kV[peak]	650kV[peak]	1425kV[peak] (400kV)/ 1050kV[peak] (220kV)
19 (i) (ii)	One-minute power frequency withstands test voltage for Secondary winding Between LV(HF) terminal & earth terminal	3kV[rms] -	3kV[rms] -	4kV[rms]	3kV[rms] 10kV[rms] for exposed terminals & 4kV[rms] for terminals, enclosed in a weatherproof box.	3kV[rms] 10kV[rms] for exposed terminals & 4kV[rms] for terminals, enclosed in a weatherproof box.
20	Class of insulation.	A	A	A	A	A
21	Material of the conductor of primary and secondary windings.	Copper.	Copper.	Copper.	Copper for EMU	Copper for EMU
22	Fault level	31.5kA [rms] for 3 second.	40 kA [rms] for 3 second.	50 kA [rms] for 3 second.	40 kA [rms] for 3 second.	50KA for 3 (220kV) / 63KA(400kV)[rms] for 3 second.
23	Minimum creepage distance.	1116mm	4495mm	7595mm	4495 mm	13020(400kV)/7595(220 kV) mm
24	Quality of oil.	EHV Grade As per IS-335.	EHV Grade As per IS-335.	EHV Grade As per IS-335.	EHV Grade As per IS- 335.	EHV Grade As per IS-335.
25	Radio interference voltage at 1.1 times maximum rated voltage at 1.0 MHZ.	-	500 micro volts.	500 micro volts.	500 micro volts.	500 micro volts.
26	Partial discharge level.	-	Less than 10 piccoulombs.	Less than 10 Piccoulombs.	Less than 10 Piccoulombs.	Less than 10 piccoulombs.
27	Seismic acceleration Horizontal – Vertical –	0.5g. 0.6g.	0.5g. 0.6g.	0.5g. 0.6g.	0.5g. 0.6g.	0.5g. 0.6g.



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28	Accuracy class of standard V.T. to be used during testing towards determination of ratio errors and phase angle errors for metering windings.	0.05 or better.				
29.	Capacitance (Pf)	-	-	-	4400 + 10%, -5%	4400 (for 220kV), 8800 (for 400kV) + 10%, -5%

**Note:**

- (i) For Station service bay equipments rated system voltage shall be 33kV and highest system voltage shall be 72.5kV.

## Annexure\_Chapter-23

### CHAPTER 23: TECHNICAL SPECIFICATION FOR 220kV, 132kV & 33kV CURRENT TRANSFORMERS (AIS)

#### 23.1.0 SCOPE OF CONTRACT

This Section of the Specification covers general requirements for design, engineering, manufacture, assembly and testing at manufacturer's works of 220kV, 132kV, 66kV and 33 kV outdoor Current Transformers.

#### 23.2.0 STANDARDS

- 23.2.1 The equipment covered by this specification shall, unless otherwise stated be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory authorities.
- 23.2.2 In case of any conflict between the Standards and this specification, this specification shall govern.
- 23.2.3 The current transformer shall comply also with the latest issue of the following Indian standard.

(i)	IS: 2705(Part-I)	Current transformers: General requirement.
(ii)	IS: 2705(Part-II)	Current transformers : Measuring Current transformers
(iii)	IS: 2705(Part-	Current transformers : Protective Current



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	III)	transformers
(iv)	IS: 2705(Part-IV)	Current transformers: Protective Current transformers for special purpose application.
(V)	<b>All relevant IEC</b>	

### 23.3.0 GENERAL REQUIREMENTS

- 23.3.1 The cores of the instrument transformers shall be of high grade, non-aging CRC steel of low hysteresis loss and high permeability.
- 23.3.2 Current transformers shall be of Live Tank design.
- 23.3.3 The instrument transformers shall be truly hermetically sealed to completely prevent the oil inside the tank coming into contact with the outside temperature. To take care of oil volume variation the tenderer are requested to quote the current transformers with stainless steel diaphragm (bellow).
- 23.3.4 The instrument transformers shall be completely filled with oil.
- 23.3.5 A complete leak proof shrouded secondary terminal arrangement shall be provided with instrument transformers, secondary terminals shall be brought into weather, dust and vermin proof terminal box. Secondary terminal boxes shall be provided with facilities for easy earthing, shorting, insulating and testing of secondary circuits. The terminal boxes shall be suitable for connection of control cable gland. IP rating of terminal box shall be IP 55. Spare terminals shall be provided. **CT secondary shorting links shall be provided along with one terminal earthing arrangement of CT winding. All doors and removable covers and plates shall be sealed all around with neoprene gaskets or similar arrangement.**
- 23.3.6 All instrument transformers shall be of single phase unit.
- 23.3.7 The instrument transformers shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.
- 23.3.8 All similar parts, particularly removable ones, shall be interchangeable with one another.
- 23.3.9 All cable ferrules, lugs, tags, etc. required for identification and cabling shall be supplied complete for speedy erection and commissioning as per approved schematics.
- 23.3.10 The instrument transformers housing shall be porcelain.
- 23.3.11 All steel work shall be degreased, pickled and phosphated and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint.
- 23.3.12 Test terminal for tan-delta/capacitance shall be provided for 220kV, 132kV CT's.
- 23.3.13 Accuracy specified shall be maintained at 25% of rated burden.
- 23.3.14 All winding(Primary/Secondary) shall be of copper. Aluminium is not acceptable

### 23.4.0 INSULATING OIL

The quantity of insulating oil for instrument transformers and complete specification of oil shall be stated in the tender. The insulating oil shall conform to the requirement of latest edition of IS: 335



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### 23.5.0 COMMON MARSHALLING BOXES (shall be supplied by CT manufacturer)

- 23.5.1 The outdoor type common marshalling boxes shall conform to the latest edition of IS 5039 and other general requirements specified hereunder.
- 23.5.2 The common marshalling boxes shall be suitable for mounting on the steel mounting structures of the instrument transformers.
- 23.5.3 One common marshalling box shall be supplied with each set of instrument transformers. The marshalling box shall be made of sheet steel and weather-proof. The thickness of sheet steel used shall be not less than 3.0 mm. It is intended to bring all the secondary terminals to the common marshalling. The marshalling box shall be of hot dipped galvanized steel.
- 23.5.4 The enclosures of the common marshalling boxes shall provide a degree of protection of not less than IP 55 (As per IS 2147).
- 23.5.5 The common marshalling boxes shall be provided with double hinged front doors with pad locking arrangement. All doors and removable covers and plates shall be sealed all around with neoprene gaskets or similar arrangement.
- 23.5.6 Each marshalling box shall be fitted with terminal blocks made out of moulded non-inflammable plastic materials and having adequate number of terminals with binding screws washers etc. Secondary terminals of the instrument transformers shall be connected to the respective common marshalling boxes. All out going terminals of each instrument transformer shall terminate on the terminal blocks of the common marshalling boxes. The terminal blocks shall be arranged to provide maximum accessibility to all conductor terminals.
- 23.5.7 Each terminal shall be suitably marked with identification numbers. Not more than two wires shall be connected to any one terminal. At least 20 % spare terminals shall be provided over and above the required number. All terminals of control circuits shall be wired up to marshalling box including spare terminals evenly distributed on all TB's.
- 23.5.8 All terminal strips shall be of isolating type terminals and they will be of minimum 10 A continuous current rating.
- 23.5.9 All cable entries shall be from bottom. Suitable removable gland plate shall be provided on the box for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable glands shall be screw on type and made of brass.
- 23.5.10 Each common marshalling box shall be provided with two numbers of earthing terminals of galvanised bolt and nut type.
- 23.5.11 All steel, inside and outside work shall be degreased, pickled and phosphated and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint. The colour of finishing paint shall be as follows: -
- i) Inside: Glossy White
  - ii) Outside: Light Grey (Shade No. 697 of IS: 5)



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### 23.6.0 BUSHINGS AND INSULATORS

- 23.6.1 Bushings and Insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture **and shall conform to IEC 60135, 60168/IS.**
- 23.6.2 Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.
- 23.6.3 Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing. No radio interference shall be caused by the bushings when operating at the normal rated voltage
- 23.6.4 The design of bushing shall be such that the complete bushing is a self-contained unit and no audible discharge shall be detected at a voltage up to a working voltage (Phase Voltage) plus 10%. The minimum creepage distance for severely polluted atmosphere shall be 31 mm/KV.
- 23.6.5 Sharp contours in conducting parts should be avoided for breakdown of insulation. The insulators shall be capable to withstand the minimum seismic acceleration of 0.5 g in horizontal direction and 0.6g in vertical direction..
- 23.6.6 Bushings shall satisfactorily withstand the insulation level specified in data sheet.
- 23.6.7 Rain shed/drain cover/dome shall be present in CT.
- 23.6.8 Bellow level indicator shall be present in CT.
- 23.6.9 Nitrite butyl rubber/Neoprene gaskets shall be used.
- 23.6.10 Critical flashover voltage of insulator and bushing shall be provided.

### 23.7.0 TESTS

#### 23.7.1 Routine/Acceptance Tests (all units)

All routine tests shall be carried out in accordance with relevant Standards. All routine/acceptance tests shall be witnessed by the Employer/his authorised representative.

23.7.2 **Type Tests:** The bidder shall furnish type test certificates and results for the all tests as per relevant Standards along with the bid for current and potential transformers of identical design. Type test certificates so furnished shall not be older than 5 (five) years as on date of Bid opening.

23.7.3 **QAP:** QAP indicating all brought out materials tests shall be submitted.

### 23.8.0 NAME PLATES

All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with full particular there on in accordance with the standard adapted. Thickness (1mm), purchase order, project name, serial no etc. shall be present in the Name plate.

### 23.9.0 MOUNTING STRUCTURES



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23.9.1 All the equipment covered under this specification shall be suitable for mounting on steel structures. Supply of mounting on **galvanised** structures is also in the scope of this tender.

23.9.2 Each equipment shall be furnished complete with base plates, clamps, and washers etc. and other hardware ready for mounting on steel structures.

### 23.10.0 SAFETY EARTHING

23.10.1 The non-current carrying metallic parts and equipment shall be connected to station earthing grid with two terminals.

### TERMINAL CONNECTORS (Shall be under manufacturer scope)

23.11.1 The equipment shall be supplied with required number of terminal connectors of approved type suitable for ACSR. The type of terminal connector, size of connector, material, and type of installation shall be approved by the AEGCL, as per installation requirement while approving the equipment drawings. No part of a clamp shall be less than 12mm. thick. All connectors shall be of Aluminium Alloy and type tested as per IEC/IS including RIV and short circuit.

### PRE-COMMISSIONING TESTS

23.12.1 Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the

equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

#### (a) Current Transformers

- (i) Insulation Resistance Test for primary and secondary.
- (ii) Polarity test.
- (iii) Ratio identification test - checking of all ratios on all cores by primary injection of current.
- (iv) Dielectric test of oil (wherever applicable).
- (v) Magnetising characteristics test.
- (vi) Tan delta and capacitance measurement
- (vii) Secondary winding resistance measurement
- (viii) Contact resistance measurement (wherever possible/accessible).
- (ix) Knee-point voltage measurement

### 23.13.0 TECHNICAL DATA SHEET FOR CURRENT

23.13.1 For 245/145/72.5/36 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired upto the terminal blocks.



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## 23.14.0 TYPE AND RATING:

23.14.1 All instrument transformer shall be outdoor type, single phase, oil immersed, self-cooled suitable for mounting on steel structure. The instrument transformer shall have the following ratings and particulars.

SL No.	A. Item	Ratings and Particulars				
		I	II	III	IV	V
A	Nominal system voltage		220kV	132 kV	33 kV	66 kV
B	Highest system voltage, kV		245	145	36	72.5
C	Rated frequency, HZ		50	50	50	50
D	System earthing		Solidly earthed	Solidly earthed	Solidly earthed	Solidly earthed
E	Insulation level					
a)	Full Wave Impulse withstand voltage: kVp (1.2/50)		1050	650	170	325
b)	One-minute p.f. Withstand voltage, kV (r.m.s.) (dry and wet)		460	275	70	140
F	Short time current for 3 seconds, kA		50	40	31.5	31.5
G	Minimum creepage distance, mm		7565	4495	1116	2247.5
H	Temperature rise		As per IS	As per IS	As per IS	As per IS
I	C.T. (i) No. of Cores		5	5	2/5	5
			As per BoQ			
	(ii) Transformation ratio	As per BoQ				



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	(iii) Rated output				
	(a) Core-1	20 VA	20 VA	20 VA	20 VA
	(b) Core-2	(PX CLASS)	(PX CLASS)	20 VA	20 VA
	(c) Core-3	(PX CLASS)	(PX CLASS)	PX (for trafo only)	PX
	(d) Core-4	(PX CLASS)	(PX CLASS)	PX (for trafo only)	PX
	(e) Core-5	(PX CLASS)	(PX CLASS)	PX (for trafo only)	PX
	(iv) Accuracy class				
	(a) Core-1	0.2S	0.2S	0.2S	0.2S
	(b) Core-2	PX	PX	5P20/PX (trafo)	5P20
	(c) Core-3	PX	PX	PX (for trafo only)	PX
	(d) Core-4	PX	PX	PX (for trafo only)	PX
	(e) Core-5	PX	PX	PX (for trafo only)	PX
	(vi) Instrument security factor				
	(a) Core-1	<5	<5	<5	<5
	(b) Core-2	-	-	-	-
	(c) Core-3	-	-	-	-
	(d) Core-4	-	-	-	-
	(e) Core-5	-	-	-	-
	(vii) Minimum Knee point voltage, Volts				
	(a) Core-1	-	-	-	-
	(b) Core-2	1:1 of CT ratio	1:1 of CT ratio	-	-



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		min	min		
	(c) Core-3	1:1 of CT ratio min			
	(d) Core-4	1:1 of CT ratio min			
	(e) Core-5	1:1 of CT ratio min			
	(viii) Maximum secondary resistance, ohm				
	(a) Core-1	-	-	-	-
	(b) Core-2	-	-	-	-
	(c) Core-3	<3	<3	<3	<3
	(d) Core-4	<3	<3	<3	<3
	(e) Core-5	<3	<3	<3	<3
	(ix) Maximum exciting current, at V <sub>k</sub> /4 mA				
	(a) Core-1	-	-	-	-
	(b) Core-2	-	-	-	-
	(c) Core-3	-	-	-	-
	(d) Core-4	-	-	-	-
	(e) Core-5	-	-	-	-
	Tandelta at U <sub>m</sub> / root 3	<3	< 3	< 3	< 3
	Rated extended primary	120%	120%	120%	120%



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	current			
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**Note:**

- (i) It is intended to use different ratios of the same CT at the same time for various protections and metering cores. The CTS should therefore be suitable for the above purpose by secondary tapings only. The ratio change by secondary taps is acceptable as long as the required CT specifications are achieved at all ratios.
- (ii) The knee point voltage specified above shall be at higher ratio/ taps.
- (iii) CT and PT sizing calculations shall be submitted. Burden values and knee point voltage, shall be decided as per the calculations during detailed engineering. However, minimum knee point voltage shall be 1:1 of CT ratio.
- (iv) For Station service bay equipment rated system voltage shall be 33kV and highest system voltage shall be 72.5kV.



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## Annexure\_Chapter-22)

### CHAPTER 22: TECHNICAL SPECIFICATION FOR 220kV, 132kV, 66kV & 33kV CIRCUIT BREAKER (AIS)

#### 22.1.0. SCOPE

22.1.1. The intention of this Section of the Specification is to cover design, manufacture, testing at manufacturer's works and of 220kV, 132kV, 66kV and 33 KV Circuit Breakers with all fittings and accessories including mounting structures as specified hereunder.

#### 22.2.0. GENERAL REQUIREMENTS

22.2.1. The circuit breaker shall be of three phase unit (gang operated) (or) three identical single-phase units (as said in data sheet), outdoor, **SF6 gas filled** single pressure puffer type (220kV, 132kV and 66kV) and VCB for 33kV. The operating mechanism shall be electrically and mechanically trip/free with anti-pumping facility suitable for remote electrical closing, tripping as well as local Operation facility as specified. The CBs are meant for installation with Transformers & **Lines and capacitor banks as applicable.**

22.2.2. The circuit breaker shall be capable of 3-ph auto-reclosing and 1-ph auto-reclosing for 220kV.

22.2.3. The circuit breaker shall be so designed to withstand the effects of temperature, wind load, short circuit, **seismic conditions** and other adverse conditions.

22.2.4. The circuit breaker shall be capable of switching transformer magnetizing currents and shall be restrike - free.

22.2.5. All similar parts, particularly removable ones, shall be interchangeable with one another.

22.2.6. All cable ferrules, lugs, tags, etc. required for cabling from equipment control cabinet/operating mechanism to the central control cabinet of the breaker shall be supplied loose as per approved schematics.

22.2.7. The SF6 breaker shall be designed to ensure that condensation of moisture is controlled by **proper selection of organic insulating materials having low moisture absorbing characteristics**

22.2.8. The support structure of circuit breaker shall be hot dip galvanised. Sufficient galvanising thickness shall be achieved with **900 gm/m<sup>2</sup> (130 micron)**. All other parts shall be painted as per painting specification enclosed separately.

22.2.9. All mechanical parts and linkages shall be robust in construction and maintenance free over at least 10,000 switching operations except for lubrication of pins/articulated joints at 5000 operations **and electrical E2 performance.**

#### 22.3.0. OPERATING MECHANISM



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- 22.3.1. A power spring operated mechanism for closing and tripping shall be provided in the breaker control cabinet. This device shall be so interlocked that while it is under maintenance, the breaker cannot be operated from remote. A slow acting, manually operated device shall be provided for inspection and maintenance purposes.
- 22.3.2. Circuit breaker operating mechanism shall be capable of storing energy for at least two complete closing and tripping operations.
- 22.3.3. Each mechanism shall have an operation counter.
- 22.3.4. The operating mechanism shall be trip-free and mounted and enclosed in a weather- proof, vermin-proof, sheet steel cabinet conforming to IP: 55 degree of protection. Sheet steel thickness shall be as specified in data sheet. The cabinet shall also house relays, control and auxiliary equipment of each breaker and provision for terminating all control, alarm and auxiliary circuits. It shall be provided with hinged doors with provision for locking and removable gland plates to be drilled at site. Inspection window shall be provided for observation of the instruments without opening the cabinet. It shall be mounted so as to provide convenient access from ground level. **Two trip coils shall be provided.**
- 22.3.5. The cabinet shall be fitted with a thermostatically controlled anti-condensation heater, a 15A, 1 phase, 5 pin socket outlets with switch and a cubicle illuminating lamp suitable for operation on 240 V AC 50Hz supply.
- 22.3.6. Circuit breakers shall feature high repeatability of absolute closing time over a wide range of parameters (ambient temperature, pneumatic pressure, control voltages, etc).
- 22.3.7. Main poles shall operate simultaneously. There shall be no objectionable rebound and the mechanism shall not require any critical adjustment. It shall be strong, rigid, positive and fast in operation.
- 22.3.8. **Pole discrepancy** shall be provided which shall detect pole position discrepancy.
- 22.3.9. The design of the circuit breaker shall be such that contacts will not close automatically upon loss of gas/ air pressure.
- 22.3.10. Closing release shall be capable of operating within the range of the rated voltage as specified in the data sheet. Shunt trip shall operate satisfactorily under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker within the range of the rated voltages specified in the Data sheet.
- 22.3.11. Working parts of the mechanism shall be of corrosion resisting material. Bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.
- 22.3.12. All controls, gauges, relays, valves, hard drawn copper piping and all other accessories as necessary shall be provided including the following:



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- 22.3.13. Low pressure alarm and lock out relay with adjustable pressure setting suitable for operation on DC system
- 22.3.14. A no-volt relay for remote indication of power failure for compressor motor/ Spring Charge motor.
- 22.3.15. As long as power is available to the motor, continuous sequence of closing and opening operations shall be possible.
- 22.3.16. After failure of power supply to the motor, at least **two close-open** operation of the circuit breaker shall be possible from stored energy.
- 22.3.17. Spring charging motor shall be standard single phase universal motor suitable for 220 volts/110volts as per site.
- 22.3.18. Motor rating shall be such that it requires only about 30 seconds for full charging of the closing spring.
- 22.3.19. Closing action of the circuit breaker shall compress the opening spring ready for tripping.
- 22.3.20. During closing, springs are discharged and after closing of breaker, springs shall automatically be charged for the next operation. Facility for manual charging of closing springs shall be provided. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.

### 22.4.0. OPERATING MECHANISM CONTROL

- 22.4.1. The breaker shall normally be operated by remote electrical control. However, provision shall be made for local electrical control. For this purpose, a local/remote selector switch, close and trip control switch/push button shall be provided in the breaker central control cabinet.
- 22.4.2. Two electrically independent trip circuit including two trip coils per breaker shall be operated from two separate DC sources. First trip coil shall be utilized for tripping the breaker on main protection fault detection. Whereas second trip coil shall be used to trip the breaker when first trip coil fails to trip the breaker and backup protection comes into operation and shall also be used to trip the breaker on command.
- 22.4.3. The trip coils shall be suitable for trip circuit supervision during both **open and close position** of the breaker. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the supplier.
- 22.4.4. The auxiliary switch with **12NO+12NC** contacts of the breaker shall be positively driven by the breaker operating rod.
- 22.4.5. A conveniently located manual tripping lever or button shall also be provided for local tripping of the breaker and simultaneously opening the reclosing circuit. A local manual closing device which can be easily operated by one man standing on the ground shall also be provided for maintenance purpose. Direction of motion of handle shall be clearly marked.



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22.4.6. When the spring get fully charged either through motor or hand cranking, the spring charging motor and the hand cranking **suitable mechanical and electrical indication shall be provided for same. On restoration of electrical supply the mechanical handle shall be automatically disengaged.**

### 22.5.0. SF6 GAS SYSTEM

22.5.1. SF6 gas shall serve as an arc-quenching medium during opening/closing operation and as an insulating medium between open contacts of the circuit breaker.

22.5.2. The circuit breaker shall be single pressure **puffer** type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.

22.5.3. All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimise distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year

22.5.4. In the interrupter assembly there shall be an absorbing product box to minimise the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.

22.5.5. Each pole shall form an enclosure filled with SF6 gas independent of two other poles (145 and 66 kV CBs) and the SF6 density of each pole shall be monitored.

22.5.6. The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:

- It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non return valve coupling.

22.5.7: SF6 gas shall be as per IEC 60376

### 22.6.0. VACUUM INTERRUPTER ASSEMBLY

22.6.1. Each pole of the circuit breaker shall be provided with vacuum interrupter, one for each phase, hermetically sealed for life and encapsulated by ceramic insulators. The interrupter shall be provided with steel chromium arc chamber to prevent vaporized contact material being deposited on the insulating body. A further shield giving protection to the metal bellows shall also follow the travel of the moving contacts to seal the interrupter against the surroundings atmosphere.



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22.6.2. It shall have high and consistent dielectric strength of vacuum unaffected by environment and switching operations. Bronzed joints should ensure retention of vacuum for life time. It shall have low and stable contact resistance due to absence of oxidation effects and shall ensure low power loss. The arcing voltage shall be low and minimum contact erosion

### 22.7.0. BUSHINGS AND INSULATORS

22.7.1. Bushings and Insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

22.7.2. Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.

22.7.3. Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.

22.7.4. Bushings shall satisfactorily withstand the insulation level specified in data sheet.

### 22.8.0. FIXED AND MOVING CONTACTS

22.8.1. Main contacts shall have ample area and contact pressure for carrying the rated current and the short time rated current of the breaker without excessive temperature rise which may cause pitting or welding. Contacts shall be adjustable to allow for wear, easily replaceable and shall have minimum moving parts and adjustments to accomplish these results. Main contacts shall be the first to open and the last to close so that there will be little contact burning and wear out.

22.8.2. Arcing contacts, if provided, shall be the first to close and the last to open and shall be easily accessible for inspection and replacement. Tips of arcing and main contacts shall be silver faced.

22.8.3. If multi-break interrupters are used, they shall be so designed and augmented that a fairly uniform voltage distribution is developed across them.

### 22.9.0. INTERLOCKS

22.9.1. Key release mechanical interlocks shall be incorporated in the operating mechanism for interlocking with the associated isolators, so that operation of the circuit breaker is dependent



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on a "key-trapped" situation. In addition, electrical interlocks with associated isolators shall be provided.

### 22.10.0. ADDITIONAL DUTY REQUIREMENTS

22.10.1. Circuit breakers shall be capable of clearing short line faults with the same impedance behind the bus corresponding to the rated fault current.

22.10.2. Circuit breakers shall be capable of breaking 25% of rated fault current at twice rated voltage under out of phase conditions.

22.10.3. The Bid shall highlight the design features provided to effectively deal with:

- a) Breaking of inductive currents and capacitive currents.
- b) Charging of long lines and cables.
- c) Clearing developing faults within the full rating of the breaker.
- d) Opening on phase opposition.

### 22.11.0. ACCESSORIES

#### 22.11.1. Gas Pressure Detector

The circuit breaker shall be provided with gas pressure monitor with temperature compensation for initiating alarm and locking the operating mechanism in the event of abnormality. **Gas pressure monitor shall be combined for all three phases for (245kV, 145kV and 66kV) Circuit Breakers. Each phase of Circuit Breaker shall be provided with pressure gauge with Red and Green zone and pressure level marked on the dial.**

#### 22.11.2. Position Indicator

Each pole of the circuit breaker shall be provided with a position indicator.

#### 22.11.3. Terminals

Each circuit breaker shall be provided with suitable terminal pads of high conductivity aluminium alloy for connecting to the line.

#### 22.11.4. Auxiliary Switches

Each circuit breaker shall be equipped with auxiliary switches with sufficient number of contacts for control, indication and interlocking purposes. Twelve normally open and twelve normally closed contacts shall be provided as spares. All contacts shall be rated for the DC voltage specified in data sheet.

#### 22.11.5. Terminal Blocks

All accessories, spare contacts of contactors and control devices shall be completely wired up to terminal block. All wirings which are connected to external circuit shall be terminated on terminal blocks installed in the control cabinet. The terminal blocks provided shall have twenty (20) percent spares. **Each terminal block shall be suitable to receive two conductors of minimum 2.5sqmm copper.**

22.11.6. Operating mechanism housing shall be supplied with all required accessories including the following:

- a) Padlocks and duplicate keys.



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- b) Space heaters equipped with automatic thermostatic control.
- c) Local/remote changeover switch.
- d) Manually operated tripping push button/lever (mechanical) conveniently located to trip all three phases simultaneously.
- e) Control switches to cut off control power supplies.
- f) Fuses as required.
- g) Two earthing terminals.
- h) Auxiliary relays required for satisfactory operation.
- i) Motor contactor with thermal release
- j) Provision for mechanical interlock with isolator.
- k) Indication Lamps for On/OFF operation

### 22.11.06:

#### 22.12.0. SUPPORT STRUCTURES

22.12.1. The Circuit Breakers shall be suitable for mounting on steel structures.

22.12.2. The support structure shall be of steel hot dip galvanised type. The height of support structure shall be designed to keep the bottom most live part and bottom of insulators of circuit breakers at minimum clearance from the plinth as specified in data sheet.

22.12.3. All necessary galvanised bolts, nuts and washers to complete the erection shall be furnished including the embedded anchor bolts for securing the supporting structure to the concrete foundations.

22.12.4. **The support structures shall be capable to withstand the minimum seismic acceleration of 0.36 g in horizontal direction and 0.6g in vertical direction.**

#### 22.13.0. NAME PLATES

22.13.1. All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with full particular there on in accordance with the standard adapted.

#### 22.14.0. EARTHING

22.14.1. Two earthing pads shall be provided on each supporting structure. Each operating mechanism control cabinet or terminal box mounted on the supporting structure shall also be connected to an earthing pad. Separately mounted control cabinets shall be provided with two earthing pads adjacent to the base of the cabinet. The earthing connection shall be bolted type and suitable for receiving **75mm x 12mm GS strip**.

#### 22.15.0. TERMINAL CONNECTORS

22.15.1. The equipment shall be supplied with required number of terminal connectors of approved type suitable for ACSR conductors. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Employer, as per installation requirement while approving the equipment drawings.

#### 22.16.0. TESTS



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22.16.1. All routine tests shall be carried out in accordance with relevant IS. All routine/acceptance tests shall be witnessed by the AEGCLs authorised representative. The tests shall include the following:

- a) Routine/Acceptance Tests (all units) i) Mechanical Operation tests
- ii) Power frequency voltage withstand test (dry) iii) Tests on auxiliary & control circuits
- iv) Measurement of resistance of the main circuit.
- v) Insulation Resistance Test

### b) Type Tests:

The bidder shall furnish type test certificates and results for the following tests along with the bid for breaker of identical design.

- i) Breaking (terminal fault, L90, etc) and making capacity test
- ii) Short-time current withstand test
- iii) Temperature rise tests
- iv) Lightning Impulse voltage test
- v) Operating Duty test
- vi) Pole Discrepancy test
- vii) Power Frequency withstand test
- viii) IP degree of protection of operating mechanism enclosure
- ix) RIV/PD test
- x) Contact Resistance of CB
- xi) IR value test for operating mechanism circuits
- xii) Creepage distance test

### c) Test Certificates

Copies of routine/acceptance test certificates shall be produced with the endorsement of the inspecting authority to the Employer before effecting despatch. The test report shall contain the following information.

- i) Complete identification data, including serial No. of the breaker.
- ii) Method of application, where applied, duration and interpretation of results in each test.

## 22.17.0. PRE-COMMISSIONING TESTS



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22.17.1. Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per approved document of the equipment AEGCL without any extra cost to the AEGCL. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to AEGCL for approval.

- (a) Insulation resistance of each pole.
- (b) Check adjustments, if any suggested by manufacturer.
- (c) Breaker closing and opening time.
- (d) Slow and Power closing operation and opening.
- (e) Trip free and anti-pumping operation.
- (f) Minimum pick-up voltage of coils.
- (g) Contact resistance measurement.
- (h) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.
- (i) Insulation resistance of control circuits, motor etc.
- (j) Resistance of closing and tripping coils.
- (k) SF6 gas leakage check.
- (l) Dew Point Measurement
- (m) Verification of pressure switches and gas density monitor.
- (n) Checking of mechanical 'CLOSE' interlock, wherever applicable.
- (o) Testing of grading capacitor.
- (p) Resistance measurement of main circuit.
- (q) Checking of operating mechanisms
- (r) Check for annunciations in control room.
- (s) **Sniffer test of VCB**

### 22.18.0. SPECIAL TOOLS AND TACKLES

22.18.1. The Bidder shall furnish a list of any special tools and tackles required for maintenance and operation purposes with recommended quantities for each substation.

### 22.19.0. TECHNICAL DATA SHEET FOR CIRCUIT BREAKER



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Sl. No.	Particulars	Unit	Data for 220kV CB	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI	VII
1	Type		SF <sub>6</sub>	SF <sub>6</sub>	SF <sub>6</sub>	VCB
2	No of poles		Single Pole/ 3 Phase Ganged Unit (for trafo)	3 (3 Phase Ganged Unit)	3 (3 Phase Ganged Unit)	3 (3 Phase Ganged Unit)
3	Service		Outdoor	Outdoor	Outdoor	Outdoor
4	Rated System Voltage	kV	220	132	66	33
5	Highest System Voltage	kV	245	145	72.5	36
6	System earthing		Solidly earthed system	Solidly earthed system	Solidly earthed system	Solidly earthed system
7	Rated Voltage of Breaker	kV	245	145	72.5	36
8	Rated Continuous Current	Amps	3150	3150	2000	<b>2500/2000/1600/1250</b>
9	Rated Frequency	Hz	50	50	50	50
10	Rated Short Circuit breaking current ( I ) - 3secs - symmetrical	kA RMS	50	40	<b>31.5</b>	31.5
11	Rated Short Circuit making current	kA PEAK	2.5*I	2.5*I	2.5*I	2.5*I
12	Duty cycle		0-0.3 Sec - CO - 3 Min -CO	0-0.3 Sec - CO - 3 Min -CO	0-0.3 Sec - CO - 3 Min -CO	0-0.3 Sec - CO - 3 Min -CO
13	First pole to clear factor		1.3	1.3	1.3	1.3
14	Operating time					
	i) Opening Time	ms	Not exceeding 50 ms	Not exceeding 50 ms	Not exceeding 50ms	Not exceeding 50 ms
	ii) Closing	ms		Not exceeding	Not exceeding	Not exceeding



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Sl. No.	Particulars	Unit	Data for 220kV CB	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI	VII
	Time D		Not Exceeding 100 ms	100 ms	100 ms	100 ms
15	Insulation level					
	i) One minute Power Frequency withstand Voltage (Dry)	kV RMS	460	275	140	75
	ii) Full Wave Impulse withstand Voltage (1.2/50 $\mu$ sec)	kV Peak	1050	650	325	170
16	Minimum clearance between phases	mm	2400	1300	630	320
17	Minimum clearance between phase to earth	mm	2400	1300	630	320
18	Minimum Ground clearance (from bottom most live part to plinth level)	mm	5500	4600	3700	3700
19	Minimum clearance from bottom of support insulator to plinth level	mm	2500	2500	2500	2500
20	i) Minimum Creepage Distance (Total)	mm	7595	4495	2247.5	1116
	ii) Minimum Creepage Distance (Protected)	mm	3798	2250		460



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Sl. No.	Particulars	Unit	Data for 220kV CB	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI	VII
21	Operating mechanism		Spring Charged		Spring Charged	
	a) Type			Spring Charged		Spring Charged
	b) Rated 3 Phase, 50Hz Voltage for Drive Motor	V	220AC	220AC	220AC	220AC
	c) Rated voltage of Shunt trip coil & operating range	V. DC	220 or 110 [50% - 110%]			
	d) Rated voltage of Closing coil & operating range	V. DC	220 or 132 [80% - 110%]			
	e) No. of trip coils	No	2 per CB	2 per CB	2 per CB	2 per CB
	f) No. of closing coils	No	1 per CB	1 per CB	1 per CB	1 per CB
	g) No of spare auxiliary contacts & contact rating	Nos AMPS	12 N/O+12 N/C (per CB) 10 A at 240V AC & 4A at 220V/ 110V DC	12 N/O+12 N/C (per CB) 10 A at 240V AC & 4A at 220V/ 110V DC	12 N/O+12 N/C (per CB) 10 A at 240V AC & 4A at 220V/ 110V DC	12 N/O+12 N/C (per CB) 10 A at 240V AC & 2A at 220V/ 110V DC
	h) Minimum thickness of steel sheet for control cabinet	mm	3	3	3	3
	i) Enclosure Protection		IP55	IP55	P55	IP55
22	Reclosing		Single/Three Phase auto reclosing	Three Phase auto reclosing	Three Phase auto reclosing	Three Phase auto reclosing
23	Support structure (Painted / Galvanised)		Galvanised	Galvanised	Galvanised	Galvanised



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Sl. No.	Particulars	Unit	Data for 220kV CB	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI	VII
24	All other parts (Painted / Galvanised)		Synthetic enamel shade 631 of IS5 (125 microns)	Synthetic enamel shade 631 of IS5 (125 microns)	Synthetic enamel shade 631 of IS5 (125 microns)	Synthetic enamel shade 631 of IS5 (125 microns)
25	Minimum size of control wiring (Copper)	Sq. mm	2.5	2.5	2.5	2.5
26	ITRV and TRV of CB interrupter		IEC	IEC	IEC	IEC



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## Annexure- CHAPTER 18

### CHAPTER 18: TECHNICAL SPECIFICATION FOR 110V DC BATTERY AND CHARGER

#### A. VALVE REGULATED LEAD ACID BATTERY

##### 17.1. SCOPE :

(i) The scope covers the design, manufacture, assembly, testing at the manufacturer's works, delivery at site, installation, testing and commissioning of 110 V D.C. Maintenance free Valve regulated Lead Acid Battery and associated battery charger with provisions of both float and boost charging of battery along with necessary accessories, fittings, etc for 220/132 kV sub-stations.

Each battery shall have sufficient capacity considering continuous emergency and intermittent loads for the periods specified below and for all bays with the charger out of service:

- Continuous DC load for protection, control, indications, alarms and interlock for 10 hours.
- Emergency lighting loads for 10 hours.
- Intermittent DC load for closing and tripping operation of Circuit Breakers, Isolators and Earth Switches. This load shall be determined considering simultaneous tripping of breakers on bus-bar protection. Duration of intermittent load shall be considered as one minute. Battery shall have 20% spare capacity. Supplier shall furnish characteristic curve for satisfactory operation and maintenance of battery under service condition.

Bidder shall select number of cells, float & boost voltage to achieve following system requirement:

System Voltage	Maximum Voltage During Float operation	Minimum Voltage available when no charger working and battery fully discharged upto 1.85V per cell
110V	121V	99V

Bidder shall furnish calculation in support of selection of capacity as well as number of Cells, Float & Boost charger current / Voltages.

(ii) The scope also covers the design, manufacture, assembly, testing at the manufacturer's works of 48 V D.C. Maintenance free Valve regulated Lead Acid Battery, having minimum capacity of 300 AH and associated battery charger with provisions of both float and boost charging of battery along with necessary accessories, fittings etc.

Each battery shall have sufficient capacity for continuous DC supply to PLCC Terminals, Protection Coupler Units, Fiber Optic Terminals, EPAXes, Remote Terminal Unit (RTU) etc. as and when required as well as float charging current of the battery.

The battery shall consist of 24 number of cells, float & boost voltage to achieve a system voltage 48V. Battery shall have 20% spare capacity. Supplier shall furnish characteristic curve for satisfactory operation and maintenance of battery under service condition.

Bidder shall furnish calculation in support of selection of Float & Boost charger current/Voltages.

##### 17.2. RATING OF BATTERY AND FUNCTION OF CHARGER:

D.C. Power Supply shall comprise a set of Battery (110V) of desired capacity, a Float charger and a Float cum Boost Battery Charger (minimum 60A) in parallel operation. In this mode the charger shall be required not only to continuously feed a variable load but also deliver trickle/boost charging current for the battery. Charger shall have 20% spare capacity. Battery will be capable of feeding the DC load requirement of the Sub-station in case of failure of the charger. Ampere-hour capacity of the battery shall be designed considering the current load and expected future load due to extension of the Sub-Station (if not specified, then minimum 3 nos of future bays are to be considered for each voltage class). A detailed design calculation for both battery & charger are to be submitted for approval.



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### 17.3. TRICKLE / BOOST CHARGE VOLTAGE:

The trickle and Boost charge voltage per cell shall be as follows:

- a) 110V Battery Bank
- i) TRICKLE CHARGE: Per Cell Voltage 2.2 V to 2.25±0.02 V
- ii) Boost charge voltage should vary between 2.23 to 2.3V/cell.

### 17.4. VOLTAGE / CURRENT REGULATION OF CHARGER:

Output voltage for float charging from battery charger shall be auto controlled by adjusting the firing angle of thyristor for float charger to keep the voltage variation within ± 1% from no load to full load and AC supply voltage variation of ±10% and frequency variation of ± 3% of 50 Hz. Manual control of output voltage shall also be possible through Auto/Manual selector switch.

The Boost / Quick charger shall be similar type as Float / Trickle charging equipment, but shall be provided with control arrangement for 'auto/manual' current regulation features, necessary for quick charging. An automatic VOLTAGE controller for boost charging shall control the output VOLTAGE WITH CURRENT LIMIT AS LIMITED FOR RESPECTIVE BATTERY CAPACITY by adjusting the firing angle of the thyristor.

### 17.5. CLIMATIC CONDITIONS:

The equipment to be supplied against the specification shall be suitable for satisfactory continuous operation under the climatic condition mentioned in chapter 2 of this bidding document.

### 17.6. DESCRIPTION OF BATTERY:

Type:

The DC batteries shall be VRLA (Valve regulated Lead Acid) type & shall be Normal Discharge type and shall conform to IS 15549:2004/ IEC 60896-21 & 22:2004/ BS 6290- PART IV/ IEEE-1188 standard. These batteries are to be factory-filled, charged & shall be suitable for a long life under continuous float operations & occasional discharges. The 110V DC system is unearthed system. The offered battery shall be compact and shall require no maintenance. All safety equipment required for installation shall be provided by the manufacturer.

#### Constructional requirements:

The design of battery shall be as per field proven practices. Partial plating of cells is not permitted. Paralleling of cells externally for enhancement of capacity is not permitted. Protective transparent front covers with each module shall be provided to prevent accidental contact with live module/ electrical connections.

#### Plates:

Positive plates shall be made pasted type using high purity corrosion resistant alloy for deep discharge, durability, maintenance free, long life both in cyclic as well as in float applications. The Grids are of Semi Radial Squarish grid to reduce internal resistance and travel current in shorter time. Negative plates shall be heavy duty, durable flat pasted plate using lead alloy pasted Semi Negative Squarish Grid. Negative plates shall be designed to match the life of Positive plates & combination of positive & negative plates shall ensure long life, durability & trouble-free operation of battery. Computer controlled/ PLC operated in-house equipment should be deployed for preparation of lead oxide and paste to ensure consistency in paste quality & properties.

#### Containers:

The container material shall have chemical & electro-chemical compatibility & shall be acid resistant and shall conform to UL-94/ ASTM-D-2863 standard. The material shall meet all the requirements of VRLA batteries and be consistent with the life of battery. The container shall be fire retardant. The porosity of the container shall be such as not to allow any gases to escape except from the regulation valve. The tensile strength of the material of the container shall be such as to handle the internal cell pressure of the cells in the worst working condition. Cell shall not show any deformity of bulge on the sides under all working conditions. The container shall be capable of withstanding the rigorous of transport, storage and handling. The containers shall be enclosed in a steel tray.

For identification, each cell/module shall be marked in a permanent manner to indicate the following information:

- (i) Cell Serial Number
- (ii) Positive & Negative, embossed on the cover
- (iii) Month & Year of Manufacturing



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### **Cell Covers:**

The cell covers shall be made of suitable material compatible with the container material and permanently fixed with the container by Hermetic Heat-Sealing technique. It shall be capable to withstand internal pressure without bulging or cracking. It shall also be fire retardant. Fixing of Pressure Regulation Valve & terminal posts in the cover shall be such that the seepage of electrolyte, gas escapes and entry of electro-static spark are prevented.

### **Separators:**

The separators used in manufacturing of battery cells, shall be of glass mat or synthetic material having high acid absorption capability, resistant to sulphuric acid & shall have good insulating properties. Sufficient separator overlap & PVC shield protection in bottom edges of the plates is to be provided to prevent short circuit formation between the edges of adjacent plates. The design of separators shall ensure that there is no misalignment during normal operation & handling.

### **Pressure Regulation Valve:**

Each cell shall be provided with a pressure regulation valve. The valve shall be self-re-sealable. The vent plug shall be made with suitable grade of fire-retardant plastic material. Each valve opening shall be covered with flame barrier capable of preventing the ingress of flame into the cell interior, when the valve opens & hydrogen/oxygen gas mixture is released. The valve unit shall be such that it cannot be opened without a proper tool. The valve shall be capable to withstand the internal cell pressure specified by the manufacturer.

### **Terminal Posts:**

Both the +ve & -ve terminals of the cells shall be capable of proper termination & shall ensure its consistency with the life of the battery. The terminals shall have lead plated adequate solid copper/ brass core cross-section to avoid overheating at maximum current load. The surface of the terminal post extending above the cell cover including bolt hole shall be coated with an acid resistant & corrosion retarding material. Terminal posts or any other metal part which is in contact with the electrolyte shall be made of the same alloy as that of the plates or of a proven material that does not have any harmful effect on cell performance. Both +ve & -ve posts shall be clearly and unambiguously identifiable.

### **Connectors, Nuts & Bolts, Heat Shrinkable Sleeves:**

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate non-corroding lead coated copper connectors of suitable size shall be provided to enable connection of the cells. Copper connections shall be suitably lead coated to withstand corrosion due to sulphuric acid/fumes at a very high rate of charge or discharge.

Nuts & bolts for connecting the cells shall be made of copper, brass or stainless steel. Copper or brass nuts & bolts shall be effectively lead coated to prevent corrosion. Stainless steel bolts & nuts can be used without lead coating.

All inter cell connectors shall be protected with heat shrinkable sleeves for reducing the environmental impact including a corrosive environment.

More than one cable may be required to be connected to the battery terminals. Suitable arrangement for termination of multiple cables shall be provided so as to avoid extra load on the battery terminals.

Necessary insulating supports for termination of these cables on batteries shall also be supplied by the bidder.

All connectors shall be capable of continuously carrying the 30 min. discharge current of the respective batteries and shall be capable to carry 4KA for 1 sec.

### **Flame Arrestors:**

Each cell shall be equipped with a Flame Arrestor to defuse the Hydrogen gas escaped during charge & discharge. Material of the flame arrestor shall not affect the performance of the cell.

### **Battery Bank Stand:**

All batteries shall be mounted in a suitable metallic stand/ frame. The frame shall be properly painted with the acid resistive paint & should have protection against harmful effects due to tropical environment. The suitable



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insulation shall be provided between stand/ frame and floor to avoid the grounding of the frame/ stand. The jointing of the frames should not leave crevices and ensure proper and tight fit.

Numbering tags for each cell shall be attached to the racks. Provision for clamping outgoing cables shall be kept.

### 17.7. CAPACITY REQUIREMENTS:

When the battery is discharged at 10-hour rate, it shall deliver 80% of Rated Capacity (corrected at 27°C) before any of the cells in the battery bank reaches 1.85 V/cell.

The battery shall be capable of being recharged from the fully exhausted condition (1.75 V/cell) within 10hrs up to 90% state of charge. All the cells in a battery shall be designed for continuous float operation at the specified float voltage throughout the life.

The capacity (corrected at 27°C) shall also not be less than Rated capacity & not more than 120% of Rated capacity before any cell in the battery bank reaches 1.75 V/cell. The battery voltage shall not be less than the following values, when a fully charged battery is put to discharge at a rate of 1/10th of the Rated Capacity:

- (a) After SIX minutes of discharge: 1.98V/cell
- (b) After SIX hours of discharge: 1.92V/cell
- (c) After EIGHT hours of discharge: 1.85V/cell
- (d) After TEN hours of discharge: 1.75V/cell

Loss in capacity during storage at an average ambient temperature of 35°C for a period of 6 months shall not be more than 60% and the cell/battery shall achieve 85% of its rated capacity within 3 charge/discharge cycles and full rated capacity within 5 cycles, after the storage period of 6 months. Voltage of each cell in the battery set shall be within 0.05V of the average voltage throughout the storage period. Ampere hour efficiency shall be better than 90% and watt-hour efficiency shall be better than 80%. However, the battery to be manufactured and to be delivered at site in such a way that load can be connected with the battery within 15 days from date of installation, date of initial charging is to be mentioned on the battery.

### 17.8. EXPECTED BATTERY LIFE

The battery shall be capable of giving 1200 or more charge/discharge cycles at 80% Depth of Discharge at an average temperature of 27°C. Depth of Discharge is defined as the ratio of the quantity of electricity (in Ampere Hour) removed from a cell or battery on discharge to its rated capacity. The battery sets shall have a minimum expected life of 20 years at Float operation.

### 17.9. ASSOCIATED EQUIPMENTS & ACCESSORIES (For each set of battery):

a)	Best quality metallic stand/frame	as per Clause 18.6.
b)	Stand insulators	+5%extra
c)	Interrowconnectors	Appropriatequantity
d)	Inter tier connectors	Appropriatequantity
e)	Centre-zero (3-0-3) volts DC Voltmeter	: 1 No
f)	Torque wrench/ Spanners	: 1 No
g)	Connection hardware, such as strips, bolts, nuts	(with 5% extra)
h)	Cable clamps with hardware	
g)	Connection hardware, such as strips, bolts, nuts	(with 5% extra)
i)	Cell numbering tags with fixing arrangement	
j)	Two sets of special tools and tackles for connecting terminals of the battery	
k)	Any other accessories not specified but required for satisfactory operation.	



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### 17.10. TYPE TEST OF BATTERY:

The Bidder/ Supplier shall supply type tested battery as per IS 15549:2004/ IEC 60896-21 & 22 over the range of at least one capacity per design. The Bidder/ Supplier shall submit necessary evidences enclosed during detailed engineering.

Sr. No.	DESCRIPTION
1	Gas Emission
2	High Current Tolerance
3	Short Circuit Current & DC Internal resistance
4	Protection against Internal Ignition from External Spark source
5	Protection against Ground Short Propensity
6	Content & Durability of required marking
7	Material Identification
8	Valve Operation
9	Flammability Rating of Material
10	Intercell Connector Performance
11	Discharge Capacity
12	Charge Retention during Storage
13	Float Service with Daily Discharge for reliable mains power
14	Recharge behavior
15	Service Life at an operating temperature of 40°C for brief duration exposure Time
16	Impact of Stress Temperature of 60°C for brief duration exposure time with 3hrs discharge test
17	Abusive Over Discharge
18	Thermal Runaway Sensitivity
19	Low Temperature Sensitivity
20	Dimensional Sensitivity at Elevated Internal Pressure & Temperature
21	Stability against Mechanical abuse of units during installation



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## 17.11. Routine Test:

- (i) Physical Examination Test
- (ii) Visual Inspection
- (iii) Dimensions, Mass & Layout
- (iv) Marking & Packing

## 17.12. ACCEPTANCE TEST OF BATTERY

- (i) Polarity Marking
- (ii) Verification of Dimensions
- (iii) Test of AHC Capacity

## LIST OF FACTORY & SITE TESTS FOR BATTERY

Sr. No	TEST	FACTORY TESTS	SITE TESTS
1	Physical Verification	YES	YES
2	Capacity Test on the cell at 1/10 <sup>th</sup> of Rated Capacity, corrected at 27°C	YES	
3	8hrs Charge & 15mins Discharge Test at Full Rated Load		YES

## B. BATTERY CHARGERS

### 17.13. SCOPE:

- (i) Battery Charger for 110V DC Battery Bank:

The DC system for 110V DC is unearthed. The Battery Chargers as well as their automatic regulators shall be of static type and shall be compatible with VRLA batteries. All battery chargers shall be capable of continuous operation at the respective rated load in float charging mode while supplying the DC load. The chargers shall also be capable of Boost charging the associated DC battery at the desired rate.

Under normal operating conditions the charger should give a D.C. output equal to the steady demand load for signal lamps, auxiliary relays etc. plus an output to trip coils and closing coils of the circuit breakers and relays as and when required as well as float charging current of the battery. Charger shall have 20% spare capability.

- (ii) Battery Charger for 48V DC Battery Bank:

The charger shall be suitable for charging the battery and supplying the load simultaneously. The entire charger scheme shall be divided in two sections, "float charger section" and "float-cum-boost charger section". The float-cum-boost charger shall be suitably operated either in float mode or in boost-cum-standby float charger mode. The float charger and the float-cum-Boost Charger shall have adjustable output current 60 Amps D.C. for 300 AH for float charging and 60 Amps DC for boost charging. Charger shall have 20% spare capability.

Under normal operating condition, with the input AC supply present, the float charger section' shall supply the DC load and also float the battery by trickle charging and the "float cum boost charger section" shall be kept off. The maximum demand load on the charger shall be 60A for 300AH Battery.

### 17.14. GENERAL DESCRIPTION FOR CHARGERS:

- a) The battery chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. When on automatic control mode during float charging, the chargers output voltage shall remain within + 1% of the set value, for AC input voltage variation of + 10%, frequency variation of + 5% a combined voltage and frequency variation of + 10% and a DC load variation from zero to full load.



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- b) The battery chargers shall have constant voltage characteristics throughout the range (from zero to full load) at the floating value of the voltage so as to keep the battery fully charged but without harmful overcharge.
- c) The chargers shall have load limiters having drooping characteristics, which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the Load limiter setting of the Charger. The Load- limiter characteristics shall be such that any sustained overload or short circuit in DC system shall not damage the Charger nor shall it cause blowing of any of the Charger fuses. The Charger shall not trip on overload or external short circuit.
- d) Uniform and step less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire float charging output range specified. Step less adjustments of the Load-limiter setting shall also be possible from 80% to 100% of the rated output current for charging mode.
- e) During Boost Charging, the Battery Charger shall operate on constant voltage with current limit mode (when automatic regulator is in service) to restrict battery charging current as specified. After completion of boost charging this float cum boost converter section either goes standby mode or float mode as desired by the system.
- f) The Charger manufacturer may offer an arrangement in which the voltage setting device for Float charging mode is also used as output voltage limit setting device for Boost charging mode and the Load-limiter of Float charging mode is used as current setting device in boost charging mode for Float cum Boost Converter section. For Float charger section shall provide separate arrangement.
- g) Suitable filter circuits shall be provided in all the chargers to limit the ripple content (Peak to Peak) in the output voltage to 1% irrespective of the DC load level, when they are not connected to a battery.
- h) MCCB

All Battery Chargers shall have sufficient MCCBs on the input side to receive cables from two sources. Mechanical interlock should be provided such that only one source shall be closed at a time. It shall be of P2 duty and suitable for continuous duty with breaking capacity minimum 25KA at 415V AC. MCCB's should have auxiliary contacts for annunciation.

i) Rectifier Transformer

The rectifier transformer shall be continuously rated, dry air cooled (A.N) an of class F insulation type. The rating of the rectifier transformer shall have 10% overload capacity. The transformer shall be of suitable rating to comply with maximum output with minimum input voltage.

j) Rectifier Assembly

The rectifier assembly shall be fully/half controlled bridge type and shall be designed to meet the duty as required by the respective charger. The rectifier shall be provided with heat sink having their own heat dissipation arrangements with natural air cooling. Necessary surge protection devices and rectifier type test acting HRC fuses shall be provided in each arm of the rectifier connections.

k) Instruments

One AC voltmeter and one AC ammeter along with selector switches shall be provided for all chargers. One DC voltmeter and DC ammeter (with shunt) shall be provided for all chargers. The instruments shall be of 96 mm X 96 mm square dial & shall be flush type, dust proof and moisture resistant. The instruments shall have easily accessible means for zero adjustment. The instruments shall be of 1.5 accuracy class. In addition to the above a centre zero voltmeter with selector switch shall also be provided for 220 V Chargers for testing purpose.

l) Air Break Switches

One DC output switch shall be provided in all chargers. They shall be air break type suitable for 500 Volts AC/ 250 V DC. The contacts of the switches shall open and close with a snap action. The operating handle of the switch shall be fully insulated from circuit. 'ON' and 'OFF' position on the switch shall be clearly indicated. Rating of switches shall be suitable for their continuous load. Alternatively, MCCB's of suitable ratings shall also be acceptable in place of Air Break Switch.

m) Fuses



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All fuses shall be HRC Link type. Fuses shall be mounted on fuse carriers which are in turn mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type base. In such case one insulated fuse pulling handle shall be supplied for each charger. Fuse rating shall be chosen by the Bidder depending on the circuit requirement. All fuses in the chargers shall be monitored. Fuse failure annunciation shall be provided on the failure of any fuse.

### n) Blocking Diode

Blocking diode shall be provided in the positive pole of the output circuit of each charger to prevent current flow from the DC battery into the charger. All the semiconductor devices shall be protected with power transient suppressor circuit.

### o) Annunciation System

Audio-visual indications through bright LEDs shall be provided in all Chargers for the following abnormalities: -

- (i) AC Power failure.
- (ii) Rectifier/chargers fuse blown (separate for Float & Float cum boost).
- (iii) Over voltage across the battery when boost charging.
- (iv) Abnormal DC Bus voltage (High/Low)
- (v) Any other annunciation if required

Potential free NO contacts of above abnormal conditions shall also be provided for common remote indication "CHARGER TROUBLE" in Owner's Control Board. Indication for charger in float mode and boost mode through indication lamps shall be provided for chargers. A Potential free contact for float/boost mode shall be provided for external interlocks.

### p) Name Plates and Marking

The name plates shall be white with black engraved letters. On top of each Charger, on front as well as rear sides, larger and bold name plates shall be provided to identify the Charger. Name plates with full and clear inscriptions shall also be provided on and inside of the panels for identification of the various equipment and ease of operation and maintenance.

### 17.15. Charger Construction

The Chargers shall be indoor, floor-mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Chargers shall be fabricated from 2.0mm cold rolled sheet steel and shall have folded type of construction. Removable gland plates for all cables and lugs for power cables shall be supplied by the Contractor. The lugs for power cables shall be made of electrolytic copper with tin coat. Power cable sizes shall be advised to the Contractor at a later date for provision of suitable lugs and drilling of gland plates. The Charger shall be tropicalized and vermin proof. Ventilation louvers, if provided shall be backed with screens. All doors and covers shall be fitted with synthetic rubber gaskets. The chargers shall have hinged double leaf doors provided on front and on backside for adequate access to the Charger's internals. All the charger cubicle doors shall be properly earthed. The degree of protection of enclosure shall be at least IP-42 as per IS: 13947 Part-1.

All indicating instruments, control switches and indicating lamps shall be mounted on the front side of the Charger.

Each Charger shall be furnished completely wired up to power cable lugs and terminal blocks and ready for external connections. The control wiring shall be carried out with PVC insulated, 1.5 sq.mm. Stranded copper wires. Control terminals shall be suitable for connecting two wires, with 2.5 sq.mm stranded copper conductors. Each wire shall be continuous from end to end and shall not have any joint within itself. The insulation grade of the wiring shall be 1100 V grade. The colour of 3 Phase, 4 Wire AC. supply shall be red, yellow, blue and black for phases and neutral. The D.C. wiring shall be of the colour other than the above (preferably grey) with the +ve and -ve marking in the ferrule. All terminals shall be numbered for ease of connections and identification. Each wire shall bare a ferrule or tag on each end for identification. At least 20% spare terminals shall be provided for control circuits.



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The insulation of all circuits, except the low voltage electronic circuits shall withstand test voltage of 2 KV AC for one minute. An air clearance of at least ten(10) mm shall be maintained throughout for such circuits, right up to the terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

### 17.16. Painting of Charger

The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

The inside of the chargers shall be glossy white. Each coat of finishing synthetic enamel paint shall be properly staved. The paint thickness shall not be less than fifty (50) microns.

### 17.17. TESTS ON CHARGER

Battery Chargers shall conform to all type tests as per relevant Indian Standard. Performance test on the Chargers shall also be carried out on each charger as per specification. Rectifier transformer shall conform to all type tests in IS: 4540 and short circuit test as per IS: 2026. Following type tests shall be carried out for compliance of specification requirements: -

- a. Voltage regulation test.
- b. Load limiter characteristics test
- c. Efficiency tests
- d. High voltage tests
- e. Temperature rise test
- f. Short circuit test at no load and full load at rated voltage for sustained short-circuit.
- g. Degree of protection test
- h. Measurement of ripple by oscilloscope.
- i. Temperature compensation feature demonstration

The contractor may be required to demonstrate to the OWNER that the chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristic, before dispatch as well as after installation at site. At site the following tests shall be carried out: -

- (i) Insulation resistance test
- (ii) Checking of proper annunciation system operation

If a Charger fails to meet the specified requirements, the Contractor shall replace the same with appropriate Charger without affecting the commissioning schedule of the Sub- Station, and without any extra cost to the OWNER.

The Contractor shall present for inspection, the type and routine test certificates for the following components whenever required by the OWNER.

- (i) Switches
- (ii) Relays/MCCBs
- (iii) Instruments
- (iv) DC fuses
- (v) SCR
- (vi) Diodes
- (vii) Condensers
- (viii) Potentiometers
- (ix) Semiconductor
- (x) Annunciator
- (xi) Control wiring
- (xii) Push buttons and contactors

Makes of above equipment shall be subject to Owner's approval.

### 17.18. DOCUMENTATION

The successful bidder shall submit four sets of drawings for approval.

The following drawing shall be supplied with the tender: -



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Outline drawings of all apparatus showing sufficient details to enable the purchaser to determine whether the design proposed can be installed satisfactorily or not. Wiring diagram of battery charger. Battery sizing calculations.

## 17.19 TECHNICAL PARAMETERS

Sl. No	DESCRIPTION	PARTICULARS
1	Type	VRLA
2	Conforming Standards	IS 15549:2004/ IEC 60896-21 & 22:2004/ BS 6290- PART IV/ IEEE-1188
3	System Voltage	110V
4	Maximum Voltage During Float operation	121V
5	Minimum Voltage available when no charger working and battery fully discharged upto 1.85V per cell	99V
6	Minimum no. of cell	55
7	Trickle charge voltage	2.2 V to 2.25±0.02V/cell
8	Boost charge voltage	2.23 to 2.3V/cell
9	When a fully charged battery is put to discharge at a rate of 1/10 <sup>th</sup> of the Rated Capacity, the battery voltage shall not be less than:	
	After SIX minutes of discharge	1.98 V/cell
	After SIX hours of discharge	1.92 V/cell
	After EIGHT hours of discharge	1.85 V/cell
	After TEN hours of discharge	1.75 V/cell
10	Battery life	1200 or more charge/discharge cycles at 80% Depth of Discharge at an average temperature of 27°C



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## Annexure A GTP Morigaon (Baghja)

Guaranteed Technical Particulars

(To be filled by the Tenderer)

### 1. LIGHTNING ARRESTER

Sl No	Particulars	To be filled in by the tenderer			
		400KV	220KV	132KV	33kV
1	Name of Manufacturer				
2	Arrester Class & Type				
3	Applicable standard				
4	Rated arrester voltage(KV)				
5	Maximum Continuous Operating Voltage(KV)				
6	Nominal Discharge Current (KA with 8/20 micro-sec wave)				
7	Long Duration Discharge Class				
8	Minimum Energy Discharge Capability(KJ/KV)				
9	Maximum Switching current impulse residual voltage at i) 1000Amps ii) 250Amps				
10	Maximum residual voltage with 1 micro second current wave at 10kA(KV <sub>p</sub> )				
11	Maximum residual voltage with 8/20 micro-sec wave (KV <sub>p</sub> ) i) 5KA ii) 10KA iii) 20KA				
12	Safe fault current (KA)				
13	Lightning Impulse withstand voltage of Arrester Housing with 1.2/50 micro-sec wave (KV <sub>p</sub> )				
14	One minute power frequency withstand voltage of housing (ry/wet)KVrms				
15	High current short duration impulse withstand level with 4/10 micrsec wave(KA) Peak				
16	Pressure Relief Class				



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17	Over voltage withstand capability				
	a) 10 seconds				
	b) 1 sec				
18	c) 0.1 sec				
	a) Reference voltage(KV)				
19	b) Reference current(mA)				
	Number of units per phase and rating of each unit				
20	Minimum total creepage distance(mm)				
21	Leakage current(mA)				
22	Total weight of Arrester(Kg)				
23	Maximum Cantilever strength of Surge Arrester(Including Wind Load)				
24	Overall Height of Surge Arrester(mm)				
Sl No	Particulars	To be filled in by the tenderer			
		400KV	220KV	132KV	33kV
25	Maximum distance from equipment to be protected by Surge Arrester (mm)				
26	Any other particulars				

## 2. Horizontal Double Break Isolators

Sl No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
1	Name of manufacturer			
2	Reference Standard			
3	Maximum Design Voltage at which the Isolator can Operate (KV)			
4	Frequency (Hz)			
5	Seismic acceleration			
6	Maximum Current that can be safely interrupted by the Isolator (Amp rms and pf )			
	(a) Inductive			
7	(b) Capacitive			
	Continuous Current rating			
8	Rated Short time Current rating for 3 sec			
	a) Main Switch			
	b) Earth Switch			



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9	Rated Peak Short time Current rating for 3 sec a) Main Switch b) Earth Switch			
10	Current density at minimum cross section Main Switch Earth Switch Of _____ A/mm <sup>2</sup> a) Main Switch i) Moving blade ii) Terminal pad iii) Contacts: iv) Terminal connector: b) Earth Switch i) Moving blade ii) Terminal pad iii) Contacts: iv) Terminal connector			
11	Maximum temperature of current carrying parts when carrying rated current continuously (°C)			
12	Maximum ambient temperature for which (a) is applicable (°C)			
13	Insulation			
	(a) One minute power frequency wet withstand voltage			
SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
	i) Across the isolating distance (KV) ii) To earth and between poles (KV)			
(b) 1.2/ 50 micro sec impulse withstand voltage (+ and – polarity) i) Across the isolating distance (KV) ii) To earth and between poles (KV)				
14	CONTACTS a) Self aligned b) Self cleaning			



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14.1	MAIN CONTACT AT HINGE ENDS : a) Type (rotary tulip) b) Swivel c) Nos of fingers d) Size of finger e) Material f) Cross sectional area g) Thickness of silver plating (min) in micron h) Housing / cover on tulip contacts i) Material and size of housing iii) No. of bearings, location and size iv) No. of bushes, joints, location and size			
14.2	MAKE BREAK CONTACTS of blade a) Type (spring less or reverse loop) b) Nos of fingers c) Size of finger d) Material e) Cross sectional area f) Thickness of silver plating (min) in micron			
14.3	No. of operation the isolator can make without deterioration of contacts			
14.4	Earth switches Contacts			
SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV



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	(a) Type of fixed contacts (b) Size of Contacts (i) Material and Grade (ii) Cross sectional area (mm <sup>2</sup> ) (c) Thickness of silver coating (Micron) (d) Moving Blade (i) Material and Grade (ii) Cross sectional area (mm <sup>2</sup> ) (e) Contact support (main and earth switch) (i) Material and size of channel/block (ii) Material and size of plate (f) Material and size of housing (iii) No. of bearings, location and size (iii) No. of bushes, joints, location and size			
18	Clearances (a) Between poles (mm) (b) Between live parts and earth (mm) (c) Between live parts when the switch is open (d) On the same pole (mm) (e) Between adjacent poles (mm)			
19	Type of interlock a) Constructional b) Mechanical c) Electrical			



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20	Number and Type of Auxiliary contacts for a) main blade b) earth switch c) Operating time for closing (secs.) d) Operating time for opening (secs.)			
21	CONTROL CABINET a) Material			
SI No	Particulars	To be filled in by the tenderer		
		400KV	220KV	132KV
	b) Thickness c) Size d) Electrical ON/OFF indication e) Type of motor f) Rating of motor g) Degree of protection			
22	<b>Insulator</b>			
	a) Type of Insulator			
	b) Standard to which insulators will confirm			
	c) Insulating material			
	d) Height of Insulator (in mm)			
	e) Total creepage distance (in mm)			
	f) Protected creepage distance			
	g) Power frequency flashover voltage (in kV rms) (a) Dry : (b) Wet :			
	Power frequency withstand test voltage (in kV rms) (a) Dry : (b) Wet :			
	Nominal system voltage			
	Highest system voltage			
	Mechanical characteristics (a) Cantilever strength : (b) Tensile strength : (c) Torsion strength : (d) Compression strength			



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### 3. SOLID CORE INSULATOR (Post Insulator)

SI No	Particulars	Unit	To be filled in by the tenderer			
			400KV	220KV	132KV	33kV
1	Highest system voltage	kV				
2	Height of unit	mm				
3	Bending strength (approximate failing load): a) Upright	Kgf				
4	Tensile strength (Approximate)	Kgf				
5	Compression strength (Approximate)	Kgf				
SI No	Particulars	Unit	To be filled in by the tenderer			
			400KV	220KV	132KV	33kV
6	Torsion strength (Approximate)	KgfM				
7	a) Power frequency flashover voltage (dry) b) (wet)	kV				
8	a) Impulse flashover voltage (Positive) b) (Negative)	kV				
9	a) One min PF withstand voltage (dry) b) (wet) (w/o arcing horns )	kV				
10	Impulse positive/negative withstand voltage	kV				
11	Power frequency puncture voltage	KV				
12	RIV a) Test V to Ground KV rms b) at 1000 KHz with grading rings	kV mV				
13	(a) Visible discharge (b) Switching surge withstand voltage	kV KV <sub>p</sub>				
14	Creepage distance a) Total b) Protected	mm				
15	Top metal fitting PCD	mm				
16	Bottom metal fitting PCD	mm				
17	All ferrous part should be hot dip galvanized to IS:2629/1966	Y/N				
18	Suitable for Hot line washing	Y/N				



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19	Corona Extinction device					
20	Dry Arcing Distance	mm				

#### 4. 400KV/22KV/132KV CVT

SI No	Description	To be filled in by the Tenderer		
		420KV	220KV	132KV
1	Applicable standard			
2	Highest system voltage KV (rms)			
3	Rated frequency(Hz)			
4	Rated system voltage KV (rms)			
5	System fault level KA (rms)			
6	System neutral earthing			
7	Installation			
8	Limits of Temperature rise (immersed			
SI No	Description	To be filled in by the Tenderer		
		420KV	220KV	132KV
	in oil)			
9	Voltage factor			
10	Rated insulation level : 1.2/50 microsecond Lightning impulse withstand voltage KV (peak).			
11	One minute Dry & Wet power frequency withstand voltage KV (rms)			
	Visual Corona xtinction voltage			
12	Radio interference voltage (max) at 156 kV (rms)			
13	Total capacitance (picofarad)			
14	a) High frequency capacitance for the entire carrier frequency range. b) Equivalent series resistance over the entire carrier frequency range (Ohms)			
15	Stray capacitance (Pico farads) & stray conductance (micro Siemens) of the low voltage terminal of a complete CVT including Electro Magnetic Unit over the entire carrier frequency range			



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15	One minute power frequency test			
	a) Withstand voltage between HF (low voltage terminal of intermediate transformer & earth terminal, KV (rms)			
	b) Withstand voltage for secondary windings & earth terminal in KV (rms).			
	c) Withstand voltage between HF(LV) carrier coupling terminal 14& earth terminal, KV(rms)			
16	Creepage distance Total (mm)			
17	Partial discharge level, Pico coulombs			
18	Seismic acceleration in g			
19	Suitable for carrier coupling			
20	Degree of protection of terminal box:			
21	<b>ELECTROMAGNETIC UNIT</b>			
	Rated primary voltage kV			
	Rated secondary voltages			
	Rated burden of secondary winding			
	Accuracy class of secondary winding: Metering: Protection:			

## 5. PLCC EQUIPMNTS

### A. LINE TRAP

SI No	Particulars	TO BE FILLED IN BY THE TENDERER		
		400 KV	220 KV	132 KV
1	Name and address of manufacturer and country			
2	Type /Model			
3	System voltage rating			
4	Continuous current rating at 50 <sup>0</sup> C			
5	Maximum symmetrical short circuit current rating for 3 sec. duration			
6	Asymmetrical peak value of first half of rated short time current			
7	Rated inductance			
8	Blocking range			
9	Minimum Guaranteed resistive component of impedance in Blocking Frequency range			
	a. Centre frequency b. Over Blocking range			
10	Type of tuning			
11	Variation in 50 Hz impedance over degree centigrade variation in ambient temperature			
12	Variation in resonant frequency band per degree centigrade variation in ambient temperature			



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13	Impedance at tuned frequency			
14	Change in impedance per degree Centigrade change in ambient temp.			
15	Attenuation in Tuned Frequency Band			
16	Attenuation at the distance of 10 kHz from the tuned frequency band			
17	Maximum Tapping loss			
18	Type of Mounting			
19	Class of insulation of line trap			
20	Temperature rise in line trap under rated continuous current (Specify the value)			
21	Visual corona Inception voltage			
22	Visual corona Extinction voltage			
23	Radio interference voltage			
24	Type of incoming & outgoing terminal			
25	Maximum working stress			
26	Ultimate tensile strength			
<b>Technical data for protective device</b>				
1	Type of Protective device provided for protection of capacitors and coil against voltage surges & type of class			
2	Basic insulation level			
SI No	Particulars	<b>TO BE FILLED IN BY THE TENDERER</b>		
		<b>400 KV</b>	<b>220 KV</b>	<b>132 KV</b>
3	Standard nominal discharge current of protective device for 8/20 micro second wave impulse			
4	Rated voltage of the protective device (Arrester)			
5	Minimum value of power frequency spark over voltage (dry & Wet) of protective device			
6	Impulse spark over voltage of protective device			
7	Virtual steepness and maximum front of wave impulse spark over voltage of protective device			
8	Maximum residual discharge voltage of protective device for 8/20 micro second impulse discharge current of			
	a) 5000 A			
	b) 1000 A			
<b>Technical data for tuning device</b>				
1	Power frequency withstand voltage for 5 sec			
2	Tuning band (Blocking band)			
3	Material of main coil			
4	Material of terminal connector			
5	Material of suspension link			
6	Material of mounting hard wares			
7	Net weight			



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8	Whether corona rings are provided?			
9	Whether Bird barriers are provided?			
10	Overall diameter			
11	Total height			
12	No. of turns in Line trap main coil			
13	Type of conductor whether solid or stranded			
14	Cross sectional area of conductor			
15	Overall conductor size			
16	Type of construction i.e. No. of coils and whether open type or covered with insulating material			
17	Type and material of spacers between turn to turn			
18	No. of tie rods in tie rod Assembly			

## B. COUPLING DEVICE

SI No	Description	To be filled in by the tenderer
1	Name of manufacturer, address and country	
2	Type, Model and Catalogue No	
3	Carrier Frequency Range	
4	Maximum temperature limit for satisfactory operation of coupling device mounted outdoor	
5	Composite loss	
6	Return loss	
7	Nominal line side impedance	
8	Nominal carrier equipment side impedance	
9	Nominal Peak Envelop power with Distortion and Inter-modulation Products 80 dB Down)	
10	Power frequency Impedance between primary terminal and Earth Terminals of Coupling Device	
11	Maximum number of PLC terminals that can be connected in parallel	
	(a) 20 W (P.E.P) PLC Terminals	
	(b)40 W (P.E.P.) PLC Terminals	
	(c) 100 W (P.E.P.) PLC Terminals	
12	1 Minute Power Frequency Insulation level between Primary and Secondary Terminals of Coupling Device	
13	Impulse (1.2/50 micro-sec) withstand level between Primary and Secondary Terminals of Coupling Device	
14	Drainage Coil :	
	(a) Power frequency impedance	
	(b)Continuous power frequency current	
	(c) Short time rating for 0.2 sec	



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15	Lighting Arrestor :	
	(a) Type of construction	
	(b) Rated Voltage	
	(c) Rated discharge current	
	(d) Maximum permissible short time current	
	(e) Impulse spark over voltage (max)	
16	Earthing Switch	
	(a) Rated Current	
	(b) Short time current	
17	Details of interlock provided with cover enclosed	
18	Overall dimensions	
19	No of HF terminals provided for carrier equipment connection	
20	Whether suitable for mounting Outdoor in Switchyard & Type of mounting	



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## C. DIGITAL POWER LINE CARRIER COMMUNICATION TERMINAL (TO BE FILLED BY THE TENDERER)

SI No	Technical parameters	TO BE FILLED IN BY THE TENDERER		
1	Name and address of manufacturer and country			
2	Model No			
3	Operating mode			
4	Modulation			
5	Nominal Bandwidth			
6	Standard compliance			
7	Nominal transmit output power (PEP)			
8	Carrier frequency range and stability			
9	Nominal output impedance			
10	Return loss in the transmit band			
11	Tapping loss			
12	AGC (Automatic Gain Control)			
13	Receiver sensitivity			
14	Receiver selectivity			
15	Power supply			
16	Power consumption			
17	Alarm relay outputs			
18	Event recording			
19	Ambient Conditions			
	Climatic condition			
	Mechanical condition			
	Vibration and shock			
20	Dimensions and weight			
21	Speech Interface	E&M	FXS	FXO
	a) Impedance			
	b) Transmit level range			
	c) Receive level range			
22	No Transit Filters			
23	No of data ports and bit rate supported			
	a) V.24 ports/RS232			
	b) V.11 ports			
	c) LAN ports			
24	Speech + data + teleprotection channel at 8 kHz B.W.			
25	Type of speech channel			
26	No of speech channel in 8 kHz and 12 kHz Bandwidth			



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27	Minimum signal to noise ratio	
28	Gross bit rate	
29	Voice interfaces supported	
30	Speech level adjustment ( $T_x$ and $R_x$ )	
31	Speech coding algorithm and bit rate supported	
32	Number of Broadband modems, transmission bandwidth and data rates	
33	Number of narrowband modems, bandwidth and data rate	
34	Type and No of channels of data multiplexer	
35	No of Digital transit ports	



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## D. DIGITAL TELE PROTECTION COUPLER

SI No	Technical parameters	TO BE FILLED IN BY THE TENDERER			
1	Application				
2	Number of units				
3	Number of commands				
4	Secure against				
5	Bandwidth requirement				
6	Processing of received signal				
7	Guard signal				
8	Number and type of inputs Method of tripping Voltage ranges				
9	Number and type of outputs Tripping voltage Tripping current				
10	Whether HMI configurable, if yes specify				
11	Test facilities				
12	Event recording				
13	Teleprotection performance		Blocking	Permissive	Direct
	Nominal transmission time	T			
	Dependability(SNR=6 dB) (Probability of not receiving a command in a maximum actual transmission time)	P			
		T <sub>r</sub>			
Security (Probability of unwanted command under worst-case SNR condition)					

## E. VALVE REGULATED LEAD ACID BATTERY

SI No	Technical parameters	To be filled in by the Tenderer
1	Type/ Designation	48V, 300AH battery bank
2	Manufacturer's type designation	
3	Ampere-Hour capacity 10hrs rate of discharge to 1.75V	
4	Total No. of Plates per cell	
5	Nominal Cell Voltage (V)	
6	No. of Cells in each Bank	
7	No. of Spare Cell, if any, in each Bank	
8	Internal Resistance for each Cell	
9	Resistance of the Battery including Inter-connection between the Cells ( $\Omega$ )	



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10	Cell Discharge rate in Ampere (from rated Voltage to final discharge rate in Ampere (i) 5hrs Discharge rate in Amp (ii) 2hrs Discharge rate in Amp (iii) 1hr Discharge rate in Amp (iv) 30min Discharge rate in Amp (v) 10min Discharge rate in Amp	
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SI No	Technical parameters	To be filled in by the Tenderer
	(vi) 1min Discharge rate in Amp (vii) 30sec Discharge rate in Amp (viii) 1sec Discharge rate in Amp (Please furnish a graph showing Amps against time for the type of battery offered)	
11	Short Circuit Current (Amps)	
12	(i) Material of Cell Containers (ii) Material used for Battery Box (iii) Trays	
13	Thickness, Type & Material of Separators	
14	Constructional details and dimension: Surface area plates of (i) Positive Plate (ii) Negative Plate in Sq.mm.	
15	(i) Ampere Hour efficiency (%) (ii) Watt Hour efficiency (%)	
16	(i) Recommended Float Charge Current & Voltage (ii) Recommended Boost Charge Current & Voltage	
17	Time required for Boost Charging from Discharged condition	
18	(i) Max. Charging Current/Cell (ii) Nominal Charging Rate	
19	(i) Whether explosion proof or vent plugs provided (ii) Whether vent is spill proof	
20	Type of Inter Cell connection & whether they are covered with plastic sleeves	
21	(i) Dimensions of each 2V Block/Cell a. Length (mm) b. Width (mm) c. Height (mm) (ii) Thickness of Container (mm)	

## 6. 220/132/33 KV, 160 MVA Auto Transformer

Sl. No	Description	To be filled in by the Tenderer
1.	Manufacturer's Name & Address of manufacturing plant	
2.	Standard applicable	
3.	Rating (MVA)	
4.	Voltage ratio (kV)	
5.	Winding connection	
6.	Vector group	
7.	Number of phases	



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8.	Frequency (Hz)	
9.	Type of cooling	
10.	<b>Rating available at any tapping with ONAN cooling</b>	
	(iv). HV (MVA)	
	(v). IV (MVA)	
	(vi). LV (MVA)	
11.	<b>Rating available at any tapping with ONAF cooling</b>	
	(iv). HV (MVA)	
	(v). IV (MVA)	
	(vi). LV (MVA)	
12.	<b>Rating available at any tapping with OFAF cooling</b>	
	(iv). HV (MVA)	
	(v). IV (MVA)	
	(vi). LV (MVA)	
13.	<b>Permissible overload</b>	
14.	<b>Impedance Data</b>	
14.1	Ohmic impedance at 75 <sup>o</sup> C and rated frequency based on rated power on HV winding (%)	
	<b>(i).</b> HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.2	(ii). HV/LV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.3	<b>(iii).</b> IV/LV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	
14.4	Tolerance applicable to above impedance	
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>
	(i). HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
	➤ Minimum tap	



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14.5	(ii). HV/LV	
	➤ Principal tap	
	➤ Maximum tap	
14.6	➤ Minimum tap	
	(iii). IV/LV	
	➤ Principal tap	
14.7	➤ Maximum tap	
	➤ Minimum tap	
	Zero sequence impedance (%)	
14.8	(i). HV/IV	
	➤ Principal tap	
	➤ Maximum tap	
14.9	➤ Minimum tap	
	(ii). HV/LV	
	➤ Principal tap	
15	➤ Maximum tap	
	➤ Minimum tap	
	Minimum Air core impedance (%)	
16	<b>Guaranteed Losses &amp; Tolerances</b>	
16.1	<b>Guaranteed Losses</b>	
	e) No load loss on principal tap at rated voltage and frequency (KW)	
	f) Load loss (Copper Loss) at rated HV and IV load without LV loading at principal tap at 75°C (KW)	
	g) Cooler loss (KW)	
	h) Total loss (a+b+c) (KW)	
	<b>Tolerances if applicable on above losses</b>	
	e) No load loss on principal tap at rated voltage and frequency (KW) at 0.9 p.u. and 1.1 p.u.	
16.2	f) Load loss (Copper Loss) at rated HV load with 5 MVA LV loading and balance on IV at principal tap at 75°C	
	g) Cooler loss (K/W)	
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>



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	h) Total loss (a+b+c), (KW)	
17.	<b>Cooling Equipment Details</b>	
17.1	Number of radiator bank and its rating as % of transformer cooling	
17.2	Radiator	
	d) Type of mounting	
	e) Material	
	f) Thickness	
17.3	No. of oil pumps per radiator bank	
	i. Type of pumps	
	ii. Oil flow rate	
17.4	Number of fans per radiator bank	
17.5	Temperature range for which setting is adjustable	
18	<b>Thermal Data</b>	
18.1	Temperature rise in top oil over an ambient of 50 <sup>0</sup> C. (°C)	
18.2	Temperature rise in winding by resistance measurement	
18.3	Winding hotspot temperature over an ambient of 50 <sup>0</sup> C. (°C)	
	i.HV	
	ii.IV	
18.4	Core hotspot temperature over an ambient of 50 <sup>0</sup> C. (°C)	
18.5	Position of core hotspot	
18.6	Thermal time constant (Hours)	
19.	<b>Maximum noise level at</b>	
19.1	ONAN cooling (dBA)	
19.2	Full load with 100% cooling (dBA)	
20.	<b>Maximum partial discharge level at 1.5 pu(pC)</b>	
21.	<b>Core</b>	
21.1	Manufacturer of core material	
21.2	Type of construction (core/shell)	
21.3	Diameter of the core (mm)	
21.4	Core area (mm <sup>2</sup> )	
	a) Yoke	
	b) Wound limb	
	c) Unwound limb	
21.5	Core material and grade used	
21.6	Type of joint between core and yoke	
21.7	Thickness of stamping (mm)	



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21.8	Percentage silicon content (%)	
21.9	Maximum flux density in core at rated frequency and at	
	a) 90% voltage (wb/sq.m)	
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>
	b) 100% voltage (wb/sq.m)	
	c) 110% voltage (wb/sq.m)	
22.	<b>Over excitation withstand time (secs).</b>	
22.1	110%	
22.2	125%	
22.3	150%	
23.	<b>Winding</b>	
23.1	Type of winding	
	a) HV	
	b) IV	
	c) LV	
	d) Regulating	
23.2	Current density at rated load	
	a) HV	
	b) IV	
	c) LV	
23.3	Conductor area	
23.4	a) HV	
23.5	b) IV	
23.6	c) LV	
23.7	Maximum current density under short circuit	
23.8	a) HV	
23.9	b) IV	
23.10	c) LV	
24.0	Magnetizing inrush current (Amps)	
24.1	No load current (Amps) at rated frequency and at	
	a) 90% voltage	
	b) 100% voltage	
	c) 110% voltage	
24.2	Voltage per turn for maximum flux density	
	a) HV (Volts)	
	b) IV (Volts)	
	c) LV (Volts)	
24.3	Resistance	
	a) HV (Ohms)	
	b) IV (Ohms)	
	c) LV (Ohms)	



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24.4	Number of turns in				
	a) HV				
	b) IV				
	c) LV				
	d) Regulating winding				
24.5	Position of winding from the core(Enclose a sketch)				
	a) HV				
	b) IV				
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>			
	c) LV				
	d) Regulating winding				
24.6	Type of Conductor				
	a) HV				
	b) IV				
	c) LV				
	d) Regulating winding				
24.7	Maximum average radial compressive stress in the winding				
	c) For CTC/epoxy bonded conductor (N/sq.mm)				
	d) For paper insulated conductor (N/sq.mm)				
24.8	Insulation system				
	Min <sup>m</sup> density of press board (gm/cc)				
	Min <sup>m</sup> Density of paper ( gm/cc)				
25.	<b>Insulation Level of Winding</b>	HV	IV	LV	
25.1	Lightning impulse withstand voltage (kVp)				
25.2	Switching Surge withstand voltage (kVp)		-	-	
25.3	Power Frequency withstand voltage (kV rms)	-			
26.	<b>Short circuit withstand current &amp; duration</b>				
26.1	Short circuit current for which transformer is designed to withstand in p.u of rated rms current				
	(i). HV				
	(ii). IV				
	(iii). LV				
26.2	Withstand time for three phase short circuit at terminals				
	i. Thermal				
	ii. Dynamic				
27.	<b>Capacitance Values</b>				
27.1	HV to earth(pF)				
27.2	IV to earth(pF)				



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27.3	LV to earth(pF)				
28.	<b>Tank</b>				
28.1	Type of Tank cover (Conventional / Bell)				
28.2	Material				
28.3	Approximate thickness of				
	(i). Sides (mm)				
	(ii). Bottom (mm)				
	iii. Cover (mm)				
28.4	Type of Tank cover joint				
29	<b>Vacuum withstand capability of</b>				
29.1	Main tank (torr)				
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>			
29.2	Radiators and accessories (torr)				
29.3	<b>Pressure withstanding capability of</b>				
29.4	Main tank (torr)				
29.5	Radiators and accessories (torr)				
29.6	<b>Gasket</b>				
29.7	Material				
29.8	Temperature withstand capability (°C)				
30.	<b>Size of oil filter hose (mm)</b>				
31.	<b>Bushings</b>	HV	IV	LV	Neut ral
31.1	Name of Manufacturer				
31.2	Rated Voltage (kV)				
31.3	Rated current (Amps)				
31.4	Total creepage distance (mm)				
31.5	Protected creepage distance (mm)				
31.6	Insulation Level of Bushing	HV	IV	LV	Neut ral
	Lightning impulse withstand voltage (kVp)				
	Switching Surge withstand voltage (kVp)			-	-
	Power Frequency withstand voltage (kV rms )				
31.7	Colour of porcelain				
31.8	Mounting				





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34.4	Range	
34.5	Step voltage	
34.6	Electrical location of tapping (HV/LV)	
34.7	Rated voltage of drive motor (volts)	
34.8	No. of revolutions to complete one step	
34.9	Time to complete one step on manual/auto operation (secs.)	
34.10	Power required (kW)	
34.11	Insulation level of tap changer	
34.12	Short circuit withstand current	
34.13	Value of tie-in-resistor and connection m) arrangement (if provided)	
34.14	No load voltage appearing on	
	(iv). Principal tap	
	(v). Maximum tap	
	(vi). Minimum tap	
35.	<b>Conservator</b>	
35.1	Total volume (Litres)	
35.2	Volume between highest and lowest levels	
36.	Type of oil preservation	
36.1	Material of air cell	
36.2	Continuous temp. withstand capability of the air cell	
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>
37.	<b>Pressure Relief Device</b>	
37.1	Manufacturer & type designation	
37.2	No. of pressure relief device provided	
37.3	Operating pressure of pressure relief device	
38.	<b>Insulating Oil</b>	
38.1	Manufacturer of the Oil	
38.2	Standards applicable	
38.3	Type of oil (Non inhibited / inhibited)	
38.4	Moisture Content (ppm)	Before first filling      Before commissioning
38.5	Max. Tan-delta value (at 90 deg. C.)	
38.6	Resistivity (ohm-cm)	



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38.7	Breakdown Strength (kV)		
38.8	Interfacial tension at 20°C (min.)		
39.	<b>Temperature Indicators</b>		
39.1	Oil Temperature Indicator		
	(iv). Name of Manufacturer		
	(v). Range		
	(vi). Accuracy		
39.2	Winding Temperature Indicator		
	(iv). Name of Manufacturer		
	(v). Range		
	(vi). Accuracy		
39.3	RWTI		
	(v). Name of Manufacturer		
	(vi). Range		
	(vii). Accuracy		
	(viii). Auxiliary supply used		
40.	<b>On line oil drying system</b>		
40.1	Name of Manufacturer & type designation		
40.2	Number & Capacity of drying element for each transformer		
40.3	Moisture absorption capacity		
41.	<b>On line dissolved hydrogen gas &amp; moisture monitoring</b>		
41.1	Name of Manufacturer & type designation		
41.2	Name of gases monitored		
41.3	Nos. of Potential free contacts for monitoring, Alarm, equipment healthiness etc		
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>	
42.	<b>Buchholz Relay</b>		
42.1	Name of Manufacturer & type designation		
43.	<b>Furnish details of processing of core coil assembly including drying method, temperature, vacuum level, clamping pressure etc.</b>		
44.	<b>Approximate dimensions</b>		
44.1	Tank (L x B x H) (mm)		
44.2	Overall dimensions with coolers (L x B x H) (mm)		



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44.3	Shipping dimensions (L x B x H) (mm)	
44.4	Height for un-tanking (mm)	
44.5	Dimensions of largest package (L x B x H) (mm)	
45.	<b>Weights of Transformer Components</b>	
45.1	Core (kg)	
45.2	Windings (Kg)	
45.3	Core & winding assembly (kg)	
45.4	Insulation (Kg)	
45.5	Tank and fittings (Kg)	
45.6	Oil (Kg)	
45.7	Untanking weight (heaviest piece) (Kg)	
45.8	Total weight (Kg)	
45.9	Weight of heaviest package (Kg)	
45.10	Total shipping weight (Kg )	
45.11	Parts detached for transport (furnish list)	
46.	<b>Proposed filling medium for transportation from works</b>	
46.1	<b>Proposed method of transformer transport from works to</b>	
46.2	<b>Proposed method of transport of transformer mounted with with bushing within the Sub-station</b>	
47.	<b>Minimum draw bar pull required to move the transformer on level track (kg)</b>	
<b>48.</b>	<b>Bimetallic Connections</b>	
48.1	Normal current rating (A)	
48.2	Short time current rating (A)	
48.3	Tensile strength (Kg)	
48.4	Maximum temperature limit	
48.5	Dimensional sketch enclosed indicating tolerances (Yes/No)	
48.6	Minimum clearance (mm)	
	- Phase to Phase	
<b>Sl. No</b>	<b>Description</b>	<b>To be filled in by the Tenderer</b>
	- Phase to Earth	
49.0	Furnish details of processing of core coil assembly including drying method, temperature, vacuum level, clamping	



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50	Name of Manufacture of Nitrogen Injection Fire Protection System	
50.1	Details of system equipments for NIFPS	
51.0	<b>Fire Extinguishing Cubicle (FEC) of NIFPS</b>	
51.1	Dimensions (LXBXH) mm	
51.2	Weight kG	
51.3	Capacity of Nitrogen cylinder	
51.4	Number of cylinders	
51.5	Pressure of Nitrogen filing	
51.6	Minimum distance of FE cubicle from the transformer	
51.7	Method of mounting	
51.8	Whether the following items are provided in FE cubicle. If so furnish make, type & other details.	
51.9	Contact manometer	
51.10	Pressure Regulator	
51.11	Oil Release Unit	
51.12	Gas release unit	
51.13	Oil drain assembly	
51.14	Pressure /limit switches	
51.15	No of contacts & spare contacts (NO & NC)	
51.16	Oil drain valve (above FEC)	
51.17	Make	
51.18	Type	
51.19	Size	
51.20	Type of metal	
51.21	Nitrogen Injection Valve (above FEC)	
51.22	Make	
51.23	Type	
51.24	Size	
51.25	Oil drain pipe	
51.26	Size	
51.27	Length	
51.28	Number of openings in the transformer tank	



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Sl. No	Description	To be filled in by the Tenderer
51.29	Material	
<b>52</b>	<b>Control Box of NIFPS</b>	
52.1	Dimensions (LXBXH) mm	
52.2	Weight	
52.3	Type & Thickness of sheet steel	
52.4	Details of components provided in the control box	
52.5	Control voltage	
52.6	Method of mounting	
52.7	Whether audio and visual alarms provided?	
<b>53</b>	<b>Transformer Conservator Isolation Valve of NIFPS</b>	
53.1	Make	
53.2	Type	

## 7. FIRE PROTECTION AND FIRE FIGHTING SYSTEM

Sl.No.	Particulars	To be filled in by the Tenderer
1	Name and Address of the Fire Protection System Supplier	
2	No. of Fire Protection System executed by the supplier and duration of successful operation for each type of Fire Protection System	
	a. Automatic HVW/MVW spray type Fire Protection System	
	b. Automatic hydrant type Fire Protection System	
3	Portable Fire Fighting Equipment	
	a. Maker's Name & Address	
	b. Standards to which conform	
	c. Type & Designation	
	d. Capacity	
	e. Mounting details	
	f. Total quantity of different type	
4	Water Hydrant System	
5	Standby Diesel Engine Driven Pump	
6	Fire detection system	
Sl.No.	Particulars	To be filled in by the Tenderer
7	Water supply System	
8	Instrumentation & Control System	



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9	Annunciation System	
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## 8. CONTROL & RELAY PANEL, BAY CONTROL UNIT, MANAGED ETHERNET SWITCH, TIME SYNCHRONISATION DEVICE AND SUBSTATION AUTOMATION SYSTEM

### A. Control & Relay Panel

Sl No	Technical Particulars	Unit	To be filled in by Tenderer
1.	<b>General</b>		
1.1	Panel Sheet thickness		
1.2	Overall dimensions		
	i) Width		
	ii) Depth		
	iii) Height		
	Total weight of the panel		
1.3	Whether panel type is simplex with swing front door		
1.4	Whether lockable glass cover provided		
1.5	Whether Rear side of panel is blocked		
1.6	Internal finish		
1.7	External Finish		
1.8	Control wiring		
	Material and Size of wiring For CT & PT circuit For other circuit		
1.9	Number of stranded in conductor		
1.10	Tinned/untinned		
1.11	Material of insulation and sheath		
1.12	Voltage grade of control wiring		
1.13	Numbered ferrules at both ends		
1.14	<b>Terminals</b>		
	a) Make		



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Sl No	Technical Particulars	Unit	To be filled in by Tenderer
	b) Current rating		
	c) Clamp type or bolt type		
	d) Maximum conductor size and number of conductor which it can receive		
	e) Disconnecting type of CT circuit		
	f) Terminal making facility provided		
	g) Crimp type connectors provided at the terminals		
	h) Spare terminals		
2.	<b>PROTECTIVE RELAYS</b>		
2.1	<b>Numeric over current / Earth fault relays</b>		
	a) Type		
	b) Current coil range		
	c) Tap range		
	d) Power consumption		
	i) Highest tap		
	ii) Lowest tap		
	e) Time of operation at maximum time dial setting		
	f) Type of characteristic		
	g) Whether draw out type or not		
	h) Trip contact rating Amps		
	i) Whether seal in contact provided or not		
	j) Is the slope setting variable?		
	k) Disturbance recorder capacity in time duration		
	l) Number of event recording		
	m) Does it have LBB protection		
	n) Does it have frequency protection, describe		
	o) Does it have voltage protection, describe		
	p) Compliance with IEC61850 protocol (Yes/ No)		



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	q) Numbers of Analogue inputs		
	r) Numbers of Binary inputs		
	s) Numbers of Binary outputs		
2.2	<b>Numeric Differential Relays</b>		
Sl No	<b>Technical Particulars</b>	<b>Unit</b>	<b>To be filled in by Tenderer</b>
	a) Manufacturer's Name & address		
	b) Type		
	c) Current coil Rating		
	d) Tap Range		
	e) Maximum VA burden at:- (i) Operating coil (ii) Restraining coil.		
	f) Is the slope setting variable?		
	g) Harmonic restraint provided or not.		
	h) Range of HT/LT ratios over which the relay can be used.		
	i) Operating time		
	j) Trip contact rating.		
	k) Whether sealed in contact provided or not.		
	l) Does it have over fluxing feature		
	m) Disturbancerecordercapacityintimeduration		
	n) Number of event recording		
	o) Does it have REF functions		
	p) Does it have O/C & E/F protection		
	q) Does it have LBB protection		
	r) Does it have frequency protection		
	s) Does it have voltage protection		
	t) Does it have Over Load protection		



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	t) Compliance with IEC 61850 protocol (Yes/ No)		
	u) Numbers of Analogue inputs		
	v) Numbers of Binary inputs		
	w) Numbers of Binary outputs		
2.3	<b>Numeric Distance Scheme, Main-I</b>		
	a) Manufacturer's Name & address		
	b) Type		
	c) Current coil Rating		
Sl No	<b>Technical Particulars</b>	Unit	<b>To be filled in by Tenderer</b>
	d) Tap Range		
	e) Maximum VA burden at:- (i) Operating coil (ii) Restraining coil.		
	f) How many zones of protections, describe them		
	g) Minimum time of operation		
	h) Does it have mho/Quad characteristics		
	i) Does it have SOTF & PSB		
	j) Does it have carrier aided protection		
	k) Does it have AR facility		
	l) Does it have directional O/C & E/F protection		
	q) Does it have LBB protection		
	r) Does it have frequency protection, describe		
	s) Does it have voltage protection, describe		
	t) Disturbance recorder capacity in time duration		
	u) Number of event recording		
	v) Compliance with IEC 61850 protocol(Yes/ No)		
	w) Numbers of Analogue inputs		
2.31	x) Numbers of Binary inputs		



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	y) Numbers of Binary outputs		
	z) Does it have Tripping logic functions (Yes/No)		
	aa) Does it have Fault Locator functions (Yes/No)		
	ab) Does it have Broken Conductor check functions (Yes/No)		
	ac) Does it have Fuse Fail Supervision functions (Yes/No)		
	ad) Whether it has df/dt function (Yes/No)		
	ae) Whether U/F is settable for multistage (Yes/No)		
<b>Fill up the as per item 2.3, with operating characteristic details</b>			
2.4	<b>Auxiliary Relays</b>		
	a. Manufacturer's Name & address		
Sl No	<b>Technical Particulars</b>	Unit	<b>To be filled in by Tenderer</b>
	b. Type		
	c. Rated current/voltage and permissible variation		
	d. Rated burden		
	e. No. and type of contacts (whether 'NO' or 'NC')		
	f. Rating of contacts		
	g. Total operating time of relays		
	h. One minute power frequency withstand voltage		
	i. Detailed literature furnished with reference (Yes/No)		
	j. Details of testing facilities provided		

## B. BAY CONTROL UNIT



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SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.	a) Manufacturer's Name & address		
	b) Size of the BCU		
	c) Disturbance recorder capacity in time duration		
	d) Whether the BCU has the capability to control two or more bays		
	e) Size of HMI window		
	f) Numbers of Analogue input		
	g) Numbers of BI		
	h) Numbers of BO		
	i) Numbers of input/output modules		
	i) Whether BCU has Synchronization features, (Yes / No)		
	j) Whether BCU has Auto Reclose features, (Yes / No)		
	k) Whether BCU has OC & EF protection function (Yes/ No)		
	l) Whether BCU has Trip Ckt Supervision facilities (Yes/ No)		
SI No	Technical Particulars	Unit	To be filled up by Tenderer
	m) Number of event recording		
	n) Compliance with IEC61850 protocol (Yes/ No)		
	p) Number of equipment it can handle		
	q) Speed of operation		
	r) Describe inherent protection functions, if any		
	s) Metering (Phase Current/Voltage, MW, MVAR, Freq, Phase angle etc)		
	t) Monitoring		



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	u) Disturbance Recorder		
	v) Card extension provisions, BI & BO (yes/No)		
	w) Whether site configurable		
	x) Nos of front configurable LED		
	y) Whether Self Supervision features provided (yes/No)		
	z) Whether communication port is in front (yes/no)		
	aa) Power card redundancy (Yes/No)		
	ab) Min & Maximum range of auxiliary voltage		
	ac) Numbers of FO ports		
	ad) %Accuracy at 1% of I <sub>N</sub> for metering		
	ae) Whether Bay mimic can distinguish the live & dead section of the bay (yes/ no)		

### C. Managed Ethernet Switch

SI No	Technical Particulars	Unit	To be filled in by Tenderer
1.0	a) Manufacturer's Name & address:		
	b) Size of the Switch		
	c) Redundant Power Card (yes/ no)		
	d) Numbers of FO ports for Bay Level switches		
	e) Numbers of FO & Copper ports for Station Level switches		
	f) Whether self-diagnostic features is available(Yes/No)		
SI No	Technical Particulars	Unit	To be filled in by Tenderer
	g) Whether Port Monitoring Software for Ethernet Switches will be provided (Yes/No)		
	h) Whether active port availability indication is available (Yes/No)		
	i) Name the Protocol used		



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	k) Standards followed (list to be provided)		
	l) Auxiliary Power Supply (mention range & type of auxiliary voltage)		

### D. Time Synchronization Device

SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.0	a) Manufacturer's Name & address:		
	b) Model No		
	b) Size of the device		
	c) Redundant Power Card (yes/ no)		
	d) Numbers of communication ports		
	e) Day Display Format		
	f) Time display Format		
	g) Date Format		
	h) Frequency display Format		
	i) Remote display Digit Height (shall be more than 100 mm)		
	k) SCADA/RCCC Interface		
	l) Heat Load (BTU/hr)		
	m) Time Synchronization Protocol		
	n) Accuracy (shall be more than 20 ns)		
	p) Configuration Software		
	q) List the Accessories along with make.		
	r) Compliance to IEC 61850 Protocol (Yes/No)		

### E. Substation Automation System

SI No	Technical Particulars	Unit	To be filled up by Tenderer
SI No	Technical Particulars	Unit	To be filled up by Tenderer
1.0	<b>General</b>		



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1.1	<b>SAS Panel</b>		
	a) Size of the Panel		
	b) Number of Panel		
1.2	<b>HMI (Main, Redundant &amp; DR Station)</b>		
	a) Manufacturer's Name & address		
	b) Model No		
	c) General Configurations		
	d) Redundant Power Supply Card (Yes/No)		
	e) Are all the input/output ports are hardware lockable (yes/no)		
	f) Size of the LED Monitor		
	g) Protocol used for HMI		
	n) Name the Protocols Compliant to		
	Are the HMIs are fire wall protected (yes/no)		
1.2	<b>Configuration of Mass Storage Device</b>		
1.3	<b>Gateways</b>		
	a) Manufacturer's Name & address		
	b) Model No.		
	c) Redundant power card (yes/no)		
	d) Compatible to IEC 68870-101/104 (Yes/No)		
	e) Time Synchronisation (yes/no)		
	f) Nos. of output ports		
	g) Whether the Gateways are expandable for future 4 numbers of bays? (yes/no)		
	h) Whether it is site configurable? (Yes/no)		
1.4	<b>Printers</b> (Please provide the information regarding Manufacturer, basic configuration for Colour laser, Dot matrix & Line printers separately)		



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1.5	Furniture (Please provide the information regarding Make, size etc for each item)		
1.6	FO cable (Please provide make, size, nos. of pair etc)		
<b>Sl No</b>	<b>Technical Particulars</b>	<b>Unit</b>	<b>To be filled up by Tenderer</b>
	Patch/CAT cable (Please provide make, size, core, type etc)		
1.7	Nos. of Licensed SAS software including NMS to be provided?		
1.8	<b>INVERTER</b>		
	a) Manufacturer's Name & address		
	b) Model		
	c) KVA Capacity		

## 9. DISC INSULATOR

Sl. No.	DESCRIPTION	To be filled in by the Tenderer			
		70 KN	90 KN	120KN	160 KN
1.	Manufacturer's name & address				
2	Type of Insulator				
3	Size of ball & socket				
4	Dimensions				
(a)	Disc diameter				
(b)	Unit spacing				
(c)	Creepage distance of the single insulator- mm				
5	Electro-mechanical strength of single insulator-kN				
6	Materials of shell				
7	<b>Electrical value</b>				
7.1	Power frequency Withstand Voltage Disc				
	(a) Dry-kV (rms)				
	(b) Wet-kV (rms)				



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7.2	Power frequency Withstand Voltage Disc				
	(a) Dry-kV (rms)				
	(b) Wet-kV (rms)				
7.3	Impulse Withstand Voltage Disc				
	1.2/50 micro second				
	(a) Positive – kV(Peak)				
	(b) Negative – kV(Peak)				
7.4	Impulse Flashover Voltage Disc				
	1.2/50 micro second				
	(a) Positive – kV(Peak)				
	(b) Negative – kV(Peak)				

## 10. 132 KV LONG ROD INSULATORS

Sl.	Description	Unit	To be filled in by the Tenderer		
			70 KN/ 90KN	120 KN	160 KN
1.0	<b>General</b>				
a)	Size and Designation of ball & Socket assembly				
2.0	<b>Dimensions</b>				
a)	Core diameter				
b)	Tolerance on core diameter				
c)	Minimum nominal creepage distance				
	1. Normal				
	2. Anti Fog				
3.0	Colour of glaze of finished porcelain insulator				
4.0	Mechanical Strength of Long Rod				
5.	<b>Minimum electrical values</b>				
a)	Power frequency <b>Withstand</b> voltage				
b)	Power frequency <b>Flashover</b> voltage (DRY/WET)				
c)	Impulse <b>Withstand</b> test voltage 1.2 x 50 $\mu$ s				
	(Dry) POSITIVE / NEGATIVE				



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d)	Impulse <b>Flashover</b> test voltage 1.2 x 50 $\mu$ s (Dry) POSITIVE / NEGATIVE				
6.	Eccentricity of Long Rod				
a)	Max. axial/radial run out				
b)	Max. angular displacement				
7.	Galvanizing				
a)	Minimum mass of zinc coating				
b)	Minimum no. of one minute dips in the standard preece test				
c)	Minimum purity of zinc used for galvanizing				

## 11. 220 KV LONG ROD INSULATORS

Sl. No	Description	Unit	To be filled in by the Tenderer			
			70 KN	90 KN	120 KN	160 KN
1.0	<b>General</b>					
a)	Size and Designation of ball & Socket assembly	mm				
2.0	<b>Dimensions</b>					
a)	Core diameter	mm				
b)	Tolerance on core diameter	$\pm$ mm				
c)	Minimum nominal creepage distance 1. Normal 2. Anti Fog	mm				
3.0	Colour of glaze of finished porcelain insulator					
4.0	Mechanical Strength of Long Rod	kN				
5.0	<b>Minimum electrical values</b>					
a)	Power frequency <b>Withstand</b>	kV				
b)	Power frequency <b>Flashover</b>	kV				



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c)	Impulse <b>Withstand</b> test voltage 1.2 x 50µs (Dry) POSITIVE / NEGATIVE	kV (pe ak)				
d)	Impulse <b>Flashover</b> test voltage 1.2 x 50µs (Dry) POSITIVE / NEGATIVE	kV (pe ak)				
e)	Corona extinction voltage level	kV				
f)	Max. RIV for string including corona rings at 156kV rms	micro volts				
6.	<b>Eccentricity of Long Rod</b>					
a)	Max. axial/radial run out					
b)	Max. angular displacement	deg				
7.	<b>Galvanizing</b>					
a)	Minimum mass of zinc coating	Gm/ sq.m.				
b)	Minimum no. of one minute dips in the standard preece test	Nos.				

## 12. OPTICAL GROUND WIRE (OPGW) – 24/48/96 Fibre

### A. CABLE CONSTRUCTION

SI No	Parameter	Unit	TO BE FILLED IN BY THE TENDERER
1.	No. of Fibres Dual Window Single-Mode:	each	
2.	Buffer Type:		
3.	Buffer Tube material		
4.	No. of Buffer Tubes:	each	
5.	No. of Fibers per buffer Tube:	each	
6.	Expected Cable Life:		
7	Buffer tube diameter	mm	
7	Filling material		
8	Filling material compliant with technical specifications?	Yes/no	
9	Strength member(s)		
10	Binding yarn/ tape		
11	Describe Central Core Design		
12	20% Aluminum Clad steel wire Diameter:	mm	
	Number:	each	
13	Aluminum alloy wires Diameter:	mm	
	Number:	each	
14	Aluminum tube inner diameter	mm	
15	Aluminum tube outside diameter	mm	



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16	Cable Diameter: (nominal ± deviation)	mm	
17	Cable Diameter: (nominal ± deviation)	mm	
<b>Mechanical Properties of Cable</b>			
18	Max. breaking load/ Ultimate Tensile Strength (UTS)	kN	
19	Fibre strain margin	%	
20	Zero fibre strain up to load	kN	
21	Weight	kg/km	
22	Crush strength	kg/mm	
23	Equivalent Modulus of elasticity	KN/m <sup>2</sup>	
24	Minimum Bending Radius without micro bending	mm	
25	Maximum Bending Radius Short Term Long Term (Continuous)	mm	
26	Tensile proof test (Screening) level	KN/m <sup>2</sup>	
27	Maximum permissible tensile stress	KN/m <sup>2</sup>	
28	Permissible CTS. tensile stress	KN/m <sup>2</sup>	
29	Maximum sag at maximum temperature and design span with no wind	mm	
30	Everyday tension , no wind	% of UTS	
31	Maximum tension at Every day condition with full wind pressure of..... Kg/m <sup>2</sup> on full projected are, 400 meter span		

## B. OPTICAL FIBRE [DUAL-WINDOW SINGLE MODE (DW-SM)]

Sl no	Parameter	Unit	As per Technical Specification	TO BE FILLED IN BY TENDERER
1	Fiber anufacturer(s)/Type:			
2	Attenuation Coefficient @ 1310 nm: @ 1550 nm:	dB/km	≤ 0.35 dB/km ≤ 0.21 dB/km	
3	Point discontinuity @ 1310nm: @ 1550nm:	dB	≤ 0.05 dB ≤ 0.05 dB	
4	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	µm	8.6 to 9.5 µm (± 0.6µm )	
5.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	ps/nm.k m	3.5 ps/(nmxkm) 5.3 ps/(nmxkm) 18 ps/(nmxkm)	
6	Mode field concentricity error		≤ 0.6 µm	
7	Zero dispersion wavelength:	nm	1300 to 1324 nm	
8	Zero Dispersion Slope	ps/nm <sup>2</sup> . km	0.092ps/nm <sup>2</sup> xkm maximum	
9	Cable Cutoff wavelength	nm	≤ 1260 nm	



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10	Temperature dependance		Induced attenuation $\leq 0.05$ dB(-60°C -+85°C)	
11	Refractive Index			
12	Refractive Index profile			
13	Cladding Design			
14	Numerical aperture			
<b>Physical &amp; Mechanical Properties</b>				
15	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm (30 mm radius, 100 turn) @1550 nm (16mm radius, 1 turn) @ 1550nm	dB	$\leq 0.05$ dB $\leq 0.05$ dB $\leq 0.50$ dB	
16	Core Diameter(nominal $\pm$ deviation) in $\mu\text{m}$	$\mu\text{m}$		
17	Core non-circularity in %			
18	Cladding Diameter (nominal $\pm$ deviation):		$125.0 \mu\text{m} \pm 1 \mu\text{m}$	
19	Polarisation mode dispersion coefficient		$\leq 0.2 \text{ ps/km}^{1/2}$	
20	Proof test level		$\geq 0.69 \text{ Gpa}$	
21	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellcore GR-20 State YES/NO)			

### C. HARDWARE AND ACCESSORIES

- Suspension Clamp Assembly:

Sl No	Description Unit	Unit	TO BE FILLED IN BY THE TENDERER
1	Minimum vertical Strength	kN	
2	Maximum Slip Strength	kN	
3	Minimum Slip Strength	kN	
4	Length (nominal)	mm	
5	Weight (nominal)	kg	
6	Total Drop (maximum) including shackles	Nm	
7	Tightening torque (nominal)	Nm	



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8	Details of Armour Rod Set a) No. of rods per clamp b) Direction of Lay c) Overall length d) Diameter of each Rod e) Tolerances (i) Diameter of each rod (ii) Length of each rod f) Material of manufacture g) UTS of each Rod h) Weight	   mm mm ±% ±% kN kg	
9	Details of Protection Splice Set (Reinforcing Rods) i) No. of rods per clamp j) Direction of Lay k) Overall length l) Diameter of each Rod m) Tolerances	   mm	
	(i) Diameter of each rod (ii) Length of each n) Material of manufacture o) UTS of each Rod p) Weight	 mm ±% ±% kN kg	

• **Dead End Clamp Assembly**

Sl No	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Minimum Slip Load	kN	
2	Length (nominal) a) Reinforcing Rods b) Dead end	mm mm	
3	Weight (nominal) a) Reinforcing Rods b) Dead end	kg kg	
4	Breaking strength (minimum)	kN	
5	Wire Size a) Reinforcing Rods b) Dead end	mm mm	

• **Vibration Damper**

Sl	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Total Weight	Kg	
2	Weight of each Damper	Kg	
3	Material of Damper Weight		
4	Clamp Material		
5	Clamp bolt tightening torque	Nm	
6	Clamp bolt material		
7	Messenger Cable Material		



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8	No. of Strands in Messenger Cable		
9	Breaking Strength of Messenger Cable	kN	
10	Resonance Frequencies a) First Frequency b) Second Frequency c) Third Frequency d) Forth Frequency	Hz Hz Hz Hz	
11	Minimum Slip Strength of Damper Clamp a) Before Fatigue Test b) After fatigue Test	kN kN	

• **Down Lead Clamp /Fastening Clamp**

SI No	Description	Unit	TO BE FILLED IN BY THE TENDERER
1	Material		
2	Suitable for OPGW (range):	mm	
3	Tightening torques	Nm	
4	Vertical load	kN	
5	Filler details (a) Material (b) diameter	mm	
6	Tower attachment arrangement		

• **Optical Fibre Distribution Panel (FODP)**

SI no	Parameter	Unit	TO BE FILLED IN BY THE TENDERER
1	Dimensions H * W * D:	cm	
2	Weight:	kg	
3	Colour and Finish:		
4	Cable Glanding and Fixing:		
5	Construction materials & Gauge:		
6	Locking arrangements:		
7	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	cm	
8	IP Protection		
9	Total number of optical couplings:	each	
10	Provision of pass through splicing	Yes/No	
11	Whether filled with encapsulant	Yes/No	
12	Method(s) for mounting:		

• **Approach Cable**

SI No	Parameter:	Unit:	TO BE FILLED IN BY THE TENDERER
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1	No. of Fiber Dual Window Single-Mode:	Each	
2	Fibre Manufacturer Dual Window Single-Mode:		
3	Buffer Type:		
4	Buffer Tube Diameter:	mm	
5	Buffer Tube material		
6	No. of Buffer Tubes:	Each	
7	No. of Fibres per Tube:	Each	
8	Identification/numbering of individual tubes:		
9	No. of empty tubes (If any):	Each	
10	Filling material:		
11	Filling material compliant with technical specifications?	Yes/No	
12	Strength member(s):		
13	Binding yarn/ tape:		
14	Describe Central Core Design:		
15	Outside Jacket Coating (if any)		
16	Jacket Thickness	mm	
17	Jacket non-circularity	%	
18	Cable Diameter: (nominal $\pm$ deviation)	mm	
19	Cable cross-sectional area	mm <sup>2</sup>	
20	Rip-cord provided?	Yes/No	
21	Fully Compliant with IEC 60974-3	Yes/No	

### Mechanical Properties of Approach Cable

22	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	
23	Fibre strain margin:	%	
24	Zero fibre strain up to load	kN	
25	Weight:	kg/km	
26	Crush strength:	kg/m <sup>2</sup>	
27	Equivalent Modulus of elasticity:	kN/mm <sup>2</sup>	
28	Minimum Bending Radius without micro bending:	mm	
29	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
30	Tensile proof test (Screening) level:	kN/mm <sup>2</sup>	
31	Maximum permissible tensile stress:	kN/mm <sup>2</sup>	
32	Permissible CTS. tensile stress:	kN/mm <sup>2</sup>	
33	Everyday Tensile Stress	N	
34	Torsion	twist/m	

### 13. AAAC POWER CONDUCTOR

Sl.No	DESCRIPTION	TO BE FILLED IN BY THE TENDERER
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1.0	Name of manufacturer and address for: (a) Aluminium Alloy rods: (b) Aluminium Alloy Conductor:	
2.0	Applicable Standard for: (a) Aluminium Alloy rods: (b) Aluminium Alloy Conductor:	
	No of Strand x Size, (No. x mm)	
3.0	Conductor over all diameter, (mm)	
4.0	Total sectional area, (mm <sup>2</sup> )	
5.0	Approx. weight, (kg/kM)	
6.0	Minimum UTS, (kN)	
7.0	Modulus of Elasticity (Final), (kg/cm <sup>2</sup> )	
8.0	Coefficient of linear expansion, (per <sup>0</sup> C)	
9.0	Calculated maximum resistance of Conductor at 20°C,	
<b>Sl.No</b>	<b>DESCRIPTION</b>	<b>TO BE FILLED IN BY THE TENDERER</b>
	(ohm/Km)	
10.0	Lay Ratio: (i) 6 wire layer (max/min) (ii) 12 wire layer (max/min) (iii) 18 wire layer (max/min)	
11.0	Particulars of Aluminium Alloy Wires (strands)	
	(a) Wire Diameter, (mm) (i) Standard: (ii) Maximum: (iii) Minimum:	
	(b) Resistivity of wire, (ohms.mm <sup>2</sup> /m)	
	(c) Density	
	(d) Co-efficient of Linear expansion (per <sup>0</sup> C)	
	(e) Cross Sectional area of Aluminium wire	
	(f) Approximate Total weight of each strand, (kg/km)	
	(g) Calculated resistance at 20°C (D.C.), (ohms/km)	
	(h) Minimum Breaking Load of each strand, (kN)	
	(i) Minimum elongation on a gauge length of 200 mm	

## 14. ACSR POWER CONDUCTOR

Sl. No.	Description	Unit	To be filled in by the bidder
1.0	Maker's Name, Address		
2.0	Particulars of Raw Materials		
2.1	Aluminium		
a)	Minimum Purity of aluminum	%	
b)	Maximum Copper Content	%	
2.2	Steel Wires/Rods		
a)	Carbon	%	
b)	Manganese	%	



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c)	Phosphorus	%	
d)	Sulphur	%	
e)	Silicon	%	
2.3	Zinc		
a)	Minimum Purity of Zinc	%	
3.0	Aluminum Strands after stranding		
3.1	Diameter		
a)	Nominal	mm	
b)	Maximum	mm	
c)	Minimum	mm	
3.2	Minimum Breaking Load of Strand	kN	
3.3	Maximum Resistance of 1m length of	Ohm	
4.0	Steel Strands after stranding		
4.1	Diameter		
a)	Nominal	mm	
b)	Maximum	mm	
c)	Minimum	mm	
5.0	Galvanizing		
a)	Minimum weight of zinc coating per Uncoated wire surface	gm/m <sup>2</sup>	
b)	Minimum number of one minute dips galvanized strand	Nos.	
<b>Sl. No.</b>	<b>Description</b>	<b>Unit</b>	<b>To be filled in by the bidder</b>
	can withstand in the preece test		
c)	Minimum number of twists in a guage length times dia of wire which the strand can in the torsion test (after stranding)	Nos.	
6.0	ACSR Stranded Conductor		
6.1	UTS of Conductor	kN	
6.2	Lay ratio of Conductor	Max.	
a)	Outer Steel Layer		
b)	12 wire aluminum layer		
c)	18 wire aluminum layer		
d)	24 wire aluminum layer		
6.3	D.C. resistance of conductor at 20°C	Ohm/Km	
6.4	Standard length of conductor	M	
6.5	Maximum length of conductor that can be	Meter	
6.6	Tolerance on standard length of conductor	%	
7.0	Direction of lay for outside layer		
7.1	Linear mass of the Conductor		
a)	Standard	Kg/Km	
b)	Minimum	Kg/Km	
c)	Maximum	Kg/Km	
8.0	No. of Cold pressure butt welding available at works	Nos.	



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## 15. Circuit Breakers

Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
1.0	Manufacturer's Name & Address of manufacturing plant		
2.0	Type of Construction		
3.0	Type of circuit breaker		
4.0	Standard applicable		
5.0	Principle of operation		
6.0	Rated voltage, kV		
7.0	Reference ambient temperature		
8.0	Continuous current in Ampere a) Reference ambient temperature 40°C b) Reference ambient temperature 50°C		
9.0	Maximum temperature rise over an ambient of 50°C		
10.0	Short time current rating a) For 1second b) For 3second		
Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
11.0	Dynamic peak circuit withstand capacity (kA peak)		
12.0	Operating duty		
13.0	Opening time in millisecond		
14.0	a) Arcing time in ms. At 100%/ 50%/ 25%/ 10% of rated breaking current. b) Arc length		
15.0	Interrupting capacity based on duty cycle specified a) Symmetrical(kA) b) Asymmetrical(kA) c) D.C.component d) Asymmetrical factor		



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16.0	Re-striking voltage characteristics at a) Symmetrical(kA) b) Asymmetrical(kA) c) D.C.component d) Asymmetrical factor		
17.0	Re-striking voltage characteristics at a) Amplitude factor b) Rate of rise of re-striking voltage(kV/ $\mu$ s) c) First pole to clear factor d) Type of device used, if any to control RRRV		
18.0	Number of breaks in series per pole.		
19.0	Length of contact travel (mm)		
20.0	Total length of break (mm)		
21.0	Rate of contact travel a) Tripping(metre/sec) b) Closing(metre/sec)		
22.0	Rated line charging breaking current (Amps)		
23.0	Rated small inductive breaking current (Amps)		
24.0	Maximum shunt capacitor bank (single bank) breaking current (Amps)		
25.0	Maximum current breaking capacity under normal condition when connected to back to back capacitor bank, Amps		
26.0	a) Type and material of main contact b) Thickness of silver plating(micron)		
27.0	Type & material of arcing contact		
28.0	Contact pressure (N/finger)		



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Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
29.0	Insulation level (I) Power frequency voltage withstand for 1 min (kVrms) (II) Lightening impulse (1.2/50 $\mu$ s) voltage withstand (kV peak)		
30.0	Insulation level (III) Power frequency voltage withstand for 1 min (kVrms) (IV) Lightening impulse (1.2/50 $\mu$ s) voltage withstand (kV peak)		
31.0	Radio interference voltage test at 28 kV ( $\mu$ V)		
32.0	Whether circuit breaker is trip free or fixed trip		
33.0	Type & designation of the drive		
34.0	Rated control voltage for closing coil (V dc)		
35.0	Pick up voltage of the closing coil		
36.0	Power required at i) Rated voltage(W) ii) 85% of rated voltage(W) iii) 110% of rated voltage(W)		
37.0	Type of tripping mechanism		
38.0	Power required at i) Rated voltage(W) ii) 70% of rated voltage(W) iii) 110% of rated voltage(W)		
39.0	i) Total interrupting time measured from instant of trip coil energising to arc extinction(ms.) ii) Closing time measured from instant of application of power to closing coil up to arcing contact touches(ms) iii) Opening time (switches)		
40.0	Maximum over voltage factor of the circuit breaker when switching off		
	i) Unloaded transformer ii) Loaded transformer		



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Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
41.0	Maximum current breaking capacity when switching off asynchronous system (out of phase condition)		
42.0	Number of operations, the circuit breaker is capable of performing without inspection, replacement of contacts, main parts of SF6 gas / vacuum bottles  i) At rated current ii) At 50% rated current iii) At rated breaking capacity iv) At 50% rated breaking capacity		
43.0	Creepage distance (mm)		
44.0	Weight of complete breaker including poles, operating mechanism and structure  i) Weight of structure(kg) ii) Weight of operating mechanism(kg) iii) Weight of SF6 gas per breaker (kg) (For exact details submit GA drawing)		
45.0	Impact loading for foundation design (to include dead load and impact value)  i) On opening(Newton) ii) On closing(Newton)		
46.0	Insulator  i) Material ii) Type iii) Insulation class iv) 1min dry power frequency withstand voltage(kVrms.) v) 10 Sec. Wet power frequency withstand voltage (kV rms.) vi) Full wave impulse withstand voltage (kVrms.) vii) Permissible cantilever loading(kg)		
47.0	SF6 gas (for SF6 breaker only)  i) Name of gas ii) Supplier of gas		



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Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
	iii) General properties of SF6 gas, Purity (mass in%) a) CF4 b) Air c) Water d) Hydrolytic fluorides(PPM.) e) Acidity(PPM.) iv) Equivalent standard v) Storage of gas vi) Thermal characteristics, Specific heat (Joules / kg °C, kcal / kg°C) vii) Sublimation temperature (at 760 Torr)°C viii) Breaking temperature (at 2.29 atm)°C ix) Physical properties a) Molecular mass(relative) b) Vapour pressure at 20°C c) Critical temperature, °C		
48.0	Whether circuit breaker suitable for 1 or 3 phase reclosing		
49.0	Minimum dead time (ms)		
50.0	Minimum reclosing time at full rated interrupting capacity (ms)		
51.0	Minimum reclaim time (seconds)		
52.0	Limits of adjustment of dead time		
53.0	Device provided to give alarm and block tripping closing of circuit breaker in case of loss of. (for SF6 Breaker only) a) SF6 gas b) Air pressure of operating mechanism		
54.0	Rated pressure (bar at 20°C gauge) & limits of pressure (for SF6 Breaker only)		
55.0	Rate of SF6 gas leakage (% per annum) (for SF6 Breaker only)		
56.0	Whether the breaker will self-close on low pressure of SF6 gas (for SF6 Breaker only)		



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Sl. No	Description	To be filled in by the Tenderer	
		220kV	132kV
57.0	Pole to pole distance i) Centre to centre ii) Clearance(mm)		
58.0	Maximum pole discrepancy i) Between poles for tripping(ms) ii) Between poles for closing(ms) iii) Between poles for C-O(ms) iv) Spare auxiliary switches provided(nos.)		
59.0	Auxiliary switch contact rating i) Continuous ii) Inductive breaking(Amp) iii) Number of spare contacts		
60.0	Clearance between i) Live part to earth(mm) ii) Live part to base of structure(mm) iii) Terminal to base of structure(mm)		
61.0	Material of operating rods/ levers		
62.0	Permissible humidity for SF6 gas (ppm) (for SF6 Breaker only)		
63.0	Refilling period for SF6 gas (years) (for SF6 Breaker only)		
64.0	Type and rating of heater		
65.0	Details and ratings of motors		

## 16. Potential Transformers (Outdoor)

Sl. No	Description	UNIT	To be filled in by the Tenderer	
			220kV	132kV
1.0	Name of the Manufacturer			
2.0	Country of Origin			
3.0	Manufacture's type and Designation			



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4.0	Standards Applicable			
5.0	Type of installation			
6.0	Windings:			



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Sl. No	Description	UNIT	To be filled in by the Tenderer	
	A). Primary Winding (i) Material (ii) Design density for short circuit current. (iii) Conductivity of metal used. (iv) Area of cross section.			
	B). Secondary Winding (i) Material (ii) Area of cross section.			
7.0	Rated primary voltage	KV		
8.0	Rated frequency	Hz		
9.0	Rated primary current	Amps		
10.0	Rated secondary current	Amps		
11.0	Ratio taps (on secondary side only)			
12.0	Type of insulation			
13.0	RIV at 1.1 x Rated voltage	mV		
14.0	Tank material and Tank coating			
15.0	Porcelain housing and it make (Single piece only)			
16.0	Sealing (Metal Bellow) provided			
17.0	Acceptable limit of temperature			

## 17. 110 V VALVE REGULATED LEAD ACID BATTERY

Sl. No.	DETAILS	To be filled in by the Bidder
1	Type/ Designation	
2	Manufacturer's type designation	
3	Ampere-Hour capacity 10hrs rate of discharge to 1.75V	
4	Total No. of Plates per cell	



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5	Nominal Cell Voltage (V)	
6	No. of Cells in each Bank	
7	No. of Spare Cell, if any, in each Bank	
8	Internal Resistance for each Cell	
9	Resistance of the Battery including Inter-connection between the Cells ( $\Omega$ )	
10	Cell Discharge rate in Ampere (from rated Voltage to final discharge rate in Ampere (i) 5hrs Discharge rate in Amp (ii) 2hrs Discharge rate in Amp (iii) 1hr Discharge rate in Amp (iv) 30min Discharge rate in Amp (v) 10min Discharge rate in Amp (vi) 1min Discharge rate in Amp (vii) 30sec Discharge rate in Amp (viii) 1sec Discharge rate in Amp (Please furnish a graph showing Amps against time for the type of battery offered)	
11	Short Circuit Current (Amps)	
12	(i) Material of Cell Containers (ii) Material used for Battery Box (iii) Trays	
13	Thickness, Type & Material of Separators	
14	Constructional details and dimension: Surface area plates of (i) Positive Plate (ii) Negative Plate in Sq.mm.	
15	(i) Ampere Hour efficiency(%) (ii) Watt Hour efficiency(%)	
16	(i) Recommended Float Charge Current & Voltage (ii) Recommended Boost Charge Current & Voltage	
17	Time required for Boost Charging from Discharged condition	
18	(i) Max. Charging Current/Cell (ii) Nominal Charging Rate	
19	(i) Whether explosion proof or vent plugs provided (ii) Whether vent is spill proof	
20	Type of Inter Cell connection & whether they are covered with plastic sleeves	
21	(i) Dimensions of each 2V Block/Cell a. Length(mm) b. Width(mm) c. Height(mm) (ii) Thickness of Container(mm) (iii) Net weight of the cell complete with acid 12V block(kg)	



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22	Expected Life Span of Battery	
23	Accessories provided	
24	Special conditions, if any	

## 18. 110V BATTERY CHARGER

Sl. No.	DETAILS	To be filled in by the Bidder	
1	Manufacturer's Name & Address		
2	Conforming Standard		
3	(ii) (i) Type & Designation of charger		
	(iii) Capacity(min.) of Battery Charger		
	(iv) Charger rate/output current		
	(v) Float charger (A) –min.30A		
	(vi) Float Cum Boost charger(A) – min 60		
	(vii) Confirm whether battery chargers are type tested as per spec.(Yes/No):		
4	% voltage regulation of Float charger		
5	% Ripple Content :		
6	Method of control		
7	Transformer	for Float	for Float Cum Boost
	a) Make :		
	b) Type :		
	c) Rating		
8	Rectifier		
	a) Make :		
	b) Type :		
	c) Rating		
8	A.C. Switch fuse unit		
	a) Make :		
	b) Continuous Rating Amps. :		
	c) Interrupting Rating KA.		
10	A.C.Contactors		
	a) Make :		
	b) Rating(Amps)		



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Sl. No.	DETAILS	To be filled in by the Bidder	
11	MCB/MCCB		
	a) Make :		
	b) Type :		
	c) Rating :		
12	Fuses		
	a) Make :		
	b) Continuous Rating Amps. :		
	c) Interrupting Rating KA. :		
13	D.C.Contactors		
	a) Make :		
	b) One (1)minute rating :		
	c) One (1)hour rating :		
14	D.C. tripple pole switch connected between battery and charger		
	a) Make :		
	b) Continuous Rating Amps :		
	c) Short Time Rating KA :		

## 19. 36 KV Double Break (DBR) Isolator

Sl no	Particulars	To be filled in by the Bidder
1	Type/installation	
2	Name of manufacturer and address	
3	Standards according to which isolators are manufactured	
4	Highest design voltage	
5	Frequency(Hz)	
6	Rated voltage(KV)	
7	Maximum current that can be safely interrupted by the isolator inductive and capacitive current	
8	Continuous current rating	
9	Rated short time current for 3 sec and 1 sec	
10	Rated peak short time current	
11	Current density at the minimum cross-section of	
	a) Moving blade	
	b) Terminal pad	
	c) Contacts	
11	d) Terminal connector	
12	Maximum temperature rise of current carrying parts when carrying rated current continuously	
13	Derating factor	
14	Insulation level	
	a) Impulse withstand voltage	
	i) phase to earth	
	ii) isolating distance	



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	b) Power frequency withstand voltage(KV peak)	
	i)Phase to earth	
	ii) isolating distance	
15	Minimum clearance in air	
	i)Between poles(mm)	
	ii)Between live part and earth	
<b>Sl no</b>	<b>Particulars</b>	<b>To be filled in by the Bidder</b>
	iii) Between adjacent poles	
	iv)on the same pole	
16	Design & Construction	
	i)no of insulators per pole	
	ii)No of breaks per pole	
	iii) Types of closing/opening mechanism	
	iv)contacts	
	a)Material and grade	
	b)Cross-sectional area	
	v)Moving Blade	
	a)Material and grade	
	b)Cross-sectional area	
	vi)Type of interlock	
	vii)Operating mechanism	
	a)Material and thickness control cabinet	
	b)Degree of protection	
viii)Tandem pipe		
a)Size class and no of pipes		
17	SUPPORT INSULATOR	
	Cantilever Strength (Kgf)	
	Min.Creepage Distance(mm)	
	Insulation Level: One minute Power frequency voltage withstand test (KVrms)	
	Insulation Level: 1.2/50 micro-sec. Lightning Impulse Voltage withstand test (KVp)	
18	Voltage of Motor Drives	
19	Rated auxiliary supply voltage to coil for close & Open Operation	
20	Number and type of auxiliary contacts for	
	main blade	
	earth switch	
	Operating time for closing (secs.)	
	Operating time for opening (secs.)	

20.

## 33/0.415KV STATION SERVICE TRANSFORMERS

SL	DESCRIPTION	(To be filled
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		in and signed by the Bidder
<b>1</b>	<b>GENERAL</b>	
1.01	Name of Manufacturer	
1.02	Manufacture's Type	
1.03	Conforming Standard	
1.04	Date of Last Type Test	
1.05	Dimension of the Main Tank ( L x B x H)	
1.06	Weight of the Transformer with oil	
1.07	Volume of the Oil (KL)	
1.08	Continuous maximum KVA Rating	
1.09	Primary Voltage (Volt)	
1.10	Secodary Voltage (Volt)	
1.11	No load voltage ratio	
1.12	Primary Current (Amp)	
1.13	Secodary Current (Amp)	
1.14	Vector Group	
<b>2</b>	<b>Insulation Level</b>	
2.01	Power frequency withstand voltage (KVrms)	
2.01.1	On H.V. side	
2.01.2	On L.V. side	
2.02	Full wave Lightning Impulse withstand voltage	
2.02.1	HV Winding(KVp)	



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2.02.2	LV Winding (KVp)	
2.03	Induced over voltage (KVrms)	
2.03.1	HV Winding	
2.03.2	iLV Winding)	
3	Rated temperature rise over maximum ambient temperature (50°C) at rated output (°C)	
3.01	oil	
3.02	winding	
3.03	Hot spot temperature	
4	Exciting current referred to H.V. & 50 c/s at (Amp.)	
4.01	90% rated voltage	
4.02	100% rated voltage	
4.03	110% rated voltage	
4.04	Power factor of excitation current at 100% rated voltage and 50 c/s	
5	No load loss (Core loss) (KW) at 50 c/s and at	
5.01	90% rated voltage	
5.02	100% rated voltage	
5.03	110% rated voltage	
5.04	Copper (load) loss at 75°C (KW) (excluding aux. Loss)	
5.05	Aux. Loss	
5.06	Total loss at normal tap and at rated frequency and at 75°C (KW) winding temperature including aux. loss.	



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6	Percentage Impedance at rated current and voltage (%)	
6.01	At normal tap	
6.02	At highest tap	
6.03	At lowest tap	
7	Resistance per phase at 75°C (Ohm)	
7.01	H.V.	
7.02	L.V.	
8	Regulation at full load (75°C) and following p.f.	
8.01	unity p.f.	
8.02	0.90 lagging	
8.03	0.80 lagging	
9	Efficiency at unity & 0.8 p.f. (lag) at various loads (Unity p.f./ 0.8 p.f.)	
9.01	100% load	
9.02	75% load	
9.03	0% load	
9.04	25% load	
9.05	Zero sequence impedance (75°C) at normal tap & maximum/minimum tap positions (Ohm)	
10	Core particulars	
10.01	Materials & grade	
10.02	Thickness of stamping (mm)	
10.03	Flux density in the core at rated voltage and 50 c/s (Tesla)	



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10.04	Flux density at 110% rated voltage and 50 c/s (Tesla)	
11	Windings :	
11.01	Current density in H.V. winding (Amp./Sq.cm.)	

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11.02	Current density in low voltage winding (Amp./Sq.cm.)	
11.03	Phase to phase clearance of HV Bushing In Air	
11.04	Phase to phase clearance of LV Bushing In Air	
11.05	Phase to phase (L.V.)	
11.06	Clearance of HV Bushing terminal to ground	
12	Tap changer	
12.01	Type of tap changer	
12.02	Taps provided at Winding (Like HV or LV )	
12.03	Position of tap ( Like on the neutral end or in the middle of the winding)	
12.04	No. of taps provided on the winding and % variation of each tap	
12.05	Permissible over loads, % of full load	
12.06	Core type or shell type	
13	HV Bushing	
13.01	Name of manufacturer	
13.02	Impulse withstand voltage on H.V. winding (KVp)	
13.03	1-min. P.F dry withstand voltage on H.V.Bushing (KVrms)	
13.04	1-min. P.F. wet withstand voltage on H.V.Bushing (KVrms)	
13.05	Details of L.T. Bushings and switch fuse assembly with regard to "Manufacturer", capacity & relevant technical particulars	

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## 21. Current Transformer (Outdoor)

SL. NO.	DESCRIPTION	400kV	220kV	132kV	33kV
1.	Bidder's name and address				
2.	Name and address of the Manufacturer				
3.	Manufacture's type designation				
4.	Standards applicable				
5.	Rated frequency (HZ)				
6.	Rated Voltage (KV)				
7.0	Rated current (A)				
7.1	Rated continuous current (A)				



7.2	Rated extended primary current (A)				
8.	Short time thermal current withstand for stipulated time duration (KA)				
9.	Dynamic current withstand (KAP)				
10.	1.2/50 $\mu$ s impulse withstand voltage (KVP)				
11.	One minute dry and wet power frequency withstand voltage (KV-rms)				
12.	No. of cores per CT				
13.	Transformation Ratio				
14.	No. of secondary turns				
15.	Rated output at all ratios for metering core (VA)				
16.	Accuracy class				
17.	Minimum Knee point voltage at different taps for all 'PS' class cores (V)				



18.	Secondary winding resistance at different taps for all cores ( $\Omega$ ) ( $75^{\circ}\text{C}$ )				
19.0	Maximum exciting current at all ratios (for all PS class cores)				
19.1	100% KPV (Knee point voltage) (mA)				
19.2	25% KPV (Knee point voltage) (mA)				
19.3	20% KPV (Knee point voltage) (mA)				
19.4	10% KPV (Knee point voltage) (mA)				
20.	Instrument security factor at different ratios.				
21.	Radio interference voltage at $1.1 V_r / 3^{1/2}$ at 1.0 MHZ (Micro volts)				
22.	Whether auxiliary CT provided for metering winding				
23.	Corona extinction voltage (KV rms)				
24.	Partal discharge level (PC)				
25.	Total creepage distance (mm)				
26.	Primary				

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26.1	No. of primary turns				
26.2	Material and cross-section of primary (mm <sup>2</sup> )				
26.3	Type of primary				
27.	Whether CT is suitable for transportation horizontally.				
28.	Percentage current (ratio) error and phase displacement in minutes at rated burden and at				
28.1	5% rated current				
28.2	10% rated current				
28.3.	20% rated current				
28.4.	120% rated current				
29.	Percentage current (ratio) error and phase displacement in minutes at 25% rated burden and				
29.1	At 5% rated current				
29.2	At 10% rated current				
29.3.	At 20% rated current				
29.4.	At 120% rated current				
30.	Quantity of oil per CT (Litres)				
31.	Standard to which oil conforms generally.				



32.	Characteristics of oil (prior to filling)				
32.1	Breakdown voltage (KVrms)				
32.2	Dielectric dissipation constant (tan delta)				
32.3	Water content (ppm)				
32.4	Gas content				
32.5	Interfacial tension at 27 <sup>0</sup> C (N/m)				
32.6	Specific resistance				
32.6.1	At 90 <sup>0</sup> C ( $\Omega$ cm)				
32.6.2	At 27 <sup>0</sup> C ( $\Omega$ cm)				
33.	Whether current transformers are hermetically sealed. If so, how ?				
34.	Total weight (Kg)				
35.	Transport weight (Kg)				
36.1	Temperature rise over an ambient temperature of 50 <sup>0</sup> C for continuous operation at rated continuous thermal current.				



36.1	Winding				
36.2	Oil				
36.3	External surface of the core, metallic parts in contact with or adjacent to insulation.				
37.	Whether CT characteristic curves enclosed.				
37.1	Ratio and phase angle curve				
37.2	Magnetisation curves				
37.3	Ratio correction factor curves.				
38.	DATA ON PRIMARY WINDING				
38.1	Rated primary current (A)				
38.2	No. of conductors in one turn				
38.3	No. of turns of primary				
38.4	Material of the primary conductors				
38.5	Size of the primary conductor (Bare/ Insulated (mm x mm)				
38.6	Cross-sectional area of each conductor (mm <sup>2</sup> )				



38.7	Total cross-sectional area of primary winding (mm <sup>2</sup> ) conductors				
38.8	Current density(A/mm <sup>2</sup> )				
	(i) At highest ratio				
	(ii) At intermediate ratio				
	(iii) At lowest ratio				
38.9	Short circuit current densiry (A/mm <sup>2</sup> )				
	(i) At highest ratio				
	(ii) At intermediate ratio				
	(iii) At lowest ratio				
38.10	Ampere-turn of Primary (AT)				
	(i) At highest ratio				
	(ii)At intermediate ratio				
	(iii) At lowest ratio				
38.11	Length of primary conductor (m)				
38.12	Weight of primary winding (kg.)				
39.	CORE				
39.1	Material and grade of the core				
39.2	Thickness of core (mm)				

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39.3	Net Iron cross-sectional area of core (mm <sup>2</sup> )				
39.3.1	Core-1				
39.3.2	Core – 2				
39.3.3	Core – 3				
39.3.4	Core – 4				
39.3.5	Core – 5				
39.4	Mean magnetic path length (cm)				
39.4.1	Core – 1				
39.4.2	Core – 2				
39.4.3	Core – 3				
39.4.4	Core – 4				
39.4.5	Core – 5				
39.5	Whether B-H curve for the core material, used, furnished ? (B-wb/m <sup>2</sup> , H-AT/cm)				

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39.6	Whether specific loss vs. flux density graph for the core material used furnished ?				
39.7	Axial length of core (mm)				
39.7. 1	Core – 1				
39.7. 2	Core – 2				
39.7. 3	Core – 3				
39.7. 4	Core – 4				
39.7. 5	Core – 5				
39.8	Inside diameter / outside diameter of the cores (mm)				
39.8. 1	Core – 1				
39.8. 2	Core – 2				
39.8. 3	Core – 3				
39.8. 4	Core – 4				
39.8. 5	Core – 5				

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39.9	Weight of the core (kg)				
39.9. 1	Core – 1				
39.9. 2	Core – 2				
39.9. 3	Core – 3				
39.9. 4	Core – 4				
39.9. 5	Core – 5				
40.	SECONDARY WINDINGS				
40.1	Rated secondary current (A)				
40.2	Material of the secondary windings				
40.3.	Size of the secondary conductor [Bare / Insulated] [mm]				
40.3. 1	Core – 1				
40.3. 2	Core – 2				
40.3. 3	Core – 3				
40.3. 4	Core – 4				



40.3. 5	Core – 5				
40.4	Cross sectional area of the secondary conductor (mm <sup>2</sup> )				
40.4. 1	Core – 1				
40.4. 2	Core – 2				
40.4. 3	Core – 3				
40.4. 4	Core – 4				
40.4. 5	Core – 5				
40.5	Current density of secondary windings (A/mm <sup>2</sup> )				
40.5. 1	Core – 1				
40.5. 2	Core – 2				
40.5. 3	Core – 3				
40.5. 4	Core – 4				
40.5. 5	Core – 5				

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40.6	No. of secondary turns				
40.6.	Core – 1				
1					
40.6.	Core – 2				
2					
40.6.	Core – 3				
3					
40.6.	Core – 4				
4					
40.6.	Core – 5				
5					
40.7	No. of layers				
40.7.	Core – 1				
1					
40.7.	Core – 2				
2					
40.7.	Core – 3				
3					
40.7.	Core – 4				
4					
40.7.	Core – 5				
5					
40.8	No. of turns / layer				
40.8.	Core – 1				
1					
40.8.	Core – 2				
2					

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40.8. 3	Core – 3				
40.8. 4	Core – 4				
40.8. 5	Core – 5				
40.9	Average length / turn of secondary windings (mm)				
40.9. 1	Core – 1				
40.9. 2	Core – 2				
40.9. 3	Core – 3				
40.9. 4	Core – 4				
40.9. 5	Core – 5				
40.10	Resistance of the conductor used for secondary winding per meter length at 75 <sup>0</sup> C (Ω/M)				
40.11	Weight of secondary windings (kg)				
40.11 .1	Core – 1				

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40.11 .2	Core – 2				
40.11 .3	Core – 3				
40.11 .4	Core – 4				
40.11 .5	Core – 5				
41	INSULATION				
41.1	Name and class of insulating material between core and secondary winding.				
41.2	Name/s of Insulating materials between secondary winding and primary windings.				
41.3	Insulating materials used to achieve grading of capacitance.				
42.	DIAMETER OF WINDINGS				
42.1	Inside / outside diameter of secondary windings (mm)				
42.1. 1	Inside / outside diameter of secondary windings (mm)				
42.1. 1	Core – 1				

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42.1. 2	Core – 2				
42.1. 3	Core – 3				
42.1. 4	Core – 4				
42.1. 5	Core – 5				
42.2	Inside / outside diameters of primary winding (mm)				
42.3	Minimum clearance from tank (mm)				
42.4	Minimum clearance from secondary to tank (mm)				
43.	TANK AND SECONDARY TERMINAL BOX				
43.1	Material of the CT tank				
43.2	Material of the CT secondary terminal box				
43.3	Thickness of CT tank material (mm)				
43.4	Thickness of CT secondary terminal box material (mm)				
43.5	Zinc coating of the CT tank (gm/m <sup>2</sup> ) as per relevant upto date ISS				

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43.6	Zinc coating of the CT secondary terminal box (gm/m <sup>2</sup> ) as per the relevant upto date ISS.				
43.7	Ingress protection rating of the secondary terminal box.				
43.8	Weight of the tank, fittings and other accessories (kg)				
44.	<b>TERMINAL CONNECTOR</b>				
44.1	Manufacturer's name				
44.2	Applicable standard				
44.3	Type				
44.4	Material of connector				
44.4.1	Clamp body				
44.4.2	Bolts and Nuts				
44.4.3	Spring washers				
44.5	Rated current (Amp)				
44.6	Rated terminal load (Kg)				
44.7	Factor of safety				
44.8	Minimum thickness of any part (mm)				

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44.9	Weight of clamp complete with hardwares (kg)				
44.10	Type test reports as per IS enclosed				
44.11	OGA drawing enclosed				
45.	INSULATOR				
45.1	Manufacturer's name				
45.2	Type				
45.3	Applicable standards				
45.4	Height (mm)				
45.5	Diameter (top) (mm)				
45.7	Total creepage distance (mm)				
45.8.	Rated voltage (KV)				

45.9	Power frequency withstand voltage for 1 min. dry and wet.  (KV – rms)				
45.10	1.2/50 micro-sec impulse withstand voltage (KVP)				
45.11	Corona extinction voltage (KV)				
45.12	Weight (Kg)				
45.13	Maximum allowable span (mm)				
45.14	Cantilever strength (Kg)				
45.15	The drawing enclosed.				
46.	Dielectric dissipation factor at 245/1.732KV (for 220KV C.T) and 145/1.732 KV (for 132 kv C.T.) at ambient temperature.				
47.	Accuracy class of standard C.T. to be used towards determination of ratio errors and phase angle errors for metering cores.				

### **Annexure-19**

The scope of work involves procurement and installation of industrial grade AC's and commercial Split ACs. The following minimum technical particulars shall be provided for industrial grade AC's-

Sl No	Specification	Required Ratings Particulars
1	Tonnage	3 and above
2	Rated Power Supply	1 phase 50HZ
3	Compressor Type	Centrifugal or its equivalent (Reciprocating compressor will not be accepted)
4	Air flow Rate (CFM)	1000 and above
5	Moisture Removal rate(Kg/hr)	4 and above
6	Compressor warranty (Year)	5 and above

-Sd-

**Project Director (AIB), AEGCL**

**MINUTES OF PREBID MEETING FOR PACKAGE P-II-E**

<b>MINUTES OF PRE-BID MEETING HELD ON:</b>	<b>20.02.2026</b>
<b>NAME OF THE PROJECT</b>	<b>ASSAM INTRA-STATE TRANSMISSION SYSTEM ENHANCEMENT PROJECTS, PHASE-II</b>
<b>FUNDING AGENCY</b>	<b>ASIAN INFRASTRUTURE INVESTMENT BANK (AIIB)</b>
<b>NAME OF THE WORK</b>	<b>CONSTRUCTION OF 220/132KV, 2X160 MVA AIS SUBSTATION AT MORIGAON ALONG WITH ASSOCIATED TRANSMISSION LINES, (PACKAGE P-II-E)</b>
<b>BID NO. ICB</b>	<b>AEGCL/MD/AIB/Phase-II/PKG:P-II-E/2026/P-II-E</b>

**OPENING REMARKS:**

Smt Jayashree Devi, Chief General Manager (PP&D), AEGCL extended a warm welcome to all the prospective bidders and introduced his team.

The Chief General Manager (PP&D), AEGCL briefed on the components included in the concerned Package-P-II-E and explained the project's scope and further requested the prospective bidders to table their most prioritized queries. AEGCL assured the prospective bidders that comprehensive reply/clarifications shall be prepared and uploaded in the AEGCL site as well as e-tender portal in response to their raised queries on the bid document.

**NAMES OF TENDER QUERIES FINALIZATION COMMITTEE MEMBERS:**

**1. FROM EMPLOYER:**

1. Smt Jayashree Devi, Chief General Manager (PP&D), AEGCL, Paltanbazar, Guwahati-01.
2. Sri. Ankur Pratim Das, General Manager, EAP, AEGCL, Paltanbazar, Guwahati-01.
3. Sri R. Khargaria, General Manager (P&D), AEGCL, Paltanbazar, Guwahati-01.
4. Sri David Bathary, General Manager Civil, AEGCL, Paltanbazar, Guwahati-01
5. Sri Anjan Jyoti Choudhury, Deputy General Manager-I, EAP, AEGCL, Paltanbazar, Guwahati-01
6. Sri. Rajarshree Sarma, Assistant General Manager EAP, AEGCL, Paltanbazar, Guwahati-01.
7. Sri. Mithun Aich, Assistant General Manager IT, AEGCL, Paltanbazar, Guwahati-01.
8. Sri Dinanath Prasad, Assistant General Manager Civil, AEGCL, Nagaon.
9. Sri Prantik Saikia, Assistant General Manager, P&D, AEGCL
10. Sri Joydeep Suklabaidya, Deputy Manager, P&D, AEGCL.
9. Sri Dibyajyoti Baruah, Social Safeguard Specialist, PMU, AEGCL.

**2. FROM PROJECT MANAGEMENT CONSULTANT, M/s WAPCOS**

1. Sri Satish Baudhiyal, Team Leader
2. Sri Tezbir Singh, Financial Expert

**3. FROM PROSPECTIVE BIDDERS:**

**A. BIDDERS THAT WERE PRESENT AT THE PRE-BID MEETING :**

1. Mr. Moidul Islam, (Tender), M/s Hemen Deka.Guwahati
2. Mr. Topojyoti Das, Manager BD, M/s Universal MEP Projects & Engineering Services Ltd. (UMPESL), Kolkata.
3. Mr Sudesh Sachan, Assistant Mananger Projects and Kumar Sanu Dey,Sr Engineer Projects, M/s RS Infra Project Ltd
4. Mr. Indrajit Saha,DPM and Mr. Shibnath Chatterjee, AGM, Lumino Industries Ltd, Kolkata .
5. Mr. Amit Kumar Jain, M/s JAKSON, (Through VC mode)
6. Mr. Monomoy Chakroborty, M/s Techno Electric and Engineering Ltd (Through VC mode)

**B. Bidders that submitted queries but did not attend the pre-bid meeting:**

1. Mr Kaushik Patni, M/s HiTech Corporation Ltd, Guwahati.
2. Mr Harshabandhan Singh, M/s Shiva Enterprises, UP

**QUERIES ON BID DOCUMENT (INSTRUCTIONS TO BIDDERS, BDS, GENERAL CONDITIONS, PC ETC.)**

**TABLE-1(A): VOLUME-1**

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
<b>Section 2: Tender Data Sheet</b>					
1	ITT 21.1	Tenderer shall furnish a Tender security in the amount of ₹ 4.5 Crores (Rupees Four Crore Fifty Lakhs) in the in the form of Bank Guarantee/RTGS/DD/FIXED DEPOSIT from Nationalised Bank (India)in favour of ASSAM ELECTRICITY GRID CORPORATION LIMITED, AEGCL payable at Guwahati, Assam	As per the guidelines issued by the Ministry of Finance, Government of India, Insurance Surety Bonds are permitted. Many Government organizations are accordingly accepting the same in lieu of Bid Security & Performance Security. we respectfully request you to kindly consider and accept the Insurance Surety Bond towards Performance Security and Bid Security for this tender	No Change. As per bid	
2	ITT 31.2	Successful tenderer shall have to submit all the undertakings in notarized form before signing of the contract. Tenderer should submit hard copy of the Tender Security in a physical envelope one hour prior to tender submission deadline otherwise tender of the tenderer shall not be opened	Please confirm that only hard copy of Tender Security is required to submit one hour prior to tender submission deadline and rest of the documents as required in tender document is required to submit through online.	Yes. Only hard copy of Tender Security is required to submit one hour prior to tender submission deadline and rest of the documents as required in tender document is required to submit through online	
3	ITT 31.2 (x) of TDS	Manufacturer's Authorization Format (MAF)	it is mentioned that MAF should be furnished for major items in non-judicial stamp paper of Rupees 100/- , whereas in Section 4 Manufacturer's Authorization format, it is mentioned that MAF should be furnished in manufacturer's letterhead and should be notarized. So, we understand that a notarized MAF should be provided in manufacturer's letterhead. Kindly confirm. We understand MAF only to be provided for Major Items i.e Power Transformer, Control & Relay panel and SAS & Transmission Line Tower. Kindly Confirm .	MAF should be furnished for Major Items i.e Power Transformer, Control & Relay panel and SAS & Transmission Line Tower in manufacturer's letterhead. However successful bidder after contract signing should submit MAF for major items in non-judicial stamp paper of Rupees 100/-	

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
<b>Section 3: Evaluation and Qualification Criteria</b>					
4	2.3.1	Submission of audited financial statements or, if not required by the law of the Tenderer's country, other financial statements acceptable to the Employer, for the last five (5) (2020-21,2021-22,2022-23,2023-24 and 2024-25) years to demonstrate the current soundness of the Tenderer's financial position	Amend the clause as under:  Submission of audited financial statements or, if not required by the law of the Tenderer's country, other financial statements acceptable to the Employer, for the last five (5) years out of last seven years (2018-19, 2019-20, 2020-21,2021-22,2022-23,2023-24 and 2024-25) to demonstrate the current soundness of the Tenderer's financial position	No Change. As per bid	
5.	2.3.2 Average Annual Turnover	Minimum average annual turnover of ₹ 115 Crore (Rupees One Hundred Fifteen Crore) calculated in terms of the amounts billed to clients for each year for work in progress or completed, within the last five years JV requirement: <b>Each Partner:20% Lead Partner:60%. All partner combine should meet the requirement</b>	A. Amend the JV requirement criteria: i. <b>Each Partner:20% Lead Partner:40%. All partner combine should meet the requirement</b> ii. <b>Each Partner:20% Lead Partner:20%. All partner combine should meet the requirement</b>	No Change. As per bid.	
5	2.3.3 Financial Resources	The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN- 3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of ₹ 20 Crore (Twenty Crore). <b>JV Requirement: Each Partner: 20% Lead Partner:60%. All partner combine should meet the requirement.</b>	The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN- 3, less all the partners' total financial obligations for the current contract commitments defined in FIN-4, meet or exceed the total requirement of ₹ 20 Crore (Twenty Crore). <b>JV Requirement: Each Partner:20% Lead Partner:20%. All partner combine should meet the requirement.</b>	No Change. As per bid.	

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
6	2.4.1 (a): Contracts of Similar Size and Nature : form EXP-1 : PART-A (For 400/220/132 kV Gas Insulated Substation)	The tenderer must have designed, supplied, erected, tested & commissioned including Civil works complete at least One (1) no. AIS/GIS of 220 KV or above voltage class; The above credential shall be from any state/ central power utility and the same should have been in successful operation for at least one year within last 7 (Seven) years as on the originally scheduled date of bid opening.	<p>A. The tenderer must have designed, supplied, erected, tested &amp; commissioned including Civil works complete at least One (1) no. AIS/GIS/<b>Hybrid GIS</b> of 220 KV or above voltage class; The above credential shall be from any state/ central power utility and the same should have been in successful operation for at least one year within last 7 (Seven) years as on the originally scheduled date of bid opening.</p> <p>B. Is this clause is applicable without Design Experience. Bidders may be permitted to fulfill the design requirement through a valid third-party technical tie-up/association agreement with an experienced design agency.</p>	<p>A. No Change. As per bid.</p> <p>B. The eligibility clause is applicable with Design experience also. The bidder if he solely not fulfilling the design experience criteria should have entered into JV agreement with party having required design experience to fulfill the criteria.</p>	
7	2.4.1 (a): Contracts of Similar Size and Nature : form EXP-1 : PART B: (Associated Transmission Lines for 400kV,220kV and 132kV Voltage Level)	The tenderer shall have executed Turnkey contracts involving design, supply, tower foundation, erection and stringing; and shall have: Successfully commissioned at least 10 ckt km of length of 220kV or above voltage level in a single project over a period of last 7 years, The above work should have been under successful operation for a minimum period of one year reckoned from the date of bid submission.	<p>A. We request you to consider the cumulative experience of two works of 132KV and 220KV transmission line for fulfilling the 10ckM length criteria.</p> <p>B. Whether execution of atleast 10ckm of 220kv or above voltage level successfully commissioned and in operation for one year but not executed under a turnkey contract shall be considered eligible? We kindly request that similar works executed on a non turnkey basis covering the required scope and voltage level may also be considered for qualification.</p>	<p>A. No Change. As per bid.</p> <p>B. No Change. As per bid.Only experience of working in turnkey contract shall be eligible for qualification.</p>	
<b>Section 4: Tender Forms.</b>					

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
8		Proposed Subcontractors, Sub-Vendor and/or Manufacturers for Major Items of Plant and Services	It is mentioned that "Tenderers can propose upto maximum of 3 (three) distinct names of reputed subcontractors/sub vendors or manufacturers." We kindly request you to allow us to propose more than 3 subcontractors, enabling us to propose a competitive Bid.	Accepted. Please refer addendum	SI No. 1 (Table 1A)
<b>Section 8: Special Condition of Contract</b>					
9	SCC clause 7	An undertaking to the effect that the spare parts shall be made available to AEGCL by the contractor for a period of ten (10) years should be furnished by the contractor. The undertaking shall be under ought by the contractor executed through non-judicial stamp paper of Rs. 100/- or above to be notarized in India.	We understand that mentioned Under taking is to be provided after signing the contract. Kindly confirm.	Under taking is to be provided after signing the contract	
<b>Section 9: Contract Forms</b>					
10	<b>Appendix 8: Functional Guarantees</b>	As the equipment and materials shall be acceptable only after successful testing as per requirements of the Specification and applicable Standards and Codes as referred to in the Specification, the GCC clause 38.4 shall not be applicable	Appendix 8 is applicable for Functional Guarantees, whereas GCC Clause no. 38.4 refers War Risk. Please review the GCC clause referred in Appendix 8, by replacing the clause 38.4 with Clause 28.4	Addendum issued.	SI no. 2 (Table 1B)

**TABLE-1(B): QUERIES ON TECHNICAL SPECIFICATIONS (VOLUME-2)**

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
1	BOQ 1: Sr no. 64	Instrument Transformers	Provided Technical Specification mentions only 132 KV & 33 KV current Transformers. Please Provide Detail Technical Specification for 220 KV, 132 KV Current transformers & CVT.	Please refer addendum	SI No. 2 (Table 2 B)

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
2	BOQ 1 : Sr no . 57	Outdoor AIS Circuit Breaker	Provided Technical Specification mentions only 132 KV & 33 KV Circuit Breaker . Please Provide Detail Technical Specification for 220 KV, 132 KV Circuit Breaker .	Please refer addendum	SI No. 3 (Table 2 B)
3	BOQ 1 : Sr no . 166	Fire Alarm & Detection including all accessories as per specification	Kindly provide detail Technical Specification for the mentioned Item	Please refer chapter 5 of Volume-2 (Land Development and Civil Works) of bid document	
4	GTP		Kindly share Approved GTP format for all the major Items .	New GTP format added Attached as Annexure A GTP Morigaon (Baghjap) Please refer addendum.	SI No. 4 (Table 2 B)
5	BOQ	Shifting of existing 33KV, 11KV and LT Lines and cables	Is there scope of dismantling and shifting of existing 33KV, 11KV and LT Lines and cables at Baghjap for successful commissioning of the project? If yes where to quote in BoQ	BoQ 5, Item no. 168	
6	BOQ - Sr No . - 119	110V VRLA Battery 600AH	As per BOQ 110 V VRLA Battery is required , but Provided Technical Specification Consists 220 V battery & charger Specification . Please provide 110 V battery & charger Specification.	Refer New Chapter in Addendum	SI No. 7 (Table 2 B)
7	BOQ - Sr No . - 3,4,5,6,7	245 KV & 145 KV Horizontal Double break Isolator	As per BOQ Horizontal Double break isolator is required , whereas in Technical Specification for 220 & 132 Kv isolators are mentioned as Horizontal Centre Break . Kindly confirm Which one is required Centre Break or Double Break?	Refer BoQ	
8	TECHNICAL SPECIFICATION OF CONTROL AND RELAY PANEL	Eligibility of CRP Vendor	Kindly Confirm whether a CR panel Supplier who is not an OEM of Numerical Protective Relays/BCUs but is an authorized partner/VAR of a reputed relay manufacturer and OEM of the Substation Automation System would be acceptable for this project.	As per Bid	
9	TECHNICAL SPECIFICATION FOR 398KV, 198KV, 120KV & 30KV SURGE ARRESTER	CI No 12.6.1	Kindly confirm whether the surge monitor is to be provided with SCADA connectivity for both ammeter and surge counter or only Surge Counter.	As per Bid	
10	SPECIFICATION FOR ACDB & SPECIFICATION FOR DCDB		Kindly provide the following details - A. For DCDB:- 1. Rating and quantities of Incomer, Bus coupler and outgoing feeders. 2. Compartmentalized/ Non-Compartmentalized 3. System voltage	Refer LT AC and LT DC SLD	

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
			B. For ACDB:- (Main ACDB, Sub ACDB, MLDB, ELDB, HVAC DB, MCBDB) 1. Rating and quantities of Incomer, Bus coupler and outgoing feeders. 2. Compartmentalized/ Non Compartmentalized 3. System voltage		
11	TECHNICAL SPECIFICATIONS OF XLPE INSULATED COPPER CONTROL AND POWER CABLE	Chapter - 9 - Clause 9.3.2- Technical parameters- Sr no. (ii)	Packaging - Steel drum packaging , each having single length cable $\geq 500$ metres. (for size less than 1000sqmm). Refer to the above mentioned clause kindly confirm whether the steel drums are returnable or non - returnable.	Returnable	
12			Specification for Insulator Strings 220KV and 132KV	Refer Chapter 43, 44, 45	
13		Clamps & Connectors	Clamps and connectors as per site requirement and EKD	Refer Chapter 41, 42	
14		Station Auxiliary Equipment	1. 440 V MCCB with Power Receiving Panel as per scheme requirement (with structure, if applicable) for 500 kVA Station Service Transformer 2. 33 kV DO Fuse for 500 kVA Station Service Transformer complete with accessories and supporting structures	Shall be shared during detailed engineering	
15		PLCC Equipment	220 kV, 1250 A Wave Trap	Refer Chapter 19	
16		Busbar Monitoring Kit	• 220 kV BMK • 132 kV BMK	Bay Marshalling Kiosk	
17		Instrument Transformers	• 220 kV, 1600-800/1-1-1-1-1 (0.2S-PX-PX-PX-PX), 1-Ph CT for Line Bay • 220 kV, 600-300/1-1-1-1-1 (0.2S-PX-PX-PX-PX), 1-Ph CT for 160 MVA Transformer Bay • 220 kV, 1600-800/1-1 (0.2S-PX-PX-PX-PX), 1-Ph CT for Bus Coupler Bay • 220 kV, 1-Ph Potential Transformer (3 Winding, Accuracy Class 0.2-3P-3P)	Refer Chapter 13 and 23 of Addendum	
18		Fire Protection System	• Hydrant system along with pumping arrangement and associated civil works • HVWS system (automatic emulsifier and manual hydrant point) for 160 MVA ICT – 2 Nos.	Please refer CI 17.42.1. of Vol II and Standard IS codes as per industrial practice.	
19		Auxiliary & Miscellaneous Systems	• Public Address System and CCTV complete with accessories as per specification	Refer chapter 32	

SL NO	Clause No./ Section/ Page No.	Description	Queries	Response	Reference to Sl. No. of Addendum [Table 2] wherever applicable
			<ul style="list-style-type: none"> <li>• Outdoor LED lighting system for approach road, switchyard area, colony area, road area, car parking, security outpost, open store shed, bore well and OHT area, including lighting panels, cabling, street lighting, switches, distribution boards, sockets, auxiliary receptacles and GI poles.</li> <li>• Lightning Protection System including 50 m high lightning masts, lightning spikes, shield wire (7/4 mm GI), down conductors etc. for the complete substation</li> </ul>		
		Transmission Line Portion	<ul style="list-style-type: none"> <li>• Monopole BXA @ 15 m for DD+0</li> </ul>	Design and drawing to be prepared by EPC as per industrial standard codes	
			<ul style="list-style-type: none"> <li>• Monopole BXA @ 20 m for DD+6</li> </ul>		
			<ul style="list-style-type: none"> <li>• Caisson Foundation</li> </ul>		