ANNEXURE-A

TECHNICAL SPECIFICATION FOR 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 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-phaseunits (as said in data sheet), outdoor, **SF6 gas filled** single pressure puffer type(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.

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/m² (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

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:

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 supply for Rangia GIS and 110volts for Nalbari GSS.

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 shal 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.

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

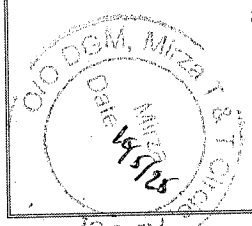
22.6.1. Each pole of the circuit breaker shall be provided with vacuum interrupter, one for each phase, hermetically sealed for life and encapsulated by ceramic insulators. The interrupter shall be provided with steel chromium arc chamber to prevent vaporized contact material being deposited on the insulating 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.

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 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

05/5/26

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 (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.

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:

15/05/25

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

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

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

Sl. No.	Particulars	Unit	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI
1	Type		SF_6	SF_6	VCB
2	No of poles		3 (3 Phase Ganged Unit)	3 (3 Phase Ganged Unit)	3 (3 Phase Ganged Unit)
3	Service		Outdoor	Outdoor	Outdoor
4	Rated System Voltage	kV	132	66	33
5	Highest System Voltage	kV	145	72.5	36
6	System earthing		Solidly earthed system	Solidly earthed system	Solidly earthed system
7	Rated Voltage of Breaker	kV	145	72.5	36
8	Rated Continuous Current	Amps	3150	2000	**2500/2000/1600/1250**
9	Rated Frequency	Hz	50	50	50

05/5/26

Sl. No.	Particulars	Unit	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI
10	Rated Short Circuit breaking current (I) - 3secs - symmetrical	kA RMS	40	**31.5**	31.5
11	Rated Short Circuit making current	kA PEAK	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
13	First pole to clear factor		1.3	1.3	1.3
14	Operating time				
	i) Opening Time	ms	Not exceeding 50 ms	Not exceeding 50ms	Not exceeding 50 ms
	ii) Closing Time D	ms	**Not exceeding** 100 ms	**Not exceeding** **100 ms**	Not exceeding **100 ms**
15	Insulation level i) One minute Power Frequency withstand Voltage (Dry) ii) Full Wave Impulse withstand Voltage (1.2/50 µsec)	kV RMS kV Peak	275 650	140 325	75 170
16	Minimum clearance between phases	mm	1300	630	320
17	Minimum clearance between phase to earth	mm	1300	630	320
18	Minimum Ground clearance (from bottom most live part to plinth level)	mm	4600	3700	3700

Sl. No.	Particulars	Unit	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI
19	Minimum clearance from bottom of support insulator to plinth level	mm	2500	2500	2500
20	i) Minimum Creepage Distance (Total)	mm	4495	2247.5	1116
	ii) Minimum Creepage Distance (Protected)	mm	2250		460
21	Operating mechanism a) Type		Spring Charged	Spring Charged	Spring Charged
	b) Rated 3 Phase, 50Hz Voltage for Drive Motor	V	220AC	220AC	220AC
	c) Rated voltage of Shunt trip coil & operating range	V. DC	220 or110[50% - 110%]	220 or110[50% - 110%]	220 or 110 [50% - 110%]
	d) Rated voltage of Closing coil & operating range	V. DC	220 or 132 [80% - 110%]	220 or 132 [80% - 110%]	220 or 132 [80% - 110%]
	e) No. of trip coils	No	2 per CB	2 per CB	2 per CB
	f) No. of closing coils	No	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 & 2A at 220V/ 110V DC
	h) Minimum thickness of steel sheet for control cabinet	mm	3	3	3
	i) Enclosure Protection		IP55	IP55	IP55

Sl. No.	Particulars	Unit	Data for 132kV CB	Data for 66kV CB	Data for 33 kV CB
I	II	III	IV	V	VI
22	Reclosing		Three Phase auto reclosing	Three Phase auto reclosing	Three Phase auto reclosing
23	Support structure (Painted / Galvanised)		Galvanised	Galvanised	Galvanised
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)
25	Minimum size of control wiring (Copper)	Sq. mm	2.5	2.5	2.5
26	ITRV and TRV of CB interrupter		IEC	IEC	IEC

15/5/14

ANNEXURE-B

TECHNICAL SPECIFICATION FOR 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 worksof 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-III)	Current transformers : Protective Current transformers
(iv)	IS: 2705(Part-IV)	Current transformers: Protective Current transformers for special purpose application.
(V)	**All relevant IEC**	

23.3.0 GENERAL IpREQUIREMENTS

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 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

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.

Mirza Date 15/5/25

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)

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

Date 14/5/25

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

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

15/5/26

23.13.0 TECHNICAL DATA SHEET FOR CURRENT

23.13.1 For **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.

23.14.0 TYPE AND RATING:

23.14.1All 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	
A	Nominal system voltage	132 kV	33 kV	66 kV
B	Highest system voltage, kV	145	36	72.5
C	Rated frequency, HZ	50	50	50
D	System earthing	Solidly earthed	Solidly earthed	Solidly earthed
E	Insulation level			
a)	Full Wave Impulse withstand voltage: kVp (1.2/50)	650	170	325
b)	One-minute p.f. Withstand voltage, kV (r.m.s.) (dry and wet)	275	70	140
F	Short time current for 3 seconds, kA	40	31.5	31.5
G	Minimum creepage distance, mm	4495	1116	2247.5
H	Temperature rise	As per IS	As per IS	As per IS
I	**C.T.**			
	(i) No. of Cores	5	2/5	5
	(ii) Transformation ratio	BoQ		As per
	(iii) Rated out put			
	(a) Core-1	20 VA	20 VA	20 VA
	(b) Core-2	20 VA	20 VA	20 VA
	(c) Core-3	(PX CLASS)	PX (for trafo only)	PX

	(d) Core-4	(PX CLASS)	PX (for trafo only)	PX
	(e) Core-5	(PX CLASS)	PX (for trafo only)	PX
	(iv) Accuracy class			
	(a) Core-1	0.2S	0.2S	0.2S
	(b) Core-2	5P20/PX (trafo)	5P20/PX (trafo)	5P20
	(c) Core-3	PX	PX (for trafo only)	PX
	(d) Core-4	PX	PX (for trafo only)	PX
	(e) Core-5	PX	PX (for trafo only)	PX
	(vi) Instrument security factor			
	(a) Core-1	<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	-	-	-
	(c) Core-3	1:1 of CT ratio min	1:1 of CT ratio min	1:1 of CT ratio min
	(d) Core-4	1:1 of CT ratio min	1:1 of CT ratio min	1:1 of CT ratio min
	(e) Core-5	1:1 of CT ratio min	1:1 of CT ratio min	1:1 of CT ratio min
	(viii) Maximum secondary resistance, ohm			
	(a) Core-1	-	-	-
	(b) Core-2	-	-	-
	(c) Core-3	<3	<3	<3
	(d) Core-4	<3	<3	<3
	(e) Core-5	<3	<3	<3
	(ix) Maximum exciting current, at Vk/4 mA			
	(a) Core-1	-	-	-
	(b) Core-2	-	-	-

Date 15/5/25

	(c) Core-3	-	-	-
	(d) Core-4	-	-	-
	(e) Core-5	-	-	-
	Tandelta at Um/ root 3	< 3	< 3	< 3
	Rated extended primary current	120%	120%	120%

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

Date 15/5/25

ANNEXURE- C

TECHNICAL SPECIFICATION FOR ISOLATORS (AIS)

10.0 TECHNICAL PARTICULARS OF 400 kV, 220 kV, 132 kV & 33 KV ISOLATOR are as follows:

	Type:	400 kV	220 kV	132 kV	66 kV	33 kV
I	II	III	IV	V	VI	VII
1	Main switch	Centre break/Pantograph	Horizontal Centre break	Horizontal Centre Break	Horizontal Centre break	Horizontal Double break
2	Service		Outdoor			
3	Applicable standard		IS : 9921 / IEC-62271-102			
4	No. of Phases		3 phase			
5	Design Ambient temperature		50°C			
6	Type of operation	Electrically Ganged	Mechanically Ganged			
7	Rated voltage (kV)	In KV	In KV	In KV	In KV	In KV
	a) Nominal	400	220	132	66	33
	b) Maximum	420	245	145	72.5	36
8	Rated current (Amps)	4000	3150	2000	1250	1250
9	Short time current for 1sec.(kA)	63	50	40	31.5	31.5
10	Rated frequency		50 HZ ± 5%			
11	System earthing		Effectively earthed			
12	Temperature rise		As per relevant IS/IEC standards			
13	Lightening Impulse withstand voltage (kVp)					
	(a) Across Isolating distance	1425(+240)	1220	750		195
	(b) To earth	1425	1050	650		170
14	1-minute power frequency withstand voltage					
	a) Across Isolating distance	815	605	315		80
	b) To earth	650	460	275		70

	Type:	400 kV	220 kV	132 kV	66 kV	33 kV
I	II	III	IV	V	VI	VII
15	Switching Impulse withstand voltage (kVp)					
	a) Across Isolating distance	900(+345)	-	-		-
	b) To earth	1050	-	-		-
16	Max. RIV for frequency between 0.5MHz and 2MHz (micro-volt)	1000 at 267kV	1000 at 156kV	500 at 92kV		-
17	Corona Extinction Voltage (kV)	320	-	-		-
18	Operating mechanism					
	a) Isolator	Motor	Motor	Motor	Motor	Motor
	b) Earth switch	Motor	Motor	Motor	Manual	Manual
19	Auxiliary voltage					
	a) Control & Interlock		220V DC 80% to 110%			
	b) Motor voltage		3 Phase 415V AC 50Hz			
	c) Heater, lamp & socket		Single phase 240 V 50HZ			
20	Safe duration of overload					
	150% of rated current		5 minute			
	120% of rated current		30 minute			
21	Minimum creepage distance of insulator (mm)					
22	Mounting structure	Tubular / Lattice	Tubular / Lattice	Tubular / Lattice	Tubular / Lattice	Tubular / Lattice
23	Operating time		Less than 12 secs			
24	Insulator Data					
	a) Bending Strength (kgf)	1000	800	800		600
	b) Height (mm)	3650	2300	1500		508
	c) Bottom PCD (mm)	300	254	184	As per IS/IEC	76
	d) No. of holes & hole dia.	8x18	8x18	4x18		4xM12
	e) Top PCD	127	127	127		76

O/o DGM, Mirza T & T Circle
Date 15/5/25

	Type:	400 kV	220 kV	132 kV	66 kV	33 kV
I	II	III	IV	V	VI	VII
	f) No. of holes & hole dia.	4xM16	4xM16	4xM16		4xM12
	g) Minimum creepage distance (mm) 31mm/kV	13020	7595	4495	2248	1116
25	Working clearance (live part to ground) (in mm)	8000	5900	4900	As per IS/IEC	4000
26	Phase Spacing (mm.)	6000	4000	3000		1500
27	Minimum clearances (mm.)					
	a) Phase to Phase	4000	2100	1300		320
	b) Phase to earth	3500	2100	1300		320
	c) Sectional clearance	6500	5000	4000		3000

- **SCOPE**

This specification provides for design, manufacturer, testing at manufacturer's Works and delivery, supervision of erection, commissioning (if required) of outdoor station type 400kV/220KV/132KV/ 33KV, Isolator with/ without earth switches, with electrical/mechanical interlock, insulators and complete in all respect with bimetallic connectors arcing horns operating mechanism, auxiliary switches, indicating devices, fixing detail etc. as described hereinafter.

10.1 STANDARDS

Disconnecting switches covered by this specification shall conform to latest edition IEC-129/IEC 62271-102 I.S.1813 and IS: 9921, IS-325 and unless specifically stated otherwise in this specification.

10.2 TYPE

The 400,220&132 KV Isolators shall be outdoor type with centre break type/Pantograph type as required [Single(SI)/ Double(DI)] Isolators suitable for electrical as well as manual operation and local/ remote operation; but 33KV Isolators (SI or DI) shall be outdoor type with three phase double break center rotating manual as well as motor operated type with local/remote operation. They shall have crank and reduction gear mechanism.

All Isolators offered shall be suitable for horizontal upright mounting on steel structures. Each pole unit of the multiple Isolators shall be of identical construction and mechanically linked for gang operation.

AS/5/25

Each pole of the Isolator shall be provided with two sets of contacts to be operated in series and the moving contact blades shall rotate in horizontal plane.

The design shall be such that the operating mechanism with the linkages shall be suitable for mounting on any of the outer pole ends without much difficulty and with minimum shifting of parts.

Moving contacts of all isolators shall rotate through 90 deg. from their "fully closed position" to "fully open position so that the break is distinct and clearly visible from ground level.

The Isolators offered by the Bidder shall be designed for Normal rating current for Isolator as follows:

400kV	220kV	132kV	66kV	33kV
4000A	3150A	2000/1600/1250A	2000/1250A	2500/1600/1250A

It should suitable for continuous service at the system voltages specified herein. The Isolators shall be suitable to carry the rated current continuously and full short circuit current of 63/50/40/31.5 KA for 400/220/132/33 KV respectively for 3 second at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage. The Isolators shall be suitable for Isolating low capacitive / inductive currents of 0.7amp at 0.15 power factor. The isolators shall be so constructed that they don't open under the influence of short circuit conditions.

The Isolators and earthing switches are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth. so that de-energized isolator and earth switch also can be manually operated when the parallel

circuit is energized.

10.3 MAIN CONTACTS

All Isolators shall have heavy duty, self-aligning and high-pressure line type **dust-free jaw** contacts made of high conductivity, corrosion resistant, hard-drawn electrolytic copper strips of proper thickness and contact area. Fixed contact should consist of loops of above copper strips suitable for 4000 Amps, 3150 Amps, 2000 Amps, and 1250Amps ratings for 400kV, 220 KV, 132KV and 33KV Isolators respectively. The hard dawn electrolytic copper strips should be silver plated 25micron thickness and fixed contacts should be backed by powerful phosphor bronze/stainless steel springs of suitable numbers. The main contacts should be preferably of tulip type design. However, the thickness and contact area of the contact should conform to the drawing approved during type test. Moving contact with moving arm should be of hard-drawn electrolytic copper of proper thickness and contact area.

These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current of 63/50/40/31.5 KA for 400/220/132/33KV respectively for **3 seconds** without any appreciable rise in temperature. The Isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition.

Fixed guides shall be provided so that even when the blades are out of alignment, closing of the switches, proper seating of the blades in between contacts and adequate pressure to give enough contact surface is ensured. The contact shall be self-cleaning by the wiping action created by the movements of the blades.

The Isolator shall be self-cleaning type so that when isolators remain closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests, contacts and springs shall be designed so that adjustment of contact pressure shall not be necessary throughout the life of the isolator. Each contact or part of contacts shall be independently sprung so that full pressure is maintained on all contact at all times.

10.4 ARCING HORN AND GRADING HORN

Suitable arcing horn made of tinned electrolytic copper which are required for guiding contacts shall be provided on the fixed and moving contacts of all Isolators. The contacts shall be of 'make before and break after" type. Aluminium alloy grading ring are to be provided for 220kV and above voltage level.

10.5 ELECTRICAL INTERLOCK / MECHANICAL INTERLOCK

The disconnecting switches whenever required shall be with an approved type electrical interlock for interlocking with the associated circuit breakers and earth switch.

Electrical interlock shall ensure reliable operation. The design should be such that the electrical circuit for the interlocking mechanism **will remain energised as per operation of the isolator with integrated earth switches.**

10.6. AUXILIARY SWITCHES

All isolators and earthing switches shall be provided with 220VDC auxiliary switches for their remote position indication on the control board and for electrical locking with other equipment. The auxiliary switch shall be provided with a minimum of six auxiliary contacts- 10 normally open and 10 normally closed and 10 normally open and 10 normally closed for earth switch. Separate auxiliary switches shall be provided for isolating and earth switches. 6 additional NO and NC contact to be provided as spare in each case.

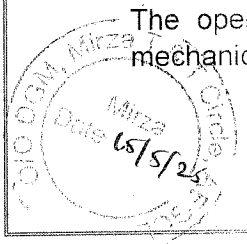
The auxiliary switches and auxiliary circuits shall have a continuous current carrying capacity of at least 10 Amps. Auxiliary switches shall not be used as limit switches. Details of make, rating and type of limit switch shall be furnished in the offer.

10.7 EARTH SWITCH

Line earth switch shall consist of three earthing blades for Isolator which normally rest against the frame when the connected Isolator is in closed position. The earthing blades for three phases shall be mechanically linked to a coupling shaft which shall be capable of being fitted on either side of the Isolator. The earthing blades shall match and be similar to the main switch blades and shall be provided at the hinge; with suitable flexible conductors with terminal lugs for connecting to the station ground bus. The earthing blades shall be operated by a separate mechanism but shall be mechanically interlocked with the main switch so that the earthing blades can be closed only when the main switches are in open position and vice-versa. The earthing blades shall be gang operated and all the three blades will operate simultaneously.

10.8 OPERATING MACHANISM

The operating mechanism shall be simple and shall ensure quick and effective **10000** mechanical operation. The design shall be such as to enable one man to operate it with



nominal effort. The operating mechanism box shall be made out of aluminium extruded (Aluminium alloy) sections of minimum 3.0 mm thickness. The operating mechanism shall be strong rigid and not subject to rebound.

The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be fitted accurately so as to prevent slackness and lost motion.

Provision shall be made for padlocking the operating mechanism of disconnecting and earth switches in both open and closed positions.

Bearings shall be ball and roller type shall be protected from weather and dust by means of cover and grease retainers. Bearings pressures shall be kept low to ensure long life and care of operation.

Each power operated isolator shall be motor driven as well as manually operated and shall be complete with local / remote selector switch and open /close push buttons.

Provision shall be made in the control cabinet to disconnect power supply to prevent local / remote power operation. **Limit switches shall be provided with required number of contacts for isolators and earth switches.**

All the terminal blocks to be used in the operating mechanism should of **Ring type** of Poly-amide/Melamine material of make like Elmex/Connectwell.

10.9 DESIGN, MATERIALS AND WORKMANSHIP

The live parts shall be designed to eliminate sharp points, edges and corona producing surfaces. Where this is impracticable, adequate shields to be provided. All ferrous metal parts shall be hot dip galvanized, as per IS 2629.All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain. All current carrying parts shall be made from high conductivity electrolytic copper .

Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys.

The **isolators** should not need lubrication of any parts except at very long interval of five year minimum.

10.10 PROTECTIVE COATINGS

All ferrous parts including bolts, nuts and washers of the switches assembly shall be galvanized to withstand at least six one minute dips in copper sulphate solution of requisite strength (Prece tests) except the threaded portions which should withstand four dips.

10.11 INSULATORS

Support insulators for all type of isolators shall be of solid core type. The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical

D.G.M, Mirza & Circle, AEGCL
Dated 15/5/20

loading on account of wind load, short circuit, **seismic** forces etc. Glazing of the porcelains shall be of uniform dark brown colour with a smooth surface arranged to shed away raise water. The porcelain shall be free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture. The porcelain and metal ports shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create under internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings. The insulator shall be suitable for water washing by rain or artificial means in service condition. Profile of the insulator shall also conform to IEC-815. Caps to be provided on top of the insulator shall be of high-grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanized. The cap shall have four numbers of tapped holes spaced on a pitch circle diameter of 127mm. The holes shall be suitable for bolts with threads having anti corrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona and shall have radio interference level **as specified in table of Clause 10.0** of Casing shall be free from blow holes cracks and such other defects.

10.12 CONTROL CABINET:

The control cabinet of the operating mechanism shall be made out of minimum 3mm thick aluminium alloy sheet. Hinged door shall be provided with pad locking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gaskets shall be provided to ensure degree of protections of at least IP 55 as per IS 2147/IS-3947. The cabinet shall be suitable for mounting on support structure with adjustment for vertical, horizontal and longitudinal alignment. Details of these arrangements shall be furnished along with the offer.

10.13 MOTOR:

Motors rated 0.5 KW and above shall be **provided with** suitable for operation on 3 phase, 415 V, 50 Hz supply. Motors of lower rating shall be single phase type suitable for 240V, 50Hz system. It shall be totally enclosed type if mounted outside the control cabinet. The motor shall withstand without damage stalled torque for at least 3 times the time lag of the tripping device. The motor shall, in all other respects, conform to the requirement of I.S. 325**. Suitable relay/device shall be provided to prevent over loading of the motor. Single phase preventer (for 3 phase meter) shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished in the offer.**

10.14 GEAR:

The dis-connector / isolator may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gear shall be made out of aluminium bronze or any other better material lubricated for life with graphite or better-quality non-drawing and non-hardening type grease. Wherever necessary automatic relieving mechanism shall be provided.

10.15 SPACE HEATERS:

Space heaters suitable for 1 phase 240V AC supply shall be provided for each motor operated operating mechanism to prevent condensation and shall be operated by MCB.

10.16 TERMINAL BLOCK AND WIRINGS

Each operating mechanism shall be provided with 1100V grade **ring** type terminal block. All auxiliary switches, **spare contact of the contactors**, interlocks and other terminals shall be wired up to terminal block. The terminal block shall have at least 20% extra terminals. All wiring shall be carried out with 1.1KV grade **PVC** insulated 2.5 sq.mm. copper wires.

10.17 INTERIOR ILLUMINATION:

A holder suitable for a 240 V lamp shall be provided in each of the motor operated mechanism of three poles & shall be door operated type.

10.18 CONTROL AND AUXILIARY SUPPLY:

A 3-phase switch with MCB for phases and link for neutral, shall be provided for power supply and a 2 pole MCB shall be provided for control supply.

10.19 POSITION INDICATOR:

A position indicator to show the isolator is in ON or OFF position to be provided.

10.20 NAME PLATE:

Isolator, earthing switches and their operating devices shall be provided with name plate. The name plate shall be weatherproof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following informations duly engraved or punched on it.

A. Isolator Base

Name: AEGCL

Name of manufacturer –

Order No. –

Type Designation –

Manufacturers serial No. –

Rated voltage –

Rated normal current –

Rated short time current (rms) and duration –

Rated short time peak current (KAP)

Weight-

Manufacturing Statndard-

B. Earthing Switch

Name: AEGCL

Name of manufacturer –

14/5/24

Order No. –

Type Designation –

Manufacturers serial No. –

Rated voltage –

Rated normal current –

Rated short time current (rms) and duration

Rated short time peak current (KAP)

Weight

C. Operating Device

Name – AEGCL

Name of manufacturer –

Order No.

Type Designation –

Reduction gear ratio –

AC motor

i) Rated auxiliary voltage

ii) Starting current

iii) Designation of AC motor as per IS 4722/325

iv) Starting torque at 80% of supply voltage

v) Over travel in degrees after cutting off supply

Total operating time in seconds

i) Close operation – Electrical

ii) Open operation – electrical

iii) Open operation – manual

10.21 PAINTING GALVANIZING AND CLIMATE PROOFING:

At interiors and exteriors of enclosures, cabinets and other metal parts (other than made up of aluminium) shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable stoving and air drying before final painting **with epoxy paint.** Colour of the final paints shall be of shade no. 697 of IS:5. The finally painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface.

Paint inside the metallic housing shall be of anti-condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

15/5/25

All components shall be given adequate treatment of climate proofing as per IS:3202 so as to withstand corrosive and severe service conditions.

All metal parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip galvanized as per IS –2629. Galvanization test will be carried out during routine test.

Complete details of painting, galvanizing and climate proofing of the equipment shall be furnished in the offer.

10.22 TESTS:

Type Tests:

Isolators offered, shall be fully type tested as per the relevant standards. The Bidder shall furnish Three sets of the following valid type test reports for their different type of offered Isolators along with the offer. The AEGCL reserves the right to demand repetition of some or all the type tests in the presence of AEGCL's representative. For this purpose, the Bidder may quote unit rates for carrying out each type test and this will be taken during bid price evaluation, if required.

a) short time withstand & peak withstand current test for Isolator & Earth Switch.

b) power frequency (Dry & Wet), Lightening Impulse dry withstand Test

c) Mechanical endurance Test

d) IP-55 test

e) Seismic test

f) Temperature Rise test

During type tests the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure and mounting arrangements shall be furnished for Purchaser's approval before conducting the type tests.

The type tests shall be conducted on the isolator along with approved insulators and terminal connectors. Mechanical endurance test shall be conducted on the main switch as well as earth switch of one isolator of each type.

Acceptance and Routine Test:

All acceptance and routine test as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchaser's representative.

Mechanical operation test (routine test) shall be conducted on isolator (main switch and earth switch) at the supplier's works as well as purchaser's substation site.

Immediately after finalization of the programme of type / acceptance, routine testing the supplier shall give sufficient advance intimation (clear 20 days advance intimation), along with shop routine test certificates, valid calibration reports from Govt. approved **(NABL)** test house for the equipment, instruments to be used during testing for scrutiny by the AEGCL to enable him to depute his representative for witnessing the tests. If there will be any discrepancies in the shop routine test certificates and calibration reports furnished by the firm then after settlement of the discrepancies only, purchaser's representative will be deputed for witnessing the tests. Special tests proposed to be conducted (if decided to conduct) as

type test on isolators, are given at Annexure- II. Thesespecial type test charges shall be quoted along with all other type tests as per relevant IEC standard and these charges shall be included in the total bid price

Test certificates of various items including but not limited to the following shall be furnished at the time of routine tests.

a) Chemical analysis of copper along with a copy of excise certificate indicating genuine source of procurement of electrolytic grade copper.

b) Bearings

c) Fasteners

d) Universal / swivel joint coupling

e) Insulators

f) Motor

g) Gears

h) Auxillary switch

i) Limit switch

j) Timer

k) Overload / single phase preventer relay

l) Interlocking devices

m) Terminal block

n) Any other item

10.23 INSPECTION:

i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the disconnectors, earth switches and associated equipment are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the works raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii) The supplier shall keep the purchaser informed in advance of the time of starting of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

iv) The acceptance of any quantity of the 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 equipment is later found to be defective.

10.24 QUALITY ASSURANCE PLAN:

The Bidder shall invariably furnish following information along with his offer, failing which his offer shall be liable for rejection.

(i) Names of sub suppliers for 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 Supplier's representative, copies of test certificate

(ii) Information and copies of test certificates as in (i) and (ii) above in respect of bought out accessories.

(iii) List of manufacturing facilities available

(iv) Level of automation achieved and lists of areas where manual processing still exists.

(v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

(vi) List of testing equipment with calibration certificates from Govt. approved(NABL) test house available with supplier for final testing equipment and test plant limitation if any, vis-à-vis the type, special acceptance and routine test specified in the relevant standards. These limitations shall be very clearly brought out in the specified test requirements.

(vii) QAP shall include acceptance criteria mentioning clause no. of applicable standard against each parameter.

The supplier shall within 30 days of placement of order, submit following information to the purchaser.

i) List of raw material as well as bought out accessories and the names of sub-suppliers selected from the lists furnished along with offer.

ii) Type test certificates of the raw material and both bought out accessories.

iii) Quality Assurance Plan (QAP) withhold points for purchaser's inspection.

The supplier shall submit the routine test certificates of bought out accessories and raw material viz. Copper, aluminum conductors, lubricating material, gear material etc. at the time of routine testing of the fully assembled isolator.

10.25 DOCUMENTATION:

All drawings shall conform to relevant international standards organization (ISO).. All dimensions and data shall be in S.I. Units.

List of Drawings and Documents

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

a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.

b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components etc.

c) Loading diagram

d) Drawings with structure for the purpose of type tests.

e) Name plate.

f) Schematic drawing.

g) Type test reports.

h) Test reports, literature, pamphlets of the bought-out items and raw material.

i) Deviation sheet/compliance sheet if applicable

Six sets of the type test report, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier risk.

The supplier shall within 2 weeks of placement of order submit four sets of final versions of all the above said drawings for AEGCL's approval. The purchaser shall communicate his comments / approval on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for AEGCL's approval within two weeks from the date of comments.

10.26 INSTRUCTION MANUALS:

Fifteen copies of the erection, operation and maintenance manuals in English to be supplied for each type of disconnector one month prior to dispatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the disconnector including but not limited to the following particulars.

(a) Marked erection prints identifying the component parts of the disconnector as shipped with assembly drawings.

(b) Detailed dimensions and description of all auxiliaries.

(c) Detailed views of the insulator stacks, metallics, operating mechanism, structure, interlocks, spare parts etc.

10.27 PACKING AND FORWARDING:

The equipment shall be packed in crates suitable for vertical / horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols.

Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information:

(a) Name of the consignee.

(b) Details of consignment.

(c) Destination.

(d) Total weight of consignment.

(e) Handling and unpacking instructions.

(f) Bill of material indicating contents of each package.

The supplier shall ensure that the bill of material is approved by the purchaser before dispatch.

10.28 SUPERVISION OF ERECTION TESTING AND COMMISSIONING (ET&C):

Purchaser proposes to utilize the services of the supplier for supervision of testing and commissioning of the equipment being supplied by him, if it is required. For this purpose, the supplier should make available the services of trained personnel (Engineers) who shall correct in the field, any errors or omissions in order to make the equipment and material properly perform in accordance with the intent of this specification. The Engineer shall also instruct the plant operators in the operation and maintenance of the commissioned equipment. The supplier shall be responsible for any damage to the equipment on commissioning the same, if such damage results for the faulty or improper ET&C. Purchaser shall provide adequate number of skilled / semi-skilled workers as well as ordinary tools and equipment and cranes required for equipment erection, at his own expenses. Apart from the above, the Purchaser shall not be responsible for providing any other facilities to the supplier. Special tools if required for erection and commissioning shall be arranged by the supplier at his cost and on commissioning these shall be supplied to the purchaser free of cost for future use.

APPENDIX – I

(Isolators)

LIST OF SPECIAL TESTS TO BE CARRIED OUT IF DECIDED BY THE PURCHASER

Sl. No.	Name of the Test	Standard to which it conforms.
1.	Test for visible Corona and Radio interference voltage (RIV) on disconnectors and terminal	NEMA Pub No. 107-1964 ISRI Pub No. 1-1972
2.	Tests on insulators	IS-2544 IEC. 168
3.	Tests on terminal connectors	IS:5561
4.	Tests on galvanized components	IS:2633
5.	Stalled torque test on motor operating mechanism	At 110% of supply voltage

5/5/25

ANNEXURE-D

TECHNICAL SPECIFICATION FOR 398KV, 198KV, 120KV & 30KV SURGE ARRESTER

TECHNICAL SPECIFICATION FOR SURGE ARRESTERS FOR 400KV, 220KV, 132KV & 33KV SYSTEMS

12.1.0. SCOPE

12.1.1. **This Section covers the specifications for design, manufacture, testing, transportation delivery at site, erection, and commissioning of class heavy duty, gapless metal (zinc) oxide Surge Arrestors complete with fittings & accessories for 400 kV, 220 kV, 132 kV and 33 kV systems.**

12.2.0. STANDARDS

12.2.1. The design, manufacture and performance of Surge Arrestors shall comply with IS: 15086 Part-4 / IEC: 60099-4 unless otherwise specifically specified in this Specification

12.3.0. GENERAL REQUIREMENT

12.3.1. The surge arrestor shall draw negligible current at operating voltage and at the same time offer least resistance during the flow of surge current. **The surge arrester shall be used in solidly earthed system**.

12.3.2. The surge arrestor shall consist of non-linear resistor elements placed in series and housed in electrical grade porcelain housing of specified creepage distance.

12.3.3. The assembly shall be hermetically sealed with suitable rubber gaskets with effective sealing system arrangement to prevent ingress of moisture.

12.3.4. The surge arrestor shall not operate under power frequency and temporary over voltage conditions but under surge conditions, the surge arrestor shall change over to the conducting mode.

12.3.5. The surge arrestor shall be suitable for circuit breaker performing 0-0.3sec.-CO-3min-CO- duty in the system.

12.3.6. Surge arrestors shall have a suitable pressure relief system to avoid damage to the porcelain
housing and providing path for flow of rated fault currents in the event of arrestor fail ure..

12.3.7. The reference current of the arrestor shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

12.3.8. The Surge Arrestor shall be thermally stable and the bidder shall furnish a copy of thermal stability test with the bid.

12.3.9. The arrestor shall be capable of handling terminal energy for high surges, external pollution and transient over voltage and have low losses at operating voltages.

12.4.0. ARRESTOR HOUSING

12.4.1. The arrestor housing shall be made up of porcelain housing and shall be homogenous, free from laminations, cavities and other flaws of imperfections that might affect the mechanical and dielectric quality. The housing shall be of uniform brown colour, free from blisters, burrs and other similar defects.

Arrestors shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.

12.4.2. The **housing shall be so coordinated that external flashover shall not occur due to application of** any impulse or switching surge voltage up to the maximum design value for arrestor. The arrestors shall not fail due to contamination. The arrester housings shall be designed for pressure relief class as given in Technical Parameters of the specification.

12.4.3. Sealed housings shall exhibit no measurable leakage.

12.5.0. FITTINGS & ACCESSORIES

12.5.1. The surge arrestor shall be complete with insulating bases, fasteners for stacking units together, surge counters with leakage current meters and terminal connectors.

12.5.2. The terminals shall be non-magnetic, corrosion proof, robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The top metal cap and base of surge arrestor shall be galvanized. The line terminal shall have a built-in clamping device which can be adjusted for both horizontal and vertical takeoff.

12.5.3. Grading corona control rings if necessary, shall be provided on each complete arrestor pole for proper stress distribution.

12.6.0. SURGE MONITOR

12.6.1. A self-contained discharge counter suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit. Leakage current meter with scale range **of 0 to 5mA peak/root 2 to** measure leakage current of surge arrestor shall also be supplied within the same enclosure. The number of operations performed by the arrestor shall be recorded by a suitable non-resettable cyclometric counter and surge monitor shall be provided with an inspection window. There shall be a provision for putting ammeter to record the current/alarm contacts suitable for communication to SCADA in the control room if the leakage current exceeds the permitted value. Similar provision shall be considered for surge counter also.

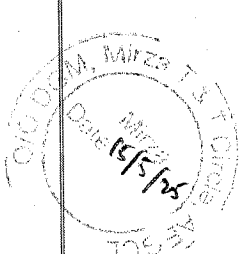
12.6.2. Surge monitor shall be mounted on the support structure at a suitable height so that the reading can be taken from ground level through the inspection window and length of connecting leads of **minimum 5kV rating** up to grounding point and bends shall be minimum.

12.7.0. TESTS

12.7.1. **Test on Surge Arrestors**

The Surge Arrestors offered shall be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 15086 (Part-4). In addition, the suitability of the Surge Arrestors shall also be established for the following:

- Residual voltage test
- Reference voltage test
- Leakage current at M.C.O.V
- P.D. test
- Sealing test



- Thermal stability test
- Aging and Energy capability test
- Watt loss test

Each metal oxide block shall be tested for guaranteed specific energy capability in addition to routine/acceptance test as per IEC/IS.

12.7.2. The surge arrestor housing shall also be type tested and shall be subjected to routine and acceptance tests in accordance with IS: 2071.

12.7.3. Galvanization Test

All Ferrous parts exposed to atmospheric condition shall have passed the type tests and be subjected to routine and acceptance tests in accordance with IS: 2633 & IS 6745.

12.8.0. NAME PLATE

12.8.1. The name plate attached to the arrestor shall carry the following information:

Rated Voltage

Continuous Operation Voltage

Normal discharge current

Pressure relief rated current

Manufacturers Trade Mark

Name of Sub-station

Year of Manufacturer

Name of the manufacture

Purchase Order Number along with date.

Energy Absorption Capability

12.9.0. PRE-COMMISSIONING TESTS

12.9.1. 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) Operation check of LA counters.
(b) Insulation resistance measurement.
(c) Third harmonic resistive current measurement (to be conducted after energisation.)

15/5/26

12.10.0. TYPE AND RATINGS may be read as:

SL No.	Particulars	420 kV	245 kV	145 kV	36 kV
I	II	III	IV	V	VII
1	Rated voltage of arrester, kV	398	216	120	30
2	Continuous operating voltage, kV	267	168	102	25
2	Rated frequency, Hz	50	50	50	50
3	Nominal discharge current of arrester, kA	20	20/10	10	10
4	(i) Min. switching surge residual voltage (2kA),kVp	IEC	IEC	IEC	IEC
	(i) Max. switching surge residual voltage (500 kA),kVp	IEC	IEC	IEC	IEC
5	Maximum residual voltage at,				
	(i) 5 kA nominal discharge current, kV (peak)	IEC	IEC	IEC	IEC
	(ii) 10kA nominal discharge current, kV (peak)	IEC	IEC	IEC	IEC
	(iii) 20kA nominal discharge current, kV (peak)	IEC	IEC	IEC	IEC
	(iv) Steep fronted wave residual voltage, kV (peak)	IEC	IEC	IEC	IEC
6	One minute power frequency withstand voltage of arrester housing, kV (rms)	650	460	275	70
7	1.2 / 50 □ second impulse withstand voltage of arrester housing, kV (peak)	1425	1050	650	170
8	Switching impulse withstand voltage (250/2500 micro second) of arrester housing dry and wet, kV (peak)	1050	-	-	-
9	Creepage distance of insulator housing (mm)	13020	7595	4495	1116
10	Line discharge class	4	3	3	3
11	Short time current rating, kA for 3 sec	63	50	40	31.5
12	Pressure Relief Class	A	A	A	A
13	Minimum cantilever strength (upright)	10kN	8N	6KN	4KN

15/5/25