<table>
<tr><td></td><td></td><td colspan="2">7. The results of the self-reset functions shall be stored in battery back memory.
8. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be available on the user interface. Sequence of events shall have 1ms resolution at device level. Measurement accuracy shall be 1 % for rated RMS Current and voltage. It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.
9. 4-20mA analog output (current signal) for use- in PLC/DCS shall be provided in all breakers. This may be provided as analog output from the Numerical relay or may be generated using a suitable CT & Current transducer. In case analog output is not available in the relay, the same may be achieved using external I/O device of same make complying with the requirement stated elsewhere in this specification.
10. In addition, any other requirement of digital & analog signals for process controls shall be taken care.</td></tr>
<tr><td rowspan="11">22</td><td rowspan="11">Auxiliary Transformer (Oil Type)</td><td>Description</td><td>Rating</td></tr>
<tr><td>Rating</td><td>2500kVA 16000kVA</td></tr>
<tr><td>Voltage Ratio</td><td>11/0.433kV 33/11.5kV</td></tr>
<tr><td>Winding</td><td>2</td></tr>
<tr><td>Nos. of Phase</td><td>3</td></tr>
<tr><td>Vector Group</td><td>Dyn11
Ynyn0</td></tr>
<tr><td>Cooling</td><td>ONAN</td></tr>
<tr><td>Tap Changer</td><td>As per system requirement</td></tr>
<tr><td>Impedance (At 750C)</td><td>As per system requirement
(at principal & other tap)</td></tr>
<tr><td>Noise level</td><td>As per NEMA TR-1</td></tr>
<tr><td>Loading Capability</td><td>At least 20% for HV winding</td></tr>
<tr><td>Flux density</td><td>Flux density Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following overfluxing conditions due to combined voltage and frequency fluctuations:
a) 110% for continuous rating.
b) 125% for at least one minute.</td></tr>
</table>

			c) 140% for at least five seconds.
		CODES AND STANDARDS a) Transformers: IS:2026, IS:6600, IEC:60076, IS 1180 b) Bushings: IS:2099, IEC:60137 c) Insulating oil: IEC:60296 d) Bushing CTs: IS:2705, IEC 60185 Indian Electricity Act 2003, BEE Guideline & CEA notification **Transformer Cooling requirements** 1.The radiators shall be detachable type, mounted on the tank. Each radiator shall be provided with a drain plug/valve at the bottom, an air release plug at the top, shut off valve at each point of connection to the tank. The radiators shall be made of Hot Dipped Galvanized Steel conforming to ISO 12944-5. 2. LT Auxiliary outdoor transformers up to and including 2500KVA, 11kV shall have maximum losses of energy efficiency level 3 rating or better as per latest BEE guideline. The outdoor transformer up to 2500KVA, 11kV shall also comply with latest IS:1180. 3.Transformer type test to be submitted for similar rating for TRAFO approval. Safety: Firefighting system shall be provided as per CEA latest regulations & amendment. **Design and Constructional features tank** 1. Tank shall be of welded construction & fabricated from tested quality low carbon steel of adequate thickness. The main tank body including tap changer, radiators and coolers shall be capable of withstanding full vacuum. 2. Tank shall be provided with suitable lifting lugs, minimum 4 jacking pads & haulage holes for wheeling in all four directions. 3. Transformers shall be mounted on detachable type bi-directional rollers for rail gauge of 1676mm. Suitable locking arrangement shall be provided to prevent accidental movement of transformer. At least two adequately sized inspection openings, one at each end of the tank for easy access to bushings and earth connections & suitable manhole shall be provided. **Core** 1. Core shall be high grade, non-ageing, cold-rolled, super grain-oriented silicon steel laminations known as Hi B grade steels or equivalent. The insulation of core to tank, tank to clamp and clamp to core shall be able to withstand a voltage of 2 KVrms for 1 min in	

		air. To facilitate testing of above during pre-commissioning stage, the core/clamp earthing has to be done outside the tank with suitable bushings. **Insulating oil** 1. No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to the relevant standards. 2. Prior to energization at site for following properties & acceptance norms: a) BDV > 60 KV b) Moisture content < 10 ppm c) Tan delta at 90^0 C 0.05 (max.) d) Interfacial tension 0.035 N/m (min) **Windings** 1. The conductors shall be of Electrolytic grade copper. All Windings of 66kV and below shall have uniform insulation. The contractor shall ensure that windings are made in dust proof & conditioned atmosphere. All windings of HT transformers shall have Thermally upgraded paper covering insulation. Transformer winding paper moisture shall be less than 0.5%. **Oil preservation** 1. Main tank and OLTC (if applicable) shall be provided with conservator tanks of adequate capacity for expansion of oil from minimum ambient to 100 °C. Conventional type conservator with indicating type cobalt free breather (transparent enclosure) shall be offered for transformer below 7.5 MVA. **Bushings** 1. The electrical & mechanical characteristics of bushings shall be in accordance with IS: 2099, IS: 3347 & IS: 12676. 2. Bushings below 52 kV shall with porcelain insulator and shall be of oil communicating / OIP (non-oil communicating type) / epoxy RIP type. All condenser bushings shall be non-communicating type. 3. The oil side shall be provided with tank which can be filled with oil. Tank shall have necessary provision for oil filling, level gauge etc. Suitable covering to be provided on air side to protect from any damage. The arrangement shall be suitable for storage in horizontal/ vertical direction in outdoor location. 4. The oil end dimension of RIP bushing shall be same for all bushings of similar voltage rating. 5. All condenser bushings shall be non-communicating type.

		6. Clamps & fittings shall be of hot dip galvanized steel. 7. Bushing & fittings shall be provided with vent pipes that shall be connected to route any gas collection through the Buchholz relay. 8. No arcing horns shall be provided on the bushings. 9. LV Bushing palm shall be Silver/Tin plated. **Bushing CTs** 1. Shall be of adequate rating for protection as required, WTI etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted. 2. All CT terminals shall be provided as fixed type terminals on the M. Box/CCC/CMB to avoid any hazard due to loose connection leading to CT opening or any other loose connection in power circuit. In no circumstances Plug In type connectors shall be used for CT & Power connection. **Marshalling box** 1. M. Box shall be of stainless steel (SS-316 or better), at least 2.5 mm thick, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. The gasket used shall be of neoprene rubber. Also Marshalling Box gland plate shall be at least 450 mm above ground level. 2. For auxiliary transformer, wiring scheme shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door. 3. TB shall be stud type for all CT & Power connections with ring type lugs. **Valves** 1. All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies with gun metal fittings. 2. Sampling & drain valves should have zero leakage rate. **Gaskets** 1. HT transformers all the gaskets shall be weatherproof & hot oil resistant of 'O' ring of Nitrile rubber for all valves, flanges, HV, LV &

		Neutral Turrets, Bushings, Tank rim, etc. For this, all the flanges shall be machined. If gasket is compressible, metallic stops shall be provided to prevent over compression. 2. The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established. **Neutral Earthing Arrangement** 1. The neutral of Transformers shall be brought through insulated support from tank to the ground level at a convenient point with copper flat, for connection to ground network (as applicable). However, neutral may be connected to NGR as per system requirement. **NGR (Neutral Grounding Resistor) (As per system requirement)** 1. Resistance at 50°C - As per system requirement 2. Rated current - 600A for 10 seconds 3. Application - Neutral Grounding of Transformers as per sys req 4. Service - Outdoor 5. Resistor material & connection - Punched stainless steel grid element type 6. Max allowable temp rise over amb. 50°C - 350 deg. C 7. Mounting - As per system requirement 8. Power frequency level - As per system requirement 9.Stacking Various sections comprising the neutral grounding resistor shall be capable of being stacked one above the other. 10. Enclosure - NGR shall be housed in a 2.5 mm thick sheet steel enclosure & DOP IP-33. A heating circuit with Thermostat to be provided inside the enclosure to control humidity. 11. Mounting Structure - The Contractor shall supply and erect a galvanized structure to support the NGR enclosure so that the base of the enclosure shall be at a minimum height of 2.4M above ground level.

		Fittings Following fittings shall be provided with Transformers, Shunt Reactor & Neutral Grounding Reactor covered under this specification. 1. Conservator for main tank with MOG (with low oil level alarm contact), drain valve & indicating type free Cobalt free breather with transparent enclosure (maximum height 1400 mm above rail level) etc. 2.Buccholz relay (magnetic type), double float type with alarm and trip contacts, along with suitable gas collecting device. Oil surge relay to be provided for OLTC. 3. For 2 MVA & above rating transformer, a minimum two numbers of spring-operated PRD (with trip contacts) with suitable discharge arrangement for oil shall be provided. Armoured cable be used between PRD to Marshalling box. PRD shall have DOP of IP-67. Plugin type connector shall be provided for proper sealing for terminating cables/ glands. 4. OTI & WTI shall be 150 mm dial type with alarm and trip contacts with max. reading pointer & resetting device. (Maximum height 1500 mm above rail level) For HT transformers WTI shall be provided for all windings, also PT-RTD with 4-20 mA signals shall be provided with OTI & WTI of these transformers. 5.Top & bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank. 6. Air release plug, bushing with metal parts & gaskets, terminal connectors on bushings (as applicable) & surge arrestor (as applicable). 7.Prismatic/toughened glass oil gauge for transformers and OLTC chamber. 8.Followings items are as applicable: - Bi-directional wheel & skids, M. Box, OCTC, Bushing CTs, Insulating Oil, Fans, pumps & oil flow indicator, Cooling equipment, Valve Schedule Plate. 9.Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs, additional 4 nos. lifting lugs for bell tank cover, inspection cover, manhole, Bilingual R&D Plate, Terminal marking plates, two earthing terminals etc. 10.Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS. 11.Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.