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STANDARD TECHNICAL SPECIFICATION

FOR

25 KVA THREE PHASE 22 kV/ 433-250V CLASS

DISTRIBUTION TRANSFORMERS

TECHNICAL SPECIFICATION FOR OUTDOOR TYPE DISTRIBUTION TRANSFORMERS OF 22 KV/ 433-250V CLASS 25KVA WITH CRGO METAL CORE/ AMORPHOUS METAL CORE.

1.SCOPE:

1.1 This specification covers design, engineering, manufacture assembly stage, testing, inspection and testing before supply and delivery at stores of oil immersed naturally cooled Three Phase 25 KVA, 22kV/433-250V Distribution Transformer for outdoor use.

1.2 It is not the intent to specify completely herein all the details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to the Bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meaning of drawings and specification and shall have the power to reject / accept any work or material which, in his judgment is there or not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

1.3 Standard Rating:

The Standard Rating shall be 25 KVA.

2.0. STANDARDS:

2.1. The material shall conform in all respects to the relevant Indian/ International Standard specifications, with latest amendments thereof, some of them are listed below.

Indian Standard	Title	International and Internationally recognised standards
ISS - 2026/1977	Specification for Power Transformers	IEC 76
ISS - 1180	Outdoor distribution Transformer up to and including 100 kVA	
ISS- 12444	Specification for Copper wire rod	ASTM B-49
ISS -	Specification for porcelain Transformer bushing	DIN 42531,23,3

3347/1967		
ISS-335/1983	Specification for Transformer Oil	BS 148, D-1473, D-1533-1934 IEC Pub 296-1969
ISS-5/1961	Specification for colors for ready mixed paints	
ISS-2099/1973	specification for high voltage porcelain bushing	
ISS-7421/1974	Specification for Low Voltage bushings	
ISS-3347	Specification for Outdoor Bushings	DIN 42531 to 33
ISS-5484	Specification for Al Wire rods	ASTM B-233
ISS-9335	Specification for Insulating Kraft Paper	IEC 554
ISS-1576	Specification for Insulating Press Board	IEC 641
ISS-6600/1972	Guide for loading of oil Immersed Transformers	IEC 76
ISS-649	Testing of Steel Sheets & Strips for Magnetic Circuits	
ISS-6162 (Part-I&II)	Paper covered Aluminium Conductor	
ISS-10028	Installation, Maintenance of Transformers	
ISS-4257	Dimension for clamping arrangement for bushings (For porcelain and metal parts)	
ISS-6160	Rectangular conductors for electrical machine	
ISS-3401	Silica gel	
ISS-1866	Codes of practice for maintenance & Supervision of Mineral insulating oil in equipment	

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above would also be acceptable. In case the bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English translations shall be furnished along with the offer.

3.0 System details:

The transformers shall be suitable for outdoor installation with 3 phase 50 Hz, 22 KV system in which the neutral is effectively earthed and they should be suitable for service under fluctuations in supply voltage up to plus 10% to minus 15%.

3.1. SERVICE CONDITIONS:

The Distribution Transformers to be supplied against this specification shall be suitable for satisfactory continuous operation under the following climatic conditions as per IS 2026 (Part-I) latest version.

i)	Location	:	At various locations in Gujarat
ii)	Max. ambient air temp. (Deg.C)	:	50
iii)	Min. ambient air temp. (Deg.C)	:	0
iv)	Max. Average daily ambient air temperature (Deg.C)	:	45

v)	Max. yearly weighted average ambient temperature (Deg.C)	40
vi)	Max. altitude above mean sea level (Meters)	1000
vii)	Maximum relative humidity :	0 to 100%
viii)	Average thunder storm days/annum:	15 nos
ix)	Average rainy days per annum:	90 days
x)	Average annual rain fall:	800/900 MM
xi)	Number of months of tropical monsoon:	3 Months

The equipment shall be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth.

4.0. PRINCIPAL PARAMETERS:

The transformers shall be suitable for outdoor installation with three phase, 50 Hz. 22kV System in which the neutral is effectively earthed and they should be suitable for service under fluctuations in supply voltage up to plus 10% to minus 15%.

The transformer shall conform to the following specific parameters.

Sl. No.	Item	Specification
1.	Continuous rated capacity.	25KVA
2.	System voltage (max.)	24 KV
3.	Rated voltage HV	22KV
4.	Rated voltage LV	433V-250V
5.	Line current HV	0.6560A
6.	Line current LV	33.33A
7.	Frequency	50 c/s +/- 5%
8.	No. of phases.	Three
9.	Connection HV	Delta
10.	Connection LV	Star (neutral brought out)
11.	Vector group	Dyn-11
12.	Type of cooling	ONAN
13.	Tap changing arrangement	Not applicable
14.	Noise level at rated voltage and frequency.	45db
15.	Permissible temperature rise over ambient.	
	(i) of top oil measured by thermometer.	35 Deg. C
	(ii) of winding measured by resistance.	40 Deg. C.
15.	Minimum clearances in air of bushing terminals with connectors fitted.	
	a) HV phase to phase/ phase to earth (mm)	330 / 280
	b) LV phase to phase/ phase to earth (mm)	75 / 55
	c) LV phase to neutral (mm)	75
	d) LV phase to neutral (mm)	55

5.0. TECHNICAL REQUIREMENTS:

5.1 MATERIAL - CRGO / AMROPHOUS CORE

a) CRGO Material:

i) The core shall be stacked core type or wound core construction using NEW high grade cold rolled grain annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the frames firmly to prevent vibration or noise. The complete design of core must ensure permanency of the core losses with continuous working of the transformers. The value of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated in the offer.

The bidder should offer the core for inspection and approval by the purchaser during manufacturing stage. Bidder's shall give notice for inspection with the following documents as applicable as a proof towards use of prime core material

- a. Invoice of the supplier
- b. Mills Test Certificate
- c. Packing List
- d. Bill of Landing
- e. Bill of entry certificate to customs

ii) Core Clamping for CRGO Stacked core:

- a. MS Channel shall be used on top and bottom
- b. Core Channel on LV side to be reinforced at equidistance, if holes / cutting is done for LT lead in order to avoid bending of channel.
- c. MS Channels shall be painted with varnish or oil-resistant paint.

iii) The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) upto 12.5% without injurious heating at full load conditions and shall not get saturated. The Bidder shall furnish necessary design data in support of this situation.

iv) The nominal flux density in any part of the core shall not exceed 1.69 Tesla at 1.0 p. u. voltage and 1.9 Tesla at 1.1 p. u. voltage. The vendor shall furnish necessary design data in support of this stipulation.

v) No load current shall not exceed 3% of full load current and will be measured by energizing the transformer at 433 volts, 50 c/s on the secondary. Increase of voltage of 433 volts by 12.5% shall not increase the no load current by Max. 6% of full load current. Test for magnetic balance by connecting the LV phase by phase to rated phase voltage and measurement of an, bn, cn voltage will be carried out

vi) Clamping and Tie-rods shall be made from HT steel & shall be Parkarised

b) AMORPHOUS METAL:

i) The core shall be high quality amorphous ribbons having very low loss formed into wound cores of rectangular shape, bolted together to the frames firmly to prevent vibration or noise. The complete design of core must ensure permanency of the core loss with continuous working of the transformers. The value of the flux density allowed in the design shall be clearly stated in the offer. Curve showing the properties of the metal shall be attached with the offer.

ii) Core Clamping for Amorphous metal Transformers

1. Core clamping shall be with top and bottom U-shaped core clamps made of sheet steel clamped HT steel tie rods for efficient clamping.
2. MS core clamps shall be painted with varnish or oil-resistant paint.
3. MS rods shall be used as tie rods.
4. Suitable provision shall be made in the bottom core clamp / bottom plate of the transformer to arrest movement of the active part.

iii) The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) upto 12.5% without injurious heating at full load conditions and shall not get saturated. The Bidder shall furnish necessary design data in support of this situation.

iv) No load current shall not exceed 2% of full load current and will be measured by energizing the transformer at 433 volts, 50 c/s on the secondary. Increase of voltage of 433 volts by 12.5% shall not increase the no load current by Max. 5% of full load current. Test for magnetic balance by connecting the LV phase by phase to rated phase voltage and measurement of an, bn, cn voltage will be carried out.

5.2. WINDINGS :

5.2.a Materials:- Super enamel covered copper Conductor or Double paper covered copper conductor shall be used for 22 KV class transformer.

5.2.b. Current density for HV and LV shall not be more than 2.5 A/sq.mm. for copper conductor. (However, +5% tolerance for LV winding is permissible)

5.2.c. H.V. Cross Section for Copper conductor shall not be less than

Sr.No.	KVA rating of Transformer	H.V. Cross section of Copper
1	25, 22KV	0.15mm ²

5.2.e L.V. Cross Section Copper conductor shall not be less than

Sr.No.	KVA rating of Transformer	L.V. Cross section of Copper
1	25, 22KV	13.33mm ²

(-5% tolerance is permissible for all rating of transformers)

Note: 1) LV winding shall be in form of even layers so that the neutral formation will be at top.

2) Manufacturer shall provide higher cross sections as required to keep winding & oil Temp. as specified, within limit.

5.2.g. Insulation material & clearances:

5.2.g(i). Materials Electrical grade insulating kraft paper of Triveni/Ballarpur/Cauvery or equivalent make subject to approval of the purchaser shall be used. Similarly Press Board of Senapaty, Whitelay or Raman make or equivalent subject to the approval of the purchaser shall be used. Perma wood / Haldi wood blocks/Press board blocks shall be used for top and bottom yoke insulation.

5.2.g(ii) Radial clearance of LV coil to core (bare conductor) shall not be less than-

Sr.No.	KVA rating of Transformer	Minimum radial clearance of coil to core
1	25, 22KV	3.5mm

5.2.g(iii) Radial clearance between HV & LV shall not be less than-

Sr.No.	KVA rating of Transformer	Minimum radial clearance between HV & LV
1	25, 22KV	14mm

5.2.e(iv) -Phase to phase clearance between HV conductors shall not be less than- 15, for 22 KV class, with a provision of minimum of 2 x 1 mm pressboard to cover the tie rods.

5.2.e(v) The minimum electrical clearance between the winding and body of the tank (between inside surface of the tank and outside edge of the windings) shall be 40 mm for 22KV.

5.2. e(vi) Minimum end insulation to earth shall be- 22 KV class 40 mm.

5.2.g(vii) No. of coils HV/Phase (minimum)-

SR.NO	KVA RATING OF TRANSFORMER	MINIMUM Nos. OF HV COILS PER PHASE for Stack/Conventional Core Type
1	25, 22KV	4

5.2.g (viii) No. of axial wedges between LV and HV winding equi -spaced around up to 25 KVA - 6 Nos. (shall stand for stacked core transformer only)

1. **Material: Super enamel covered copper conductor / DPC Covered copper conductor.**
2. **LV winding shall be in even layers so that neutral formation will be at top.**
3. **The winding construction of single HV coil wound over LV coil is preferable.**
4. **Inter layer insulation shall be Epoxy dotted Craft Paper.**
5. **Proper bonding of inter layer insulation with the conductor shall be ensured. Test for Bonding strength to be conducted.**
6. **Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be within limits as specified in GTP.**

5.2.1 OIL:

The insulating oil shall comply with the requirements of relevant standards IS 335 / 1993 or BS 148 or REC 39/1993 . Oil shall be filled under vacuum of 250 tor +/- 5 %.

5.3 LOSSES: The bidder should guarantee individual No load loss and load loss without any positive tolerance. The bidder should also guarantee the total losses at 50% load condition (50% of rated kVA rating at rated voltage and frequency and at 75 deg centigrade without any positive tolerance.

Voltage Ratio	kVA Rating	No load losses in Watts (Max) for AMT/CRGO	Full load losses in Watts (Max) At 75 Deg. c.
22000/433 - 250 V	25	28/80	615

The above losses are maximum allowable and there would not be any positive tolerance.

Bids with higher losses than the above specified values would be treated as Nonresponsive.

Transformers with losses less than those specified above will be capitalized during bid evaluation as indicated below:

Loss Capitalization factors:

- A. Iron losses - Rs. 175.12 / W.
- B. Copper losses – Rs 56.91/ W.

5.3.1. Percentage Impedance:

KVA Rating	Percentage Impedance.
25, 22 kV	$\leq 4.5\%$

% impedance shall be subject to tolerance specified in IS:2026 - 1977.

Bids not meeting the limits indicated above will be treated as non-responsive

5.3.2 Temperature rise: The temperature rises over ambient shall not exceed the limits described below:

Top oil temperature rise measured by thermometer: 35 deg.C

Winding temperature rise measured by resistance: 40 deg.C

Bids not meeting the above limits of temperature rise will be treated as non-responsive

5.4 PENALTY FOR NON PERFORMANCE:

5.4.1. During testing, if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser will have right to exercise one of the following options

- a) Reject the complete lot
- b) Penalty shall be recovered from the bidder for the excess losses as under

No load loss - @ Rs 395.00 per watt

Load Loss at 100%load - @79.00 per watt

5.4.2. Transformers with temperature rise and impedance beyond guaranteed values:

5.4.2.1.Purchaser reserves the right to reject any transformer during the test at supplier’s works, if the temperature rise exceeds the guaranteed values.

5.4.2.2 Purchaser reserves the right to reject any transformer during the test at supplier’s works, if the impedance values differ from the guaranteed values including tolerance.

5.4.2.3 Purchaser also reserves the right to retain the rejected transformer and take it into service until the Bidder replaces it with a new transformer at no extra cost. The delivery as per contract will be counted when the new transformer as per specification is provided by the manufacture.

5.5 INSULATION MATERIAL :

- a) Material: Electrical grade insulation Kraft Paper of standard make or better material subject to approval of the purchaser. Pressboard of standard make or better material subject to approval of purchaser.
- b) All spacers, axial wedges / runners used in windings shall be made of pre-compressed Pressboard solid, conforming to type B 3.1 of IEC 641-3-2. In case of cross-over coil winding of HV all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges / runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely. Insulation shearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and dimensional variations.

5.6 TANK:

The transformer tank can be with radiator fins/ rounded or elliptical cooling tubes or made of corrugated panels.

For Rectangular plain tank:

- i. The transformer tank shall be of robust construction rectangular in shape and shall be built up of tested MS sheets.
- ii. The internal clearance of tank shall be such that, it shall facilitate easy lifting of core with coils from the tank without dismantling LV bushings.
- iii. All joints of tank and fittings shall be oil tight and no bulging should occur during service. The tank design shall be such that the core and windings can be lifted freely. The tank plate shall be of such strength that the complete transformers when filled with oil may be lifted bodily by means of lifting lugs. Inside of tank shall be painted with varnish / Hot oil.
- iv. Manufacturer should carry out all welding operations as per the relevant ASME standards and submit a copy of the welding procedure qualifications and welder performance qualification certificates to the customer.
- v. The four walls of the tank shall be made of two “L” shaped sheets (without joints) fully welded at the corners from inside and outside of the tank for withstanding a pressure of 0.8 kg/cm² for 10 minutes.
- Top cover plate shall be slightly slopping approx. 10mm towards HV bushing and ends of cover plate shall be bent to 90° downwards so as to avoid entry of water through the cover plate gasket.
- vi. The tank shall be reinforced by welded angle on all the outside walls on the edge of the tank to form two equal compartments. Permanent deflection when the tank without oil is subject to a vacuum of 525 mm of mercury for rectangular tank and 760 mm of mercury for round tank, shall not be more than **5 mm upto 750 mm length and 6 mm upto 1250 mm length. The tank shall further be capable of withstanding a pressure of 0.8 kg/sq.cm (g) and a vacuum of 0.3 kg/sq.cm(g) without any deformation**

vii. The radiators can be tube type or fin type or pressed steel type to achieve the desired cooling to limit the specified temperature rise. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the calculation sheet.

viii. Lifting lugs: 4 Nos. welded heavy duty lifting lugs of MS plate 8 mm thick (min) suitably reinforced by vertical supporting flat welded edgewise below the lug on the side wall.

ix. Pulling lugs: 4 Nos. of welded heavy duty pulling lugs of MS plate 8 mm thick (min) shall be provided to pull the transformer horizontally.

x. Top cover fixing bolts of G.I adequately spaced and 6 mm Neoprene bonded cork gaskets confirming to IS 4253 part-II shall be placed between tank and cover. The bolts outside tank shall have 2 flat washers & one spring washer.

5.6.8. Conservator

On Transformers of all ratings with rectangular plain tank the provision of conservators is obligatory.

When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fixed to the conservator which shall also be provided with a drain plug and a filling hole (1¼" normal size thread) with cover. The capacity of a conservator tank shall be designed to contain 10% of the total quantity of oil and its contraction and expansion due to temperature variations. Normally 3% quality of total oil will be contained in the conservator. In addition the cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

The inside diameter of the pipe connecting the conservator to the main tank should be within 30 to 50 mm and it should be projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to -5 deg C) should be above the sump level.

5.6.9. Breather

Breather shall be screwed type. It shall have die cast aluminum body & further, inside container for silica gel shall be of tin sheet, Volume of Silica gel breather shall be 0.5 Kg. The make and design of breather shall be subject to approval of G.E. Board. Inverted U-shape pipe shall be used for connection of breather.

5.7 SURFACE PREPARATION & PAINTING

5.7.1. General

5.7. 1.1All paints shall be applied in accordance with the paint manufacturer's recommendations. Particular attention shall be paid to the following:

- a) Proper storage to avoid exposure as well as extremes of temperature.
- b) Surface preparation prior to painting.
- c) Mixing and thinning
- d) Application of paints and the recommended limit on time intervals between coats.
- e) Shelf life for storage

5.7.1.2 All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

5.7.1.3 All primers shall be well marked into the surface, particularly in areas where painting is evident, and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to manufacturer's recommendations. However, where ever airless spray is not possible, conventional spray be used with prior approval of purchaser.

5.7.1.4 The Supplier shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.

5.7.2. Cleaning and Surface Preparation

5.7.2.1 After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.

5.7.2.2 Steel surfaces shall be prepared by Shot blast cleaning or Chemical cleaning by Seven Tank process including Phosphating to the appropriate quality.

5.7.2.3 The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirements and shall be sufficiently free from all water contamination to ensure that the cleaning process is not impaired.

5.7.2.4 Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale shall only be used where blast cleaning is impractical. Manufacturer to explain such areas in his technical offer clearly.

5.7.3. Protective Coating

5.7.3.1 As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

5.7.4. Paint Material

Followings are the types of paint that may be suitably used for the items to be painted at shop and supply of matching paint to site:

5.7.4.1 Heat resistant paint (Hot oil proof) for inside surface.

5.7.4.2 For external surfaces one coat of Thermo Setting Powder paint **or** 1 coats of Zinc chromate primer followed by 2 coats of Synthetic Enamel / Polyurethane base Paint These paints can be either air drying or stoving.

5.7.4.3 The color of the finishing coats shall be dark admiral gray confirming to No. 632 of IS-5 of 1961

5.7.5. Painting Procedure

5.7.5.1 All painting shall be carried out in conformity with both Specification and with the paint manufacturer's recommendation. All paints in any one particular system, whether shop or site applied, shall originate from one paint manufacturer.

5.7.5.2 Particular attention shall be paid to the manufacturer's instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, roller, conventional or airless spray and shall be applied under the manufacturer's

recommended condition. Minimum and maximum time intervals between coats shall be closely followed.

5.7.5.3 All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.

5.7.5.4 Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the Supplier shall remove the unsatisfactory paint coating and apply another. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%. In all instances where two or more coats of the same paint are specified, such coatings may or may not be of contrasting colours.

5.7.5.5 Paint applied to items that are not to be painted shall be removed at Supplier's expense, leaving the surface clean, unstained and undamaged.

5.7.6. Damaged Paintwork

5.7.6.1 Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that originally employed.

5.7.6.2 Any damaged paint work shall be made good as follows:

- a) The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.
- b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.
- c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

5.7.7. Dry Film Thickness

5.7.7.1 To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour.

5.7.7.2 Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.

5.7.7.3 Particular attention must be paid to full film thickness at edges.

5.7.7.4 The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as given below.

Sl. No.	Paint Type	Area to be painted	No. of coats	Total film thickness (min.)
1.	Thermo setting paint.	inside outside	01 01	20 microns 60 microns
2.	Liquid paint a)Zinc chromate (Primer)	Outside	01	30 microns

	b)Synthetic Enamel / Poly Urethane (Finish coat)	Outside	02	25 microns each
	c)Hot oil paint / Varnish	inside	01	35 / 10 microns

5.7.8. Tests

5.7.8.1 The painted surface shall be tested for paint thickness.

5.7.8.2 The painted surface shall pass the Cross Hatch Adhesion test, Salt spray test and Hardness test as per the relevant ASTM standards.

NOTE: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

5.8. BUSHINGS:

5.8.1 For 22 KV Transformers - 24 KV class bushings shall be used and further for LV side, viz 433 volts, 1.1KV terminal bushing shall be used. Bushing of the same voltage class shall be interchangeable bushing with plain shed as per IS 3347. Bushings shall be mounted on top plate only. Sheet metal pocket shall be designed in such a way that all HT bushings shall be parallel and maintain equidistance throughout.

The arrangement of bushing at top plate is only acceptable. The HV bushings shall have to be installed on turret, flange and gaskets to prevent eventual entry of water. The turret height should be of 50mm. Radiator shall be provided on both sides on HV and LV sides. Bushings of following makes having type tested as per IS 2099 and approved by the PGVCL shall only be used & are acceptable.

H.V. BUSHINGS:

- 1) JAYASHREE
- 2) BEPCO.
- 3) W.S. INSULATORS
- 4) JAIPUR GLASS
- 5) SESHASAYEE
- 6) LUSTER CERAMICS
- 7) AGRAWAL SALT CO.,BIKANER.
- 8) B.P.P.L., BIKANER.
- 9) VENKATESHWARA CERAMICS P.LTD.
- 10) CJI PORCELAIN INDIA LTD.
- 11) VISHAL MALLEABLE LTD.

L.V. BUSHINGS:

- 1) J.S.I. (RISHRA)
- 2) LUSTER CERAMICS
- 3) JAIPUR GLASS
- 4) AGRAWAL SALT CO., BIKANER.
- 5) B.P.P.L., BIKANER.

- 6) VENKATESHWARA CERAMICS, PVT.,LTD
- 7) CJI PORCELAIN
- 8) MAXWELL CERAMIC, WADHWAN.
- 9) RAVIKIRAN
- 10) VISHAL MALLEABLE LTD.

Note: Embossing on bushing showing the Manufacturer's name shall be clearly visible, even after fixing the same on Transformer.

5.8.2 The bi-metallic connectors shall have to be fitted on HV/LV terminals having capacity of double the size of rated HV/LV current of transformer.

5.8.3 Internal connection:

a) HV winding:

- i) In case of HV winding all jumpers from winding to bushing shall have cross section larger than winding conductor.**
- ii) Inter coil connection shall be done by brazing.**
- iii) In case of CU winding Delta joint shall be with brazing only.**
- iv) Lead from Delta joint shall be connected to bushing rod by brazing only.**

b) LV Winding:

LV star point shall be formed of CU flat of sufficient size and length. Lead from winding shall be connected to the flat by brazing.

Firm connection of LV winding to bushing shall be made of adequate size of "L" shape flat. Connection of LV coil lead to "L" shape flat shall be made by brazing.

"L" shape flat/lug shall be clamped to LV bushing metal part by using nut, locknut and washer.

5.9. Tank Base Channel:

Two numbers of channels of size 75 x 40 mm are to be provided 25 KVA Transformer.

5.10. Terminal markings

High voltage and Low voltage phase windings shall be marked both in the terminal board inside the tank and on the outside with capital letter 1U, 1V, 1W and low voltage winding for the same phase marked by corresponding small letter 2u, 2v, 2w. The neutral point terminal shall be indicated by the letter 2n. Neutral terminal to be brought out and connected to local grounding terminal by an Earthing strip.

5.11 FITTINGS:

The following standard fittings shall be provided.

- a) Rating and terminal marking plates non-detachable
- b) Earthing terminals with lugs - 2 Nos.

- c) Lifting lugs for main tank & top cover
 - d) Terminal connectors on the HV/LV bushings
 - e) Thermometer pocket with cap - 1 No.
 - f) Air release device
 - g) HV bushings - 3 Nos.
 - h) LV bushings - 4 Nos.
 - i) Pulling lugs - 4 Nos
 - j) Stiffener angle 40x40x5 mm and vertical strip of 50x5 mm flat
 - k) Radiators - No. & length may be mentioned (as per heat dissipation calculations)
 - l) Arcing horns for **HV bushings**.
- m) Prismatic Oil level guage indicating the position of oil marked as follows.
- Min. (-5 deg.C)
 - 30 deg. C
 - Max. 90 deg. C
- n) Drain cum sampling valve
 - o) Oil filling hole having p. 1- ¼ " thread with plug and drain valve on the conservator.
 - p) Silicagel breather
 - q) Base channel 75x40 mm **2 Nos to be provided for all rating transformers.**

5.12. FASTENERS:

All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads or the technical equivalent.

Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals. All nuts and pins shall be adequately locked.

Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

All ferrous bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion, by hot dip galvanizing, except high tensile steel bolts and spring washers which shall be electrogalvanised/ plated. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar metals.

Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.

The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

Taper washers shall be provided where necessary.

5.13. MOUNTING ARRANGEMENT:

The under base of all transformers shall be provided with two 75 x 40 mm channels 460 mm long with holes to make them suitable for fixing on a platform or plinth

5.14. OVERLOAD CAPACITY

The transformers shall be suitable for loading as per IS: 6600 / 1972

5.14.1 The inspection of proto type transformer.

The Manufacturer shall have to offer one no of prototype transformer for along with relevant drawing as stated in tender specification clause 17 for approval of PGVCL before offering first lot.

The proto type shall be subjected to following test.

- 1) Verification of CRGO / AMORPHOUS laminations material document and quality.**
- 2) Verification of internal parameters with respect to drawing and GTP.**
- 3) All Routine tests/ acceptance test as per clause 6.1 & 6.4**
- 4) Temperature rise test as per clause no 6.2.(i)**
- 5) Verification of Air pressure test certificate from manufacturer of tank.**
- 6) Unbalanced current test.**

The manufacturer has to submit the following details along with offer of prototype transformers

- i) G.A. Drawing.**
- ii) Internal Construction Drawing.**
- iii) Name plate drawing**
- iv) Technical Details Sheet.**
- v) HT/LV Bi metallic connectors.**
- vi) Drain cum sampling Valve Drawing.**
- vii) Drawing for month & year of manufacture to be written on conservator tank & body.**
- Viii) Core details drawing**
- ix) Short circuit capacity calculation sheet**
- x) Cooling capacity calculation**
- xi) Technical details as per PGVCL's Prescribed Performa for design & constructional details**

The above drawings are illustrative. However, the bidder may submit their own drawing if they so desires. However , offer without drawings shall not be considered. Also each pages of technical bid & price bid shall be provided with seal of manufacturer & duly signed.

5.14.2 GUARANTEE FOR THE TRANSFORMERS;

The suppliers shall have to return guarantee failed Transformers duly repaired and tested as per approved GTP and Tender specifications within 30 Days from the date of receipt at repair shop without any cost, failing which the Bank Guarantee submitted by them shall be encashed without any Notice and all business will be stopped with said supplier at least for a period of 3 Years.

- 1) **Guarantee period shall be 60 months from the date of supply. If any transformer fails during this guarantee period, the supplier shall repair the same at his cost at his works.**
- 2) **The supplier situated outside Gujarat State shall have to establish suitable and adequate arrangement for repairing and testing of failed transformer in Gujarat State at his cost. This arrangement shall have to be continued up to the completion date of guarantee period of supply of last lot.**
- 3) **After intimation of failure of transformer failed within guarantee period, PGVCL will arrange for the dispatch of guarantee period failed transformer to firm's works at the cost of PGVCL. On receipt of guarantee period failed transformer at firm's works, the external inspection will be carried out by the representative of PGVCL not below the rank of Junior Engineer. The cost of any outer component damage not because of supplier's fault and required to be provided will be reimbursed to the supplier as per the approved rate of PGVCL on the strength of joint external inspection report. No. internal inspection of failed unit is to be carried out in presence of representative of PGVCL. However, the supplier may prepare an internal inspection report of failed unit for his study and analysis. If required, such analysis shall be furnished to PGVCL.**

After joint inspection, the failed transformer shall be repaired within one month and the repaired unit duly tested shall be dispatched by supplier at his cost to the concerned consignee from where the failed unit was received along with the test report. If the transformer is not repaired and delivered back or dispatched without complete test report within this period, than the cost of GP failed transformer shall be recovered from the supplier's pending / ensuing bill against the order or any other of order. In case, the supplier does not have further order, the cost of GP failed transformers shall be recovered from the Bank Guarantee furnished. Testing of transformer will be done in presence of Company's Engineer to ensure no change in losses as per GTP after repair. Transformer found with higher losses than GTP will not be accepted and cost thereof will be recovered.

6.0. TESTS:

- a) All the equipment offered shall be fully type tested by the bidder or his collaborator as per the relevant standards including the additional type tests mentioned at clause 6.2.at any Govt. approved lab like ERDA/CPRI. The type test must have been conducted on a transformer of same design. The Bidder shall furnish Four sets of type test reports along with the offer. **Offers without type test reports will be treated as Non-responsive.**
- b) Special tests other than type and routine tests, as agreed between purchaser and Bidder shall also be carried out as per the relevant standards.
- c) The requirements of site tests are also given in this clause.
- d) The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted with the bid.

6.1. ROUTINE TESTS:

1. Ratio, polarity and phase sequence.
2. No Load current and losses at service voltage and formal frequency
3. Load losses at rated current and normal frequency
4. Impedance Voltage test

5. Resistance of windings at each tap, cold(at or near the test bed temp.)
6. Insulation resistance
7. Induced over voltage withstand test.
8. Separate source voltage withstand test.
9. Neutral current measurement
10. Oil samples (one sample per lot) to comply with IS 1866.
11. Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 110% voltage.

6.2 TYPE TESTS TO BE CONDUCTED ON ONE UNIT:

In addition to the Tests mentioned in para 6.1 following Tests shall be conducted.

1. Temperature rise test for determining the maximum temperature rise after continuous full load run. The ambient temperature and time of test should be stated in the test certificate.
2. Impulse voltage test: As per clause 13 (With chopped wave) IS - 2026 part-III latest version. BIL for 22 kV shall be 150 kV Peak.

3. Air Pressure Test: As per C1.22.5 of IS - 1180 / part-I/1989
4. Short Circuit withstand test: Thermal and dynamic ability.
5. Magnetic Balance Test
6. Noise-level measurement
7. Measurement of zero-phase sequence impedance.
8. Measurement of Harmonics of no-load current
9. Pressure relief device test (**if provided**)

10. Transformer tank shall be subjected to specified vacuum. The tank designed for vacuum shall be tested at an internal pressure of 0.35 kg. Per sq.cm. absolute (250 mm of Hg) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the values specified below:

Horizontal length of flat plate (in mm) Permanent deflection (in mm)

Up to & including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.5
2001 to 2250	11.0
2251 to 2500	12.0
2501 to 3000	16.0
Above 3000	19.0

11. Transformer tank together with its radiator and other fittings shall be subjected to pressure corresponding to twice the normal pressure or 0.35 kg / sq.cm. whichever is lower, measured at the base of the tank and maintained for an hour. The permanent deflection of the flat plates after the excess pressure has been released, shall not exceed the figures for vacuum test.

12. The pressure relief device shall be subject to increasing fluid pressure. It shall operate before reaching the test pressure as specified in the above class. The operating pressure shall be recorded. The device shall seal-off after the excess pressure has been released.

Type test certificates for the tests carried out on prototype of same specifications shall be submitted along with the bid.

The purchaser may select the transformer for type tests randomly.

6.3. TESTS AT SITE: The purchaser reserves the right to conduct all tests on Transformer after arrival at site and the manufacturer shall guarantee test certificate figures under actual service conditions.

In order to ensure quality the acceptance test shall be carried out even after installation of transformer within guarantee period. If acceptance test standards are not met during such field test, 5% penalty may be imposed on all transformers supplied as per the proto type design.

6.4. ACCEPTANCE TESTS: The transformers shall be subjected to the following routine/ acceptance test in presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 1180 and IS: 2026.

1. Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP / QA Plan and contract drawings.
2. Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report
3. All tests as specified in clause 6.1

6.5 Inspection & testing of transformer Oil:

The transformer oil to be filled shall be I.S.I. marked confirming to REC Specification 39/1985 (R1993) and I.S. 335/1993 with latest amendments.

The firm has to make arrangement for testing of transformer oil sample taken out from the manufactured transformer in an independent laboratory in presence of PGVCL representative if required.

To ascertain the quality of the transformer oil the original manufacturers' test report shall be submitted at the time of inspection.

The sample of transformer oil filled in prototype will be sent by firm to ERDA for testing as per I.A.S. 1866/1993 with amendment No. 1/1987 latest amendment applicable at the time of testing.

During testing of oil sample at ERDA, if the same passes than only testing charges shall be reimbursed by PGVCL. If it fails then charges will not be reimbursed by PGVCL. Further after replacement/filtering of oil, second oil sample shall be drawn from same transformer at the request of firm in the presence of PGVCL engineer and shall be tested at ERDA at the cost of firm. The testing shall also be witnessed by PGVCL engineer if required. In case of failure of second sample,

the prototype transformer shall be rejected and only after a modification or refilling with proper quality of oil, the same shall be offered by the firm. Any delay on this will be on account of firm.

For bulk supply also similar procedure for oil testing shall be followed, however, the sampling rate of sample shall be 1 number of transformers out of 100 numbers or part thereof for the ordered quantity including repeat order if any.

In case of failure of first oil sample, second oil sample from same/another transformer in the same offered lot, shall be drawn by firm in presence of Inspector of PGVCL at the request of firm after filtration/replacement of oil from all transformers of offered lot and same shall be tested at ERDA at the cost of firm.

The cost of deputing PGVCL Inspector for drawing the second oil sample at firm's works shall be reimbursed by firm of PGVCL.

In the event of failure of second oil sample, the whole lot offered from which sample have been drawn and failed will be rejected.

The supplier shall maintain the register for the oil consumption and for this they have to show the challan or bill of the supplier of oil. The Inspector of PGVCL shall verify the record as well the quantity physically available in the factory at the time of drawing the oil samples and shall put his signature in the register.

6.6 TOLERANCES: Unless otherwise specified herein the test value of the transformers supplied would be within the tolerance permitted in the relevant standards. No positive tolerance is allowed on guaranteed No Load and Load losses.

7.0. INSPECTION:

All tests and inspection shall be made at the place of manufacturer and unless other wise especially agreed upon the manufacturer and the purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge to satisfy him that the material is being furnished in accordance with specification.

The manufacturer shall provide all services to establish and maintain quality of workman ship in his works and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

Along with the bid the manufacturer shall prepare Quality Assurance Plan identifying the various stages of manufacture, quality checks performed at each stage and the Customer hold points. The document shall also furnish details of method of checking, inspection and acceptance standards / values and get the approval of purchaser or his representative before proceeding with manufacturing. However, purchaser or his representative shall have the right to review the inspection reports, quality checks and results of manufacturer's in house inspection department which are not customer hold points and the manufacturer shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection etc. Manufacturer should submit the list of equipment for testing along with latest calibration certificates to the purchaser.

Purchaser shall have every right to appoint a third party inspection to carryout the inspection process. The purchaser has the right to have the test carried out at his own cost by an independent agency wherever the dispute regarding the quality of supply. Purchaser has right to test 1% of the supply

selected either from the stores or field to check the quality of the product. In case of any deviation purchaser have every right to reject the entire lot or penalize the manufacturer, which may leads to blacklisting among other things.

8.0. QUALITY ASSURANCE PLAN:

8.1. The Bidder shall invariably furnish following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.

- i) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in the presence of Bidder's representative, copies of test certificates.
- ii) Information and copies of test certificates as in (I) above in respect of bought out accessories. iii) List of manufacturing facilities available.
- iv) Level of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi) List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall posses 0.1 class instruments for measurement of losses.
- vii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection as per Annexure.

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

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

8.3 The successful Bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

9.0. DOCUMENTATION:

The Bidder shall furnish along with the bid the dimensional drawings of the items offered indicating all the fittings.

- i) Dimensional tolerances
- ii) weight of individual components and total weight

10.0 PACKING & FORWARDING:

10.1 The packing shall be done as per the manufacturer's standard practice. However, it should be ensured that the packing is such that, the material would not get damaged during transit by Rail /Road / Sea.

10.2 The making on each package shall be as per the relevant IS.

11.0 MANADATORY SPARES:

Mandatory spares shall be supplied as per the purchaser's requirement.

12.0 CHALLENGED TESTING:

The other manufacturer can also request challenged testing for any test based on specification and losses. The challenger would request for testing with testing fee. The challenge test fees are proposed at least three time the cost of testing .This is likely to deter unnecessary challenges. The challenger would have the opportunity to select the sample from the store and any such challenge should be made within the guaranty period. The party challenged, challenger and the utility could witness the challenged testing.

The challenged testing would cover the

- 1) Measurement of magnetizing current.
- 2) No load losses test.
- 3) Load losses test (at 50% loading or as per acceptance test).
- 4) Temperature rise test.

The challenged test could be conducted at NABL accredited laboratory, like ERDA and CPRI Bhopal. If the values are within limit the product gets confirmed else not confirmed. No positive tolerance in losses be permitted. If the product is not confirmed the manufacturer would pay the challenge fee and challenger would get the fee refunded. However as a redressal system the challenger would be allowed to ask for fresh testing of two more samples from the store and the same be tested in NABL laboratory in presence of party challenged, challenger and the utility. If any one or both sample does not confirm the test then the product is said to have failed the test. In such cases the manufacturer will be declared as unsuccessful manufacturer for the said product with wide publicity and would not be allowed to compete in tenders of the Company for the period of three years and 10% penalty would be imposed.

13.0. Drawings:

One copy of the dimensional drawing and internal construction drawing of each transformer shall be submitted with the tender. These drawings shall be of A-3 (420 x 297 mm) size only. Format and pattern of the drawings shall be as per specimen drawing attached with the tender specification. Guaranteed and other technical particulars of the transformers as per the A/T shall also be submitted in A-4 size for our approval. In the Performa attached with tender only.

14.0 GTP-. Guaranteed and other particulars for transformers.

To be filled in and submitted by the tenderer in the Performa attached with the tender.

15.0 . Schedule:

15.1 The tenderer shall fill in the following Schedules which from part of the tender specification and offer. In schedule 'A' the specific values shall be furnished and only quoting of IS reference is not sufficient. If the schedule are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule 'A' Guaranteed Technical Particulars (Annexure- I,II & III).

Schedule 'B' Schedule of Deviations from Specification.

Schedule 'C' Schedule of Tenderer's Experience.

Schedule 'D' Schedule of Deviation from specified standards.

Schedule 'E' Schedule of Deviations from specified Test requirements.

15.2. All deviations from the specifications shall be brought out in the schedules of deviation (Schedules 'B','D' & 'E'). The discrepancies between the specification and the catalogues, literatures and indicative drawings which are subject to change, submitted as part of the offer, shall not be considered and representation in this regard will not be entertained. If it is observed that there are deviations in the offer in G.T.P. of elsewhere other than those specified in the deviation schedule 'B' then such deviations shall be treated as deviations.

15.3. For any deviation from the specification, which is not specifically brought out in the schedule of deviations, the offer may be liable for rejection. The deviation brought out in the schedule shall be supported by authentic documents, standards and clarifications, otherwise the offer may be liable for rejection.

15.4. The tenderer shall submit the list of orders for similar type of equipments, executed of under execution during the last three years, with full details in the schedule of Tender's experience (Schedule 'C') to enable the purchaser to evaluate the tender.

16.0 Tender Drawings to be enclosed:

i) G.A. Drawing.

ii) Internal Construction Drawing.

iii) Name plate drawing

iv) Technical Details Sheet.

v) HT/LV Bimetallic connectors.

vi) Drain cum sampling Valve Drawing.

vii) Drawing for month & year to be written on conservator tank & body.

Viii) Core details drawing

ix) Short circuit capacity calculation sheet

x) Cooling capacity calculation

The above drawings are illustrative. However, the tenderer may submit their own drawing if they so desires. The bidder shall submit above details along with offer as well as before offering the prototype transformer.

16.0 AUDIT INSPECTION:

After inspection of ordered transformer by the User Department Inspector, field engineer may pick up samples from the lots supplied at RSOs/ or other stores of the Company or from the works of party, for quality check at random. The samples picked up will be tested for Acceptance Test /Type Tests or the tests as decided by Company, at Government approved laboratory, in presence of representatives of supplier and PGVCL, as per relevant ISS/BIS/PGVCL Specification and GTP, as under:

(i) One number of each rating of transformer shall be picked up at random by field engineer from RSO's / or other stores of the Company or from the works of party and will be tested for Acceptance Tests & Temperature Rise Test.

(ii) One number of each rating of transformer sealed at party's works by field engineer will be tested for (a) Impulse Test (b) Short Circuit Test (c) other Type Tests(if decided by the Company).

As regard bearing test charges,

(i) For transformers picked up for testing from RSOs/ or other stores of the Company or from the works of party, PGVCL will bear total expenses. However, for witnessing the tests, supplier shall have to bear their own expenses.

(ii) For transformers sealed at party's works for Type Tests, if sample passes in all tests, PGVCL will bear only testing charges.

However, if sample fails in any of the tests, cost of testing charges including transportation, loading unloading etc. will have to be paid by supplier. Alternatively, it will be recovered from supplier's bills.

In case, if the materials do not confirm to specifications or fails at Government approved laboratory or other laboratory decided by the Company for testing and if subsequent testings are to be carried out (which will solely at Company's discretion), all Testing fees, expenses of the inspector & other expenses incurred by the Company will be to successful tenderer's account. For acceptance as above, the decision of the Company shall be final & will be binding to successful tenderer.

The test results will be binding on the suppliers. Company in general will not allow re-sampling. If the material fails in any of the acceptance tests carried out (except for no load and load losses), the materials supplied till date will be considered as rejected and if replacement is not possible due to consumption of the materials, Company will deduct penalty @ 5% of the end cost prices of all transformers supplied till date of receipt of failure report. If the same are not utilized / consumed, Company at sole discretion may ask for replacement or may accept the material with penalty as above. For failure in No Load and or Load Losses, transformers supplied till date of receipt of failure report shall be rejected or penalty @ Rs.395.00 per watt for No Load Losses and penalty @ Rs.79.00 per watt for Load Losses for the transformers supplied till date of receipt of failure report shall be charged. The decision of the Company will be binding on the successful tenderer.

In the event of transformer failing during any of the type tests (temperature rise test is part of type test), following recovery shall be made.

Recovery, equivalent to 1% of end cost of particular rating transformers supplied against the order till receipt of test reports.

Further in case, any transformer taken for type testing, fails either in short circuit test or impulse test or temp. rise test, or other type tests (if decided by the Company), supplier will be allowed for modification in their design and other technical parameters. In that case, supplier will have to obtain prior approval from PGVCL for such proposed changes / modifications desired to be effected, by submitting revised drawings and other technical details, clearly indicating the changes proposed to be made, compared to previous design.

In case, if transformers shall fail in testing and same are rejected or accepted with penalty, Company shall pick up another transformer for Acceptance Tests / Type Tests (as the case may be) of same rating from replaced and or subsequently supplied lots for testing to have verification of the quality of other transformers supplied.

In case of any dispute for testing, the Company's decision will be final and binding to the supplier. If supplier will not agree to accept the Company's decision, the order for balance quantity will be cancelled without any clarification and material will be purchased by the Company at risk and cost of the supplier.

The minimum lot to be offered for inspection shall be as under:

- i) At least 33% of each rating or as mentioned in delivery schedule of the order, whichever is less, for the ordered quantity up to 100 Nos.
- ii) Minimum 50 Nos. of each rating or as mentioned in delivery schedule of the order, whichever is less, for the ordered quantity above 100 Nos.

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SCHEDULE -A

ANNEXURE-I

GUARANTEED & OTHER PARTICULARS FOR DISTRIBUTION TRANSFORMERS

(To be furnished by the Manufacturer)

Sr. No.	Description	25 kVA
1.	Make & Manufacturer	
2.	Place of Manufacture	
3.	Voltage Ratio	22000/433V
4.	Rating in kVA	25 KVA
5.	Core Material used and Grade a) Flux density b) Over fluxing without saturation (Curve to be furnished by the Manufacturer in support of his claim)	
6.	Maximum temperature rise of a) windings by resistance method b) Oil by Thermometer	
7.	Magnetising (No load) Current at a) Normal Voltage b) Maximum Voltage	
8.	Core loss in watts a) Normal Voltage b) Maximum Voltage	
9.	Resistance of Windings at 20 deg. c (with 5% tolerance) a. HV Winding (ohms) b. LV Winding (ohms)	

10.	Full load losses (watts) at 75 deg.C. Current density used for
11.	a) HV winding. b) LV winding.
12.	Clearances a) Core & LV b) LV & HV c) HV Phase to Phase d) End insulation clearance to Earth e) Any point of winding to tank
13.	Regulation at a) Unity P.F. b) 0.8 P.F. at 75 deg.C.
14.	% Impedance at 75 deg.C.
15.	Flash Test HV 28 kV / 50 HZ for 1 minute LV 3 kV/50 Hz for 1 minute
16.	Over potential Test Double Voltage & Double frequency for 1 minute
17.	Impulse test value in KV
18.	Weight content of a) Core lamination (min) b) Windings (min) Aluminum./Copper c) Tank & Fittings d) Oil e) Oil qty (min) f) Total Weight
19.	Oil Data 1. Qty for first filling (min) 2. Grade of oil used

	<p>3. Maker's name</p> <p>4. BDV at the time of filling</p>
20.	<p>Transformer:</p> <ol style="list-style-type: none"> 1) Overall length x breadth x height 2) Tank length x breadth x height 3) Thickness of plates for <ol style="list-style-type: none"> a) Side plate (min) b) Top & Bottom plate (min) 4) Conservator Dimensions
21.	<p>Radiation:</p> <ol style="list-style-type: none"> 1) Heat dissipation by tank walls exclusive top & bottom 2) Heat dissipation by cooling tube 3) Dia & thickness of cooling tube 4) Whether calculation sheet for selecting cooling <p>Area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.</p>
22.	<p>Inter layer insulation provided in design for</p> <ol style="list-style-type: none"> 1) Top & bottom layer 2) In between all layer 3) Details of end insulation 4) Whether wedges are provided at 50% turns of the HV coil
23.	<p>Insulation materials provided</p> <ol style="list-style-type: none"> a) For Conductors (1) HV (2) LV b) For Core
24.	<p>Material and Size of the wire used</p> <ol style="list-style-type: none"> 1) HV <ol style="list-style-type: none"> a) SWG/mm b) Dia. 2) LV <ol style="list-style-type: none"> a) Strip size b) No. of Conductors in parallel c) Total area of cross section (sq.mm.)
25.	<p>Is the name plate gives all particulars as required in Tender</p>

26.	Particulars of Bushings HV / LV 1) Maker's name 2) Type IS-3347/IS-1180 3) Rating as per I.S. 4) Dry power frequency voltage withstand test 5) Wet power frequency voltage withstand test
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NOTE: The following shall be specifically confirmed

1. Whether the offer conforms to the limits of impedance mentioned in the specification
2. Whether the offer conforms to the limits of temperature rise mentioned in the specification
3. Whether the losses of the transformers offered are within the limits specified
4. Whether the transformer offered is already type tested for the design and test reports enclosed.

SEAL & SIGNATURE OF THE TENDERER

SCHEDULE -A

ANNEXURE-II

ADDITIONAL DETAILS

Sl.No.	Description	Unit
1.	Core Grade	
2.	Core diameter	mm
3.	Gross Core area	cm
4.	Net Core area	cm
5.	Flux density	Tesla
6.	Wt. of Core	kg.
7.	Loss per kg. of Core at the specified Flux density	
8.	Core window height	Watts
9.	Center to center distance of the core	mm
10.	No. of L.V. Turns	mm
11.	No. of H V turns	
12.	Size of LV Conductor bare/ covered	mm
13.	Size of HV conductor bare/covered	mm
14.	No. of parallels	
15.	Current density of LV winding	amps/sq.mm.
16.	Current density of HV winding	amps/sq.mm
17.	Wt. of the LV winding for Transformer	kg.
18.	Wt. of the HV winding for Transformer	kg.
19.	No. of LV Coils/phase	
20.	No. of HV coils / phase	
21.	Height of LV Windings	mm
22.	Height of HV winding	mm

23.	ID/OD of LV winding	mm
24.	ID/OD of LV winding	mm
25.	Size of the duct in LV winding	mm
26.	Size of the duct in HV winding	mm
27.	Size of the duct between HV & LV	mm
28.	HV winding to LV winding clearance	mm
29.	HV winding to tank clearance	mm
30.	Calculated impedance	%
31.	HV to earth creepage distance	mm
32.	LV to earth creepage distance	mm

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SCHEDULE - A

ANNEXURE-III

SOURCE OF MATERIALS/PLACES OF MANUFACTURE, TESTING AND INSPECTION

Sr. No	Item	Source of Material	Place of Manufacture	Place of testing and inspection
1	Laminations			
2	Copper Conductor/ Aluminum Conductor			
3	Insulated winding wires			
4	Oil			
5	Press Boards			
6	Kraft Paper			
7	MS Plates / Angles / Channels			
8	Gaskets			
9	Bushing HV / LV			
10	Paints			

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SCHEDULE-B

DEVIATIONS FROM SPECIFICATION

SR.NO.	CLAUSE NO.	DETAILS OF DEVIATION

NAME OF FIRM-----

NAME & SIGNATURE

OF TENDERER -----

DESIGNATION -----

DATE -----

SCHEDULE - C

SCHEDULE OF TENDERER'S EXPERIENCE

Sr. No.	Name of Client & Description	Value of order along- with cap. of transformer	Period of supply and commissioning	Name & address to whom reference may be made
1	2	3	4	5

NAME OF FIRM-----

NAME & SIGNATURE

OF TENDERER -----

DESIGNATION -----

DATE -----

SCHEDULE - D

SCHEDULE OF DEVIATION FROM SPECIFIED STANDARDS

Sr. No.	Particulars	Stipulation of specified standards		Stipulation of standard adopted by Tenderers		Remarks
		Standard Ref.	Stipulations	Standard Ref.	Stipulations	

NAME OF FIRM-----

NAME & SIGNATURE

OF TENDERER -----

DESIGNATION -----

DATE -----

SCHEDULE - E

DEVIATION FROM SPECIFIED TEST REQUIREMENTS SPECIFIED IN RELEVANT AND PRESENT SPECIFICATIONS.

Sr. No.	Name of Test	Standard No. and clause no.	Requirement of standards	Proposed deviation	Reason for deviation
1	TYPE TEST				
2	ADDITIONAL TEST				
3	ACCEPTANCE TEST				
4	ROUTINE TEST				

NAME OF FIRM _____

NAME & SIGNATURE
OF TENDERER _____

DESIGNATION _____

DATE _____

QUALITY ASSURANCE PLAN FOR DISTRIBUTION TRANSFORMERS

Scope and Purpose:

This document indicates the requirement expected by the Purchaser from the manufacturer of Transformers. Manufacturer shall submit for purchaser's approval a quality assurance plan in line with this document incorporating specific document numbers for "format of records", "acceptance norms" and "reference documents" for purchaser's approval.

Quality assurance plan is the document setting out the specific quality practices, resources, and sequence of activities relevant to a particular product. Quality plan helps both the purchaser and supplier as it defines each and every material used, every stage of manufacturing process, characteristics to be checked, extent of check, reference documents, acceptance norm and format of record specifically.

Abbreviations:

PS- Plant Standard / Process Specification

TR - Test Report

IS - Indian/ International Standard

CS- Customer Specification

AD - Approved Document such as Drawing, Purchase Order

V- Verified by

P - Performed by

W - Witnessed by

H- Hold by Purchaser

1 - Purchaser

2 - Manufacturer

3 - External laboratory

4 - Sub Vendor QC

Notes:

1. Minor: The characteristics of a component, process or operation whose failure neither materially reduce the usability of the product in operation, nor does it affect the aesthetic aspects.

2. Major: The characteristics of a component, process, or operation whose failure may cause operation failure which cannot be readily corrected, at site cause substandard performance, increase erection and maintenance cost, reduce life or seriously affect aesthetics.

3. Critical: The characteristic of a component, process, or operation failure of which will surely cause operating failure or intermittent troubles which is difficult to rectify at site or render the unit unfit for use or safety hazards.

4. “Failure” of a characteristic means failure to meet the ‘accepted norms’

5. Sampling: Generally sampling will be done in accordance with IS: 2500. Sampling will be as under:-

If 100% “Witness” of tests is carried out by Prime supplier, Customer will witness on sample basis or if 100% “Witness” of tests is carried out by Sub Vendor, Manufacturer will witness on sample basis.

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SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									V	P	W	H	
1	2	3	4	5	6	7	8	9	10				11
<u>RAW MATERIALS</u>													
1.	CRGO coils / Amorphous ribbons	Dimensions	Major	Measurement	100 %								
		Specific losses	Major	Measurement	100 %								
		Chemical Analysis	Major	Measurement	Sample / lot								
		Surface Insulation Resistance	Major	Measurement	100%								
		Transit Damages	Major	Visual	100 %								
		Stacking Factor	Major	Measurement	100 %								
2.	Copper Wire Rods	Tensile strength	Major	Measurement	100 %								
		Elongation	Major	Measurement	100 %								
		Dimensions	Major	Measurement	100 %								
		Transit damages	Major	Visual	100 %								
		Cracks & twists	Major	Visual	100 %								
		Resistivity	Major	Measurement	100 %								
		Chemical Analysis	Major	Measurement	one sample/ Consignment								

	Oil temperature	Major	Measurement	100 %								
	Fixing of accessories & fittings as per drawing	Major	Visual	100 %								
	Leak proofness	Major	Pressure test	Sampling								

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									V	P	W	H		
1	2	3	4	5	6	7	8	9	10				11	
01	<u>INSPECTION & TESTING</u>													
	ROUTINE TESTS	a. Windings Resistance	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2			1	
		b. Voltage Ratio & Voltage vector Relationship	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2			1	
		c. Load loss and Impedance Voltage Measurement	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2			1	
		d. No load loss & No load current	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2			1	
		e. Neutral Current	Critical	Measurement	100 %	CBIP Manual	CBIP Manual	TC	1	2			1	

		Measurement										
		f. Insulation resistance	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2		1
		g. Induced over Voltage test	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2		1
		h. Separate source Voltage with stand tests	Critical	Measurement	100 %	IS 2026	IS 2026	TC	1	2		1
		i. Magnetic balance test	Critical	Measurement	Sampling			TC	1	2		1
02	TYPE TESTS	a. Short circuit test	Critical	Measurement	One / Each Rating	IS 2026	IS 2026	TC		3	1	1
		b. Temperature rise test	Critical	Measurement	One / Each Rating	IS 2026	IS 2026	TC		2	1	1
		c. Lightning Impulse Voltage test	Critical	Measurement	One / Each Rating	IS 2026	IS 2026	TC		3	1	1
		d. Measurement of accoustic noise level	Critical	Measurement	One / Each Rating	IS 2026	IS 2026	TC		2	1	1
		e. Vacuum test	Critical	Measurement	One / Each Rating	IS 1180	IS 1180	TC		2	1	1
		f. Pressure test	Critical	Measurement	One / Each Rating	IS 1180	IS 1180	TC		2	1	1