

North Eastern Electricity Supply Company of Odisha
Limited

SECTION – IV (B)

TECHNICAL SPECIFICATIONS

OF
33/.4 KV 100 KVA DISTRIBUTION TRANSFORMERS

Tender No. : NESCO/DEPOSIT/13

Date: 02.01.13

GROUP- A

TECHNICAL SPECIFICATION OF 33/0.4 KV, 100 KVA Distribution Transformer

1.0 SCOPE :-

This specification covers design, manufacturing, testing and delivery of the 100 KVA, 33/0.433KV, three phase, double wound oil immersed, Oil Natural (ON), outdoor type distribution transformers (conventional type) suitable for out door use as auxiliary transformer in 33/11 KV primary substation.

The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.

1.2 It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements.

1.3 The design and constructional aspects of materials shall not withstanding any anomalies, discrepancies, omissions, in-completeness, etc. in these specifications and will be subject to good engineering practice in conformity with the required quality of the product, and to such tolerances, allowances and requirements for clearances etc. as are necessary by virtue of various stipulations in that respect in the relevant Indian Standards, IEC standards, I.E. Rules, I.E. Act and other statutory provisions.

1.4 The Bidder / supplier shall bind him to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

1.5 Tolerances:

The tolerance of guaranteed performance figures shall be as specified in the (Part-I) table 7 of latest issue of IS 2026 or relevant International Standard except wherever specified otherwise in this specification.

2.0 System Particulars :-

The transformers shall be suitable for outdoor installation with following system particulars and they should be suitable for service under fluctuations in supply voltage as permissible under Indian Electricity Rules.

▪ Nominal System Voltage	:	33Kv	
▪ Corresponding Highest System Voltage	:	36Kv	
▪ Neutral earthing	:	Solidly earthed	
▪ Frequency	:	50Hz with +/- 5% tolerance	
▪ Number of phase	:	3	
▪ Nominal short circuit levels			
33 KV systems	:	25 KA	
11 KV systems	:	12.5 KA	
▪ Insulation levels			
1.2/50 micro sec impulses withstand			
33 KV system	:	170 KV	:
11KV system	:	75 KV	
▪ Power frequency one minute withstand			
33 KV system	:	70 KV	
11 KV system	:	28 KV	
LV system	:	2 KV	

3.0 SERVICE CONDITIONS:

3.1 Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions :-

i.	Max. Ambient air temperature	:	50 Deg.C
ii.	Max. Relative humidity	:	100 %
iii.	Max. Annual rainfall	:	1450 mm
iv.	Max. Wind pressure	:	150kg/sq.m
v.	Max. Altitude above mean sea level	:	1000mtrs.
vi.	Isoceraunic level	:	50
vii.	Seismic level (Horizontal acceleration)	:	0.3g.
viii.	Climatic Condition		Moderately hot and humid tropical climate conducive to rust and fungus growth.
ix.	Reference Ambient Temperature for Temperature rise :		50 Deg C

3.2 The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

4.0 APPLICABLE STANDARDS:-

4.1 The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes.

4.2 The Distribution Transformers shall conform to IS : 2026 as amended up to date or other International Standards for equal or better performance.

4.3 Unless otherwise specified, the equipment offered shall conform to latest applicable Indian, IEC, British or U.S.A. Standards and in particular, to the following :-

a.	IS 2026 (part I,II,IV)/1997, (Part-III)/1981, (Part-V)/1994	Power & Distribution Transformer
b.	IS : 1180 / 1989 (part-1)	Outdoor type, Three phase distribution transformers up to and including 100 KVA, 11KV.
c.	IS : 335 / 1993	New insulating oil – Specification (fourth revision)
d.	IS:2099/ 1986, IS:7421 – 1988, IS:3347 (Part-I/Sec-2)-1979, IS:3347 (part-I/Sec-I) – 1982 Amended up to date	Bushing
e.	IS 5	Colours for ready mixed paints and enamels.
f.	IS 13730 (part – 27) 1996	Specification for particular types of winding wires.
g.	IS : 3073 / 1974, IS : 3070 (Part – II)	Specifications for Lighting Arrestor
h.	CBIP Publication No. 295:2006	Manual on transformers

4.4 In case of conflict arising out due to variations between the applicable standard and the standards

specified herein the provisions of this specification should prevail.

5.0 Specific Technical Requirement :

5.1 Standard KVA Ratings :-

The standard ratings for transformer shall be 100 KVA

5.2 Nominal Voltage Ratings

- i. Primary voltage ; 33KV
- ii. Secondary voltage: 0.433 KV.

5.3 Winding connections :-

- i. H.V. Winding : Delta
- ii. L.V. Winding : Star

The neutral of the L.V. winding shall be brought out to a separate insulated terminal. The voltage group shall be Dyn –11.

5.4 Temperature Rise :

- i. The temperature rise for top oil over an ambient temperature of 50⁰ C should be 40⁰ C maximum (measured by thermometer in accordance with IS 2026 or relevant International Standard). i.e Max. Temp. of top oil shall not exceed 90⁰ C.
- ii. Temperature rise for winding over an ambient temperature of 50⁰ C should be 45⁰ C maximum (measured by resistance method in accordance with IS 2026 or relevant International Standard). i.e. Max. Temp. of winding shall not exceed 95⁰ C.

5.5 No Load Voltage Ratio :-

The no load voltage ratio shall be 33000/433 Volts

6.0 Design & Construction :-

6.1 Co

- i) The core shall be stacked type
 - a) For Stack core :- The core shall be of high grade cold rolled grain oriented (C.R.G.O) annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together to the frames firmly to prevent vibration or noise. All core clamping bolts shall be effectively insulated. The complete design of core must ensure permanency of the core losses with continuous working of the transformers.
 - b) The top yoke shall be one and no cut core shall be accepted in any case.
- ii) The grade of core laminations shall be M4 or better.

The grade of core laminations shall be required to submit the manufacturer's test report showing the watt Loss per kg and the thickness of the core lamination, to ascertain the quality of Core materials.

The purchaser reserves the right to get sample of the core material tested at any Government recognized laboratory.

- iii) The transformer core shall not be saturated for any value of V/f ratio to the extent of 112.5% of the rated value of V/f ration (i.e. 33000/50) (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and will not get saturated. The bidder shall furnish necessary design data in support of this situation.

iv) Flux density :-

Flux density should be less than 1.60 Tesla at the rated voltage and frequency. The value of the flux density allowed in the design shall be clearly stated in the offer along with graph.

- v) The No load current at rated voltage shall not exceed the percentage given bellow.

AT Rated Voltage : 2% of the full load current in LT winding
At 112.5% Rated Voltage : 4% of the full load current

- vi) Number of steps of core shall be minimum of **5(Five)** Standard steps

6.2 Winding:-

- i. Materials : Double paper covered electrolytic Copper conductor shall be used HV and LV winding for 33kv class.
- ii. Current Density: Current density for HV and LV winding should be less than **2.5A/sq.mm** for Copper conductor.
- iii. L.V. Neutral formation shall be at top.
- iv. The stacks of windings are to receive adequate shrinkage treatment.

6.3 Tap Changer (for 100 KVA only)

- i) Tap changing shall be carried out with the transformer off circuit.
- ii) Tap positions shall be numbered as follows:
 - Tap 1 +5%
 - Tap 2 +2.5 %
 - Tap 3 0
 - Tap 4 -2.5%
 - Tap5 -5%
- iii) Provision shall be made for locking of tap switch handle using a padlock.

6.4 Losses:

The Total Losses (No load losses + Load Losses) 100 KVA, 33/0.433 KV and rated voltage shall not exceed the values indicated as below:

KVA	NO LOAD LOSS (W) (Max)	LOAD LOSSES (W) at 75 ^o C (Max)
100	260	1760

No positive tolerance for losses of 33/0.433 kv. Distribution transformers as per IS : 1180 (Part 1) amended upto date. In case the actual loss values exceed the above guaranteed values, the transformers shall be rejected at the risk, cost and responsibility of the supplier.

The values guaranteed in G.T.P. for flux density, no load current at rated voltage, no load current at 112.5% of rated voltage and no load loss at rated voltage shall be individually met.

6.5 Insulation material & clearances:

- i. Materials – Makes of Electrical grade insulating craft paper, precompress Board, Perma wood insulation shall be declared in GTP by the bidder. The test reports for all properties as per relevant I.S. amended up to date shall be submitted during inspection.
- ii. The electrical clearance between the winding and body of the tank (between inside surface of the tank and outside edge of the windings) should not be less than 60 mm for 33 KV class.

Minimum external clearances of bushing terminals

HV	Ph to PH	350 mm
	Ph to E	305 mm
LV	Ph to-Ph	75mm.
	Ph to E	40mm

6.6 Impedance Value –

The percentage impedance at 75^o C. shall be **4.5%** for 100 KVA transformers with positive tolerance of 10%. No negative tolerance on percentage impedance is allowed.

7.0 Tank

7.1 The transformer tank shall be made up of prime quality M.S. sheets of rectangular shape. No other shape will be accepted. The transformer tank shall be of robust construction. All joints of tank and fittings should be oil tight and no bulging shall occur during service. The tank design shall be such that the core and windings can be lifted freely. The tank plates shall be of such strength that the complete transformer when filled with oil may be lifted bodily means of the lifting lugs provided. Tank inside shall be painted by varnish. Top cover plate shall be slightly sloping; approximately 5 to 10 deg. Towards HV bushing and edges of cover plate should be bent downwards so as to avoid entry of water through the cover plate gasket. The width of bend plate shall be 25 mm min. the top cover shall have no cut at point of lifting lug. The rectangular tank shall be fabricated by welding at corners.

7.2 Two „L” shaped sheet shall be jointed at corner only to provide rectangular shape. Horizontal or vertical joints in tank side walls and its bottom or top cover will be not allowed. In addition the cover of the main tank shall be provided with an air release plug.

Side wall thickness : **3.15 mm. (min)**
 Top and bottom plate thickness : **5 mm. (min.)**

7.3 Reinforced by welded angle 40 x 40 x 6 MM on all the outside walls on the edge of tank to form two equal compartments. The permanent deflection is not more than 5 mm up to 750 mm length and 6mm up to 1250 mm length when transformer tank without oil is subject to air pressure of 35 Kpa above atmospheric pressure for 30 min. Pressure test shall be performed carefully at the time of 1st stage inspection only to confirm the adequacy of reinforcement angle and gauge of the tank and certified by inspector.

7.4 All welding operations to be carried out by MIG process.

7.5 Lifting lugs: 4 nos. welded heavy duty lifting lugs of MS plate of 8mm thickness suitably reinforced by vertical supporting flat of same thickness as of lug welded edgewise below the lug on the side wall, up to reinforcing angle. They shall be so extended that cutting of bend plate is not required.

7.6 Pulling lugs: 4 nos. of welded heavy duty pulling lugs of MS plate of 8mm thickness shall be provided to pull the transformer horizontally.

7.7 Top cover fixing bolts: GI nut bolts of 3/8” dia, with one plain washer shall be used for top cover fixing, spaced at 3” apart. 6mm neoprene bonded cork oil resistance gaskets conforming to type B/C IS 4253 Part-II amended up to date will be placed between tank and cover plate.

7.8 Vertical clearance ; - The height of the tank shall be such that minimum vertical clearance up to the top cover plate of 120 mm is achieved from top of tap changer.

8.0 Painting

- 8.1 All 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.
- 8.2 All paints, when applied in normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
- 8.3 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 the manufacturer's recommendations. However, wherever airless spray is not possible, conventional spray be used with prior approval of purchaser.
- 8.4 The supplier shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.
- 8.5 Cleaning and Surface Preparation :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.
- 8.6 Steel surfaces shall be prepared by Sand/Shot blast cleaning or Chemical cleaning by Seven tank process including Phosphating to the appropriate quality.
- 8.7 The pressure and Volume of the compressed air supply for the blast cleaning shall meet the work requirements and shall be sufficiently free from all water contamination prior to any painting.
- 8.8 Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale and shall only be used where blast cleaning is impractical.
- 8.9 Protective Coating : As soon as all items have been cleaned and within four hours of the subsequent drying they shall be given suitable anticorrosion protection.
- 8.10 Paint Material : Followings are the type of paints that may be suitably used for the items to be painted at shop and supply of matching paint to site:
- i) Heat resistant paint (Hot oil proof) for inside surface.
 - ii) For external surfaces one coat of Thermo Setting Paint or 2 coats of Zinc chromate followed by 2 coats of Epoxy paint. The colour of the finishing coats shall be dark admiral Gray (or approved shade) conforming to No.632 or IS 5: 1961.
- 8.11 Painting Procedure : All painting shall be carried out in conformity with both specifications and with the paint manufacture's recommendations. All paints in anyone particular system. Whether shop or site applied, shall originate from one paint manufacturer.
- 8.12 Particular attention shall be paid to the manufacture'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 conditions. Minimum and maximum time intervals between coats shall be closely followed.
- 8.13 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 warm.

- 8.14 Where the quality of film is impaired by excess film thickness,(wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coatings 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 paints are specified, such coatings may not be of contrasting colors.
- 8.15 Paint applied to items that are not to be painted, shall be removed at supplier's expense, leaving the surface clean, un-stained and undamaged.
- 8.16 Damages to Paints Work : Any damage occurring to any part of the painting scheme shall be made good to the same standard of corrosion protection and appearance as that originally employed.
- 8.17 Any damaged paint work shall be made as follows:
- The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
 - A priming coat shall immediately be applied, followed by a full paint finish equal to the originally applied and extending 50mm around the perimeter of the originally damaged.

The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before & after priming.

- 8.18 Dry Film Thickness: To the maximum extent practicable, the coats shall be applied as a continuous film of uniform thickness and free of pores. Over-spray, skips, runs, sags and drips should be avoided. The different coats may or may not be the same colour.

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

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

9.0 Heat Dissipation (Radiator) :

- Heat dissipation by tank walls excluding top and bottom should be 500W / sq.mtr..
- Heat dissipation by fin type (pressed steel) 1.25 mm thick elliptical type/tubular type radiator will be worked out on the basis of manufacturer's data sheet. The tenderer shall submit the calculation sheet with the offer or the offer shall stand rejected.
- Radiators should be fixed at right angle to the sides and not diagonally. The size of the radiator shall be such that it covers at least 50 % of the bottom yoke, full core and complete top yoke.

10.0 Conservator :

- The total volume of conservator shall be such as to contain 10% of total quantity of oil. Normally 3% quantity of the total oil will be contained in the conservator. Dimension of the conservator shall be indicated on the General Arrangement Drawing.
- Oil level indicator shall be provided on the side which will be with fully covered detachable flange with single gasket and tightened with MS nut-bolt.
- The inside diameter of the pipe connecting the conservator to the main tank shall be within 20 to 50mm and it should be projected into the conservator in such way that its end is approximately 20mm above the top of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to (-) 5 deg.) should be above the sump level.
- The pipe from conservator tank connecting to main tank shall be minimum 25mm (min.) dia and shall have a slopping flap so that the oil falling from the pipe shall not fall directly on the active job and shall fall on the side walls only.
- The conservator shall be provided with the drain plug and a filling hole (30 mm dia) with cover.

11.0 Breather :

Breather joints will be screwed type. It shall have die-cast aluminum body or of Poly propylene materials and inside container for silica gel shall be of tin sheet, in case of aluminum die cast breather. Makes of the breather shall be subject to purchaser's approval. Volume of breathers shall be suitable for 250 gm. Of silica gel. The make and design of breather shall be subject to approval of purchaser.

12.0 Terminals :

Brass rods 12mm diameter for HT with necessary nuts, check-nuts and plain thick tinned washer.

13.0 Bushings & Connections :

13.1 For 33 KV class 36KV bushing, shall be used and for 433 volts 1.1 KV bushing shall be used. Bushings of the same voltage class shall be interchangeable. Bushings with plain shed shall be as per relevant IS: 3347 amended up to date. HV bushings shall not be mounted on the top of the transformer tank & LV bushings shall be mounted outside of the transformer tank

13.2 Only continuous sheet metal pocket shall be provided for mounting all HV/LV bushing and **the same shall not be fixed on pipes**. Sheet metal pockets shall be designed in such a way that all H.V. Bushings shall remain parallel and at equal-distance throughout. Bushings having type tested, as per relevant IS amended up to date shall only be acceptable. Bushings on top cover shall not be acceptable.

13.3 HV bushings shall be mounted on curvature shaped embossed plate, in such a way that all H.V. Bushings shall remain parallel and at equal-distance throughout. Bushings having type tested, as per relevant IS amended up to date shall only be acceptable.

13.4 The minimum creep age distance for both HV & LV Bushings shall not be less than 25mm per KV.

14.0 Internal connections :**14.1 H.V. 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 by crimping and brazing.
- iii. Lead from delta joint shall be connected to bushing rod by brazing only.

14.2 L.V. Winding :

- i. L.T. Star point shall be formed of Copper flat of sufficient length & size. Lead from winding shall be connected to the flat by crimping and brazing.
- ii. Firm connections of L.T. winding to bushing shall be made of adequate size of „L” shaped flat. Connection of L.T. Coil lead to „L” shape flat shall be by crimping and brazing. Alternatively „L” shape lug of adequate capacity effectively crimped shall be acceptable.
- iii. „L” shape flat/lug shall be clamped to L.V. Bushing metal part by using nut, lock-nut and washers.
- iv. For copper winding crimping and silver brazing alloy shall be used.

15.0 Tank base channel:

It should be of two numbers of 75mm x 40mm channel for 100 KVA transformers.

16.0 Terminal Marking Plates and Rating Plates :

Terminals shall be provided with terminal marketing plates. The transformer shall be provided with riveted rating plate of minimum 8 SWG aluminum anodized material sheet in a visible position. The entries of the rating plate shall be in indelibly marked (i.e. by etching, engraving or stamping).

Marking as NESCO and „Sr.No.“ of transformer shall be engraved on transformer main tank below L.T. bushings.

The name of the company, order No., capacity, month and year of manufacturing shall be engraved on separate plate which shall be firmly welded to main tank and shall form integral part of the tank. The detail drawings are to submitted by the bidder for approval.

17.0 Fittings:

The fittings on the transformers shall be as under :

1	Rating and diagram plate	1no.
2.	Earthing terminals with lugs	2 no.
3.	Lifting lugs	4 no.
4.	Oil filling hole with cap (on conservator)	1 no.
5.	Drain valve – 20mm for all T/Fs	1no.
6.	Conservator with drain plug.	1 no.
7.	Thermometer pocket	1 no.
8.	Explosion vent	1 no.
9.	Silica gel breather	1no.
10.	Platform mounting channel	2 no.
11.	Oil level gauge indicating 3 positions of oil marked as below :	1 no.
	Minimum (-) 5°C.	
	Normal 30°C	
	Maximum 98° C	
12.	HT & LT bushing	3 nos. of HT bushing with Bi-metallic connector and 4 nos. of LT bushing shall be provided. Each bushing (HV & LV) should be provided with 3 nos. of brass nuts and 2 plain brass washers.
13	Radiators	As per Cl. No. 8 (B,C)
14.	Arcing Horns for HT bushings	HV bushings to be fitted with adjustable duplex arcing horns.
15.	Pulling lugs	4 nos.
16.	Metallic cover spot welded to tank for drain valve shall be provided.	
17	Off load tap changer	1 no (for 100 KVA Only)

18.0 Transformer Oil

Transformer oil to be used in all the Distribution transformers shall comply with the requirements of latest IS 335/1983 amended up to date thereof. In addition the oil should conform to „Ageing Characteristics" specified below for New Oil and Oil in Transformers. Type test certificates of oil being used shall be produced to at the time of stage inspection.

New Oil-Ageing characteristics after accelerated ageing test 96 hrs. at 115 °C (open beaker method with copper catalyst):

- i. Specific Resistance (Resistivity).
 - a) at 20° C :- 2.5×10^{12} Ohm-Cm (Min)
 - b) at 90°C :- 0.2×10^{12} Ohm-Cm (Min)
- ii. Dielectric dissipation factor – 0.20 (Max. tandelta) 1t 90°C.
- iii. Total acidity mg/KOH/gm-0.05 (Max.)
- iv. Total sludge value (%) by weight – 0.05 (Max.)
- v. The method of testing these aging characteristics is given in Appendix – C of IS 335 amended up to date.
- vi. Oil filled in Transformers : The important characteristics of the transformer oil after it is filled in the transformer (within 3 months of filling) shall be as follows:-

Sr. No.	Characteristics	Specifications
1.	Electric Strength (Breakdown voltage)	30 kV (Min)
2.	Dielectric dissipationfactor (Tan Delta) at 90 deg.C.)	0.01 (Max)
3.	Specific Resistance (Resistivity) at 27 deg. C (ohm-cm)	10×10^{12}
4.	Flash Point, P.M. (Closed)	140° C (Min)
5.	Inter facial tension at 27°C	0.03 N/M (Min)
6.	Neutralization value (total acidity)	0.05 Mg. KOH/gm (Max.)
7	Water content PPM	35 (Max.)

19.0 Test and Inspection :-

19.1 Testing facility

- 19.1.1 The bidder should have adequate testing facility for all routine and acceptance tests and also arrangement for measurement of losses, resistance, etc. details of which will be enumerated in the tender.
- 19.1.2 The inspector of the purchaser will witness routine & type tests. In order to facilitate this, the manufacturer shall give a 15 days notice that the material is ready for inspection & testing. The material shall be dispatched only after approval of such test reports and issue of Dispatch clearances by the purchaser. However the purchaser reserves the right to retest the transformers after delivery at any National Accredited Testing Laboratory in case of any disputes regarding guaranteed specifications of supplied transformers at a later date during guarantee period. The cost of such retesting shall be borne by the supplier.

19.2 Routine Tests :-

- i. All transformers shall be subjected to the following routine tests at the manufacturer's works. The tests are to be carried out in accordance with the details specified in IS 2026 or as agreed upon between the purchaser and the manufacturer.
 - a) Measurement of winding resistance.
 - b) Ratio, polarity and phase relationship.
 - c) Impedance voltage.
 - d) Load losses.
 - e) No-load losses and No-load current.
 - f) Insulation resistance.
 - g) Induced over voltage withstand.
 - h) Separate source voltages withstand.
- ii. All the routine tests shall be conducted in the suppliers' laboratory at their cost.

- iii. Heat run test shall be arranged free of cost on the unit selected from the 1st lot by Authorized Representative.
- iv. The calculations to confirm the thermal ability as per Clause no. 9.1 of latest IS: 2026 Part-I or equivalent International Standard shall be submitted to our representative.

19.3 **Type Tests :**

The bidder should submit the report of following tests carried out in a NABL accredited laboratory :-

- a) Temperature Rise Test
- b) Short Circuit Test containing the measured no load loss and load loss.
- c) Impulse Test

The balance type tests as stated below, should be carried at the manufacturer's works invariably in the presence of representative of the purchaser at the time of inspection from the first lot.

- i. Temperature Rise Test.
- ii. Air pressure test as per clause no.22.5 of IS:1180 (Part-I)/1989.
- iii. Unbalanced current test.

In respect of the successful bidder, the purchaser reserves the right to demand repetition of some or all the above tests in presence of the purchaser's representative. In case the unit fails in the type tests or routine tests, the complete lot offered shall be rejected.

19.4 **Submission Routine Test Certificate**

The successful bidder shall submit the routine test certificate along with documentary evidence for having paid the Excise Duty for the following raw materials viz. Oil, Aluminum, copper for conductors, insulating materials, core materials, bushings at the time of routine testing of the fully assembled transformer.

19.5 **Stage Inspection (if applicable)**

19.5.1 Supplier shall give 15 days" advance intimation to the purchase dept. to organize stage inspection in which assembly of core, windings and other core materials etc. would be inspected. In respect of raw materials such as core stamping, winding conductor, oil etc. successful bidder shall use these materials manufactured/supplied by the standard manufacturers and furnish the manufacturer's test certificates, as well as, proof of purchase from those manufacturers documentary evidence for having paid the excise duty for the information of the department. Purchaser will depute his representative at the time of stage inspection.

19.5.2 Total lot will be tested for acceptance tests at factory, in the presence of purchaser's representative before dispatch.

19.5.3 The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representatives at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications and shall not prevent subsequent rejection if the equipment is found to be defective.

19.5.4 The purchaser may at its option, open a transformer supplied to the Stores, in presence of supplier at site or at Stores. If any of the technical particulars are seen to be in variance than the guaranteed technical particulars, the whole lot of transformer will be rejected without any liability on purchaser.

19.5.5 Testing of all Distribution Transformers for no load and full load losses.

After inspection of new transformers at factory for acceptance of the lot, all distribution transformers from the lot will be tested for no load and full load losses at all stores. Bidder has the liberty to be present at the time of testing.

19.5.6 Inspection & testing of Transformer Oil :

The bidder shall make arrangements for testing of transformer oil to be used in the transformers testing will be done in presence of purchaser's representative.

To ascertain quality of transformer oil, original manufacturer's test report should be furnished to (Testing) at the time of factory inspection for acceptance of the lot.

19.6 Rejection :-

Apart from rejection due to failure of the transformer to meet the specified test requirements the transformer shall be liable for rejection on any one of the following reasons.

- i. Losses exceed the specified values mentioned in specification.
- ii. Impedance voltage value exceeds the guaranteed value plus tolerances as per specification.
- iii. Type test are not carried out as per the specification.
- iv. Drawings are not submitted as per the specification.
- v. GTP not submitted as per the specification.
- vi. Heat dissipation calculation sheet are not submitted as per the specification.

19.7 Quality Assurance

- a) The bidder shall invariably furnish Test certificates and information as following along with the offer failing to which the offer will be rejected.
 - i. Aluminium and copper conductor.
 - ii. Transformer oil.
 - iii. Core
 - iv. Insulating paper
 - v. Porcelain Bushings
 - vi. Steel Plate used for Tank.
 - vii. List of testing & measuring equipments indicating the make, type, year of manufacture, Last date of Calibration, Name of the agency carried out the calibration etc. Purchaser reserves the right to visit the works of manufacturer to ensure the available testing facility prior to placement of order.
- b) Names of the supplier for the raw materials, list of standard accordingly to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder's representatives, copies of type test certificates.
- c) Information and copies of test certificate as in (i) above respect of bought out accessories including terminal connectors.
- d) List of manufacturing facilities available. In this list the bidder shall specifically mention whether lapping machine, vacuum drying plant, air conditioned dust free room with positive air pressure for provision of provision of insulation and winding etc. are available with him.
- e) Level of automation achieved and list of areas where manual processing still exists.
- f) List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.
- g) Special features provided in the equipments to make it maintenance free.
- h) List of testing equipment available with the bidder for final testing of transformers and test plant limitation, if any, vis-à-vis the type, special acceptance and routine tests specified in the relevant standards and the present specification.

20.0 Drawings :-

A set of following drawings with all dimensions shall be submitted by the Bidder along with the offer :

- a) General Dimensional drawing.
- b) Core Assembly drawing.
- c) Internal Construction Drawing.
- d) Rating & Diagram Plate Drawing.
- e) HV/LV Bushings indicating measurement of creep age distances.
- f) Operation and Maintenance Manual.

The drawings shall be of A-3 (420x297mm) size only. The bidder should also supply along with his offer the pamplete/ literatures etc. for fittings/accessories.

The bidder should not change design once offered as per A/T, Approved drawings and Type Test Reports.

The successful Bidders shall submit complete set of Drawings of transformer in triplicate indicating dimensions for approval and get approved it before offering 1st stage inspection.

21.0 Performance Guarantee:

All transformers supplied against this specification shall be guaranteed for a period of 30 months from the date of receipt at the consignee's Stores Center or 24 months from the date of commissioning, whichever is earlier. However, any engineering error, omission, working provisions, etc. which do not have any effect on the time period, shall be attended to as and when observed / pointed out without any price implication.

22.0 COST DATA SHEET:-

The bidders shall submit the cost data sheets indicating the break up prices and quantity of each raw material and components along with the unit rates required for manufacture the offered transformers along with the offer. The cost data sheet format is enclosed herewith. If the rates quoted are not justified with the cost data sheets, the offer shall not be considered for evaluation and placement of the order.

23.0 NON COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non compliance with this specification, documenting the effects that such non compliance is likely to have on the equipment's life and operating characteristics. Each Non Compliance shall refer to the relevant clause of the specification.

Where there are no deviations from specifications, the bidder shall so indicate by stating "No deviations" in this schedule.

Clause No.	Non Compliance

24.0 Type Test Certificates Schedule

24.1 On this schedule a list of the test certificates included with the bid shall be provided. Each certificate listed shall be referred to the relevant specification clause and item of equipment to which the test applies.

Sl. No.	Particular of Test	Type Test Certificate Ref	Year of Test

24.2 In case of any doubt in the Type test reports submitted by the bidder, the Purchaser reserves the right to verify the original Type Test Reports, as well as to refer to the concerned laboratory directly without recourse to be bidder.

Dy. General Manager (P&S)
NESCO, Balasore, ODISHA

**GUARANTEED & OTHER TECHNICAL PARTICULARS
FOR 100 KVA (33/0.433 KV) STATION TRANSFORMERS
(To be furnished by the Manufacturer)**

Table : A

Sl. No.	Description	Specified	Bidder's Offer
1.	Make & Manufacturer	152026/IEC 76	
2.	Place of Manufacturer		
3.	Voltage Ratio	33/0.433	
4.	Rating in KVA	100	
5.	Full load current		
	HV :	1.75A	
	LV :	133.34 A	
6.	Core Material used and grade	≤ 1.6 T	
	a) Flux density		
	b) Over fluxing without saturation (Curve to be furnished by the manufacturer in support of his claim)		
7.	Maximum temperature rise of		
	a) Windings by resistance method	40 °C	
	b) Oil by Thermometer	35 °C	
8.	Magnetizing (No load) Current at		
	a) Normal Voltage	2%	
	b) Maximum Voltage	4%	
9.	Losses (should be in line with the Type Test report to be submitted along with the technical bid) in watts at 75 ⁰ C		
	a) No Load loss at rated voltage & frequency	260 W (Max.)	
	b) Full load loss at rated current and principal tap	1760 W (Max.)	
10.	Resistance of Windings at 20 Deg. C (With 5% tolerance)		
	a) HV Winding (Ohms)		
	b) LV Winding (ohms)		
11.	Total losses in watts at 75 ⁰ C		
12.	Current density used for		
	a) HV Winding	< 2.5 A/sq.mm	
	b) LV Winding	< 2.5 A/sq.mm	
13.	Short Circuit performance		
	a) Short ckt. Current withstand capability	500 MVA	
	b) Duration	2 sec.	

14.	% Impedance at 75 C	4.5	
15.	Radiation :		
	a) Heat dissipation by tank walls exclusive top & bottom		
	b) Heat dissipation by cooling tube		
	c) Dia & thickness of cooling tube		
	d) Calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise to be enclosed.		
16.	Efficiency at 75 Deg. ⁰ .	a) Unity P.F.	b) 0.8 P.F.
	1) 125% load		
	2) 100% load		
	3) 75% load		
	4) 50% load		
	5) 25% load		
	6) Max. efficiency		
	7) Load at which Max. efficiency occurs		
17.	Regulation at 75 Deg. ⁰		
	a) Unity P.F.		
	b) 0.8 P.F. at Deg. C		
18.	Separate source power frequency one minute withstand Voltage		
	a) HV	70KV	
	b) LV	2KV	
19.	Over potential Test Double Voltage & Double frequency for 1 minute		
	a) HV	66KV	
	b) LV	0.866KV	
20.	Impulse Test		
	a) HV	170KV	
	b) LV		
21.	Oil Data		
	1. Qty. for first filling (min.)		
	2. Grade of oil used		
	3. Maker"s name		
	4. BDV at the time of filling		
	5. Moisture content at the time of Filling Tank	< 3PPM	

Signature of the Bidder with seal

TABLE - B

Sl. No.	Description	Specified	Bidder's Offer
1.	Clearances (in mm)		
	a) Core & LV		
	b) LV & HV		
	c) HV Phase to Phase		
	d) End insulation clearance to Earth		
	e) Any Point of winding to tank		
	f) Between HV Coils		
2.	Inter layer insulation provided in design for		
	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		
	5) No of wedges provided		
3.	Insulation materials provided		
	a) For Conductors (1) HV (2) LV		
	b) For Core		
4.	Weight Content of		
	a) Core lamination (min.)		
	b) Windings (min.)		
	c) Tank & Fittings		
	d) Oil		
	e) Oil Qty. (min.)		
	f) Total Weight		
5.	Transformer :		
	1) Overall length x breadth x height		
	2) Tank length x breadth x height		
	3) Thickness of plates for		
	a) Side Plate (min)		
	b) Top & Bottom Plate (min.)		
6.	Size of the wire used		
	1) HV a) SWG / min		
	b) Dia		
	c) Area (Sq. mm)		
	2) LV a) Strip Size		
	b) No. of Conductors in parallel		
	c) Total area of cross section (sq.mm)		
7.	Is the name plate gives all particulars are required in Tender		

8.	Particulars of Bushings HV / LV		
	1) Maker"s Name		
	2) Type IS – 3347/IS-1180		
	3) Rating as per I.S.		
	4) Dry Flash over voltage KV at 50 C/s.		
	5) Wet Flash over voltage KV at 50 C/S		
9.	Details of tapping provided on HV side		
10.	Type of earth terminal are spring & lock washers included	Yes/No	
11.	Type of HV terminal		
	Metal used for terminal for terminal stud Brass/Copper tightening bolt diameter	12mm	
	a) Minimum Phase to Phase clearance	355mm	
	b) Minimum Phase to Earth clearance	305mm	
12.	Type of LV terminal		
	Metal used for terminal for terminal stud Copper tightening bolt diameter	12mm	
	b) Minimum Phase to Phase clearance	75mm	
	b) Minimum Phase to Earth clearance	40mm	
13.	Insulation resitance values		
	HV to Earth (Minium)	2000 mega ohm	
	LV to Earth (Minium)	500 mega ohm	
	HV to LV (Minium)	2000 mega ohm	

Signature of the Bidder with seal

TABLE - C

Sl. No	Description	Unit	Bidder's Offer
1	Core Grade		
2	Core diameter	mm	
3	Gross Core area	cm	
4	Net Core area	cm	
5	Loss per Kg. Of core at the	watts	
6	Core window height	mm	
7	Centre to center distance of the core	mm	
8	No. of LV Turns	mm	
9	No. of HV Turns	mm	
10	No. of Parallels		
11	Size of LV Conductor bare /	mm	
	Size of HV Conductor bare /	mm	
12			
13	Current density of LV winding	amps/sq.mm	
14	Current density of HV winding	amps/sq.mm	
15	Wt. of the LV winding for	kg.	
16	Wt. of the HV winding	kg.	
17	No. of LV coils / phase		
18	No. of HV coils / phase		
19	Height of LV winding	mm	
20	Height of HV Winding	mm	
21	ID / OD of LV winding	mm	
	ID / OD of LV winding	mm	
22	Size of the duct in LV winding	mm	
23	Size of the duct in HV winding	mm	
24	Size of the duct between HV & LV	mm	
25	HV winding of LV clearance	mm	
26	LV winding to tank clearance	mm	
27	Calculated impedance	ohm	
28	Calculated impedance	%	
29	HV to earth creepage distance	mm	
30	LV to earth creepage distance	mm	
31	Winding Material		
	HV		
	LV		

Signature of the Bidder with seal

