

**UTTAR & DAKSHIN HARYANA BIJLI VITRAN NIGAM**



**Specification No. CSC- XVIII/DH/UH/P&D/2009-2010**

## **TECHNICAL SPECIFICATION**

**FOR  
OUTDOOR TYPE**

**SINGLE PHASE OIL IMMERSED COMPLETELY SELF PROTECTED  
DISTRIBUTION TRANSFORMERS 10, 16 & 25 KVA, 11 kV / 250 Volts  
& 11 kV/ $\sqrt{3}$  / 250 Volts**

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**Common Specifications  
Committee  
UHBVN & DHBVN**

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**1.0 SCOPE:**

This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed naturally cooled 11 kV / 250V, 11 kV/ $\sqrt{3}$  / 250V Single phase 'Completely Self Protected' Distribution Transformers.

**1.1** 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 upto the Bidder's guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is 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.

**1.2 STANDARD RATINGS:** Standard Ratings of single Phase (1 $\phi$ ) Transformers shall be 10, 16 & 25 KVA.

**2.0 STANDARDS:**

**2.1** The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereof; some of them are listed below.

Indian Standard	Title	International & Internationally recognized standard
ISS-2026 (Part-I to IV)	Specification for Power Transformer	IEC-76
ISS-1180 (Part 1& 2) 1989	Outdoor Three Phase Distribution Transformer	
ISS-3347/1967	Specification for Porcelain Transformer Bushings	DIN 42531,2,3
ISS-7421/1974	Specification for Low Voltage Bushings	
ISS - 12444	Specification for copper wire rods	ASTM B - 49
ISS-335/1983	Specification for Transformer Oil	BS 148/ASTM D1275, D1533, IEC Pub 296-1969
ISS-3070/1974	Specification for Lightning Arresters	IEC 99-1
ISS-6600/1972	Guide for loading of oil immersed transformers	IEC 76
ISS-2099/1973	High Voltage Porcelain Bushings	IEC 137
ISS 9335	Specification for Insulating Kraft Paper	IEC 554

ISS 1576	Specification for Insulating Press Board	IEC 641
ISS 5/1961	Specification for colors for ready mixed paints	
ISS-13947 (Part 2) 1993	Specification for LT Circuit Breaker	IEC 947-2 (1989)

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 SERVICE CONDITIONS:

The Distribution Transformers & other equipment/material to be supplied against this specification shall be suitable for satisfactory operation under the following climatic Conditions as per IS-2026 (Part-I) latest revision

i)	Location	At various locations in the state of Haryana
ii)	Max ambient temperature (deg.c) -	60
iii)	Min ambient air temperature (deg. c)	-5
iv)	Max average daily ambient temperature (deg. c)	40
v)	Max. yearly weighed average ambient temperature (deg. C)	32
vi)	Max. altitude above mean sea level (Meters)	1000
vii)	Minimum Relative Humidity (%age )	26
viii)	Max. Relative Humidity (%age)	95
ix)	Avg. no of Rainy days/ year	120
x)	Avg. annual rainfall	900mm
xi)	Maximum wind pressure	195 Kg./m Sq.

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 Single phase, 50 c/s 11 kV systems in which the neutral is effectively earthed and they should be suitable for service under fluctuations in supply voltage upto plus 10% to minus 15%

The transformer shall conform to the following specific parameters.

Rated HV side value ( $11 \text{ kV}$  or  $11/\sqrt{3}$ ) shall be specified in the detailed bill of quantity by Owner.

S.No.	ITEM				
1.	Continuous capacity	rated	10 kVA	16 kVA	25 kVA
2.	System voltage (max)		12 kV	12 kV	12 kV
3.	Rated voltage HV		$11/\sqrt{3} / 11 \text{ kV}$	$11/\sqrt{3}/ 11 \text{ kV}$	$11/\sqrt{3} / 11 \text{ kV}$
4.	Rated voltage LV		250 V	250 V	250 V
5.	Line current HV		1.57 A / 0.909 A	2.52 A / 1.45 A	3.96 A / 2.27 A
6.	Line current LV		40 A	64 A	100 A
7.	Frequency		50 c/s +/- 5%	50 c/s +/- 5%	50 c/s +/- 5%
8.	No. of Phases		Single	Single	Single
9.	Type of cooling		ONAN	ONAN	ONAN
10.	Tap changing arrangement		Not applicable	Not applicable	Not applicable
11.	Over fluxing limit (Due to combined effect of Voltage and Frequency)		12.5 %	12.5 %	12.5 %
12.	Permissible temperature rise over ambient				
	i) Of top oil measured by thermometer		35 deg.C	35 deg.C	35 deg.C
	ii) Of winding measured by resistance		40 deg.C	40 deg.C	40 deg.C
12.	Minimum clearances in air		AS per IS - 1180 latest	AS per IS - 1180 latest	AS per IS - 1180 latest
	a) HV phase to phase/ phase to earth (mm)		255/140	255/140	255/140
	b) LV phase to phase/ phase to earth (mm)		75/40	75/40	75/40

## 5.0. TECHNICAL REQUIREMENTS:

### 5.1. Winding connection & terminal arrangements:

Both ends of primary winding shall be brought out through HV bushing. For  $11 \text{ kV}/\sqrt{3}$  Transformers, Neutral end of the primary HV winding shall be brought out for connecting to 'Neutral' supply wire. There shall be provision for

connecting 'Neutral' terminal, to local 'Earth' by way of a tinned Copper strip, of adequate size and dimension. The secondary winding shall be connected to two LV bushings.

## **5.2. Bushings**

- i) The bushings shall conform to the relevant standards specified.
- ii) For HV, 12 kV class bushings shall be used and for LV, 1.1 kV class bushings shall be used.
- iii) The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.
- iv) The HV bushings shall be fixed to the top cover of the transformer and the LV bushings shall be fixed to transformer on sides and in the same plane. The bushing rods and nuts shall be of brass.
- v) The HV bushings shall not have arcing horns.

## **5.3 CORE , WINDINGS, OIL AND INSULATION MATERIAL**

### **5.3.1 CORE MATERIAL:**

Transformer core shall be shell type or core type wound core construction using new and high quality CRGO steel with heat resistant insulating coating or Amorphous Metal. The core shall be properly stress relieved by annealing. The transformer shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious beating. The operating flux density shall be such that there is a clear safe margin over the over fluxing limit of 12.5%.

The bidder shall offer the core for inspection and shall get it approved from the bidder during manufacturing stage. Bidder 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 line
- d. Bill of Lading
- e. Bill of entry certificate to customs

#### **NOTE:**

I) "Equal weightage shall be given to the transformers with Amorphous Metal Core and CRGO core".

II) In case of variable prices, price variation in respect of amorphous metal core shall be of any extent on negative side as per IEEMA indices applicable for CRGO core but there will be no price variation allowed for amorphous core on the positive side".

### **5.3.2 WINDING**

HV and LV windings shall be wound from copper conductors covered with DPC / Enamel. The windings shall be progressively wound in LV-HV coil design for better voltage regulation and mechanical strength. The inter layer insulation shall be of epoxy resin bond paper. The type of winding shall be indicated in the tender whether LV windings are of conventional type or foil

wound. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.

### **5.3.3. Oil:**

The insulating oil shall comply with the requirements of IS 335 / 1993.

### **5.4 BUSHING TERMINALS:**

HV terminal shall be designed to directly receive ACSR conductor upto 7/2.59 mm (without requiring the use of lug) and the LV terminals shall be suitable for directly receiving LT cables (aluminum) ranging from 10 Sq.mm to 25 Sq.mm both in vertical and horizontal position and the arrangements should be such as to avoid bimetallic corrosion. Terminal connectors must be type tested as per IS : 5561

### **5.5. TANK:**

**5.5.1** The oil volume inside the tank shall be such that even under the extreme operating conditions, the pressure generated inside the tank does not exceed 0.4 kg/sq. cm positive or negative. There must be sufficient space from the core to the top cover to take care of oil expansion.

**5.5.2** The tank cover shall have plasticized surface at the top to guard against bird faults. Alternately, suitable insulating shrouds shall be provided on the bushing terminals.

**5.5.3** The Transformer tank shall be of robust construction round in shape and shall be built up of tested CRCA / MS Sheet.

**5.5.4.** The tank shall be capable of withstanding a pressure of 1 kg/cm<sup>2</sup> (g) and a vacuum of 760 mm of Hg for 30 minutes without any permanent deflection (Air pressure test shall conduct as per IS -1180 )

**5.5.5.** The L - seam joint, C - seam joint and all fittings and accessories shall be oil tight and no deflection / bulging should occur during service.

**5.5.6** Manufacturer should carry out the 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 Purchaser.

**5.5.7.** The circular bottom plate edges of the tank should be folded upward, for at least 25 mm, to have sufficient overlap with vertical sidewall of the transformer.

**5.5.8.** Tank shall have permanent lugs for lifting the Transformer bodily and there shall be facilities for lifting the core coil assembly separately.

**5.5.9.** The Transformer tank and the top cover shall be designed in such a manner as to leave no external pockets in which water can lodge.

**5.5.10.** The Transformer shall be provided with two mounting lugs suitable for fixing the transformer to a single pole by means of 2 bolts of 20 mm diameter as per ANSI C 57.12.20-1988.

**5.5.11.** Both mounting lugs are made with steel of min. 5 mm thickness.

- 5.5.12. Minimum Oil level mark shall be embossed inside the tank.
- 5.5.13. Jump proof lips shall be provided for upper mounting lug.
- 5.5.14. Mounting lugs faces shall be in one plane.
- 5.5.15. The top cover shall be fixed to the tank through clamping only.
- 5.5.16. HV bushing pocket shall be embossed to top side of the top cover so as to eliminate ingressing of moisture and water.
- 5.5.17. The edges of the top cover shall be formed, so as to cover the top end of the tank and gasket.
- 5.5.18. Nitrile / neoprene rubber gaskets conforming to latest IS 4253 part-II shall be provided between tank and top cover.
- 5.5.19. **Tank Sealing:**  
The space on the top of the oil shall be filled with dry air or nitrogen. The nitrogen plus oil volume inside the tank shall be such that even under extreme operating conditions, the pressure generated inside the tank does not exceed 0.4 kg/sq. cm positive or negative. The nitrogen shall conform to commercial grade of the relevant Standard.

## 5.6 SURFACE PREPARATION & PAINTING

### 5.6.1. General

- 5.6.1.1 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.
- 5.6.1.2 All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
- 5.6.1.3 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 shall be used with prior approval of Purchaser.
- 5.6.1.4 The manufacturer shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.

### 5.6.2. Cleaning and Surface Preparation

- 5.6.2.1 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.

**5.6.2.2** Steel surfaces shall be prepared by Shot blast cleaning to Grade Sa. 2.5 of ISO 8501-1 or Chemical cleaning by Seven Tank process including Phosphating ( IS 3618).

**5.6.2.3** 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.

**5.6.2.4** Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale and shall only be used where shot blast cleaning is impractical. Manufacturer shall indicate such location, for owner's information, in his offer.

### **5.6.3. Protective Coating**

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

### **5.6.4. Paint Material**

Following 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:

**5.6.4.1** Heat resistant paint (Hot oil proof) for inside surface / varnish.

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

**5.6.4.3** The color of the finishing coats shall be dark admiral gray conforming to No. 632 of IS-5 of 1961

### **5.6.5. Painting Procedure**

**5.6.5.1** 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.

**5.6.5.2** 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.

**5.6.5.3** 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.

**5.6.5.4** 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



thickens 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.

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

**5.6.6. Damaged Paintwork**

**5.6.6.1** 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.

**5.6.6.2** 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.

**5.6.7. Dry Film Thickness**

**5.6.7.1** 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 of the same colour.

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

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

**5.6.7.4** 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 Dry film thickness (min.)
1.	Thermo setting paint	inside outside	01 01	20 microns 60 microns
2.	<b>Liquid paint</b> a) Zinc chromate (primer) b) Polyurethane base (Finish coat) c) Hot oil paint / Varnish	outside outside inside	01 02 01	30 microns 25 microns each 35 / 10 microns

### **5.6.8. Tests**

**5.6.8.1** The painted surface shall be tested for paint thickness.

**5.6.8.2** 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.

### **5.7 RATING AND TERMINAL PLATES:**

There shall be a rating plate on the transformer containing the information given in the relevant Indian Standard. The HV winding terminals shall be marked 1U and 1N. The corresponding secondary terminal shall be marked as 2u and 2n.

### **5.8 PRESSURE RELEASE DEVICE:**

The transformer shall be equipped with a self sealing pressure release device design to operate at a minimum pressure of 8 PSI (0.564 kg/cm<sup>2</sup>).

### **5.9. FITTINGS:**

**5.9.1** The following standard fittings shall be provided.

- a) Two earthing terminals.
- b) Two lifting lugs.
- c) HT side neutral earthing strip
- d) Rating and terminal marking plates.
- e) Metal oxide lightning arrester.
- f) Pressure relief device.
- g) Circuit Breaker operating mechanism.
- h) Oil immersed LT circuit breaker make, type and technical details and its provision along with operating rod.
- i) HV fuse links.
- j) Signal light.
- k) HV bushings.
- l) LV bushings.
- m) HV & LV terminal connectors.
- n) Top cover fixing clamps.
- o) Mounting lugs - 2 Nos.
- p) Bird guard.
- q) LV earthing arrangement
- r) Any other fitting necessary for satisfactory performance of the manufacture.

### **5.10 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 galvanising, except high tensile steel bolts and spring washers which shall be electro-galvanised / 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. Protective washers of suitable material shall be provided front and back of the securing screws.

#### 5.11 LOSSES:

The total losses at 50% loading and 100% loading shall not exceed the following values:

Voltage Ratio	Rating KVA	Total losses at 50% loading in Watts at 75° C (Max.)	Total losses at 100% loading in Watts at 75° C (Max.)
11000/250V	10	65	200
11/√3/250 V	10	65	200
11000/250V	16	100	250
11/√3/250 V	16	100	250
11000/250V	25	110	350
11/√3/250 V	25	110	350

These losses are maximum allowable and there would not be any positive tolerance. Transformers with higher losses than the above specified losses would be rejected.

#### NOTE: -

Whenever the star ratings as promoted by BEE for the above transformers become available the values of 4-Star ratings shall be adopted by the Nigam.

#### 5.11.1 IMPEDANCE:

The recommended percentage impedance at rated frequency and at 75° C is ≤ 4% with tolerance as per IS-2026.

### 5.11.2 TEMPERATURE RISE:

The temperature rise 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

### 5.12 PENALTY FOR Non performance

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

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

5.12.1.2 Purchaser's 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.

5.12.1.3. 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 manufacturer.

### 5.13. Protection:

The transformer shall have the following additional fittings as its integral part:

#### 5.13.1. The transformer shall have the following CSP features.

##### i) INTERNAL HV FUSE ON THE HT SIDE OF TRANSFORMER:

**Specification for the HV fuse:** Expulsion/any other suitable fuse placed in series with the primary winding. This fuse is to be mounted normally inside of the primary bushing and is connected to the high voltage winding through a terminal block. This has to protect that part of the electrical distribution system which is ahead of the distribution transformer from faults which occur inside the distribution transformer i.e., either in the windings or some other part of the transformer. It shall be ensured that this fuse does not blow for faults on the secondary side (LT side) of the transformer i.e., the blowing characteristic of the fuse and LT breaker shall be so coordinated that the fuse shall not blow for any faults on the secondary side of the transformer beyond LT Breaker and those faults shall be cleared by the LT breaker only.

##### ii) INTERNALLY MOUNTED, OIL IMMersed 'LT' BREAKER ON THE 'LV' SIDE OF THE TRANSFORMER:

**LT Circuit breaker:** All LT faults after the breaker shall be cleared by this breaker. As such it shall be designed for perfect coordination with the HT fuse for various current multiples. The two characteristics shall be drawn on the same sheet to indicate coordination between the circuit breaker and fuse. The bidder shall carry out coordination test as indicated above, and this forms one of the tests for acceptance.

The Breaker shall be coordinated thermally with the transformer design to follow closely the variations of oil temperature, due to fluctuating loads and ambient temperatures.

This is to be accomplished by connecting the breaker in series between the secondary winding and the secondary bushings. The breaker shall be located in the same oil as the core and coil assembly so that the bimetal are sensitive to the temperature of oil as well as the load current (offers with LV breakers of MCCB type are not acceptable to the purchaser).

The circuit breaker shall also be closed and opened manually standing on ground. The current carrying parts of breaker shall be copper plus a set of copper tungsten current interrupting contacts.

The cross section of the current carrying parts of the breaker shall withstand the full load current at a current density not more than 2.5 A/sq.mm (for additional mechanical strength the area should be more).

**iii) LOAD MANAGEMENT SIGNAL LIGHT:**

A signal light shall be provided to give information about the loading condition of the transformer. It shall forewarn any overloading problem at the installation such that a change out of the existing transformer with a higher capacity transformer can be planned. The signal light mechanism shall not reset itself when the load drops from the overloaded condition. The signal light shall remain lighted once the signal light contacts close due to overload and can be turned off by manual operation. (The signal light shall not give indication for momentary overloading).

**5.13.3 11 kV LIGHTING ARRESTERS:**

High surge capacity 9 kV, 5 kA class II type lightning arrester conforming to relevant Indian Standard Specification shall be mounted on the transformer, clamped securely to the tank, to protect the transformer and associated line equipment from the occasional high voltage surges resulting from lightning or switching operations. The earthing terminal of the lightning arresters shall be connected solidly to the transformer tank earthing terminal.

**5.13.4 OVER LOAD CAPACITY:**

The transformer shall be suitable for loading as per latest IS 6600.

**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. 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 test certificates for all the 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 tests.
2. No load current and losses at service voltage and normal frequency.
3. Load losses at rated current and normal frequency.
4. Impedance Voltage test.
5. Resistance of windings cold (at or near the test bed temp.)
6. Insulation resistance.
7. Induced over voltage withstand test.
8. Separate source voltage withstand test.
9. Breaker coordination test.
10. Oil samples test (one sample / lot) to comply with IS 1866

**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 NO. 13 (with chopped wave) of IS-2026 part-III as per latest version. BIL for 11 kV shall be 95 kV peak instead of 75 kV.
3. Air pressure Test: As per Clause 24.5.1 of IS-1180/ part-II/1989.
4. Short Circuit Withstand Test: Thermal and dynamic ability.
5. Permissible flux density and over fluxing withstand test  
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.

**6.4 TOLERANCES:** Unless otherwise specified herein the test value of the transformers supplied should be within the tolerance permitted in the relevant standards.

**6.5 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 despatch 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.
4. One transformer per lot shall be tested at NABL, accredited independent laboratory for performance measurements at free of cost.

**7.0 INSPECTION:**

- i) 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.

- ii) 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.
- iii) 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.
- iv) 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.
- v) The supplier will give 15 days advance intimation to enable the Purchaser depute his representative for witnessing the acceptance and routine tests.
- vi) Should any inspected or tested materials / equipment fail to conform to the specification, the Purchaser may reject the materials and supplier will either replace the rejected materials or make alterations necessary to meet specifications requirements free of costs to the Purchaser.
- vii) In the case of transformers, instrument transformers and meters inspection will be conducted every year, for the first 5 years on a 2% sample of the quantities supplied. Samples will be collected at random to establish that the guaranteed technical parameters are as per the submitted bid by the supplier. In the case of non-adherence, the purchaser may take suitable action on the supplier including cancellation of vendor registration and banning further dealings, depending on the gravity of the deviation. These random inspections may be entrusted to a third party.
- viii) **WARRANTTEE**  
The supplier shall be responsible to replace, free of cost, with no transportation or insurance cost to the Purchaser, up to destination, the whole or any part of the material which in normal and proper use proves the defective in quality or workmanship, subject to the condition that the defect is noticed within 78 months from the date of receipt of material in stores or 72 months from the date of commissioning whichever period may expire earlier. The consignee or any other officer of Nigam actually using the material will give prompt notice of each such defect to the supplier. The replacement shall be effected by the supplier within a reasonable time, but not, in any case, exceeding 45 days. The supplier shall, also, arrange to remove the defective within a reasonable period, but not exceeding 45 days from the date of issue of notice in respect thereof, failing which, the purchaser reserve the right to dispose of defective material in any manner considered fit by him (Purchaser), at the sole risk and cost of the supplier. Any sale proceeds of the defective material after meeting the expenses incurred on its custody, disposal handling etc., shall however be credited to the supplier's account and set off against any outstanding dues of the purchaser against the supplier. The warranty for 72/78 months shall be one time.

## **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 at material 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 test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.
- ii. Information and copies of test certificates as in (1) 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 inspections.
- 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 possess 0.1 class instruments for measurement of losses.
- vii. Quality Assurance Plan (QAP) with hold points for purchaser's inspection. As per Annexure shall be submitted along with the bid.

**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:**

- a) Completely dimensioned drawings indicating general arrangement and details of fittings, clearances and winding details shall accompany the tender.
- b) Drawings of internal constructional details, fixing details of and coils should also be indicated. Tank dimensions, position of fittings, clearances between leads within the transformer, core grade of laminations, distance of core centers, area of conductor bare and with insulation. No. of coils, No. of turns per coil material of bushing metal parts etc., shall also be furnished with tender.

## **10.0. PACKING & FORWARDING:**

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

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

## **11.0 MANDATORY SPARES:**

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

## **12.0. PROTOTYPE TRANSFORMER**

The prototype transformer on which type test got conducted shall be supplied to UHBVN / DHBVN duly sealed after completion of type testing in the beginning itself before commencement of supply. The bidder shall furnish an affidavit that all his balance transformers shall meet with prototype in all respects (internal & external). Nigam can randomly select any transformer & verify the internal / external details with the prototype sample at any time during warranty period.



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

The purchaser may select any transformer from the offered lot for inspection during subsequent lots for carrying out temperature rise test from any Govt. approved lab.

Further the purchaser may select the transformer for type tests randomly.

**13.0. CHALLENGE CLAUSE: -**

The material offered/received after the inspection by the authorized inspecting officer may again be subjected to the test for losses or any other parameter from any Testing House/in-house technique of the Nigam & the results if found deviating un-acceptable or not complying to approved GTP's the bidder shall arrange to supply the replacement within thirty (30) days of such detection at his cost including to & fro transportation.

In addition to this penalty @10% of cost of the inspected lot of material shall be imposed

**14.0. GUARANTEED TECHNICAL PARTICULARS**

The guaranteed technical particulars of the transformer shall be given by the tenderer (**Annexure-I, II & III**) along with the tender. Tenders without GTPS shall be out rightly rejected.

**Director/Technical-I  
UHBVN, Panchkula**

**Director/Project,  
DHBVN, Hisar**

**CE/PD&C  
UHBVN, Panchkula**

**CE/P&D  
DHBVN, Hisar**

**FA&CAO/MM  
UHBVN, Panchkula**

**FA&CAO/MM  
DHBVN, Hisar**

**SE/P&D  
UHBVN, Panchkula**

**SE/P&D  
DHBVN, Hisar**

**ANNEXURE - I**

**GUARANTEED TECHNICAL PARTICULARS FOR COMPLETELY SELF PROTECTED DISTRIBUTION TRANSFORMERS**

SI.No.	Description	10 KVA	16 KVA	25 KVA
1.	Name of the manufacturer and place of manufacturer :			
2.	Continuous max. rating as per this specification. :			
3.	Normal ratio of transformer :			
4.	Method of Connection HV / LV :			
5.	Max. Current density in Windings. :			
	a) Higher voltage Amps/sq.cm :			
	b) Lower voltage Amps/sq.cm :			
6.	Max. Hot Spot Temp. Deg. C. (Ambient air temp. on which above is based) Deg.C. :			
7.	a) Max. observable Oil temp. Deg.C.(ambient air temp. on which above is based) Deg.C. :			
	b) Max. Winding Temperature at an ambient temp. of :			
8.	Fixed losses at normal voltage ratio (watts) :			
9.	Load losses at normal Voltage ratio (watts) :			
10.	Total losses at normal voltage ratio (watts) :			
11.	Efficiency at normal voltage :			
	i) Unity Power Factor :			
	a) At 50% Load :			
	b) At 75% Load :			
	c) At full Load :			
	ii) 0.8 Power Factor :			
	a) At 50% Load :			
	b) At 75% Load :			
	c) At full Load :			

12. Regulation as percentage of normal voltage. :  
 a) At unity power factor % :  
 b) At 0.8 Power factor lagging % :
13. % Impedance voltage at normal ratio between HV & LV windings :
14. Type of transformers, shell type / core type wound core :
15. Type of Insulation used in :  
 a) HV Windings :  
 b) LV Windings :
16. Type of insulation used in :  
 a) Core bolts :  
 b) Core bolt washers :  
 c) End plates :  
 d) Core lamination :
17. Impulse test voltage level :  
 HV Windings :  
 LV Windings :
18. Characteristics of transformer oil :
19. Total content of oil in liters :
20. Whether transformer will be transported with oil? :
21. Type of transformer tank :
22. i) Approx. overall dimensions :  
 a) Height mm :  
 b) Breadth mm :  
 c) Width mm :  
 ii) Tank dimensions :  
 a) Diameter mm :  
 b) Height mm :
23. Weight of insulated conductor :  
 a) HV (min.) kg. :  
 b) LV (min.) kg. :
24. Weight of core (min.)kg (CRGO or Amorphous metal)
25. Weight of complete transformer arranged for transport kg. :
26. Current Transformer data

## ANNEXURE-II

## ADDITIONAL DETAILS

Sl.No.	Description	
1.	Core Grade	
2.	Core dimensions	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 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 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

### ANNEXURE-III

#### SOURCE OF MATERIALS/PLACES OF MANUFACTURE, TESTING AND INSPECTION

Sl.No	Item	Source Material	of	Place of Manufacture	Place of testing and inspection
1.	Laminations				
2.	Aluminium / Copper				
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				
11.	Lightening Arresters				
12	Current Transformer				