

**Request for Proposal for Distribution Transformer for ITMT- office at IIA,CREST campus.**

**Request for Proposal  
Design, Manufacture, Supply, Testing and Commissioning of 800 KVA Distribution Transformer at  
Indian Institute of Astrophysics CREST campus Hoskote, Bangalore, Karnataka.**



**DISTRIBUTION TRANSFORMERS (ONAN)**

**1.0 SCOPE**

- 1.1 This Specification covers the design, manufacture, inspection and testing at the works, packing, transportation, delivery, testing and commissioning of the following:  
11 KV / 433V, 3 PHASE, copper winding, 750KVA, Dyn11 with Z=as per ECBC  
ONAN cooled outdoor type transformer

**2.0 SITE CONDITIONS**

- 2.1 Temperature : Maximum 45 Deg. C Minimum 12 Deg. C  
2.2 Humidity : Not more than 50% at maximum temperature.  
2.3 Rainfall : 800 – 1500mm Per Annum.  
2.4 Altitude : Less than 1000 meters above MSL.

**3.0 SYSTEM DESCRIPTION**

- 3.1 Primary system voltage  
Nominal voltage : 11000 V  
Maximum : 12000 V  
3.2 Secondary system Voltage : 433 V  
3.3 Input voltage variation limits : -10% to +10%  
3.4 No. Of phases : 3

- 3.5 Frequency : 50 c/s
- 3.6 Frequency variation limits : +/-3%
- 3.7 Fault level : Not exceeding 500MVA at 11KV
- 3.8 Neutral earthing on HV & LV side : Solidly earthed
- 3.9 Control supply : 240V, 1ph. AC/24V 2 wire D.C

#### **4.0 REFERENCE STANDARDS**

- 4.1 Power transformer IS 2026
- 4.2 Fittings & accessories IS 3639
- 4.3 Degree of protection IS 2147
- 4.4 Tests IS 2026
- 4.5 Tolerance on guaranteed particulars IS 2026
- 4.6 Electrical insulation classified by Thermal stability IS 1271
- 4.7 Insulating oil IS 335
- 4.9 Installation and maintenance of transformer IS 10028
- 4.10 Guide for loading of oil immersed Transformer I S 6600

#### **5.0 DESIGN AND PERFORMANCE REQUIREMENTS**

- 5.1 The distribution transformers shall be oil filled type ONAN cooled. The transformer shall be in compliance with Datasheet
- 5.2 Transformers shall operate without injurious heating at the rated capacity within +10 percent of the rated voltage of that particular tap.
- 5.3 Transformers shall be capable of delivering the rated current at a voltage equal to 105 percent of the rated voltage without exceeding the limiting temperature rise.
- 5.4 Overloads shall be allowed within the conditions defined in the loading guide of the applicable standard. Under these conditions, no limitations by terminal bushings, or other auxiliary equipment shall apply.
- 5.5 Transformers, complete with bushings / cable boxes, shall be designed and constructed to withstand without damage, the effects of external short circuits as per the specified standards.

## **6.0 CORE**

- 6.1 The magnetic circuit shall be constructed from high-grade cold rolled non-ageing grain oriented silicon steel laminations.
- 6.2 The insulation structure for the core to bolts and core to lamination plates shall be such as to withstand a voltage of 2000 V for one minute.

## **7.0 INTERNAL EARTHING**

The framework and clamping arrangement of core and coil shall be securely earthed inside the tank by copper strap connection to the tank.

## **8.0 WINDINGS**

- 8.1 Windings shall be of electrical grade copper
- 8.2 Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service.
- 8.3 The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.
- 8.4 The insulation of the winding shall be uniformly insulated and shall be of class-A.
- 8.5 The winding shall withstand peak impulse voltage of 75KV and power frequency voltage withstand of 28KV/ 3KV for HV/ LV respectively.
- 8.6 The temperature raise of the winding shall be limited to 50 degree C by winding resistance method over an ambient of 40 degree C.

## **8.1 TANK**

- 9.1 The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of glossy, oil and weather resisting non-fading paint of specified shade. The interior of the tank shall be cleaned by shot blasting and painting with two coats of heat resistant and oil insoluble paint. The colour shade for final painting of the tank shall be shade 631 of IS: 5
- 9.2 Tank together with radiators, coolers, conservator, bushing vessel and other fittings shall be designed to withstand without permanent distortion, the following conditions:
- i) Full vacuum of 760 mm of Hg. For filling with oil by vacuum.
  - ii) Internal gas pressure of 0.35kg/cm<sup>2</sup> (5lbs / sq.in) with oil at operating level.
- 9.3 The surface of the cover shall be suitably sloped so that it does not retain water.**
- 9.4 The material used for gaskets shall be cork-neoprene or approved equivalent.
- 9.5 Each transformer shall be provided with following valves on the tank:

- i) Drain valves so located as to completely drain the tank
- ii) Combined filling and filter valve at top of the tank of 50mm size
- iii) Oil sampling valves
- iv) One 15mm air release filing

## **10.0 TAP Changing Arrangement**

The transformer shall be provided with a Motorised On Load Tap Changing Gear, covering a total tapping range as mentioned in Clause 1.12 Data Sheet in steps of 1.25% to accommodate for a corresponding HV voltage variation so as to ensure a constant no load secondary voltage of 433V.

The On Load Tap Changing equipment shall be complete with:

- a. On Load Tap Changing Gear, mounted on to the transformer tank.
- b. Indoor type Remote Tap Changing Control Cubicle (RTCC) panel, fitted with Electronic Automatic Voltage Regulating Relay (AVR)

The On Load Tap Changing equipment shall be suitable for the following tap-change operations :

- a. Local Manual tap change operation, with cranking handle
- b. Local electrical tap change operation, with raise and lower switches or push buttons on the OLTC panel.
- c. Remote electrical, non-automatic independent / Group simultaneous tap change operation, with raise and lower switches or push buttons on RTCC Panel.
- d. Remote electrical, automatic tap change operation, with AVR. A PT of suitable ratio shall be provided on the LV side as a feedback signal to the AVR to effect automatic changeover without additional cost to the Employer.

## **11.0 BUSHINGS**

- 11.1 Bushings shall be designed and tested to comply with IS 2026 (Part III) and to suit the current class.
- 11.2 Bushings shall be so located on the transformers that full flashover strength will be utilised and minimum clearance as required for the BIL shall be realised between live parts and live parts to earthed structures.
- 11.3 The bushing terminal shall be rated to carry the bushing rated current without exceeding a temperature rise of 45 deg. C in an ambient of 40 deg. C. The connector/clamp shall be designed to be corona free at the maximum rated line to ground voltage.
- 11.4 For HV minimum clearance of 280 mm between phase to phase and 140 mm between phase to earth should be maintained. For LV side clearance should be 26mm and 19mm respectively.

## **12.0 CABLE BOXES AND DISCONNECTING CHAMBERS**

- 12.1 Disconnecting chambers suitable for Primary and secondary shall be provided
- 12.2 Cable boxes shall be suitable for terminating the cables

## **13.0 FITTINGS AND ACCESSORIES**

Following fittings shall be provided:

- 13.1 Bushing Terminals complete with connectors for the cables as mentioned above.
- 13.2 Neutral bushing terminal complete with connector for earth conductor.
- 13.3 Inspection cover
- 13.4 Rating and terminal marking plates.
- 13.5 Two earthing terminals for tank, HV and LV cable boxes and marshalling box.
- 13.6 Lifting lugs for:
  - a) Lifting complete transformer with oil and
  - b) lifting core and coils
- 13.7 Drain cum sampling valve with plug or cover plate.
- 13.8 Silica gel dehydrating breather
- 13.9 Oil level Indicator with minimum marking and low level contact
- 13.10 OTI with alarm & trip contacts
- 13.11 WTI with alarm & trip contacts
- 13.12 Conservator
- 13.13 Air Release Device
- 13.14 Jacking Lugs
- 13.15 Filter Valve
- 13.16 Buchholz Relay with shut off valves on either side of the relay.
- 13.17 Explosion vent with diaphragm / pressure relief valve. The device shall be rain-proof after operation. An equaliser pipe connecting the pressure relief device to the conservator shall be supplied.
- 13.18 The under base shall be provided with Bi-directional plain roller for pacing on a platform or plinth

## **14.0 INSULATING OIL**

The transformer shall be filled with transformer insulating oil as per IS 335 and transformer shall be shipped along with the oil.

## 15.0 **TESTS**

Transformers shall be completely assembled at Works to ascertain that all parts fit correctly.

### 15.1 **Routine Tests**

Routine tests as per specified standards shall be performed on all transformers at manufacturer works and also at site before commissioning. The following additional points may be noted :

- i) 2kV withstand test for all wiring.
- ii) Zero phase sequence impedance test.
- iii) Dissolved gas analysis (One transformer)
- iv) Temperature rise test (One transformer)
- v) Voltage ratio at all taps
- vi) Resistance of each winding of each phase shall be measured at principal and at all the taps and corrected to 75 deg. C.
- vii) No load loss and exciting current shall be measured at rated frequency at 90%, 100% and 110% rated voltage. These tests shall be done after impulse tests if the latter is conducted. Exciting current shall be measured on each phase and recorded. Form factor shall be noted during the test and included in the test report.
- viii) Magnetic balance test.
- ix) Calibration of temperature indicators and relays.

### 15.2 Type Tests

CONTRACTOR shall furnish type test certificates along with the Tender. In the absence of the same, CONTRACTOR shall carry out the type tests without any cost implication to the EMPLOYER. Test certificates for short circuit test and Impulse test conducted for similar transformer shall be furnished.

### 15.3 Test Reports

Test results shall be corrected to a reference temperature of 75deg.C.

Two copies of preliminary test results shall be submitted for the EMPLOYER'S approval before dispatch of transformer.

Additional bound copies of complete test results including all tests on transformers, auxiliaries, and current transformer characteristics shall be furnished with the transformer.

## **16.0 LOSSES**

- 16.1 For the purpose of evaluation of Tenders, the quoted load losses and iron losses will be increased to take into consideration tolerance as permitted by applicable standards, in the event the losses are indicated exclusive of tolerance.
- 16.2 Should the losses as measured on the transformer after manufacture be found in excess of the guaranteed losses with plus tolerance, the CONTRACTOR shall pay to the EMPLOYER, penalty charges based on the capitalization of cost indicated above.

## **17.0 REJECTION**

EMPLOYER may reject any transformer if during tests any of the following conditions arise:

- 17.1 Load loss exceeds the guaranteed value by 20% or more.
- 17.2 Impedance value differs the guaranteed value by  $\pm 10\%$  or more.
- 17.3 Oil or winding temperature rise exceeds the specified value by 5°C.
- 17.4 Transformer fails on impulse test.
- 17.5 Transformer fails on power frequency voltage withstand test.
- 17.6 Transformer is proved to have been manufactured not in accordance with the agreed specification.

## **18.0 GUARANTEES**

- 18.1 The items of performance on transformers shall be guaranteed either under penalty or under correction. The temperature rise guarantee shall have zero tolerance on the positive side

## **19.0 DATA TO BE FURNISHED BY THE VENDOR AFTER AWARDING THE CONTRACT**

- 19.1 Positive Sequence impedance at maximum voltage tap.
- 19.2 Positive Sequence impedance at minimum voltage tap.
- 19.3 Zero sequence impedance at principal tap.
- 19.4 Efficiency at 75°C winding temperature  
At full load  
At 75% full load  
At 50% full load.
- 19.5 Maximum efficiency and load at which it occurs
- 19.6 Regulation at full load at 75°C winding temperature at
- 19.7 Unity power factor
- 19.8 0.85 power factor lag.
- 19.9 Resistance per phase at  
HV winding: ohms

- LV winding: ohms
- 19.10 Conductor area (sq. mm) and current density (amp / cm<sup>2</sup>)
  - HV winding
  - LV winding
- 19.11 Type of winding
  - HV
  - LV
- 19.12 Insulating materials for inter turn insulation
  - HV winding
  - LV winding
- 19.13 Insulating materials for inter winding insulation
  - Insulating materials between
  - Winding and core
  - Laminations of core
  - Make, type, dial size, number of contacts and contact ratings current and voltage rating for following items
  - Magnetic oil level gauge
  - Dial type thermometer
  - Winding temperature indicator
  - Gas and oil actuated relay
  - Thermal withstand capability under full short circuit conditions, in terms of number of times of occurrence of short circuit and corresponding anticipated percentage reduction in transformer life. Relevant calculation shall be submitted.
- 19.14 **DRAWINGS**
  - The following drawings shall be submitted for the EMPLOYER'S approval in the stipulated time
- 19.15 General outline drawings as submitted with the bid
- 19.16 General outline drawings showing plan, front elevation, and side elevation, with all fittings and accessories, locating dimensions of cable entries, earthing terminals, foundation/floor fixing details, jacking pads and weights of the following
- 19.17 Marshalling box
- 19.18 Cable boxes
- 19.19 Disconnecting chambers
- 19.20 Bushings
- 19.21 Plan, elevation, terminal details, mounting details, make and type number, current and voltage rating, creepage distances and principal characteristics.
- 19.22 Rating and diagram plates
- 19.23 Marshalling box terminal connections wiring diagram.



**20. TEST REPORTS**

Test results shall be corrected to a reference temperature of 75°C.

20.1 Two copies of test results shall be submitted for EMPLOYER approval before dispatch of transformer.

20.2 Additional bound copies, as required by the EMPLOYER of complete test results including all tests on transformer, bushing, shall be furnished.