# ANDREW YULE AND COMPANY LIMITED
# (A GOVERNMENT OF INDIA ENTERPRISE)
# ELECTRICAL DIVISION
# SWITCHGEAR UNIT
# 14 MAYURBHANJ ROAD
# KOLKATA 700023.

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TENDER NO: Tender No. ED/SWG/TR/33/11/25/FT dated 22/03/2013

**Last Date of Sale of Tender Documents: 05/04/13 upto 4 pm**

**Last Date of submission of Offer: 06/04/13 upto 4 pm**

**Techno-Commercial Bid of Tender will be opened on 08/04/13 at 11 am**

Cost of Tender documents: Rs. 200/- (Rupees Two Hundred Only)
TENDER DOCUMENT IS AVAILABE FROM OUR OFFICE OR MAY BE DOWNLOADED FROM OUR WEBSITE: www.andrewyule.com
COST OF TENDER TO BE SUBMITTED IN THE FORM OF DEMAND DRAFT IN CASE TENDER IS DOWNLOADED FROM WEBSITE.

1. **Description of Item**

   1) 25KVA , 11KV/0.433KV,3phase distribution transformer—5000nos/10000nos/20000nos

2. **Eligibility Criteria**: Only manufacturers of tendered items are to quote. Manufacturer has to submit full address of works with their valid registration with NSIC/SSI/DGS&D/Registrar of Companies in their own name to be submitted with their offer. AYCL will provide the drawing & design for the aforesaid Transformer .Manufacturer should have type test certificate from CPRI or type test certificate from NABL accredited Laboratory for the aforesaid transformer. Vendor's manufacturing capacity should be 500nos/month.
3. **Method & Mode of Submission** :
   Two Bid System – Part – I & Part - II

   - **Part – I**: Techno Commercial Bid: This part of offer should contain the documents & details asked for as under: [**In no case should contain / indicate the offered prices**]

   (a) Confirmation of our Technical Specification.
   (b) Confirmation of all Commercial Terms & Conditions as specified under Tender Condition (a) to (j) below.
   (c) Specify VAT registration no.
   (d) Documentation, including Testing Facilities available.
   (e) Credentials of the vendor
   (f) EMD
   (g) Unpriced Format.

   - **Part – II**: Price Bid: This part of the offer should contain only price portion. Discount if any, applicable (on basic price / landed price etc), should be clearly spelt out both in figures and words. However, no conditional discount will be considered for the purpose of evaluation of the offer.
   - Part – "I "(Techno Commercial Bid) will be opened in specified date and time as given in the covering page, in presence of the attending tenderers or their authorized representatives.

   - Part – "II "(Price Bid) will be opened only of those tenders whose Part "I" is found to be techno commercially acceptable. Such tenderers will be intimated to attend the opening. Separate price to be indicated for Core grade 23ZDMH85 & grade M4.
     Separate price to be quoted for a qty of 5000nos, 10000nos & 20000nos of transformers on **annual rate contract basis**. AYCL reserves the right to extend the rate contract for another one year also.

**NOTE:** For proper identification both PART – "I" and PART – "II" should be kept in separate sealed envelopes and clearly be marked on top of the envelop as mentioned above i.e. PART "I" - TECHNO COMMERCIAL BID and PART "II" – PRICE BID. Both these envelopes should again be kept in a third sealed envelope). All the envelopes must be sealed and the Tender no and Due date of opening must be super scribed thereupon.

**4. Tender Condition:**

(a) **EMD:** The value of Earnest Money to be deposited by the tenderer should be Rs. 200000/- (Rupees Two Lakhs only). Earnest Money Deposit (EMD) should be in the form of Demand Draft drawn in favour of " Andrew Yule & Company Limited" payable at Kolkata and must be accompanied with the quotation i.e. PART – I of the bid. For unsuccessful tenderer, EMD shall be refunded immediately after finalization of the tender. EMD shall be forfeited if any tenderer withdraw their offer before finalization

of the tender. Or fails to submit order acceptance within 15 days from the date of order. If any vendor has any dues from AYCL – Switchgear Unit Kolkata, EMD may be adjusted against such dues on the basis of specific request of the vendor in written in this regard.

Besides who are MSMED units may apply for exemption from furnishing EMD / BG in lieu of EMD by making necessary documents in support of the same.

(b) **Performance Bank Guarantee**: 10% of the value of contract shall be furnished as Performance Bank Guarantee valid till the guarantee period.

(c) **Guarantee / Warrantee**: the tenderers shall give a warranty of satisfactory performance for the unit offered by them for a period of 39 months from the date of receipt and acceptance of material. All service backup to be provided during guarantee period at free of cost.

**(d) Terms of Payment**: 90 days direct credit.

**(e) Inspection / Testing**

Initial inspection to be done at manufacturer's works at different stages of production. Final inspection will be done at our works. Please conform acceptance. Final Inspection / Test parameters to be achieved.

(f) **Liquidated Damage** : If the delivery is delayed beyond the date of schedule date of dispatch in the purchase order , penalty will be leived @ ½% per week subject to a maximum of 5% . Please confirm acceptance.

(g) **Risk Purchase Clause**: The Company reserves the right to impose Risk Purchase clause as For delay in execution / supply, we shall have every right to do the same from other agency/s which shall be deemed fit and the additional cost of the same (Incidental / consequential) shall be to your account which with respect to our intimation or observation whatsoever. Please confirm acceptance.

(h) **Legal condition**: All disputes relating to this offer or relating to the price of the goods supplied hereunder or otherwise arising between the seller and buyer shall be subject to and referred to the court of competent jurisdiction situated within the limits of the city of Kolkata, neither the seller nor the buyer shall take or adopt any legal proceedings to enforce any claim against the order relating to this order or arising there from in any court other than the court of compete tent jurisdiction within the limits of the city of Kolkata.

(i) **Price Basis**: Price [FOR AYCL Kolkata],

(j) **Cost of Tender**: Tenderers, who will procure the document in cash, they have to submit the money receipt with techno commercial bid otherwise the tenderers have to submit the demand draft (Drawn in favour of ANDREW YULE & CO LTD) with techno commercial bid.

**NOTE**

(1) Proper loading in price shall be made by us for important terms i.e. payment terms, cost of delivery to the destination, Sales Tax / VAT, other taxes & duties etc. having financial implication.

(2) Offer sent through email fax and envelopes without super scribing the Tender Number with the due date will not be considered. The complete offer should be typed in the letterhead of the tenderers (Hand written quotations will be summarily rejected). Quotations, erased and overwritten shall be summarily rejected, unless authenticated with the tenderer's signature.

L1 will be determined on landed cost basis.

In the rate contract, the order quantity is to be placed on all the vendors, who have agreed to negotiated L1 rate & terms, provided preference will be given to original L1 which will be more than 50% considering his technical and commercial ability and the remaining quantity will be procured from L2, L3 etc. where preference will be given to L2 considering the original value. The quantity for L2 will depend upon his technical & commercial ability and should not be more than 30% of the total quantity. Balance will go to L3 and other vendors following same principle. However AYCL also reserves the right to place full quantity of tender to only L1 bidder if necessary. Detailed manufacturing drawings will be handed over to the vendor in the event of P.O. only.

Special Note: Guaranteed Technical Particulars & Drawings are enclosed herewith.

Following points to be strictly adhered to for 25KVA distribution transformer

This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing at works before supply of 3 phase, 50 Hz, core type, oil immersed self cooled Distribution Transformer confirming to IS:1180 and IS:2026 of 1977as amended from time to time for outdoor use.

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, 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 Suppliers supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The transformer and accessories shall be designed to facilitate operation, inspection, manufacture and repairs.

The transformers shall be manufactured strictly as per specification, without any deviations.

## 1. STANDARDS

The materials shall conform in all respects to the relevant Indian/International Standards, with latest amendments thereof unless other wise specified herein. Some of them are listed below:

| Indian Standard | Title | International and internationally recognised standards |
|---|---|---|
| IS:2026/1977 (Parts 1 to 5) | Specification for Power Transformers | IEC:76 |
| IS:1180/1989 (Parts 1 &2) | Outdoor distribution transformer up to and including 100kva | |
| IS:12444 | Specification for copper rod | ASTM B-49 |
| IS:335/1993 | Specification for transformer Oil | BS148, D-1473, D1533-1934, IEC Pub 296 |
| IS:5/1944 | Specification for colours for ready mixes colours | |
| IS:104/1979 | Ready mixed paint, brushing zinc chromate, priming | |
| IS:2099/1986 | Specification for high voltage porcelain | |

| | | |
|---|---|---|
| | bushing | |
| IS:649/1997 | Testing for steel sheets and strips and magnetic circuits. | |
| IS:4257 | Dimensions for clamping arrangements for bushings. | |
| IS:7421 | Specification for low Voltage bushings | |
| IS:3347 (Parts I to IV) | Specification for Outdoor Bushings | DIN 42531 to33 |
| IS:5484 | Specification for Al Wire rods | ASTM B:233 |
| IS:9335 | Specification for Insulating Kraft Paper | IEC 554 |
| IS:1576 | Specification for Insulating Press board. | IEC 641 |
| IS:6600 | Guide for loading of oil Immersed Transformers. | IEC76 |
| IS:2362 | Determination of water content in oil for porcelain bushing of transformer, by Karl fischer method-test method. | |
| IS:6162/1971 (Parts I & II) | Paper covered aluminium conductor. | |
| IS: 6160/1971 | Rectangular electrical conductor for electrical machines. | |
| IS: 5561/1970 | Electrical power connector. | |
| IS:6103/1971 | Testing of specific resistance of electrical insulating liquids. | |
| IS:6262/1971 | Method of test for power factor and dielectric constant of electrical insulating liquids. | |
| IS:6792/1992 | Determination of electrical strength of insulating oil. | |
| IS:10028/1985 (Parts I to III) | Insulating and maintenance of transformers. | |
| IS: 10028: | Selection, installation & maintenance of transformers | |
| IS: 3401 | Silica gel | |
| | REC specification No.2 | |

**2. SERVICE CONDITIONS:**

The materials used to manufacture of Distribution Transformer to be supplied against this specification shall be suitable for outdoor satisfactory continuous operation under the following climatic conditions.

a. Ambient Air Temperature - 5°C to 50°C
b. Relative Humidity - 0 to 100%
c. Altitude - 0 to 100 Meters.

**3. SYSTEM DETAILS:**

The transformers shall be suitable for outdoor installation with 3Phase, 50 Hz, 11kV System in which the neutral is effectively earthed and the same shall be suitable for service under fluctuations in supply voltage up to 12% permissible under Indian Electricity Rules and the frequency variation of -5% and +2% (47.5Hz to 51.0Hz).

**4. The transformers shall conform to the following specific parameter:**

| Sl No. | Item | 11kv Distribution transformers |
|---|---|---|
| 1. | System voltages (max). | 12kV |
| 2. | Rated voltages HV | 11kV |
| 3. | Rated voltages LV | 433-250V |
| 4. | Frequency | 50Hz |
| 5. | Phases | Three |
| 6. | Connection HV | Delta |
| 7. | Connection LV | Star (Neutral brought out) |
| 8. | Vector group | Dyn-11 |
| 9. | Type of cooling | ONAN |
| 10. | % of impedance at 75 ºC | 4.5% |
| 11. | Fault level of the system | 750MVA |

Audible sound levels (decibels) at rated voltage and frequency for liquid immersed distribution transformer shall be as below (NEMA Standards)

| kVA rating | Audible sound levels (decibels) |
|---|---|
| 0-50 | 48 |
| 51-100 | 51 |

**5. TECHNICAL REQUIREMENTS:**

**Core Material: CRGO Material**

The core shall be high grade stack/wound type of high grade cold rolled grain oriented annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the framed to prevent vibration or noise. The core shall be stress relived by annealing under inert atmosphere if required. The complete design of core must ensure permanency of the core loss with continuous working of the transformers.

The Supplier should offer the core for inspection and approval by the purchaser during manufacturing stage.

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

No-load current shall not exceed 3% of full load current and will be measured by energising the transformer at 433 volts, 50Hz on the secondary. Increase of voltage of 433 volts by 12.5% shall not increase the no-load current by 6% (maximum) full load current.

**6. WINDINGS:**

HV and LV windings shall be wound from Super Enamel covered/ Double Paper covered aluminium conductor.

LV windings shall be such that neutral formation will be at top.

Inter layer insulation shall be Epoxy dotted Kraft Paper.

Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted.

Dimensions of winding coils are very critical. Dimensional tolerances for windings coils shall be with in limits as specified in Guaranteed Technical Particulars.

Current density for HV and LV winding should not be more than 1.6 Ampere per sq mm for aluminium conductor.

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

Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor.

**7. Oil:**

The insulating oil shall comply with the requirements of IS:335 or BS:148. Use of recycled oil is not acceptable. The specific resistance of the oil shall not be less than 2.5 x 10^12 ohm-cm at 27°C when tested as per IS 6103.

Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling.

**The oil shall be filled under vacuum.**

The transformer shall be supplied complete with first filling of oil and the same shall comply with IS: 335/1993 with latest revisions thereof and ageing characteristics specified.

**a) NEW OIL**

| SL. No. | Characteristics | Requirements |
|---|---|---|
| 1 | Appearance | Oil shall be clear and transparent and free from suspended matter and sediments. |
| 2 | Density (Max) at 29.5° C | 0.89 g/cm$^3$ |
| 3 | Kinematic viscosity (max) | 27 Cst at 27°C |
| 4 | Interfacial tension at 27°C (Min) | 0.04N/M |
| 5 | Flash point (Min) | 140°C |
| 6 | Neutralization value<br>a) Total acidity (Max)<br>b) Inorganic acidity/Alkalinity | <br>0.02mg KOH/gm.<br>Nil |
| 7 | Pour point (max) | -6°C |
| 8 | Corrosive sulphur | Non Corrosive |
| 9 | Electric strength (break down voltage (min) with 2.5mm gap)<br>a) New Unfiltered oil as in received condition.<br>b) After filtration. | <br>30KV (RMS)<br>60KV (RMS) |
| 10 | Dielectric dissipation factor (tan delta) at 90°C (Max) | 0.002 |
| 11 | SK Value (Max) | 12% |
| 12 | Water content (Max) | 50PPM |
| 13 | Specific Resistance (Min) (Resistivity)<br>a) At 90°C (min)<br>b) At 27°C (min) | <br>35 x $10^{12}$ Ohm – cm.<br>1500 x $10^{12}$ Ohm – cm. |
| 14 | Oxidation Stability<br>a) Neutralization value after oxidation (Max.)<br>b) Total sludge after oxidation (Max.) | <br>0.40 Mg/KOH/g.<br>0.1 % by weight |
| 15 | Ageing characteristics after accelerated ageing (Open breaker method with copper catalyst)<br>a) Resistivity at 27°C<br>b) Resistivity at 90°C<br>c) Dielectric loss factor (tan delta) at 90°C<br>d) Total acidity mg KOH/g<br>e) Sludge Content (Max.) | <br>2.5 x $10^{12}$ Ohm - cm (min)<br>0.2 x $10^{12}$ Ohm - cm (min)<br>0.2 (Max.)<br>0.05 (Max.)<br>0.05 by weight. |
| 16 | Presence of oxidation in hibitor (Percent by weight) | The oil shall not contain antioxidant additives |

**Remarks:** Value of 0.05% (max) shall be treated as absence of oxidation inhibitor.

| SL. No. | Characteristics | Requirements |
|---|---|---|
| 1 | Electric Strength | 50kV Min. With 2.5mm Gap |
| 2 | Dielectric dissipation factor (Tan delta) at 90°C | 0.01 Max |
| 3 | Specific resistance (Resistivity) at 27°C | 19 x $10^{12}$ Ohm-cms. |
| 4 | Flash point P.M. (Closed) | $140^{0}$C(Min) |
| 5 | Interfacial tension at 27°C | 0.03 B+N+M or more |
| 6 | Neutralization value (total acidity) | 0.5mg of KOH/g or less |
| 7 | Water content PPm | 33 (Max) |

b). The important characteristics of the transformer oil after it is filled in the transformer (with in 3 months of filling) shall be as follows.

All tests to verify the characteristics mentioned as above shall be carried out in accordance with IS: 335/1993.

**8. PERCENTAGE IMPENDENCE:**

The value of impedance of transformer at 75°C shall be 4.5% shall be in accordance with IS: 2026.

**9.**

The temperature rises over ambient shall not exceed the limits given below:

a. Top oil temperature rise measure by thermometer : 35°C
b. Winding temp rise measured by resistance method: 40°C

**TRANSFORMERS not meeting the above limits of temperature rise will not be accepted**

The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Supplier shall submit the calculation sheet in this regard.

**10. NO LOAD VOLTAGE RATIO:**

The No Load Voltage ratio shall be 11000/433-240V, for all capacities of distribution transformers at normal tap.

**11. INSULATION LEVELS:**

| Sl No. | Voltage (kV) | Impulse Voltage (kV Peak) | Power Frequency Voltage (kV) |
|---|---|---|---|
| 1 | 0.433 | - | 3 |
| 2. | 11 | 95 | 28 |

**12. DESIGN & CONSTRUCTION:**

**CORE:**

a) The core shall be of high grade CRGO steel sheet of 23ZDMH85 or ***CRGO gradeM4 of thickness 0.23mm*** or superior to that having low loss and non ageing grain oriented, 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. The value of the flux density shall not be more than 1.7 tesla at 50 HZ.

The construction of core, internal clearances minimum effective area of cross section, minimum Nos. of core steps etc., shall be strictly as per the drawings enclosed.

b) The transformers 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 ratio i.e., 11kV/50Hz. (Due to combined effect of voltage and frequency) upto 12.5% without injurious heating at full load conditions the core shall not be saturated.

The supplier shall furnish necessary design data in support of this condition

c) The maximum thickness of core laminations shall not exceed 0.3mm. Further the lamination sheets used for top yoke, bottom yoke etc., shall be of single piece.

d) No load current, shall be measured by energizing the transformers at 433 volts 50 C/S on the secondary for distribution transformers. Increase of voltage by 10% shall not increase the no load current disproportionately high. Test for magnetic balance by connecting the LV phase by phase to rated phase voltage and measurement of an, bn, cn, voltage shall be carried out. The no load current shall not exceed 3% in respect of the transformer at rated voltage & frequency.

The minimum
(1) Effective core area
(2) Number of core steps
(3) Internal clearance

Shall be furnished by the Supplier . Minimum effective cross sectional area of the core to be provided are as follows:

1) 25KVA - 41.18 sq.cm.

**Note:** If the manufacturer uses the better quality CRGO steel for the core the manufacturer has to furnish the area of cross section of the core along with the design details.

e) The unbalance current in the neutral shall not be more than 2% of the rated current.

**13. CORE CLAMPING:**

1) M.S.Channel 75 x 40mm for 25KVA transformers on top and bottom shall be used for clamping the core.

2) 2 Nos. of 12mm high tensile vertical bolts in parallel in each side shall be provided. The size of the Bolts to be provided in parallel are as follows:

a) 25KVA - 2 Nos. of 12mm High Tensile Bolts

3) Channel on LV side to be reinforced at equidistance if hole cutting is done for LT lead so as to avoid bending of channel.

4) M.S. Channels are to be painted by varnish and corrosion oil resistant paint before use.

5) Flat or cut channel shall not be used.

6) Core mounting is to be done with ISF 50x10 .

7) Clamping arrangement should be strong enough to withstand mechanical forces. The mechanical strength shall be proven by short circuit test.

**TIE BOLTS:**

Four horizontal tie rods (or high tensile steel) of 12mm dia for transformers to be used. Rods to be effectively insulated with kraft paper tube of thickness I.5mm.

i) All top and bottom Yoke nuts bolts and tie rods shall be painted with oil and corrosion resistant paint before use.
ii) Channel - (top yoke) on LV side to be reinforced at equidistance if hole cutting is done to avoid bending of channel.
iii) The flat provided at the core shall be as per the drawings enclosed and shall not be cut through the length.
iv) Tie rods shall be effectively earthed.
v) Drawing of the building of the core shall be got approved before start of the work

**14. WINDINGS:**

a) **Material-** Double layer paper covered Aluminium conductor shall be used.
b) The nominal HV winding cross section shall be as follows:

| SL. No. | Rating | |
|---|---|---|
| 1 | 25KVA | 0.7854 Sq.mm. |

c) The nominal LV winding cross section shall be as follows:

| SL. No. | Rating | |
|---|---|---|
| 1 | 25KVA | 18.33 Sq.mm. |

d) LV winding shall be in even layers

e) The neutral formation shall be at top

**Note:** If any other than the above cross section of HV/LV windings, details shall be furnished.

**15.**

The Supplier shall guarantee individually the no-load losses and loss without any positive tolerance. The Supplier shall also guarantee the total losses at 50% and 100% load condition (at rated voltage and frequency and at 75°C).

The maximum allowable losses & impedance at rated voltage and rated frequency permitted at 75°C for 11/0.433kV transformers as follows:

| No load Voltage Ratio | Ratings (kVA) | Max Losses at 50% loading (watts) | Max Losses at 100% loading (watts) | Percentage impedance (subject to tolerance as per IS 2026) |
|---|---|---|---|---|
| 11000 : 433-250V | 25 | 210 | 695 | 4.5% |

**16. TOLERANCE:**

No positive tolerance shall be allowed on the maximum losses displayed on the label for both 50% and 100% loading values.

**17.**

During testing at supplier's works, if it is found that the actual measured losses are more than the values quoted by the Supplier, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot.

Purchaser shall reject the entire lot during the test at suppliers works, if the temperature rise exceeds the specified values.

Purchaser shall reject any transformer during the test at suppliers works, if the impedance values differ from the guaranteed values including tolerance.

**18. INSULATION, INSULATION MATERIAL& CLERANCES:**

Electrical grade insulation epoxy dotted Kraft Paper to be used for interlayer insulation.

All spacers, axial wedges/runners used in windings shall be made of pre-compressed Pressboard-solid, conforming to type B 3.1 of IEC641-3-2. In case of cross- over coil winding of HV all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely. Insulation shearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and dimensional variations.

a) Press board blocks at top and bottom of each coil assembly shall be provided. There must be atleast 4 blocks per phase/coil of each of thickness of 30mm. Core wrapper shall be of minimum of 1mm thick.

   The channel at phase barrier board shall be of 2mm thick press board. The tie rod insulation craft paper shall be of thickness 1mm. Between HV and LV windings addition press Board cylinder of at least 2mm in addition to spacers shall also be provided.

b) No. of vertical/axial wedges minimum 18 Nos., shall be provided depending upon the capacity of transformers between LV and HV windings and equispaced around LV. The wedge shall be minimum 6.5mm thick wide.

c) The inter layer insulation shall be provided between HV windings layers depending on the design. The details shall be furnished.

d) The Neutral connection of LT winding shall be formed using aluminium strip of same size as that of 'S' type link of size 25x3mm.

e) The Delta formation of HV winding shall be made using copper jumper leads of size 1.6mm dia. for 25KVA, 2.65MM transformers. The leads shall be enclosed in Kraft insulated paper tube.

f) Double paper covering shall be used for winding insulation both for HV & LV windings. Either preformed corrugated cylindrical boards or cylindrical compressed boards with spacers shall be provided between HV & LV windings. Press board of type - D IS: 1576 to be used for top and bottom yoke insulation. The electrical grade insulating paper shall be of Triveni/Ballarpur or equivalent make subject to approval

of ***AYCL***. Press boards used shall be of M/s. Senapathi whitely or M/s. Raman Boards or equivalent make subject to approval of ***AYCL***.

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

   1. for 25 KVA - 3.5MM

h) Radial clearance between HV and LV coils shall not be less than 10mm for all capacities.

i) Phase to phase clearance between HV coils shall not be less than 15mm. A minimum of 2 Nos. of 1mm press board shall be used to cover the tie rods.

j) The minimum electrical clearance between the winding and body of the tank (between inside surface of the tank and outside edge of the winding) shall not be less than ***30***mm.

k) End insulation to earth shall not be less than 25mm.

l) HV & LV coils single coil multi layer winding shall be used for all capacities of transformers.

m) Tap lead shall be insulated with 1.5 mm thick paper insulation. Inspection of windings prior to tankings shall be done. Manufacturing drawing for the transformer showing various clearance shall have to be approved by the ***AYCL***.

**19. TANK:**

The internal clearance of tank shall be such, that it shall facilitate easy lifting of core with coils from the tank without dismantling LV bushings.

All joints of tank and fittings shall be oil tight and no bulging should occur during service.

Inside of tank shall be painted with varnished/hot oil resistant paint.
Top cover of the tank shall be slightly slopping to drain rain water.

The tank plate and the lifting lugs shall be of such strength that the complete transformer filled with oil may be lifted by means of lifting shackle.

The rating and serial no's. of the transformer shall be embossed/punched on the tank of transformer/ on transformer name plate fitting sheet of the transformer. In addition to name plate details of transformer fitted to the transformer tank.
Manufacturer should carry out all welding operations as per the relevant ASME standards and submit a copy of the welding procedure and welder performance qualification certificates to the ***AYCL***.
The transformer tank shall be of robust construction only in rectangular/ Octagonal shape and shall be built up of electrically tested welded mild steel top and bottom plates thickness of ***5 mm for 25kVA*** and 3.15 mm (minimum) for the side wall thickness.

Suitable reinforcement by welded angle shall be provided on all the outside walls on the edge of the tank. The permanent deflection shall not be more than 5mm up to 750mm length and 6mm up to 1250mm length and 8mm up to 1750mm length when transformer tank without

oil is subjected to Air pressure test as per IS:1180.

Under operating conditions the pressure generated inside the tank should not exceed .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. The space above oil level in the tank shall be filled with dry air or nitrogen conforming to commercial grade of IS:1747.

The tank shall further be capable of withstanding a pressure of ***0.8kg/sqcm(g)*** and a vacuum of 0.7 kg/sq.cm (g) without any deformation.
The radiators can be tube type or fin type or pressed steel type to achieve the desired cooling to limit the specified temperature rise.

1) **Lifting lugs:**
   2 Nos, of welded heavy duty lifting lugs of M.S. Plate 8mm thick suitably reinforced by vertical supporting flat welded edgewise below the lug on the side wall shall be provided.

2) **Top Cover Fixing Bolts:**

   - 6mm Neoprene bonded cork gaskets confirming to IS-4352 Part-II shall be placed between top cover plate and tank.

   - GI bolts and nuts shall be size 12mrn x 40mm with one plain and one spring washer suitably apart (100mm) to press the cover.

3) Tolerance on tank dimensions shall be limited to -5% to + 10%.

**20.**

a) Heat dissipation by tank walls excluding top and bottom should be 500 watts / Sq. mtr.
b) The guaranteed temperature rise of oil and winding shall be found by conducting temperature rise test in presence of the representative of the ***AYCL***.

**21. TOTAL MINIMUM OIL VOLUME:**

| Sl. No. | Rating | Oil in Ltrs. (inclusive for oil absorbed in core coil assembly) |
|---|---|---|
| 1 | 25KVA | 85 |

**NOTE:** If the specified amount oil is insufficient, additional quantity may be furnished and absorption of oil in the core and winding assembly is more than permissible value first filling oil volume should be increased accordingly detailed calculation of absorption shall be submitted.

**Weight(approx) of major materials of complete Transformer**

1. **CRGO----------80kg**
2. **H.V(SEM)---- 27kg**
3. **L.V(DPC strip)---------12kg**
4. **Tank----------80kg**
5. **Radiator----------2nos**
6. **Oil----------97ltr**
7. **Insulation: Approx6Kgs**

**22. BREATHERS :**

Breather joints shall be of bolted type. It shall have die cast Aluminium body and inside container for Silica gel shall be of tin. Makes of Breathers shall be subject to ***AYCL*** approval.
The volume of the breather shall be

a) 250 grams of silica gel breather shall be provided for 25 KVA.

The breather shall have an inspection window to view the condition of the silica gel.

**23. TERMINALS:**

Brass rods 12mm dia for HT and LT for 25KVA Transformers may be provided.

a) HT/LT Bimetallic connectors shall be provided to 25KVA transformers.

b) The HV and LV windings conductor shall not be terminated to the bushing rod directly.

c) The HV winding shall be linked through a terminal lug and copper jumper lead of size 1.6mm dia for 25KVA transformers. The leads shall be enclosed in kraft paper tube.

d) The LV winding shall be terminated using inverted 'S' type link of size 25x3mm Aluminium strip for 25KVA transformers.

1) All the leads / links shall be immersed in oil.
2) All the leads/links shall be taken neatly strapped on an insulated press Board/wooden Bus Bar.

**24. BUSHINGS:**

I. For 11KV, 12KV Bushings (confirming to IS: 2099/1986) with single gap arcing horns shall be used and for 433 volts, 1.1KV terminal Bushings confirming to IS: 7421/1974shall be used. Bushings of the same voltage class shall be interchangeable. The dimensions of Bushings shall be as per IS-3347 and these Bushings shall be mounted on side of the tank or on the top cover. The bushings mounted on the side shall not have an inclination of more than 30 degrees from the vertical as per CBIP manual and IS-2099. Only sheet metal pocket shall be provided for mounting HV bushings alternately the same can be mounted on pipes. Creepage distance shall not be less than 25mm/KV as per IS: 2099-1986.

II. **Brazing of all internal connections** – All jumpers from windings to bushing shall have a cross section larger than tile winding conductor. For copper, silver brazing alloy to be used. For aluminium, L&T aluminium brazing rods shall be used.

III. The minimum phase to phase and phase to earth external clearances for HV & LV Bushings shall be as follows:

| | **Minimum clearances** | |
|---|---|---|
| | **Phase to phase (in mm).** | **Phase to earth** |
| HV Bushings | 255 | 140 |
| LV Bushings | 75 | 40 |

The above 140 mm. clearance does not apply to arcing horn gap.

**25. TANK BASE CHANNEL:**

a) For 25KVA Trans. ISMC 75 x 40mm. channel shall be used for base.

**26. TERMINAL MARKING PLATE AND RATING PLATES:**

The transformer shall be provided with a brass plate showing the relative physical position of the terminal and their markings.. This shall be in accordance with IS: 2026. The transformers shall be provided with rating plate furnishing the information as specified in IS-2026.

The month and year of delivery shall be indicated on the rating plate. The rating plate shall be embossed / engraved type but not painted. The serial No. of transformer shall follow the code Nos. as detailed below. These shall be punch marked on the transformer tank and also on the top cover.

| Alpha | Numeric | Numeric | Numeric | Numeric |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |

Alpha represents code name of manufacturer.

Numeric 1. Represents capacity

i.e. , code - 01 for 25KVA

Numeric 2 - Represents year of manufacturer.

Numeric 3 - Represents month of manufacture.

Numeric 4 - Represents SL. No. of Transformers.

**27. SURFACE PREPARATION AND PAINTING:**

**General**

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

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

**28. 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.

Steel surface shall be prepared by shot blast cleaning (IS: 9954) to grade Sq. 2.5of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS: 3618).

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

**29. PROTECTIVE COATING:**

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

**30. PAINT MATERIAL:**

Following are the types of paint which may be suitably used for the items to be painted at shop and supply of matching paint to site;

For inside surface, Heat resistant paint (Hot oil proof).

For external surfaces one coat of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel/Polyurethene base paint. These paints can be either air drying or stoving.

**31. PAINTING PROCEDURE:**

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

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 coating. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%.

**32. DAMAGED PAINTWORK:**

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

**33. DRY FILM THICKNESS:**

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

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

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

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) (microns) |
|---|---|---|---|---|
| 1. | Thermo setting powder paint | Inside outside | 01<br>01 | 30<br>60 |
| 2. | Liquid Paint<br>a)Epoxy (primer)<br>b) P U. Paint (Finish coat)<br>c)Hot oil Paint/Varnish | Out side<br>Outside<br><br>Inside | 01<br>02<br><br>01 | 30 25 each<br><br>35/10 |

**34. TESTS FOR PAINTED SURFACE:**

The painted surface shall be tested for paint thickness.

The supplier shall guarantee the painting performance requirements for a period of not less than 5 years.

**35. FITTINGS:**

The following standard fittings shall be provided:

1. Rating and terminal marking plates, non-detachable.
2. Earthing terminals with lugs-2 Nos.
3. Lifting lugs for main tank and top cover - 2nos.
4. Terminal connectors on the HV/LV bushings (For bare terminations only)
5. Thermometer pocket with cap - 1 No.
6. HV bushings - 3 Nos.
7. LV bushings - 4Nos.
8. Stiffener
9. Arcing horns
10. Prismatic oil level gauge-----1no
11. Top filter valve
12. De-hydrating Silicagel breather—1no
13. Base channel 75x40mm for up to 100kVA
14. Pressure relief device or explosion vent.
15. Pressed steel Radiators – as per requirement
16. Pulling lugs-------2nos
17. Drain cum sampling valve

**36. 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 6mm in diameter except when used for small wiring terminals.

All nuts and pins shall be adequately locked.

**37. TESTS:**

Type tests, routine tests and acceptance tests shall be conducted on transformers, of each capacity. All the equipments offered, shall be fully type tested as per the relevant standards.

**40. TYPE TEST**

The following shall constitute the type tests as per IS-1180 (Part I) and IS: 2026/CBIP manual.

a) Measurement of winding resistance
b) Measurement of voltage ratio and check of voltage vector relation ship
c) Measurement of impedance voltage/Short circuit impedance and load loss.
d) Measurement of no-load loss and current
e) Measurement of Insulation resistance.
f) Induced over voltage withstand test.
g) Separate source voltage withstand test.
h) Impulse voltage withstand test: With chopped wave of IS: 2026 part -III. BIL for 11kV shall be 95kV peak instead of 75kV.
i) Temperatures rise test
j) Short circuit withstand test: Thermal & Dynamic ability.
k) Air pressure test
l) Permissible flux density and over fluxing.
m) Un Balance current test: The value of unbalance current indicated by the Ammeter as shown in the test arrangement of CBIP manual shall not be more than 2% of the full load current.

n) Magnetic balance test
o) Noise level measurement.
p) Measurement of Zero phase sequence impedance.

**41. Routine Tests:**

All transformers manufactured shall be subjected to the following routine test, at the manufacturer's works - In accordance with IS:1180 (Part I & II) and IS:2026.

1) Measurement of winding resistance.
2) Measurement of voltage ratio, polarity, phase sequence and Check of voltage vector relationship
3) Measurement of impedance voltage/short circuit impedance and load losses at rated current and normal frequency.
4) Measurement of no load loss current and neutral current.
5) Measurement insulation resistance.
6) Induced over voltage withstand test.
7) Separate source voltage withstand test.
8) Neutral current measurement: The value of zero sequence current in the neutral of the star winding shall not be more than 2% of the full load current.
9) Oil samples (one sample per lot) to comply with IS: 1866.
10) Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 110% rated voltage.
11) Pressure and vacuum test for checking the deflection.

**42. Type and Routine Test certificates:**

1. All the type and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of ***AYCL*** representative.

2. It may also be noted that the purchaser reserves the right to conduct short circuit test and impulse voltage withstand test in accordance with the IS, afresh on each ordered rating, even if the transformers of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the purchaser either at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to purchaser's stores. The findings and conclusions of these tests shall be binding on the supplier.

3. Immediately after finalization of tile programme of type/ acceptance/ routine testing, the supplier shall give advance intimation to the ***AYCL*** to enable to depute its representative for witnessing the tests. The routine test certificate shall be submitted along with tile inspection offer.

**43. ACCEPTANCE TEST:**

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

Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP and contract drawings.

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

Temperature rise test as per the discretion of AYCL.

The representative of AYCL shall be entitled at all reasonable times during manufacture to inspect, examine & test at supplier's premises the materials & workmanship of all equipments to be supplied in the event of P.O. In case of failure of any transformer in the routine tests, the whole offered lot will be rejected. AYCL if required may conduct type test on the offered lot for inspection. In that case, testing charges will be borne by AYCL if the selected transformer withstand type tests. In case the selected transformer fail in type test, testing charges etc will be borne by the supplier & the offered lot will be rejected.

The selected samples shall be subjected to the following acceptance tests at the manufacturer's works in accordance with the relevant ISS:

1. Insulation resistance
2. Separate source voltage withstand test
3. Induced over voltage withstand test
4. Measurement of windings resistance cold (at or near the test bed temperature)
5. Measurement of Voltage ratio and check of voltage vector relationship
6. Measurement of Impedance voltage and load losses at rated current and normal frequency.
7. Measurement of total losses at rated voltage and normal frequency (at 50% & 100% loading).
8. Measurement of No load losses & current at 100 % and 112.5% of rated voltage and normal frequency.
9. Checking of rating and terminal marking plate.
10. Checking of weights, dimensions, fittings and accessories, tank sheet thickness, oil quantity, material, finish, paint thickness and workmanship as per purchase order and contract drawings.

11. Physical verification of core – coil dimension, internal clearances, provisions of required oil ducts in the HV and LV winding, conductor sizes, individual weights of HV and LV winding core laminations etc., with reference to contract drawings and type test report(s) by dismantling selected unit(s). The physical verification shall be conducted on units equivalent to one unit per 50 Nos. or part thereof of offered quantity randomly selected from the offered lot. The dismantled unit(s) after re-assembly shall be accepted by the purchaser after routine testing in presence of his representative.

During final inspection, sheet thickness shall also be measured of the transformer opened for physical verification. The instrument for measurement of sheet thickness will be provided by the supplier.

12. Oil dielectric strength (break down voltage) test shall be carried out on the transformers opened for physical verification and average value shall be calculated.

13. Checking of manufacturer's test certificates and invoices for major raw materials shall be done and copies thereof duly signed by firm's representatives and inspecting officers shall be enclosed with the inspection report.

Invoices of CRGO material shall be provided by the supplier to the inspecting officer at the time of inspection and same shall be verified by the inspecting officer.

**Following tests shall also be carried out at manufacturer's works on one complete unit of Transformers unit:**

i) Air pressure test on empty tank of transformer opened for physical verification test. (See note below)
ii) Measurement of unbalance current.
iii) Magnetic Balance Test (See note below)
iv) Oil Leakage Test (See note below)

After successful inspection, the inspecting officer shall ensure that all the offered transformers are complete and duly fitted with name, rating and diagram plate, identification plate (on tank body & Top cover) as specified in this specification.

**NOTE:**

**1. INSULATION RESISTANCE MEASUREMENT:**

Insulation resistance of selected samples shall be measured with a 2500V Megger, of standard make. The minimum insulation resistance shall be furnished by the supplier.

**2. AIR PRESSURE TEST:**

This test shall be conducted as type test at the time of inspection of first lot, at the manufacturer's works. The pressure gauge and vacuum gauge shall be duly calibrated and sealed by an independent recognised test lab(s).

The test procedure shall be as detailed below:

The tank shall be fixed with a dummy cover with all fittings including bushings in position and shall be subjected to air pressure of 0.8 $Kg/cm^2$ (gauge pressure), for 30 minutes.

Permanent deflection of flat plate, after pressure has been released, shall not exceed specified value

**3. MAGNETIC BALANCE TEST:**

This test shall be conducted as an additional test on one sample transformer from each lot offered for inspection.

**4. OIL LEAKAGE TEST:**

The oil leakage test shall be conducted on one unit selected from the offered lot of each rating. Transformer complete in all respects shall be subjected to the pressure corresponding to 0.5 Kg / $cm^2$ and maintained for three hours. No leakage should be there.

**44.**

**a)** The purchaser at their discretion may select one transformer from the supplied first LOT of 100 Nos at random for conducting the Type tests mentioned for testing at CPRI. The supplier shall arrange these tests including loading, unloading and to & fro transportation from our stores to the test house. **The testing charges shall be borne by the supplier.**

NOTE: For subsequent LOTs, purchaser (***AYCL***) at its discretion may conduct type tests at CPRI. In such cases, the testing charges will be borne by the purchaser in case the selected transformer

withstands type tests. If the selected transformer fails in type tests, then the testing charges shall be borne by the supplier only & in that case total offered lot for inspection will be rejected.

**45.** In the event of failure / unsatisfactory results of the transformer(s) in Dynamic & Thermal Ability to withstand Short Circuit Test / impulse type tests/ any other type tests, the supplier shall have to replace the supplies already made and no further transformers shall be accepted.

The application of low voltage to the middle limb will induce approximately equal voltages on the two end limbs. The application of voltage to the end limbs will induce greater voltage in the middle limb and less voltage in the other end limb. Uniformity of induced voltages shall confirm the healthiness of the transformer windings.
The procedure for the test shall be as under:
a) Apply 250 Volts between LV terminals-2u-2n and measure voltages between 2v-2n & 2w –2n.
b) Apply 250 Volts between 2v-2n and measure voltages between 2u-2n & 2w-2n.
c) Apply 250 Volts between 2w-2n and measure voltages between 2u-2n & 2v-2n.

The measured voltages shall satisfy the conditions detailed as above occur.

**a. TOLERANCES:**

Unless otherwise specified herein, the values of different parameters of the transformers supplied shall be within the tolerance permitted in the IS-2026 on the guaranteed values. Positive tolerance is not applicable for losses and negative tolerance not applicable for cross sections of winding specified.

**b. FINISHING:**

The exterior of the transformer tank and other ferrous fittings shall be thoroughly cleaned, scrapped/sand blasted and given a priming coat and two finishing coats of durable oil the weather resistance paints or enamel. The colour of finishing coats for transformers shall be as follows, as per IS: 5.
a) For 25 KVA - Sky Blue shade No. 101

**46. Testing of Transformer oil:**

To ascertain the quality of the transformer oil, the original manufacturer's tests report should be submitted at the time of inspection. Arrangements should also be made for testing of transformer oil, after taking out of the sample from the manufactured transformers and tested in the presence of purchaser's representative.

**i. Guarantee:**

The manufacturers of the transformer shall provide a guarantee of **39months from the date of supply**. In case the distribution transformer fails within the guarantee period the purchaser will immediately inform the supplier who shall take back the failed DT within 5 days from the date of the information at his own cost and replace / repair the transformer within 15 days of date of intimation with a roll over guarantee.

The outage period i.e., period from the date of failure till unit is repaired/ replaced shall not be countered for arriving at the guarantee period.

**b) Inspection:**

To ensure about the quality of transformers, the inspection shall be carried out by the purchaser's representative at following two stages:

1. Online anytime during receipt of raw material and manufacture/assembly whenever the purchaser desires.
2. At finished stage i.e., transformers are fully assembled and are ready for despatch.

The stage inspection shall be carried out.

After the main raw-material i.e., core and coil material and tanks are arranged and transformers are taken for production on shop floor and a few assembly have been completed, the firm shall intimate the purchaser in this regard, so that an officer for carrying out such inspection could be deputed, as far as possible within two days from the date of intimation. During the stage inspection a few assembled core shall be dismantled (only in case of CRGO material) to ensure that the CRGO laminations used are of good quality. Further, as and when the transformers are ready for despatch, an offer intimating about the readiness of transformers, for final inspection for carrying out tests as per relevant IS shall be sent by the firm along with Routine Test Certificates. The inspection shall normally be arranged by the purchaser at the earliest after receipt of offer for pre- delivery inspection. The proforma for pre delivery inspection of distribution transformers is placed.

In case of any defect/defective workmanship observed at any stage by the purchaser's inspecting officer, the same shall be pointed out to the firm in writing for taking remedial measures. Further processing should only be done after Clarence from the inspecting officer/ purchaser.

All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacture and purchaser at the time of purchaser. the manufacture shall offer the inspector representing the purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include stage inspection during manufacturing stage as well as active part inspection during acceptance tests. The supplier shall give 2 days advance intimation to the purchaser to organize stage inspection of the Transformer in which the assembly of core and the winding could be inspected. The ***AYCL*** may at its option, open a transformer supplied to the stores, in the presence of the supplier at site or at ***AYCL*** stores. If any of the technical particulars are seen to be at variance with the guaranteed technical particulars the whole lot of transformers will be rejected and risk purchase resorted to.

**47. Inspection and Testing of Transformer Oil:**

To ascertain the quality of the Transformer oil, the original manufacturer's test report should be submitted at the time of inspection. Also arrangements shall be made for testing of Transformer oil, after taking out the sample from the manufactured Transformer and tested in the presence of ***AYCL***'s representative or in any independent laboratory viz., B.D.V. test should be conducted in presence of ***AYCL*** representatives.

a. **QUALITY ASSURANCE PLAN:**

In respect of raw materials such as core stamping, winding, conductor, insulating paper and oil, the manufacturer shall use these materials manufactured/supplied by the standard

manufacturers and furnish the manufacturers test certificates as well as the proof of purchase from these manufacturers (excise gate pass) for information of corporation.

Statement giving list of important raw materials including but not limited to:

a) Core material
b) Winding material
c) Insulation paper and press boards.
d) Transformer oil
e) Bushings
f) Tanks, and radiators

Names of sub supplier for the raw materials, List of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier's representatives, copies of test certificates.
.Information and copies of test certificates in respect of bought out accessories.

List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such tests and inspections.

Special features provided in the equipment to make it maintenance free.

List of testing equipment available with the Supplier for final testing of transformers vis-à-vis, the type, special, acceptance and routine tests specified in the relevant standards. The limitations shall be very clearly brought out in the relevant schedule i.e., schedule of deviations from specified test requirements.

The supplier shall within 10 days of placement of order, submit following information to tile purchaser.

a) List of raw materials as well brought out accessories and the names of sub suppliers selected from those furnished along with offer.

b) Type test certificates of the raw material and bought out accessories.

c) Quality Assurance Plan (QAP) with hold points for purchaser's inspection. The quality assurance plans and hold points shall be discussed between the purchaser and supplier before the QAP is finalized.

The supplier shall submit the routine test certificate of bought out items and raw material, during routine testing of the fully assembled Transformer.

b. **DOCUMENTATION:**

All drawings shall conform to international standards organization (ISO) 'A' Series of drawing sheet/Indian standards specification IS:656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in SI Units.

The supplier shall furnish all the details of constructional feature showing tile details of all the items in the plan, sectional elevation and tile side elevation and indicate these details/dimensions.

The supplier shall furnish the magnetization characteristic curve for the core material of the transformer.

Two sets of the type test reports, duly approved by the ***AYCL*** shall be submitted by the supplier for distribution before commencement of supply.

Supplier shall furnish the 2 Sets of drawings for approval.

The manufacture of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without written approval of the company. All manufacturing and fabrication work in connection with the equipment prior to the approval of tile drawing shall be at tile suppliers risk.

Approval of drawings / work by ***AYCL*** shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirement of the latest revision of applicable standards, rules and codes of practices. The equipments shall conform in all respects to high standards of engineering design workmanship and latest revisions of relevant standards at the time of supply and the ***AYCL*** shall have the power to reject any work or materials which in his judgment is not in full accordance there with.

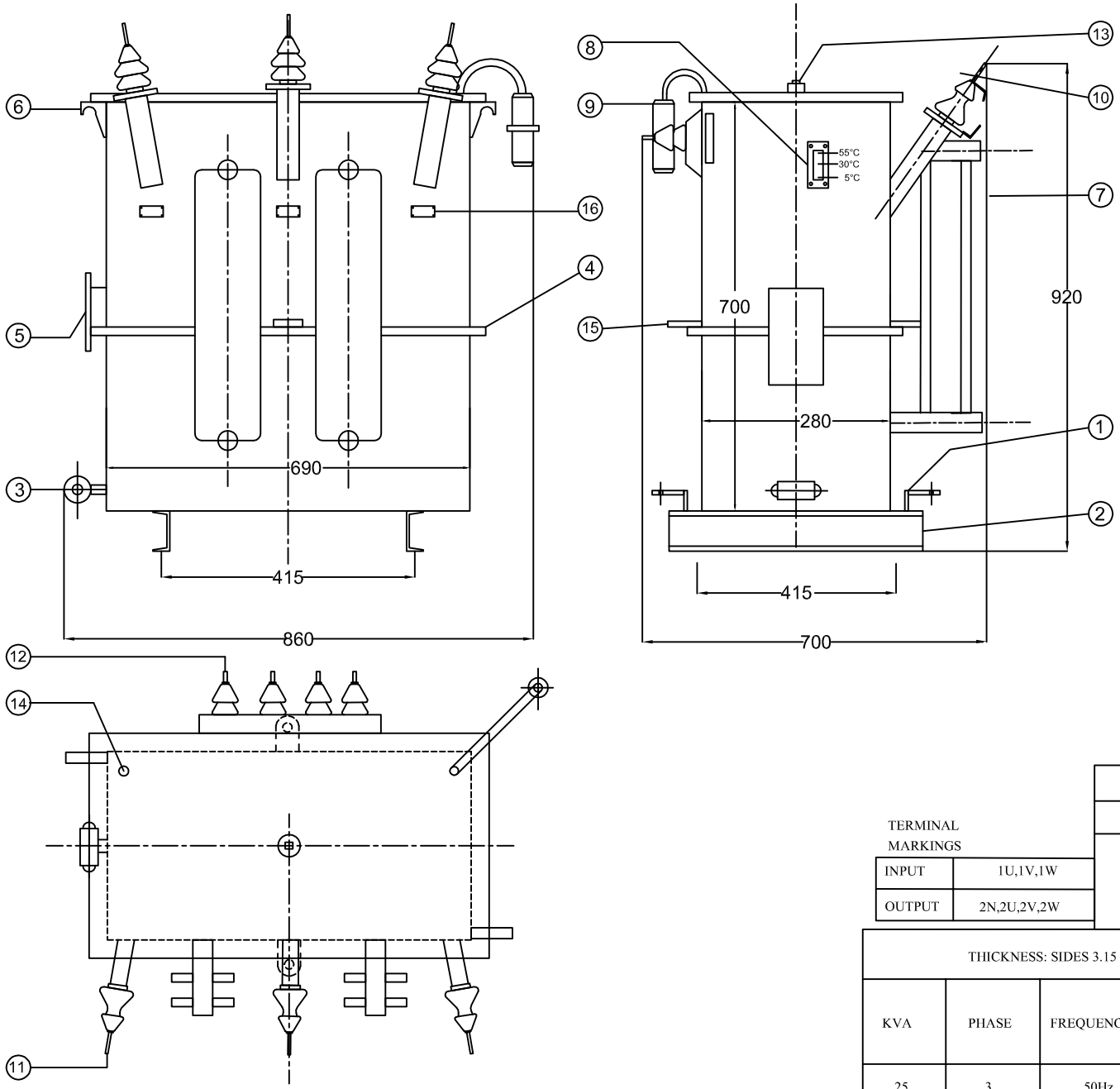
**c.**

Each consignment shall be accompanied by a detailed packing list containing the following information.

a) Name of the Consignee.
b) Details of Consignment.
c) Destination.
d) Total weight of consignment
e) Signs showing upper / lower side of the crate.
f) Bill of Materials including contents of each package.

The monogram/name of the firm shall be blanked on the top cover of the Transformer.

d. One metal strip to be provided to each transformer, on which the Serial No. of the transformer shall be punched and the strip to be welded to the radiator, which is fixed to the transformer tank.




| ITEM | DESCRIPTION | NO. OFF |
|---|---|---|
| 16 | NON-DETACHABLE TERMINAL MARKING PLATE | 7 |
| 15 | PULLING LUG | 2 |
| 14 | THERMOMETER POCKET | 1 |
| 13 | OIL FILLING HOLE WITH CAP | 1 |
| 12 | LV OUTDOOR BUSHING WITH FITTINGS | 4 |
| 11 | HV OUTDOOR BUSHING WITH FITTINGS | 3 |
| 10 | NON ADJUSTABLE ARCING HORN | 3 |
| 9 | SILICAGEL BREATHER | 1 |
| 8 | OIL LEVEL GUAGE (PLAIN) | 1 |
| 7 | RADIATOR BANK | 2 |
| 6 | LIFTING LUG | 2 |
| 5 | NAME, RATING AND DIAGRAM PLATE | 1+1 |
| 4 | STIFFNER | - |
| 3 | OIL DRAIN CUM SAMPLING VALVE WITH PLUG (3/4") | 1 |
| 2 | UNDERBASE CHANNEL 75 X 40 | 2 |
| 1 | EARTHING TERMINAL WITH LUG | 2 |

| MIN. ELE. CLEARANCE IN AIR | | |
|---|---|---|
| H.V. SIDE | PH. TO PH. | 255 |
| | PH. TO E. | 140 |
| L.V. SIDE | PH. TO PH. | 75 |
| | PH. TO E. | 40 |

| WEIGHT DETAILS | |
|---|---|
| TOTAL WEIGHT OF TRANSFORMER | 305 KGS |
| WTS. OF TANK/ FITTINGS | 97 KGS |
| WTS. OF CORE COIL ASSEMBLY | 130 KGS |
| WTS. OF OIL. | 78 KGS |
| VOL. OF OIL | 95 LTRS |

| DESCRIPTION | |
|---|---|
| Max. Total Losses | As Per BEE 3 Star Specification |
| At 50% Loading | 210 watts |
| At 100% Loading | 695 watts |

TERMINAL MARKINGS

| | |
|---|---|
| INPUT | 1U,1V,1W |
| OUTPUT | 2N,2U,2V,2W |

THICKNESS: SIDES 3.15 mm. TOP AND BOTTOM 5 mm. MATERIAL : M..S. (With IS tol)

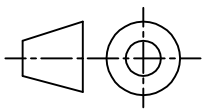
| KVA | PHASE | FREQUENCY | VECTOR GROUP | COOLING | VOLTAGE (V) | | CURRENT (A) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | H.V. | L.V. | H.V. | L.V. |
| 25 | 3 | 50Hz | Dyn11 | ONAN | 11000 | 433 | 1.31 | 33.34 |

| SL. NO. | REVISION | BY | DATE |
|---|---|---|---|
| | | | |

REMARKS: a) OVERALL DIMENSIONS & WEIGHTS ARE SUBJECT TO TOLERANCE ±10%
b) ALL DIMNS. ARE IN mm UNLESS OTHERWISE SPECIFIED.



PROJECTION SYMBOL



ANDREW YULE & CO. LTD.
ELECTRICAL DIVN. BRENTFORD UNIT
KOLKATA - 700 088

| | NAME | DATE |
|---|---|---|
| DRAWN | | |
| CHECKED | | |
| APPROVED | | |

FILE NO.: SCALE : N.T.S.

TITLE :- OGA OF YULE MAKE TRANSFORMER

DRAWING NO. :-

REV. 0 SHEET 1 OF 1