By Regd. Post with Ack. Due.

NORTHERN POWER DISTRIBUTION COMPANY OF TELANGANA LTD
WARANGAL – 506 001.

(PURCHASE ORDER)

Phones: 0870-2461507.
Fax : 0870-2461519.

Ph : 040 – 30712222.
Fax: 040 – 30712245.

From
The Chief General Manager / P&MM,
2-5-31/2, 1st Floor, Vidyuth Bhavan,
T.S.N.P.D.C.L, Corporate Office,
Nakkalagutta, Hanamkonda,
Warangal – 506 001.
GSTIN No. 36AABCN2875L3Z1.

To
M/s. Toshiba Transmission & Distribution Systems (India)Private Limited,
Rudraram, Patancheru Mandal,
Sangareddy District, Telangana.
Pin : 502329, India

SAP No.	5	1	0	0	0	0	1	9	2	8

P.O.No.CGM/P&MM/NPDCL/Wgl./GM/DE-2/A3/PM-5352/17, Dt.17-10-2017.

Sir,

Sub : TSNPDCL – P&MM Wing - Tender Specification No. STN-11/17-18 - Supply of **2 Nos.** 33/6.6 KV 3.15 MVA Power Transformers for Water Grid Works – **Purchase Order** – Issued – Reg.

Ref : 1. Tender Specification No. STN-11/17-18
2. Lr.No.CGM/P&MM/NPDCL/WGL/GM/P2/A3/STN-11/17-18/ D.No.2481/16, Dt.13.10.2017.
3. Firm's acceptance letter Dt. 16.10.2017

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1). **ACCEPTANCE :** I, acting for and on behalf of and by the order and direction of TSNPDCL accept the rates for supply of **2 Nos.** 3.15 MVA Power Transformers for Water grid works as per Clause–3.0 Schedule of material and as per the above cited correspondence subject to the following terms and conditions.

2). **PRICES :** The prices indicated in schedule of materials are variable in rupees and inclusive of F&I, SGST @ 9% and CGST@ 9% and with the terms and conditions as per tender specification No. STN-11/17-18.

The prices indicated in schedule of materials are variable in rupees as per IEEMA price variation formula given in the specification with base rates prevailing on **01-09-2017** and with 30% ceiling on positive side and no ceiling on negative side as per general terms & conditions of specification.

$$P = \frac{PO}{100}\left[10 + 33\,\frac{C}{Co} + 24\,\frac{ES}{ESo} + 8\,\frac{IS}{Iso} + 4\,\frac{IM}{IMo} + 6\,\frac{TO}{TOo} + 15\,\frac{W}{Wo}\right]$$

If the date of delivery as defined in the P.V. formula is beyond the contracted delivery date the scheduled delivery date or inspection offer date or the actual delivery date which ever is advantageous to the Purchaser will form the basis for calculation of price variation.

The price variation bills shall be claimed separately which will be paid after approval of the same by this office and after adjustment of recoveries, if any, intimated by field officers. You shall claim only the prices as indicated in the purchase order in your regular bills.

The date of delivery for the purpose of price variation shall be date on which the material is notified as being ready for inspection/ despatch (in the absence of such notification the date of manufacturer's despatch note shall be considered as the date of delivery) or the contracted delivery date including any agreed extension thereto whichever shall be the earlier.

As far as practicable, prices will be revised (upward or downward) abinitio, to take care of any variation in prices of raw materials as defined above but if for any reason it is not found to practicable shall be effected at the contracted price and price variation claimed subsequently through a supplementary bill which will be paid as per the documentary evidence, proof or certificate in regard to the price variation bill is required by this office, the supplier shall have to furnish the same.

If there is downward revision in the prices of raw materials at the time of supply, the suppliers shall invariably claim the invoices at reduced rates on account of such downward revision.

The unloading charges at destination stores shall be to TSNPDCL's account.

3). **SCHEDULE OF MATERIALS:**

Sl. No.	**Description**	**Qty. in (Nos.)**	**FADS Price (Rs. Ps.)**	**Amount (Rs. Ps.)**
1.	3150 KVA, 33/6.6 KV, 3-Phase Delta/ Star, 50 cycles, oil immersed, naturally self cooled, core type, outdoor power transformer (double wound with insulated copper wire conductor) conforming to latest IS:2026 with ON LOAD TAP CHANGING GEAR on HV side for HV variation of +5% to –15% in 16 equal steps of 1.25% with accessories and required oil conforming to ISS:335 latest version.	2	**31,95,245.70** Ex-Works : 26,95,500.00 F&I : 12,335.34 SGST@9% : 2,43,705.18 CGST@9% : 2,43,705.18	63,90,491.40
		2	**Total**	**63,90,491.40**
(Rupees Sixty Three Lakhs Ninety Thousand Four Hundred and Ninety One and Forty Paisa Only)				

Guarantee Maximum Allowable Losses:

	3.15 MVA
No Load Losses	3.0 Kw (Max.) (No positive tolerance is allowed)
Load Losses	16 Kw (Max.) (No positive tolerance is allowed)
Impedance	7.15% (The tolerance will be applicable as per IS : 2026.)

4). **PERFORMANCE GUARANTEE :** You are requested to furnish performance bank guarantee in the prescribed proforma within 15 days of receipt of purchase order to the extent of 10% value of the purchase order valid upto 6 months over and above the guarantee period to draw 100% payment. **The Bank Guarantee shall be furnished only from the Nationalized/Scheduled Bank.**

5). **DELIVERY :** You shall commence and complete the supplies of the above Power Transformers as follows.

Date	Qty. In Nos.
31.12.2017	2
TOTAL	**2**

However you are requested to advance the deliveries on written request from TSNPDCL. Drawings of Power Transformers and OLTC may be got approved before commencement of supplies. Samples of fittings stated in the Annexure-I shall also be got approved along with the drawings.

Delay in delivery of materials, free at destination stores due to non-availability of transport facility and any such reasons will not be considered. It is the responsibility of the supplier to make alternate arrangements for transporting the materials so as to see the material reaches the destination within the stipulated period.

The TSNPDCL shall have the right to vary the delivery schedule mentioned in this purchase order due to any operational exigencies at any time during the execution of the order by the supplier after due notice. Unloading of the materials at the destination stores shall be arranged by the consignee at TSNPDCL cost.

TSNPDCL shall have the right to vary the ordered quantity by ± 50% at any time during the execution of the order.

6). **TERMS OF PAYMENT :**

100% payment along with F&I, taxes and duties will be made on or after 30 days reckoned from the date of receipt of material/ equipment at destination/ stores, duly transferring the said amount to the bank account of the supplier by the purchaser bank. The supplier will have to predefine the Bank details while entering into contract.

The 100% payment mentioned above is subject to on submission of 10% performance security as per clause-39 of specification by the supplier.

The supplier should invariably submit test certificates and other documents, the purchaser specifies as soon as despatch is made so that they can be checked and approved well in advance.

The performance guarantee to be executed in accordance with this specification will be furnished on a stamp paper of value Rs. 100. The Bank Guarantee will be extended if required suitably, in accordance with the provisions of clause No. 39 of specification.

If the supplier has received any over payments by mistake or if any amounts are due to the TSNPDCL due to any other reason, when it is not possible to recover such amounts under the contract resulting out of this specification, the TSNPDCL reserves the right to collect the same from any other amount and or Bank guarantees given by the company due to or with the TSNPDCL.

When the supplier does not at any time, fulfill his obligations in replacing /rectifying etc., of the damaged / defective materials in part or whole promptly to the satisfaction of the TSNPDCL Officers, the TSNPDCL reserves the right not to accept the bills against subsequent dispatches made by the supplier and only the supplier will be responsible for any demurrages, wharf ages or damage occurring to the consignments so dispatched.

7). **DESPATCH:** Please arrange to supply the articles specified herein and dispatch them by goods train or lorry freight prepaid to the persons and stations which will be issued separately.

8). **ACKNOWLEDGEMENT:** The railway receipt/lorry receipt should be sent to the persons noted against each item and should be accompanied by two copies of the invoice/challan one of which will be returned to you direct in token of acknowledgement of receipt of the goods. A copy of the Invoice shall be sent to this office as soon as despatch is made.

9). **LOSS OR DAMAGE :** You are responsible for the safe delivery of the goods in good condition at destination stores. You should acquaint yourself of the conditions obtaining for handling and transport of the goods to destination and shall include and provide for security and protective packing of the goods so as to avoid damage in transit.

External damages or shortages that are prima facie the results of rough handling in transit or due to defective packing will be intimated within a fortnight of the receipt of the materials. Internal defects, damages or shortages of any internal parts which cannot ordinarily be detected on a superficial visual examination though due to bad handling in transit or defective packing would be intimated within 2 months from the date of receipt of these articles. In either case, the damaged or defective materials should be replaced by you free of cost to TSNPDCL.

If no steps are taken within 15 days of receipt of intimation of defects or such other reasonable time as the TSNPDCL may deem proper to afford the TSNPDCL may without prejudice to its other rights and remedies cause to be repaired or rectified the defective materials or replace the same and recover or rectified the defective materials or replace same and recover the expenditure incurred therefore from the deposits such as EARNEST MONEY DEPOSIT, SECURITY DEPOSIT AND PERFORMANCE GUARANTEE or other monies available with the TSNPDCL /TSTRANSCO or by resorting to legal action and also decline to accept further delivery of material/equipment.

Where any plant/machinery or other materials supplied by you is found to be defective in whole or in part WITHIN THE GUARANTEE PERIOD you will be intimated of the same. You should take immediate steps to rectify the defect or to replace the defective materials free of cost within 30 days from the date of receipt of intimation.

The defective portions or whole of the equipment so replaced or renewed should give satisfactory performance till the expiration of 6 months (six) from the date of such replacement or until the end of guarantee period whichever is later.
For the purpose of any legal construction, the material shall be deemed to pass into TSNPDCL's ownership only at the destination stores where they are delivered and accepted.

The TSNPDCL reserves the right apart from the above said provisions, not to accept further dispatches of materials and connected bills etc., under conditions of your continued negligence to rectify repair or replace any equipment or materials supplied earlier and received in damaged condition or failed during the guarantee period or not conforming to the purchase order/specification conditions.

10). **GUARANTEE:**

i) The material have been guaranteed by you for satisfactory operation for a minimum period of **5 Years (6 Months)** from the date of receipt of the material/Equipment in good condition i.e. Form-13 date and the same shall be embossed on a separate metal sheet, painted prominently and welded to the transformer tank just below the name plate.

ii) In case any unit fails within the guarantee period the same shall have to be guaranteed by you for satisfactory performance for an extra period of 6 months from the date of re-commissioning. If the same unit fails again for second time within the guarantee period, you may be asked to replace it with a New Unit at the discretion of TSNPDCL.

iii) Please note that you shall rectify or replace the defective materials within 30 days of receipt of intimation of defects or such other reasonable time as TSNPDCL may deem proper to afford failing which payment to the extent of failed units will be deducted from the subsequent bills/ bank guarantees.

11). **CHALLENGE TESTING:** "The other manufacture can also request challenge testing for any test based on specification and losses. The challenger would request for testing with testing fee. The challenge test fees are proposed at least three times the cost of testing. This is likely to deter unnecessary challenges. The challenger would have the opportunity to select the sample from the store/**Sub-station/Sub-station site of TSNPDCL** and any such challenge should be made within the guarantee period. The party challenged, and the utility could witness the challenged testing.

The challenged testing would cover the

1. Measurement of magnetizing current
2. No Load losses test.
3. Load Losses test (At 50% loading or as per acceptance test)
4. Temperature rise test.
5. Physical Verification.

The challenge test could be conducted at NABL accredited laboratory, like ERDA and CPRI. If the values are within limit the product gets confirmed else not confirmed. No positive tolerance in losses is permitted. If the product is not confirmed the manufacture would pay the challenge fee and challenger would get the fee refunded. However as redressal system the challenger would allowed to ask for fresh testing of two more samples from the store and the same be tested in NABL laboratory in presence of party challenged, challenger and the utility.

If any one or both sample does not confirm the test then the product said to have failed the test. In such cases the manufacture will be declared as unsuccessful manufacturer for the said product with wide publicity and would not be allowed to compete in tenders of the Boards for the period of three years and heavy penalty would be imposed".

12). **DEFECTIVE SUPPLIES :** If, during the guarantee period, any of the goods are found to be defective in materials or workmanship, they shall be replaced by you free of cost.

13). **PENALTY FOR LATE DELIVERY :**

GENERAL:- The delivery of materials as per the agreed schedule of delivery is the essence of the contract and no extension of the time for delivery would be allowed except under recognized force majeure conditions.

For supplies made beyond the agreed delivery schedule, penalty shall be levied for an amount of equivalent to ½ % of the **total Contract** value of the material not delivered within the prescribed time limit for every week of delay or part thereof subject to a maximum of 5% of cost of the undelivered portion within scheduled time.

The date of certified receipt of materials at destination stores in good condition will be taken as the date of delivery. For calculation of penalty the date of receipt of material at destination stores is the "Date of Delivery" subject to the condition that, the materials is received in good condition. For penalty, the number of days would be rounded off to the nearest week and penalty calculated accordingly.

Any variation up or down in Taxes or other statutory levies, or new levies introduced after placing of the order, under this specification, shall be to the TSNPDCL's account, provided that, the delivery schedules are adhered to by the supplier. In case, if there are increases in excise duty or sales tax or other statutory levies or new levies after the agreed delivery dates, the supplier shall bear the impact of these levies and if there is downward variation/revision TSNPDCL shall be given credit to that extent.

In case you do not adhere to the delivery schedule the TSNPDCL reserves the right to purchase the balance quantity from the open market and recover expenditure incurred from you. This is in addition to the right of the TSNPDCL mentioned in first para of this clause and under law.

14). **FORCE MAJEURE:** The supplier shall not be liable for any liquidated damages for delay or for failure to perform the contract, for reasons of force majeure such as acts of God, acts of public enemy, action of Government, fires, floods, epidemics, quarantine restrictions, strikes, riots, lockouts, riots freights embargoes and provided that the supplier shall be within (10) days from the beginning of such delay notify the TSNPDCL in writing of the cause of delay. The TSNPDCL shall verify the facts and grant such extension as facts justify.

15). **EXTENSION OF TIME:** If the completion of supplies is delayed due to reason beyond the control of the supplier, the supplier shall without delay give notice to the purchaser in writing of his claim for an extension of time. The purchaser on receipt of such notice may agree to extend the contracted delivery to such date as may be reasonable but without prejudice to other terms and conditions of the contract.

16). **DRAWINGS AND MANUALS:** The following drawings of 6 sets shall be furnished for our approval.

a) Rating plate.
b) Diagram plate with tap position and relative HV/LV voltage.
c) Outline diagram i.e., complete dimensional drawing showing the general arrangement, fitting details and clearances.
d) Valve diagram.
e) Details of weather proof marshalling box.
f) Marshalling box wiring diagram.
g) Core coil assembly drawing and weights of main component parts (Internal construction)

h) Oil flow diagram.
i) General arrangement of OLTC (*)
j) Schematic diagram of OLTC (For local manual and local electrical control)

(*) As furnished by manufacturer and as per specification.

Note :

1) A detailed operation and maintenance manual with each unit shall be supplied by you to the consignees.

2) The detailed short circuit and temperature rise calculations shall be furnished along with the drawings.

17). **INSPECTION :** The accredited representative of TSNPDCL / accredited representative Govt. institution 3rd party identified by TSNPDCL shall have access to the suppliers works at any time during working hours for the purpose of inspecting the materials and may select samples from the materials to be offered for inspection. You shall offer the equipment for 3rd party stage wise inspection. The contractor shall provide facilities for testing such samples at any time. The supplier shall keep this office informed 15 days in advance about the manufacturing programme so that arrangements can be made for inspection. As soon as the materials are ready, you shall submit the routine test certificates. The despatches shall be effected only if the test results comply with specification.

In case of materials are not of acceptable quality or not confirming to specification, the materials will be rejected. You have to re-offer the material for inspection. In such case the 2nd inspection charges are to your account only. In case the materials are rejected in the 2nd inspection also, the TSNPDCL reserves the right to cancel the order.

The despatches shall be made only after the inspection by the TSNPDCL's satisfaction or such inspection is waived by this office.

TSNPDCL reserves the right to insist for witnessing the acceptance / routine tests of the bought out items.

18). **TESTS & TEST CERTIFICATES :** The latest certificates containing the results of the tests as per IS-2026/1977 (or latest issue) must be submitted to the Chief General Manager/P&MM and got approved by him before sending bills for payment which will not be paid unless these are approved (vide Clause-6).

a) Heat run test shall be carried out on one unit of each capacity free of cost.

b) You have to submit records of impulse and short circuit test certificates of Power Transformers ordered essentially, as a representative of the transformers being purchased and as on evidence of impulse & SC tests conducted out at free of cost and certificates furnished.

c) The losses specified in the purchase order are without positive tolerance and no negative tolerance is allowable for percentage impedance.

d) If the actual losses are more than the guaranteed losses, the transformers will be totally rejected.

e) The SC withstand test report must be accompanied by the drawings of the active part and general arrangement of fittings, duly inspected and certified by testing agency. The SC tested unit will not be accepted for supply to TSNPDCL.

f) TSNPDCL shall have all the rights to conduct type tests at its own cost by an independent agency, whenever there is a dispute regarding the quality of supply (or) interpretation of test results. In the event of failure of transformer in such tests the expenses incurred in testing shall be to your account. The failed unit will not be accepted for supply to TSNPDCL even after repairs.

g) The addition to the routine tests listed in IS-2026, the following tests shall be carried out by the supplier on each and every unit manufactured by them.

i) Oil leakage test.
ii) Dielectric test on transformer oil.
iii) Check for pre shrinkages.
iv) Spill current on neutral.

19). **GUARANTEED TECHNICAL PARTICULARS:** The Technical particulars as per IS & Annexure – III have been guaranteed by you for the supplies against this order.

20). **INSURANCE :**

The Materials / equipment supplied under the Contract will be fully insured against loss or damage incidental to manufacture or acquisition, transportation and delivery and also storage for **45** days at destination stores.

The bidder shall a) Initiate and pursue insurance claim till settlement, and b) Promptly arrange for repair and/or replacement of any damaged items in full irrespective of settlement of insurance claim by the under Writers. c) All costs because of insurance liabilities covered under the contract will be to supplier's account. The supplier shall provide the Purchaser with a copy of all insurance policies and documents taken out by him in pursuance of the 'Contract'. Such copies of documents shall be submitted to the purchaser immediately after such insurance coverage. The supplier shall also inform the Purchaser in writing at least sixty (60) days in advance, regarding the expiry, cancellation and/or change in any of such documents and ensure revalidation/renewal etc., as may be necessary well in time.

The risks that are to be covered under the insurance shall be comprehensive and shall include but not limited to, the loss or damage in transit, storage, due to theft, pilferage, riot, civil commotion, weather conditions, accident of all kinds, fire, flood, war risk (during ocean transportation) bad or rough handling etc. The scope of such insurance shall cover the entire contract value.

The insurance will be in an amount equal to 100% FADS value of Materials / equipment on all risks basis. The policy will have a provision for extension to cover further storage if necessary at destination stores / site at TSNPDCL cost. **The insurance beneficiary shall be TSNPDCL.**

21). **DESPATCH INSTRUCTIONS:** All the materials detailed in Clause-3 must be consigned and despatched as per despatch instructions to be issued after inspection and the bills sent to as follows.

Sl. No.	**To be sent to the TSNPDCL's Stores at**	**Materials to be consigned and despatched to ADE/Stores/TSNPDCL.**	**Paying Officer to whom bills & RR to be sent to Accounts Officer/Expr. O/o. SE./Opn.**
1.	Warangal	Warangal	Warangal
2.	Karimnagar	Karimnagar	Karimnagar
3.	Nizamabad	Nizamabad	Nizamabad
4.	Khammam	Khammam	Khammam
5.	Nirmal	Adilabad	Adilabad

22). **PACKING :**

I). The packing may be in accordance with the manufacturer's standard practice unless otherwise specified, you shall however ensure that the packing is such that the equipment reach the department stores without damages after transport by Road. The packing should stand unloading and inter stores transfer with reasonable care.

ii) Whenever you despatch materials to consignee, you should prepare the following information in the form of packing slip in quadruplicate and send the same to the consignee and obtain his acknowledgement on the same. The consignee will return to you one copy of the packing slip with his remarks. The proforma of the packing slip shall be as follows.

iii) You shall invariably send to the purchasing officer copy of the delivery challan whenever materials are despatched.

23). **NOTE :** It may be noted that

a) The prices cited are Variable with 30% ceiling on positive side and no ceiling on negative side and with base date as 01-09-2017.

b) The ownership of the materials would rest with you till they are all received at destination in good condition.

c) Freight charges shall be prepaid.

d) The materials may be duly insured at your cost as per specification.

e) **Interchangeability :** All similar materials and removable parts of similar equipment shall be interchangeable with each other.

f) **Name Plate :** The equipment shall be marked with your trade mark, Sl. No. and the year of manufacture, capacity and other details as specified in the relevant ISS and as stated in Annexure-I. The P.O.No. and date and words TSNPDCL must be etched on the name plate.

g) For the transformers failed within the guarantee period, you shall rectify the same within 30 days from the date of receipt of such information (or) mutually agreed period, whichever is earlier.

24). **TRAINING OF TSNPDCL PERSONNEL :** TSNPDCL reserves the right to depute TSNPDCL's personnel for training at your works relating to design manufacture, assembly, testing and operation and maintenance in batches. You shall provide necessary facilities during training period specified by TSNPDCL.

25). **GENERAL :**

i) Your bills in duplicate along with a duplicate copy of invoice and substantiating vouchers for all extra claims to be made separately should be forwarded to the Paying officers mentioned in the dispatch instructions.

ii) All General and technical correspondence should be addressed to the Chief General Manager/P&MM, Corporate Office, 1ST Floor, Vidyut Bhavan, TSNPDCL, Hanumakonda, Warangal – 506 001.

iii) All Correspondence regarding bills, payment etc. should be addressed to the Paying Officers cited in the dispatch instructions with a copy to the Pay Officer, TSNPDCL , Warangal– 506 001.

iv) All and any disputes or differences arising out of or touching this order shall be decided by counts or tribunals situated in Warangal. No suit or other legal proceedings shall be instituted elsewhere.

v) Unless otherwise specified, you shall abide by all the terms and conditions specified in the specification No.STN-11/17-18

vi) This is in regularization of preliminary acceptance by you vide reference 3rd cited above.

vii) Please return within a period of 15 days one copy of the purchase order duly signed in token of acceptance of all the terms and conditions of this order and furnish 10% Performance Security.

Encl : Annexure – I , II & III.

Yours faithfully,
Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

We accept all the terms and Conditions of this order.

SIGNATURE OF THE CONTRACTOR

Copy Communicated to **:-**

The Chief General Manager/ Finance./NPDCL/Warangal.
The Chief General Manager/Commertial/NPDCL/Warangal.
The Chief General Manager/O&M/NPDCL/Warangal.
The Chief General Manager/P&MM/CPDCL/4th Floor, Corporate Office, Mint Compound, Hyderabad – 500 004.

Copy to:-

The Superintending Engineer/Operation/WGL, KNR, KMM, NZB & ADB.
The Divisional Engineer/Transformers/ WGL, KNR, KMM, NZB & ADB.
The Accounts Officer/Expr. O/o. SE/Opn./ WGL, KNR, KMM, NZB & ADB.
The Asst. Divisional Engineer/Stores/ WGL, KNR, KMM, NZB & NML.
The Divisional Engineer/IT/TSNPDCL/Warangal :
(Place the Scanned Purchase Order copy in the TSNPDCL Website).

// FORWARDED BY ORDER//

Divisional Engineer/P&MM-2
TSNPDCL/Warangal.

ANNEXURE - I

LIST OF FITTINGS AND ACCESSORIES

1. Oil conservator with filling hole and gap and drain in cock.
2. Oil level gauge with 10° C, 30° C, 60° C and 98° C marking. .
3. Silica gel breather.
4. Air release plug
5. Two numbers of earthing terminals with lugs
6. On load tap changing gear with Buchholtz relay / oil surge relay.
7. Drain valve, filter valve
8. Buchholtz relay (double float)
9. Radiators with valves (size LxBxH) Qty (Nos.)
10. Lifting lugs with fastening holes
11. Four Nos. Jacking pads
12. Inspection covers (2 Nos.)
13. Thermometer pockets (2 Nos.)
14. Winding temperature indicator with two contacts)
15. Pressure relief device.
16. Rating and diagram plate and flow chart
17. Oil temperature indicator (dial type with one contact for alarm)
18. Marshaling box
19. HT & LT bushings. These bushings shall be provided with bimetallic clamps suitable for panther ACSR Conductor. The bushing rods for all capacities should be of ¾" dia for HV and 1" dia for LV or M20 copper size for all capacities.
20. Necessary oil for first filling.
21. Bottom mounting channel (min. size of channel shall be 250x 80/82mm for 3.15 MVA Power Transformer.
22. Necessary features on transformer tank for mounting LAs on both HV & LV shall be provided and they shall be detachable type and not to be welded.
23. Explosion vent with diaphragm
24. Valve in equalising pipe
25. Pulling eyes – 8 Nos.
26. Sampling devices (bottom and top).

Note: Any other fittings that are necessary for the satisfactory operation of the transformers shall be provided without any extra cost.

Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

ANNEXURE - II

FLUX DENSITY :

The maximum flux density in any part of the core and yoke, at normal ratio and at normal voltage and frequency, of each transformer shall be stated. The normal flux density for cold rolled grain oriented steel laminations shall not exceed 1.69 tesla, at normal tap position. Over fluxing should be limited to 12.5%.

However, incase of transformers with variable flux the voltage variation which would affect flux density at every tap shall be kept in view while designing transformers.

VIBRATION AND NOISE :

Every care shall be taken to ensure that the design and manufacture of all transformers and auxiliary plant shall be such as to reduce noise and vibration to the level of that obtained in good modern practice. The maximum noise level should be below 45db.

The manufacturer will ensure that the noise level shall not be more than 5 decibels above the NEMA standard publication TR-1.

SUPRESSION OF HARMONICS :

The transformers shall be designed with particular attention to the suppression of harmonic voltages, especially the third and fifth, so as to eliminate wave form distortion and from any possibility of high frequency disturbances, inductive effect loop circulating currents between the neutral points at different transforming stations reaching such a magnitude as to cause interference with communication circuits. For achieving this suppression of harmonics delta connected stabilizing winding should be avoided.

CORE :

The core shall be constructed from high grade cold rolled non-ageing grain oriented silicon steel laminations, M4 or Superior Grade.

In case if it is found at any stage that the core used is defective/ second used/ scrap cored (or) no load/ load losses found to be more than the stipulated limit, the supplier is liable for imposing heavy penalty or Black listing the firm or both at the discretion of TSNPDCL.

MAGNETIC CIRCUIT :

The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and the production of flux components at right angles to the planes of the laminations which may cause local heating.

Every care shall be exercised in the selection, treatment and handling of core steel to ensure that as practicable the laminations are flat and the finally assembled core is free from distortion.

Each lamination shall be insulated with a material that will not deteriorate due to pressure and the action of hot oil.

Oil ducts shall be provided where necessary to ensure adequate cooling. The winding structure and major insulation shall not obstruct the free flow of oil through such ducts, where the magnetic circuit is divided into pockets by cooling ducts parallel to the plane of the laminations or by insulation material above 0.25mm thick tinned copper strip brazing pieces shall be inserted to maintain electrical continuity between pockets.

The frame work and clamping arrangements shall be earthed.

The class and type of insulation used on the core bolts and under the nuts and side plates shall be stated in the guaranteed technical particulars. Adequate core clamping arrangements shall be made to prevent distortion or wavy form of laminations and withstand short circuit forces. Core clamping bolts shall be effectively insulated with craft paper and fibre glass tubes.

MECHANICAL CONSTRUCTION OF CORE

All parts of the cores shall be of robust design, capable of withstanding any shocks to which they may be subjected during lifting, transport, installation and service.

All structural members of the assembled cores shall be of steel. All castings shall be fitted and structural steel adequately cleaned and painted before being built into the structure. Any non-magnetic or high resistance alloy used shall be of established quality.

Adequate fitments shall be provided to enable the core and windings to be lifted.

Suitable provision shall be made for the storage of any removable portions of the lifting tackle on the transformer tank.

Adequate provision shall be made to prevent movement of the core and winding relative to the tank during transport and installation or while in service.

The supporting frame work of the cores shall be so designed as to avoid the presence of pockets which would prevent complete emptying of the tank through the drain valve or cause trapping or air during filling.

WINDINGS:

All windings shall be made of electrolytic high conductivity copper, shall be fully insulated as defined in IS:2026. All neutral points shall be insulated for the voltage specified in IS 2026. The windings shall be so designed that all coil assemblies of identical voltage, rating shall be inter changeable. The maximum allowable current density is 2.5 A/Sq. mm.

Power Transformer shall be designed to withstand the impulse test voltage as per IS 2026.

The transformer shall withstand the power frequency voltage test as per IS:2026.

The windings shall be designed to reduce to a minimum the out-of-balance forces in the transformer at all voltage ratios.

The insulation of transformer windings and connection shall be free from insulating composition liable to soften, ooze out, shrink or collapse during service.

The stacks of windings shall receive adequate shrinkage treatment before finalassembly.

The coil clamping arrangement and the finished dimensions of any oil duct shall be such as will not impede the free circulation of oil through the ducts.

No strip conductor wound on edge shall have a width exceeding six times its thickness.

The conductors shall be transposed at sufficient intervals in order to minimize eddy currents and equalize the distribution of currents and temperature along the windings.

The HV winding shall be arranged so as able to be removed without hindrance to and causing any damage to the LV winding.

BRACING OF WINDING :

The windings and connections of all transformers shall be braced to withstand shocks which may occur during transport or due to switching and other transport condition during service.

Coil clamping rings, if provided shall be of steel.

Any metal pieces in contact with laminated rings shall be so designed and secured that they do not weaken the electrical or the mechanical properties of the rings.

If the transformer winding is built up of section of disc coils, separated by spacers, the clamping arrangements shall be such that equal pressures are applied to all columns of spacers. All such spacers shall be securely located, shall be of suitable material and shall receive adequate shrinkage treatment before assembly.

INTERNAL EARTHING ARRANGEMENTS

INTERNAL EARTHING GENERAL: All metal parts of the transformer with the exception of the individual core laminations, core bolts, and associated individual clamping plates shall be maintained at some fixed potential.

EARTHING OF CORE CLAMPING STRUCTURE:

The top main core clamping structure shall be connected to the tank body by a copper strip. The bottom clamping structure shall be earthed by one or more of the following methods.

a) By connection through vertical tie-rods to the top structure

b) By direct metal-to-metal contact with the tank base, maintained by the weight of the core windings.

c) By a connection to the top structure on the same side of core as the main earth connection to the tank.

EARTHING OF MAGNETIC CIRCUIT :

The magnetic circuit shall be earthed to the clamping structure at one point only through a link placed in an accessible position beneath an inspection opening in the tank cover. The connection to the link shall be on the same side of the core as the main earth connection.

Magnetic circuits having an insulated sectional construction shall be provided with a separate link for each individual section where oil ducts or insulating barriers parallel to the plane of the laminations divide the magnetic circuit into two or more electrically separate parts the ducts or barriers shall be bridged in accordance with Clause 5.13.4 and the magnetic circuit shall not be regarded as being of sectional construction.

EARTHING OF COIL CLAMPING RINGS :

Where coil clamping rings are of metal at earth potential, each ring shall be connected to the adjacent core clamping structure on the same side of transformer as the main earth connections.

SIZE OF EARTHING CONNECTIONS :

All earthing connections with exception of those from the individual coil clamping rings shall have cross sectional areas of not less than 0.8 Sq

cms. Connections inserted between laminations may have the cross sectional area reduced to 0.2 Sq cm.

TANK :

Tank Construction: The tanks of all transformers shall be complete with all accessories and shall be designed so as to allow the complete transformer in the tank and filled with oil to be lifted by crane or jacks, transported by road, rail or water without over straining any joint and without causing subsequent leakage of oil.

The main tank body excluding tap changing compartments, shall be capable of withstanding a full vacuum of 760 mm of mercury, when empty of oil.

The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding in any direction without injury when using rollers, plates or rails.

Normally a detachable under base will be used, but in case transport facilities permit, a fixed under base can be used.

Where the base is of a channel with iron construction, it shall be designed to prevent retention of water.

The base channels for the transformers covered by this specification shall be 250x80/82 mm .

Tank stiffeners shall be continuously welded to the tank and designed to prevent retention of water.

Wherever possible the transformer tank and its accessories shall be designed without pockets wherein gas may collect. Where pockets cannot be avoided pipes shall be provided to vent the gas into the main expansion pipe. The vent pipes shall have minimum inside diameter of 15mm except for short branch pipes which may be 6mm minimum inside diameter.

All joints other than these which may have to be broken shall be welded.

LIFTING AND HAULAGE FACILITIES :

Each tank shall be provided with:

(a) Lifting lugs suitable for lifting the transformer complete with oil.

(b) A minimum of four jacking lugs, in accessible positions to enable the transformers complete with oil to be raised or lowered using hydraulic or screw jacks. The maximum height of the lugs above the base shall be:

(i) Transformers upto and including 10 tonnes weight, 800 mm excluding the under base dimensions.

(ii) Transformers above 10 tonnes weight, 500 mm excluding the under base dimensions.

(c) Suitable haulage holes shall be provided.

TANK COVER :

Each tank cover shall be of adequate strength, and shall not distort when lifted. Inspection openings shall be provided as necessary to give easy access to bushings, for changing ratio or winding connections, or testing the earth connections at the link board. Each inspection opening shall be of suitable size for the purpose for which it is provided and atleast two openings one at each end of the tank shall be provided.

The tank cover and inspection covers shall be provided with suitablelifting arrangements. Unless otherwise approved inspection covers shall not weigh more than 25 kg each.

The tank cover shall be fitted with pockets for a thermometer and for the bulbs of the oil winding temperature indicators, protection shall be provided wherever necessary for each capillary tube.

The thermometer pocket shall be fitted with a captive screwed cap to prevent the ingress of water.

The pockets shall be located in the position of maximum oil temperature at CMR and it be possible to remove the instrument bulbs without lowering the oil in the tank (C.M.R - Continuous Maximum Rating)

CONSERVATOR VESSELS, OILS GAUGES AND BREATHERS:

A conservator complete with sump and drain valve shall be provided in such a position as not to obstruct the electrical connections to the transformer having the capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and the cooling equipment from the minimum ambient temperature to 90 Deg C the minimum indicated oil level shall be with the lead pipe from the main tank covered with not less than 15mm depth of oil and the indicated range of oil levels shall be from minimum to maximum.

If the sump is formed by extending the foot pipe inside the conservator vessel, this extension shall be for atleast 25mm. The conservator shall be designed so that it can be completely drained by means of the drain valve provided, when mounted as in service.

One end of the conservator shall be bolted into position so that it can be removed for cleaning purpose.

Normally one oil gauge magnetic / prismatic / plain type shall be provided.

The Oil level at 10 Deg.C, 30 Deg.C, 60 Deg. C and 98 Deg.C (Max.) shall be marked on the gauge.

Taps or Valves shall not be fitted to oil gauge.

The oil connection from the transformer tank to the conservator vessel shall be arranged at a rising angle of 3 to 9 Degrees to the horizontal upto the Buchholtz relay and shall consists of

a. For transformers from 1600 to 8000 KVA – 50mm inside diameter pipes as per IS : 3639.

b. A valve shall be provided at the conservator to cut off oil supply to the transformer after providing a straight run of pipe for atleast a length of five times the internal diameter of the pipe on the tank side of the gas and oil actuated relay and atleast three times the internal diameter of the pipe on the conservator side of the gas and oil actuated relay.

Each conservator vessel shall be fitted with a breather in which a silica gel is the dehydrating agent and designed so that:

a. The passage of air is through the silica gel.

b. The external atmosphere is not continually in contact with the silicagel through provision of an oil seal.

c. The moisture absorption indicated by a change in colour of the tinted crystals can be easily observed from distance.

d. All breathers shall be mounted at approximately 1400 mm above ground level.

e. The breather shall be poly breather with see-through container for silicagel and with metallic frames with suitable threading to fix the breather to the pipe of the transformer. Plastic frames are not acceptable. The samples of Breather are to be got approved by the TSNPDCL before supply.

FILTER DRAIN VALVES, SAMPLING DEVICES AND AIR RELEASE PLUG

Each transformer shall be fitted with the following:

a) One drain valve of minimum 50mm shall be provided

b) One 50 mm valve at the top and one 50 mm valve at the bottom of the tank mounted diagonally opposite to each other for filtration purpose.

c) A drain valve as specified below shall be fitted to each conservator.

d) For diameter upto 650 mm, size of the valve 15mm, for diameter above 650mm size of valve 25mm.

e) A robust oil sampling device shall be provided at the top and bottom of the main tank. The sampling device shall not be fitted on the filter valve.

f) One 15 mm air release plug.

g) All other valves opening to atmosphere shall be fitted with blank flanges.

COOLER AND RADIATOR CONNECTIONS :

Valves and valve mountings shall be provided as specified under cooling plant Section 5.32.

VALVES

All valves shall be of gun metal or cast steel or may have cast iron bodies with gun metal fittings. They shall be of way type with internal screw and shall be opened by turning counter clock wise when facing the hand-wheel. The valves shall be of robust construction and it should be possible to operate the valves without application of much force.

Means shall be provided for pad locking the bottom valves in the open and close positions. This is required for the valves where opening device like hand-wheel, keys etc are the integral part.

Every valve shall be provided with an indicator to show clearly the position of the valves. All valves shall be provided with flanges having machined faces. The drilling of valve flanges shall comply with the requirements of IS: 3639.

PRESSURE RELIEF DEVICE :

The pressure relief device shall be provided of sufficient size for rapid release of pressure that may be generated within the tank, and which might result in damage to the equipment. The device shall operate at static pressure of less than the hydraulic test pressure for transformers tanks. Means shall be provided to prevent the ingress of rain.

Unless otherwise approved the relief device shall be mounted on the main tank, if on the cover, shall be fitted with skirt projecting 25mm inside the tank and of such a design to prevent gas accumulation.

Two diaphragms of suitable design and material shall be used one at the base and the other at the mouth of the vent pipe.

An oil gauge is required on the stand pipe for indicating fracture of diaphragm.

One of the following methods shall be used for relieving or equalizing the pressures in the pressure relief devices.

a) An equalizer pipe connecting the pressure relief device to the conservator.

b) The fitting of silicagel breather to the pressure relief device breather being mounted in a suitable position for access at ground level.

EARTHING TERMINAL :

Two earthing terminals capable of carrying for a second, full lower voltage short circuit current of the transformer shall be provided. Provisions shall be made at positions close to each of the bottom two corners of the tank for bolting the earthing terminals to the tank structure to suit local conditions.

RATING AND DIAGRAM AND PROPERTY PLATES :

The following plates shall be fixed to the transformer tank at an average height of about 1750 mm above ground level.

a) A rating plate bearing the data specified in the appropriate clauses of IS : 2026.

b) A diagram plate showing the internal connections and also the voltage vector relationship of the several windings in accordance with IS : 2026 and in addition a plain view of the transformer giving the correct physical relationship of the terminals. When links are provided in accordance with clause – 5.35 (Voltage Ratio) for changing the transformer ratio, than approved means shall be provided for clearly indicating ratio for which the transformer is connected, no load voltage shall be indicated for each tap.

c) A plate showing the location and function of all valves and air release corks or plugs. This plate shall also warn operators to refer to the maintenance instructions before applying the vacuum treatment for drying.

The above plates shall be of material capable of withstanding continuous outdoor service.

JOINTS AND GASKETS :

All gaskets used for making oil tight joints shall be of proven material such as granulated cork bonded with neoprine rubber unless otherwise specified, and samples shall be got approved by the Chief General Manager.

COOLING PLANT :

General

a) Radiators and Coolers shall be so designed as to avoid pockets in which moisture may collect and shall withstand the pressure tests.

b) Unless the pipe work is shielded by adequate earth metal the clearance between all pipe work and live parts shall be more than the clearance for live parts to earth.

RADIATORS MOUNTED DIRECTLY TO THE TANK/BANKED :

Radiators connected directly to the tank shall be detachable and shall be provided with machined or ground flanged inlet and outlet branches. 19mm drain plug shall be provided at the bottom and 19mm air release plug shall be provided at the top of each radiator for draining and filling. These two plugs shall have neoprine rubber gaskets only.

The radiator fins shall be manufactured from a steel sheet with a thickness of not less than 1 mm.

Valves shall be provided on the tank at each point of connection to the tank. These valves shall have neoprene rubber gaskets 6mm thick on either side.

The oil circuits of oil coolers shall be provided with the following:

a) A valve at each point of connection to the transformers tank.
b) Removable blanking plates to permit the blanking off the main oil connection of each cooler.
c) A drain valve of 25mm at the lowest point of each bank of cooler.
d) Air release plug 15 mm.

All radiator groups shall be provided with butting sby 50x50x6mm MS angle.

OIL PIPING AND FLANGES :

Drain valves / plugs shall be provided in order that each section of pipe work can be drained independently.

VOLTAGE CONTROL (On load type) :

The OLTC shall confirm to IS : 8468 – 1977.

a) 3.15, MVA Transformer shall be provide with voltage control equipment of on load tap changing type on the HV side for HV variation of +5% to – 15% in 17 equal steps of 1.25% for varying its effective transformation ratio whilst the Transformers are on load and without producing phase displacement. Electrical operation of OLTC is to be provided

(b). It shall not be possible to operate the Electric work drive when the manual operating gear is in use.

VOLTAGE CONTROL OFF LOAD:

The equipment for local electrical and local manual operation shall be provided and shall comply with the following conditions.

a) It shall not be possible to for any two electric controls to be in operation at the same time.

b) Operation from local/ remote control switch shall cause one tap movement only.

c) All electrical control switches and the local operating gear shall be clearly labeled in a suitable manner to indicate the direction of the tap changing.

d) The local control switches shall be mounted in the marshalling box or driving gear housing.

e) The equipment shall be so arranged as to ensure that when a tap change has been commenced it shall be completed independently of the operation of the control relays or switches. If a failure of the auxiliary supply during tap changing or any other contingency would result in that movement not being completed adequate means shall be provided to safeguard the transformer and its auxiliary equipment.

Suitable apparatus shall be provided for each transformer to give indications as follows:

A mechanical indication of the number of tapping position shall be provided to the OLTC gear of the transformer.

All relays and operated devices shall operate correctly at a voltage between the limits specified in the relevant Indian standards.

The tap changing switches and mechanism shall be mounted in oil tanks or compartments mounted at an accessible position on the transformer tank.

Any enclosed compartment not oil filled shall be adequately ventilated. Metal clad heaters shall be provided in the driving mechanism chamber and in the marshalling box, all contractors relay coils or other parts shall be suitably protected against corrosion or deterioration due to condensation, fungi etc.

The location of OLTC tank as viewed from the 33 KV side shall be on left side of the transformer.

The oil in those compartments of the main tap changing apparatus which do not contain contacts used for making or breaking current shall be maintained under conservator head by means of pipe connection from the highest point of the chamber to the conservator. This connection shall be controlled by suitable valve and shall be arranged so that any gas leaving the chamber will pass into the gas and oil actuated relay. A separate Bucholtz relay / oil surge relay shall be provided for the on load tap changer chamber.

It shall not be possible for the oil in those compartments of the tap change equipment which contain contacts used for making or breaking current to mix with the oil in the compartments containing contracts not used for making or breaking current.

Any DROP DOWN tanks with tap changing apparatus shall be fitted with guide rods to control the movement during lifting or lowering operations. The guide rods shall be so designed as to take support of the associated tank when in the fully lowered position. Lifting gear fitted to DROP DOWN tanks shall include suitable device to prevent run away during lifting and lowering operations.

Each compartment in which the oil is not maintained under conservator head shall be provided with a suitable direct reading oil gauge.

The alternating supply for electrical operation of the control and indicating gear shall be standard 415 volts, three phases, 4 wire, 50 Hz.

Limit switches shall be provided to prevent over running of the mechanism and except where modified in clause shall be directly connected in the circuit of the operating motor. In addition a mechanical stop or other approved device shall be provided to prevent over running of the mechanism under any conditions. Limit switches may be connected in the control circuit of the operating motor provided that a mechanical de-clutching mechanism is incorporated.

Thermal devices or other means shall be provided to protect the motor and control circuits. All relays, switches, fuses etc., shall be mounted in the marshalling box or driving gear housing and shall be clearly marked for purposes of identification.

The control circuits shall operate at 110 V single phase to be supplied from a transformer having a ratio of 240/55-0-55V with the centre point earthed through a removable link mounted in the marshalling box or tap changer drive.

The whole of the apparatus shall be of robust design and capable of giving satisfactory service without undue maintenance under the conditions to be met in service, including frequent operation.

A five digit counter shall be fitted to the tap changing mechanism to indicate the number of operations completed by the equipment.

5.36.17A permanently legible lubrication chart shall be fitted within the driving mechanism chamber.

ON LOAD TAP CHANGER

The following type and routine tests shall be carried out on on-load tap changer and motor drive mechanism in accordance with IS 8468-1977 or its latest version.

TRANSFORMERS WITH REMOTE ON LOAD TAP CHANGER

PROVISION:

In the wiring diagram of local control switch provision shall be made for connecting a remote control panel suitable for remote operation, if necessary in future for OLTC operation.

BUSHINGS, INSULATORS AND TERMINALS :

Transformers shall be fitted with bushing insulators.

The electrical characteristics of bushings and bushing rods shall be in accordance with IS 3347 and IS 2099.

Bushing insulators for 33 KV shall be provided with arcing horns except for neutral bushings.

Clamps with double nuts and spring washers shall be provided for the "Bushing Rods".

The rod gap shall be adjustable type to enable a coordination of insulation level with surge diverters.

Any stress shield shall be considered as integral part of the bushing assembly.

Special precautions shall be taken to exclude moisture from paper insulation during manufacture, assembly, transport and erection. The surface of all paper insulations shall be finished with non-hydro scopic varnish which cannot be damaged easily.

Each porcelain bushing or insulator, and paper bushing shall have marked upon it the manufactures identification mark, and such other mark as may be required to assist in the representative allocation of batches for the purposes of the samples tests.

Clamps and fittings made of steel or malleable iron shall be galvanised. All bolts threads shall be greased before erection.

The bushing flanges shall not be of re-entrant shape which may trap air.

The bushing turrets shall be provided with vent pipes which shall be connected to route any gas collection through the Bucholtz relay.

The clearances in air between live conductive parts and live conductive part to earthed structures shall be as follows:

Nominal system voltage kV rms.	Test Voltage impulse kV P	Clearances	
		Phase to phase mm	Phase to earth mm
6.6 kV	75 kV P	280 mm	205 mm
33 kV	170 kV P	350 mm	320 mm

Necessary features on transformer tank for mounting LAS on both HV and LV sides shall be provided. They should be detachable type and not to be welded. A suitable earth strip shall also be provided for each LA and it should be brought out separately to the ground insulation from the tank.

TEMPERATURE INDICATING DEVICES AND ALARM :

Transformer shall be provided with Temperature indications for measuring Transformer oil temperature and Transformer winding temperature. These samples of temperature indicator shall be got approved before supply.

Except where outdoor types of indicators are supplied, the temperature indicators shall be housed in the marshalling box. Winding temperature indicators are to be provided.

The tripping contacts of winding temperature indicators shall be adjustable to close between 60 Deg. C and 120 Deg. C and alarm contacts to close between 50 Deg. C and 100 Deg. C and both shall reopen when the temperature has fallen by about 10 Deg. C.

All contacts shall be adjustable on a scale and shall be accessible on removal of the cover.

The temperature indicators shall be so designed that it shall be possible to check the operation of the contacts and associated equipment.

Connections shall be brought from the device to terminals placed inside the marshalling box.

GAS AND OIL ACTUATED RELAYS

Each transformer shall be fitted with gas and oil actuated relay [Buchholtz Relay] equipment having contacts which close following oil surge or low oil level conditions.

Each gas and oil actuated relay shall be provided with a test cock and a flexible pipe connection for checking the operation of the relay.

Where specified to allow gas to be collected at ground level a pipe approximately 5 mm inside diameter shall be connected to the gas release cock of the gas and oil actuated relay and brought down to a point approximately 1.25 mts above ground level, where it shall be terminated by a cock.

A machined surface shall be provided on the top of each relay to facilitate the setting of the relays and to check the mounting angle in the pipe and the cross level of the relay.

The design of the relay mounting arrangements, the associated pipe work and the cooling plant shall be such that mal operation of the relays shall not take place under normal service conditions.

The pipe work shall be so arranged that oil and gas arising from the transformer shall pass into oil actuated relays. The oil circuit through the relay shall not form delivery path in parallel with any circulation oil pipe, nor shall it be tied into or connected through a pressure relief vent, sharp bends in the pipe work shall be avoided.

When a transformer is provided with two conservators the gas and oil actuated relays shall be arranged as follows.

If the two conservators are connected to the transformer by common oil pipe one relay shall be installed in the common pipe.

If the two conservators are piped separately to the transformer two relays shall be installed, one in each pipe connection.

Adequate clearances between all pipe work and live metal shall be provided.

MARSHALLING BOX :

1 The sheet steel vermin proof, with ventilated and weather proof marshaling box (as per IP55) of a suitable construction shall be provided for the transformer ancillary apparatus. The box shall have sloping roof and the interior and exterior painting shall be in accordance with relevant clause of cleaning and painting.[26.0 to 33.0]

2 The marshalling box, wherever provided, shall accommodate the following equipments. Alternative weather proof instruments can be mounted out door.

a) Temperature indicators

b) Control and protection equipment for the local electrical control of tap changer, if the same cannot be accommodated in the motor driving gear housing and

c) Terminal board and gland plates for incoming and out going cables.

3 All the above equipments except (c) shall be mounted on panels and back of panel wiring shall be used for inter connection.

4 The temperature indicators shall be so mounted that the dials are not more than 1600 mm ground level and the door(s) to adequate size.

5 To prevent internal condensation an approved type of metal clad heater shall be provided controlled by suitable switch. Ventilation levels shall be provided.

6 All incoming cables shall enter the kiosk form the bottom and gland plate shall be not less than 450mm from the base of box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture form the cable trench.

7 Undrilled gland plate shall be provided for accommodating glands for incoming and outgoing cables.

CONTROL CONNECTIONS AND INSTRUMENT WIRING, TERMINAL BOARDS & FUSES :

All wiring connections, terminal boards, fuses and links shall be suitable for tropical atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation and the bared ends of stranded wire shall be sweated together to prevent creepage of oil along the wire.

There shall be no possibility of oil entering, connection boxes used for cables or wiring.

Panel connections shall be neatly and squarely fixed to the panel. All instruments and panel wiring shall be run in PVC or non rusting metal cleats of the limits compression type. All wiring to a panel shall be taken from suitable terminal boards.

Where conduits are used, the runs shall be laid with suitable falls, and lowest parts of the run shall be external to the boxes. All conduits runs shall be adequately drained and ventilated. Conduits shall not be run at or below ground level.

When 415 volts connections are taken through junction boxes or marshalling boxes they shall be adequately screened and 415 'VOLTS DANGER' notices must be affixed to the outside of the junction boxes or marshaling boxes.

All box wiring shall be in accordance with relevant IS. All wiring shall be of a stranded copper of 660 V grade and size not less than 4.00 sq mm for CT leads and not less than 2.5 sq mm for other connections.

All wires of panels and all multi core cables shall have ferrules, which bear the same number at both ends.

At these ends of inter connection between the wiring carried out by separate contractors; where a change of number cannot be avoided double ferrules shall be provided on each wire. The change of numbering shall be shown on the appropriate diagram of the equipment.

The same ferrule number shall not be used on wires in different circuits on the same panels.

Ferrules shall be of white insulating material shall be provided with glassy finish to prevent the addition of dirt. They shall be clearly and durably marked in block and shall not be affected by damp or oil.

Stranded wires shall be terminated with crimped tubular lugs. Separate washers shall be used for each wire. The size of the washers shall be suited to the size of the wire terminated. Wiring shall in general be accommodated in the sides of the box and the wires for each circuit shall be separately grouped. Back of the panel wiring shall be arranged so that access to the connecting stems of relays and other apparatus is not impeded.

Wires shall not be jointed or tied between terminal points

Wherever practicable circuits, in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit shall be marked on the associated terminal boards.

Where apparatus is mounted on panels all metal cases shall be separately earthed by means of copper wire or strip having a cross section of not less than 2 sq. mm. Where strip is used, the joints shall be sweated.

All wiring diagram for control and relay panel shall preferably be drawn as viewed from the back and shall show the terminals boards arranged as in service. All diagrams shall show which view is employed.

Multi core cable tails shall be so bound that each wire may be traced without difficulty to its cables.

The screens of screen pairs of multi core cables shall be earthed at one end of the cable only. The position of earthing connections shall be shown clearly on the diagrams.

All terminal boards shall be mounted towards the rear doors to give easy access to obliquely and to enable ferrule numbers to be read without difficulty.

Terminal boards rows should be spaced adequately not less than 100 mm apart to permit convenient access to wires and terminations.

Terminal boards shall be so placed with respect to the cable gland (at the minimum distance of 200 mm) as to permit satisfactory arrangements of multi core cable tails.

Terminal board shall have pairs of terminals for incoming and outgoing wires. Insulating barriers shall be provided between adjacent connections, the height of the barriers and the spacing between terminals such as to give adequate protection, while allowing easy access to terminals. The terminals shall be adequately protected with insulating dust proof covers.

No live metal shall be exposed at the back of the terminal boards.

All fuses shall be of the cartridge type and shall conform to relevant IS

Fuses and links shall be labeled.

Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

ANNEXURE - III
GUARANTEED TECHNICAL PARTICULARS

I. STANDARD FORM OF TECHNICAL PARTICULARS:

Sl. No.	Description			Particulars 3.15 MVA, 33/6.6kV (CRGO, Copper)
I.	**STANDARD FORM OF TECHNICAL PARTICULARS:**			
1	Name of the Manufacturer		:	TOSHIBA TRANSMISSION & DISTRIBUTION SYSTEMS (INDIA) PRIVATE LIMITED
2	Service		:	Outdoor
	Type		:	Conventional
3	Ratings:			
	Rated kVA	kVA	:	3150
	Rated Voltage of HV/LV	kV	:	33/6.6
	No load voltage Ratio	kV	:	33/6.6
	Temperature rise in oil	°C	:	50
	Temperature rise by resistance/ winding of	°C	:	55
	Rated frequency	c/s	:	50
4	Number of Phases		:	3
5	Connections - High Voltage		:	DELTA
	- Low Voltage		:	STAR
	- Vector group of reference		:	Dyn 11
6	Tappings - High Voltage	%	:	+5% to -15% in steps of 1.25%
	Low Voltage	%	:	NIL
7	No load loss at rated voltage	kW	:	3.0(Max.)
8	Load loss at rated current at 75°C	kW	:	16.0(Max.)
9	% Impedance at rated current and frequency at 75°C	%	:	7.15% (IS tolerance) @ rated tap
10	Reactance at rated current and frequency	%	:	7.14%(IS tolerance) @ rated tap
11	Efficiencies at 75°C at unity power factor			
	At full load	%	:	99.40
	At 3/4 full load	%	:	99.49
	At 1/2 full load	%	:	99.56
12	Regulation at full load at 75°C			
	At unity power factor	%	:	0.51
	At 0.8 power factor lagging	%	:	4.83
13	No load current at rated voltage and frequency	%	:	2 % of Full Load Current
14	Approximate weights:			
	i) Core	Kg	:	3200
	ii) Windings	Kg	:	1750 (with covering +Insulation)
	iii) Core with frame	Kg	:	3700
	iv) Tank and fittings	Kg	:	3250
	v) Oil (Excluding OLTC Oil)	Kg	:	2180
	vi) Total weight	Kg	:	11250
15	Approximate quantity of oil (including OLTC - Oil)	Ltrs.	:	3067 (First filling)
16	Approximate overall dimensions:			
	Length	mm	:	4100
	Breadth	mm	:	2815
	Height	mm	:	3080
17	Terminal arrangements - High Voltage		:	Bare Bushings
	- Low Voltage		:	Bare Bushings
18	Reference standard		:	IS:2026/IEC-60076
19	Remarks		:	Nil

II.	**ADDITIONAL TECHNICAL PARTICULARS:**			
1	Approximate Max. flux density at rated voltage & Frequency CGS Lines/cm²		:	16900(1.69 Tesla)
2	Efficiencies at 75°C at 0.8 Power Factor lagging			
	At full load	%	:	99.25
	At 3/4 full load	%	:	99.37
	At 1/2 full load	%	:	99.45
3	Load at which maximum efficiency occur (full load)	%	:	43
4	Maximum efficiency	%	:	99.56 @ unity power factor
5	Impulse levels with 1/50 ms wave			
	High Voltage	kV	:	170 kVpeak
	Low Voltage	kV	:	75 KVpeak
6	No load loss at 110% rated voltage and rated frequency	kW	:	6(Approx.)
7	No load current at 110% rated voltage and rated frequency	Amps	:	4% of Full Load current
8	Type of windings			
	High Voltage		:	Disc+separate tap(spiral)
	Low Voltage		:	Continuous Disc Winding
9	Insulation materials			
	Turn insulation high voltage		:	Paper covering
	Turn insulation low voltage		:	Paper covering
	Insulation core to low voltage		:	Press Board
	Insulation high voltage to low voltage		:	Press Board
10	Clearances			
	Minimum clearance between phases			
	a) In oil	mm	:	15mm (min) (between limbs)
	b) Out of oil	mm		280mm(LV) & 400mm(HV) in air
	Minimum clearance high voltage to earth in oil	mm	:	40 mm(min) (HV winding to yoke)
	Minimum clearance high voltage to tank in oil	mm	:	40mm(min) - on length side 40mm(min) - on width side
III	**DETAILS OF TANK:**			
1	Length x Breadth x Height	mm	:	2150x835x1570
2	Approximate thickness of sides	mm	:	5 mm (IS Tolerance applicable)
3	Approximate thickness of top	mm	:	8 mm (IS Tolerance applicable)
4	Approximate thickness of bottom	mm	:	8 mm (IS Tolerance applicable)
5	Approximate thickness of tube Radiators	mm	:	1.0 mm (IS Tolerance applicable)
6	Minimum clearance height for lifting core and windings from tank	mm	:	5300
7	Shipping details - Parts detached for transport		:	Radiators, Conservator, Explosion vent &Breather
	Approximate weight of heaviest package	Kg		10000
	Approximate dimensions of largest package			
	Length	mm	:	3995
	Breadth	mm	:	2050
	Height	mm	:	2500
IV	**DETAILS OF AUXILIARY WINDINGS:**			Not Applicable
1	Rating			
	Rated kVA		:	
	Rated Voltage	kV	:	
2	Connections		:	
3	Tappings		:	
4	Impedance at 75°C rated current at			
	With respect to high voltage	%	:	
	With respect to low voltage	%	:	

V	**DETAILS OF BUSHINGS:**			**(HV/LV)**
1	Type		:	Porcelain
2	Momentary Power Frequency dry withstand voltage	kV	:	As per IS 2099
3	Visible power frequency Discharge voltage	kV	:	As per IS 2099
4	One minute dry withstand power frequency voltage	kV	:	HV:70 KVrms& LV:28 KVrms
5	One minute wet withstand power frequency voltage	kV	:	HV:70 KVrms& LV:28 KVrms
6	Full wave withstand impulse voltage	kV	:	HV:170 KVpeak& LV:75 Kvpeak
7	Under oil flashover or puncture withstand voltage	kV	:	As per IS 2099
8	Creepage distance in air	mm	:	16mm/kV(min)
9	Recommended gap setting	mm	:	HV:200 & LV:80
10	Weight of assembled bushing	Kg	:	HV:12 & LV:6.5
VI	**DETAILS OF ON LOAD TAP CHANGING GEAR:**			
1	Make		:	OLG / CTR or its Equivalent
2	Type		:	On Load
3	Rating	MVA	:	3.15 MVA
	Rated voltage	kV	:	33 KV
	Rated current	A	:	200 A
	Step voltage	V	:	412.5
	No. of steps		:	16
4	Control		:	Local Manual / Electrical
5	Auxiliary supply details		:	3-PH,415V,50HZ
6	Voltage control		:	Local Manual / Electrical
7	Line drop compensation		:	No
8	Parallel operation		:	Yes
9	Protective devices		:	Oil Surge Relay, Pressure relief device
10	Approx. overall weight	Kg	:	410(Excluding oil)(for OLG)
11	Approx. overall dimensions	mm	:	1592.5X852X1085 (for OLG)
12	Approx. overall quantity of oil	Ltrs.	:	390(for OLG)
VII	**DETAILS OF TYPE TESTS:**			
	1. Type Test : (a) Is the offered design type-tested? (Yes/No). (b) If yes, fill up the following table.			Description of Power Transformer with losses : Description : 3.15 MVA, 33/11 KV , Losses: NLL: 3KW (Max.) LL: 17 KW (Max.) Date of Test: Impulse – 06.01.2016. Short circuit – 13th & 14th January, 2016 Tested Laboratory and location : CPRI , Bangalore
1 (a)	Short-circuit dynamic and thermal withstand test			
(b)	Impulse withstand test with chopped wave as per clause no.13 of IS-2026, part-III			
2	Whether the transformer conform to IS-2026 (Yes/No)			YES
3	OLTC Particulars			
(i)	Make:CTR/OLG or equivalent			YES
(ii)	Type: ON LOAD, Linear/Coarse type Continuous			**Coarse fine**
(iii)	Rating:			33KV, 200Amps (+5% to -15% in steps of 1.25%)
(iv)	Control: Manual & Electrical and compatible for RTCC and Parallel operation.			YES
(v)	Auxiliary supply : 3-Phase, 440V, 50 Hz			YES
(vi)	Approx. overall weight			410(Excluiding oil) (for OLG)
(vii)	Approx. overall dimensions			1592.5X852X1085 (for OLG)
(viii)	Approx. overall quantity of oil	lts		390(for OLG)
4	Any technical deviations offered (Yes/No) If yes, mention the clause no. and reason for deviation			NO
5	Type of supports for HV delta, line and tap leads			25 mm Parma wood
6	Material and size of HV delta and tap leads			15.0 Sq.mm cross section MPC Copper - Delta leads & 10.0 Sq.mm cross section MPC Copper - Tap leads
7	Size of core frame channel			300x 90 mm
8	Size and no. of core studs			Not applicable
9	Size and no. of tie rods			M30 X 3.5 , 8Nos.
10	Limit of unbalance of LV neutral (max)			3%

VIII	**FURTHER ADDITIONAL DETAILS:**			
1	Core Grade		:	Confirming to HIB
2	Core diameter	mm	:	318
3	Gross core area	Sq.cm	:	768.315
4	Net core area	Sq.cm	:	745.266
5	Flux density	Tesla	:	1.69(max)
6	Weight of the core	Kg	:	3200
7	Loss per Kg of core at the Specified Flux Density		:	0.745W/kg at 1.67Tesla
8	Core Window Height	mm	:	794
9	Centre to centre distance	mm	:	662
10	No. of L.V.Turns			138
11	No. of H.V.Turns			1191 at Rated Tap
12	Size of L.V.conductor bare/covered	mm	:	15.5x2.7/115.93x3.13
13	Size of H.V.conductor bare/covered	mm		9.3x2.0/9.73x2.43 (Main Winding) 4.5x3.3/5.0x3.8 (Tap Winding-1) 4.3x3.5/5.3x4.5 (Tap Winding-2)
14	No. of parallels			HV:1 & LV:3
15	Current density of L.V.Winding	Amps/mm^2	:	2.5 (max.)
16	Current density of H.V.Winding	Amps/mm^2	:	2.5 (max.) (at principal tap)
17	Wt. of the H.V. winding copper for transformer	Kg	:	1100 (weight for 3 limbs-including insulation)
18	Wt. of the L.V. winding copper for transformer	Kg	:	650 (weight for 3 limbs-including insulation)
19	No. of L.V.Coils/ Phase		:	1COIL
20	No. of H.V.Coils/ Phase		:	1COIL
21	Height of L.V.winding	mm	:	695
22	Height of H.V.winding	mm	:	695(MAIN WINDING) 757(TAP1&TAP2 WITH EDGE STRIP)
23	ID/OD of L.V. winding	mm	:	340/416
24	ID/OD of H.V. winding	mm	:	483/576(HV-main),610/618(TAP-1),630/639(TAP-2)
25	Size of the duct in L.V. winding	mm	:	Spacer between Discs 2.8 mm
26	Size of the duct in H.V. winding	mm	:	Spacer between Discs 2.8 mm Min (MAIN)
27	Size of the duct between H.V. & L.V.	mm	:	6.0mm
28	HV winding to LV clearance	mm	:	17mm (min)
29	HV winding to tank clearance	mm	:	40 mm(min) - on length side 40 mm(min) - on width side
30	Calculated impedance	%	:	7.15% (IS tolerance) @ rated tap
31	HV to earth creepage distance	mm	:	16mm/kv (in air)
32	LV to earth creepage distance	mm	:	16mm/kv (in air)

Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

VIII GUARANTEED TECHNICAL PARTICULARS FOR OILS

Sl. No.	**Characteristics**	**Particulars as per ISS:335/93**
1.	Appearance	The oil shall be clear & transparent & free from suspended matter or sediments.
2.	Density at 29.5 deg. C (Max.)	0.89 g/cm3
3.	Kinematics viscosity at 27 deg. C (Max.)	27 CST
4.	Interfacial tension at 27 deg. C (Max.)	0.04 N/m
5.	Flash point. Pensky-Marten (Closed) (Min.)	140 deg.C
6.	Pour Point (Max.)	-6 deg.C
7.	Neutralization value : a) Total acidity (Max.) b) Inorganic acidity / alkalinity	 0.03 mg KOH/g NIL
8.	Corrosive sulphur	Non – corrosive
9.	Electric strength (breakdown voltage) (Min.) a) New un-filtered oil b) After filtration	 30 kv (rms) 60 kv (rms)
10.	Dielectric dissipation factor (Tan Delta at 90 deg. C) (max.)	0.01
11.	Specific resistance (Resistivity) a) At 90 deg. C (Min.) b) At 27 deg. C (Min.)	 35 x 10^{12} ohms – cm 1500 x 10^{12} ohms – cm
12.	Oxidation stability a) Neutralisation value after oxidation (Max.) b) Total sludge, after oxidation (Max.)	 0.40 mg KOH/g 0.10% by Wt.
13.	Agening characteristics after accelerating ageing (Open Breaker Method with copper catalyst) for 96 Hrs. as per ASTM D-1934-1978 a) Specific resistance(Resistivity) i)At 27 deg. C (Min.) ii)At 90 deg. C (Min.) b) Dielectric dissipation factor Tan Delta at 90 deg. C (Max.) c) Total acidity (Max.) d) Total sludge value (Max.)	 2.5 x 10^{12} ohms – cm 0.20 x 10^{12} ohms – cm 0.20 0.05 mg KOH/g 0.05 percent by weight
14.	Presence of oxidation inhibitor	Nil
15.	Water content (Max.)	50 ppm

Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

CONTRACT FORM

THIS AGREEMENT made the. ..... day of. ..... 200 Between. .....(Name of Purchaser) of the one part and. .....(Name of Supplier) of the other part:

WHEREAS the Purchaser invited bids for certain Materials / equipment and ancillary services viz., ... (Brief description of Materials / equipment and Services) and has accepted a bid by the Supplier for the supply of those Materials / equipment and services in the sum of .....(Contract Price in Words and Figures) (hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions will have the same meanings as are respectively assigned to them in the Conditions of Contract referred to.

2. The following documents will be deemed to form and be read and construed as part of this Agreement, viz.:

(a) the Bid Form and the Price Schedule submitted by the Bidder;

(b) the Schedule of Requirements;

(c) the Technical Specifications;

(d) the General Conditions of Contract;

(e) the Purchaser's Notification of Award.

3. In consideration of the payments to be made by the Purchaser to the Supplier as hereinafter mentioned, the Supplier hereby covenants with the Purchaser to provide the Materials / equipment and services and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Purchaser hereby covenants to pay the Supplier in consideration of the provision of the Materials / equipment and services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

Brief particulars of the Materials / equipment and services which will be supplied/ provided by the Supplier are as under:

	Brief Description of Materials/Equipment & services	Quantity to be supplied	Unit Price Rs.	Total Price Rs.	Delivery Terms

TOTAL VALUE: (Rupees _____only)

DELIVERY SCHEDULE:

IN WITNESS whereof the parties hereto have caused this Agreement to be executed on the day and year first above written.

Signed, Sealed and Delivered by the

said. .....(for the Purchaser)

in the presence of. .....

Signed, Sealed and Delivered by the

said. .....(for the Supplier)

in the presence of. .....

NOTE: To be executed on a Rs.100/- Non-judicial stamp paper.

Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

iv) All and any disputes or differences arising out of or touching this order shall be decided by counts or tribunals situated in Warangal. No suit or other legal proceedings shall be instituted elsewhere.

v) Unless otherwise specified, you shall abide by all the terms and conditions specified in the specification No.STN-11/17-18

vi) This is in regularization of preliminary acceptance by you vide reference 3rd cited above.

vii) Please return within a period of 15 days one copy of the purchase order duly signed in token of acceptance of all the terms and conditions of this order and furnish 10% Performance Security.

Encl : Annexure – I , II & III.

Yours faithfully,
Sd/-
(B. ASHOK KUMAR)
CHIEF GENERAL MANAGER,
P&MM/NPDCL/WARANGAL.

We accept all the terms and Conditions of this order.

SIGNATURE OF THE CONTRACTOR

Copy Communicated to **:-**

The Chief General Manager/ Finance./NPDCL/Warangal.
The Chief General Manager/Commertial/NPDCL/Warangal.
The Chief General Manager/O&M/NPDCL/Warangal.
The Chief General Manager/P&MM/CPDCL/4th Floor, Corporate Office, Mint Compound, Hyderabad – 500 004.

Copy to:-

The Superintending Engineer/Operation/WGL, KNR, KMM, NZB & ADB.
The Divisional Engineer/Transformers/ WGL, KNR, KMM, NZB & ADB.
The Accounts Officer/Expr. O/o. SE/Opn./ WGL, KNR, KMM, NZB & ADB.
The Asst. Divisional Engineer/Stores/ WGL, KNR, KMM, NZB & NML.
The Divisional Engineer/IT/TSNPDCL/Warangal :
(Place the Scanned Purchase Order copy in the TSNPDCL Website).

AO CSRO

// FORWARDED BY ORDER//

26/10

Divisional Engineer/P&MM-2
TSNPDCL/Warangal.