

**GOVERNMENT OF MIZORAM**  
**OFFICE OF THE ENGINEER-IN-CHIEF : POWER & ELECTRICITY DEPARTMENT**  
**'KAWLPHETHA' NEW SECRETARIAT COMPLEX**  
**MIZORAM : AIZAWL**

**NOTICE INVITING TENDER**

*Dated Aizawl, the 20<sup>th</sup> November, 2017*

**No.996/1/17-E-in-C(PD)/6** : The Engineer-in-Chief, Power & Electricity Department, Govt. of Mizoram, on behalf of Governor of Mizoram, invites sealed tenders in duplicate from reputed manufacturers or their authorized dealer for **Design, Manufacture, Supply, Testing and Commissioning of 2nos. of 25MVA, 132/33kV Power Transformer**. Details may be had from the Executive Engineer (Design & Monitoring) office of the Engineer-in-Chief (P&E) on any working day from the date of issue of this notice to **dt.31.12.2017** on payment of Rs.1000/- (non-refundable) in the shape of Demand Draft only, in favour of "Engineer-in-Chief, Power & Electricity Department, Mizoram" and payable at SBI, Dawrpui Branch, Aizawl, Mizoram only. Tender bids will be received upto **1300 hrs** on **dt.05.01.2018** and will be opened at **1400 hrs** on the same date. Details are also available at [www.tender.miozram.gov.in](http://www.tender.miozram.gov.in).

Sd/-  
LIANNHINGLOVA PACHUAU  
Engineer-in-Chief (P&E)

*Memo No.996/1/17-E-in-C(PD)/6*

*Dated Aizawl, the 20<sup>th</sup> November, 2017*

Copy to:-

1. The PS to Hon'ble Minister, Power & Electricity Department, Govt. of Mizoram for favour of information.
2. The Secretary to the Govt. of Mizoram, Power & Electricity Department for favour of information.
3. The Joint Secretary (Tech), Power & Electricity Department, Aizawl for favour of information.
4. The Director I & PR, Govt. of Mizoram with a request to arrange publications of Tender Notice as follows. The Tender Notice may please be published in 1 (one) issue of any 2 (two) Local Newspaper and 1 (one) issue each of any 2 (two) National News papers within 15 (fifteen) days. Bill in triplicate enclosing copy of the advertisement tear sheet may be submitted to the undersigned for making payment.
5. The Principal Informatics Officer, Department of Information Communication Technology, Govt. of Mizoram with a soft copy of the NIT with a request to post in the Official website.
6. All Chief Engineers under Power & Electricity Department for information and wide circulation.
7. All Superintending Engineers under Power & Electricity Department for information and wide circulation.
8. All Executive Engineers under Power & Electricity Department for information and wide circulation.
9. Office Notice Board.

Superintending Engineer (PDM)

## **ABBREVIATED NOTICE INVITING TENDER**

### **TENDER NOTICE**

The Engineer-In-Chief, Power & Electricity Department invites sealed tenders from reputed manufacturers or their authorized dealer for the supply and commissioning of **2Nos of 25MVA, 132/33kV Power Transformer.**

For details, please visit [www.tender.mizoram.gov.in](http://www.tender.mizoram.gov.in) or contact the Office of the Engineer-In-Chief, P&E Department, Mizoram

Sd/-

Lianghinglova Pachuau  
Engineer-in-Chief  
Power & Electricity Department  
Mizoram: Aizawl

**Note : This Abbreviated Notice Inviting Tender is for Regional News Paper**

**GOVERNMENT OF MIZORAM  
POWER AND ELECTRICITY DEPARTMENT  
MIZORAM : AIZAWL**



**TENDER DOCUMENT**

**NOTICE INVITING TENDER NO 2 OF 2017-2018**

(Vide No. 996/1/17-E-in-C(PD)/\_\_)

**Name of work : Design, Manufacture, Supply, testing and commissioning of 2nos of 25MVA, 132/33kV Power Transformer**

*Sept, 2017*

**Office of the Engineer-in-Chief, P&E Deptt : Aizawl, Mizoram**

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**TERMS & CONDITIONS OF TENDER**

**1. Tender Documents :**

Tender documents shall be sold to the intending Tenderers, who are manufacturers or their authorized dealers only on receipt of Rs.1,000.00 (Rupees One thousand) only (non-refundable) in the shape of demand draft drawn on any scheduled bank in favour of the Engineer-in-Chief, Power & Electricity Department, Aizawl, Mizoram payable at State Bank of India, Dawrpui Branch, Aizawl, Mizoram. Further, the tender submitted using tender documents other than duly obtained as stated above if any, will be summarily rejected.

Tender documents are available at the website [www.tender.mizoram.gov.in](http://www.tender.mizoram.gov.in).

**2. Scope of work:**

The scope of work hereby tendered in brief shall include Manufacture, Testing before dispatch, Supply, Delivery, testing and commissioning at site of 2 Nos of 25MVA, 132/33kV Power Transformers in conformity to technical specifications enclosed.

**3. Pre-qualification/Eligibility Criteria :**

- i) The Tenderer should be a regular manufacturer/ Original Equipment Manufacturer (OEM) or authorized representative/Dealer. In case the vendor is authorized representative of OEM, the complete system should be sourced from OEM only. Valid Authorisation Certificate/Letter from Original Equipment Manufacturer (in case of not directly quoted by OEM) for quoting of their system and provide support for commissioning and after sales services.
- ii) The Original Equipment Manufacturer (OEM) should have at least 5 years of experience in manufacturing of the equipment and have an experience of supplying and commissioning directly or through their authorized dealer/representative to reputed organizations, especially NITs/IITs/Central Universities/IISERs/CSIR labs, Power Utilities etc. Document for proof of such supplies at least for the preceding three years, where successful supply and installations have been made during this period should be given together with the full address, telephone numbers and fax numbers of the customers. Performance Certificate regarding satisfactory performance of the equipment from at least four mentioned organisations (issued within 1 year prior to opening of this tender) should be submitted along with the tender.
- iii) Manufacturer should comply with relevant international standards/specifications and meet certification requirements with valid certificates for manufacturing practices of the equipments. Valid certificate to prove the genuineness of the products and of international standard i.e Manufacturer's certificate and ISO/ISI certificate must be enclosed.
- iv) The Tenderer should provide maintenance support for the equipment as and when required by the Department. The Tenderer should submit the documentary evidences of having established mechanism/after sales service facilities for prompt services as and when required, indicating clearly the nearest 'after sales service centre' from Mizoram indicating detailed contact address etc.

**4. Tax Clearance :**

The successful tenderer should produce GST Registration Certificate before supply order is placed.

**5. Guaranteed Technical Particulars :**

The GTP (Guaranteed Technical Particulars) of the equipments along with their complete technical description supported by drawing shall be furnished by the tenderer. Relative specification like IS/BS/IEC/BEE etc. should be mentioned.

**6. Examination of the Documents :**

The Tenderer shall examine Conditions of the Tender and Specifications to satisfy himself about all the Terms & Conditions and circumstances affecting the Tendered Price. He shall quote price(s) according to his own views on these matters and understand the quoted prices are inclusive of all taxes, duties, freight, insurance etc.. The Tenderer shall give his/her signature with seal in each and every page of the Tender Document as an indication of his/her acceptance of the Terms and Conditions of the Tender and submit with the tender offered.

No overwriting is allowed In the Tender. Dated initial should be given by the Tenderer to all corrections, if any, and the seal stamped on each.

Tenderers should submit the following along with their tenders :

1. Document for proof of Regular Manufacturer/Original Equipment Manufacturer (OEM).
2. Valid Authorisation Certificate/Letter from Original Equipment Manufacturer (in case of not directly quoted by OEM).
3. Proof of document for at least 5 years of experience in manufacturing of the equipment and have an experience of supplying and commissioning directly or through authorized dealer/representative to reputed organizations, especially NITs/IITs/Central Universities/IISERs/CSIR labs, Power utilities etc. Document for proof of such supplies at least for the preceding three years, where successful supply and installations have been made during this period should be given together with the full address, telephone numbers and fax numbers of the customers. Performance Certificate regarding satisfactory performance of the equipment from at least four mentioned organisations (issued within 1 year prior to opening of this tender) should be submitted along with the tender.
4. Valid House Tax Payee Certificate in case of Tribal Tenderer.
5. Court fee stamp worth Rs.8.25 in case of Non-Tribal Tenderer.
6. ISI/ISO Certificate.

**7. Earnest Money :**

The Tenderer shall have to furnish Earnest Money for Rs.11,70,000/- ( Rupees eleven lakhs fifty thousands only) in the shape of Bank Draft/Deposit at call pledge in favour of the Engineer-in-Chief, Power and Electricity Department, Aizawl, Mizoram in a separate cover superscribing the Tender Specification Number and Date of opening. Tribal Tenderers are allowed to submit Earnest Money for half the above amount on production of tribal certificate issued by competent authority. Manufacturers registered with NSIC, DGT&D and also SSI unit under Government of Mizoram is exempted for payment of Earnest Money provided Registration Certificate is enclosed.

**8. Price :**

- i) Price quoted should be firm and FOT delivery at site within Aizawl.
- ii) Price quoted should be quoted both in figure and in words using Schedule of Prices given in Price Schedule (Annexure-II).
- iii) Price should be inclusive of all taxes, duties, insurance, freight, handling charges, etc.
- iv) If there is any discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price should be corrected.
- v) Similarly, if there is any discrepancy between the words and figures the price/amount in words should prevail.

**9. Validity :**

Tender should be kept valid for a period of 180 days from the date of opening the tender.

**10. Terms of Payment :**

- i) 80% of the equipment cost shall be made on receipt of equipments and materials at Site in full and in good condition.
- ii) Balance 20% payment of equipment cost will be made after successful commissioning against submission of performance guarantee in the form of Bank Guarantee
- iii) 100% payment of testing and commissioning charge will be made after successful commissioning at site.

**11. Delivery :**

The equipments are to be delivered within 120(one hundred twenty) days from the date of issue of order.

**12. Preparation and Submission of tender :**

- i) The tender should be submitted in two envelopes, i.e, one containing earnest money and the other containing all tender offered with all documents specified in clause 6.
- ii) The tender without Earnest Money shall be summarily rejected.
- iii) All the envelopes should bear the name and address of the Tenderer and marking should be made for the original and duplicate copy.
- iv) One tender per tenderer (i.e. only one tender should be submitted by each tenderer).
- v) Tenderer should offer only one make of transformer.

**13. Reservation :**

The undersigned/Owner reserves the right to accept or reject, partly or wholly, or all the tenders without assigning any reason thereof if the situation so warrants. Further, he is not bound to propose the lowest Tenderer for selection. **The Technical Committee of the Department shall scrutinize and evaluate tenders with reference to the documents submitted by the Tenderer to be placed before the Purchase Advisory Board.** The Tenderers who do not accept the terms of payment as specified in clause no 10 above will be liable for rejection.

In the event of any specified date for submission or opening of the tender being declared as holiday, the tender will be received/opened at the appointed time on the next working day.



**14. Guarantee :**

The Suppliers shall guarantee for satisfactory performance of the equipment for a minimum period of 12 (twelve) months from the date of commissioning or 18 (eighteen) months from the date of receipt whichever is earlier. In the event of any defect in the equipments within the guarantee period, the Tenderer shall guarantee to repair/replace to the satisfaction of the purchaser free of cost.

**15. Performance guarantee:**

The Successful tenderer will have to deposit of an amount 10% of the equipment cost in the form of Bank guarantee as per Format enclosed in Annexure-I from a Nationalized or scheduled Bank in lieu of performance guarantee. The Bank guarantee should be valid for a period of 12 months which may be extended as per requirement to cover guarantee period.

**16. Insurance of materials :**

The material shall be fully insured by the supplier at his cost against damage, lost, pilferage etc. in transit. Copy of insurance document should be sent along with evidence of despatch. No responsibility shall be accepted by the purchaser on the materials before they are received at site by the consignee.

**17. Extension of time :**

If the supply of the material is delayed due to reasons 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 within 10(ten) days of Schedule date of delivery. The Purchaser on receipt of such notice may agree to extend the contract delivery date as may be reasonable but, without prejudice to other terms and conditions of the contract.

**18. Address :**

All correspondences with regard to the above may be made to the following address :

Engineer-in-Chief  
Power & Electricity Department  
'Kawlpheha' New Secretariat Complex  
Aizawl : Mizoram, Pin -796001.

## TECHNICAL SPECIFICATION

### 1. SCOPE OF THE WORKS :

#### 1.1 Scope :-

The scope covers the design, manufacture, testing before despatch, supply, delivery, erection and commissioning of the 2 Nos of 25 MVA, 132/33 kV Power Transformers.

#### 1.2 Climate Conditions:

The climate condition at site under which the equipments must operate satisfactorily are as follows :-

- |     |   |   |                       |
|-----|---|---|-----------------------|
| 1)  | Maximum temperature of air in shade           | : | 40°C                  |
| 2)  | Minimum temperature of air in shade           | : | 2°C                   |
| 3)  | Maximum humidity                              | : | 93%                   |
| 4)  | Isoceraunic level                             | : | 60                    |
| 5)  | Average number of rainy days per year         | : | 150                   |
| 6)  | Average annual rainfall                       | : | 2280 mm               |
| 7)  | Number of months of Tropical Monsoon per year | : | 5                     |
| 8)  | Average number of Thunderstorm per year       | : | 25                    |
| 9)  | Maximum wind pressure at height of 30m        | : | 200 Kg/m <sup>2</sup> |
| 10) | Wind velocity at a height of 30m              | : | 160Km/hr              |
| 11) | Altitude                                      | : | 500-1000m             |
| 12) | Maximum ambient temperature                   | : | 45°C                  |
| 13) | Maximum average daily ambient temperature     | : | 35°C                  |
| 14) | Maximum average yearly ambient temperature    | : | 30°C                  |

#### 1.3 Standard :

The Power Transformers, their accessories and fittings, insulating oil etc. shall conform to the latest edition of the following standards (as amended update) except where specified otherwise this specification.

Power Transformer	IS:2026/IEC-76
On load Tap Changer	IS:8468
Insulating Oil	IS:335
Gas Oil Operated Relay	IS:3637
Current Transformer	IS:2705
Fittings and Accessories for Power Transformer	IS:3639
bushing for alternating	
Voltage	IS:2099
Guide for loading	IS:6600
Marking and arrangement for Switchgear Bushbars	IS:375
main connection and auxiliary wiring	
Degree of protection for enclosures	IS:2147

#### 1.4 Drawings :

Within 30 days after receipt of the order, the Supplier will be required to furnish four prints of the following drawings for approval.

- Outline dimensional drawings of Power Transformers and accessories.
- Assembly drawings and weight of main component parts.

- iii) Shipping drawings showing dimensions and weights of each package.
- iv) HV and LV bushing and assembly drawings.
- v) Control and wiring diagrams and drawings showing temperature indicator/recorder circuits and control system for cooling equipments.
- vi) Drawings showing typical sectional views of the windings with details of insulation, cooling circuits, method of coil tracing and core construction.
- vii) Detailed foundation drawings.
- viii) Drawing giving details of name plate, terminal marking and connection diagram.

### **1.5 Design :**

The Transformer and accessories shall be designed to facilitate easy inspection, cleaning and repairs. The Transformer and all its accessories shall be designed to withstand without injury the thermal and mechanical effects of any external short circuit to earth and of short circuit at the terminal of any winding for a period of 2 sec. the short circuit level of the HV system to which the Transformer shall be connected is 25KA.

**1.6** The similar ratio Transformers shall operate satisfactorily in parallel with each other and share load equally from zero to full rating of the Transformer.

**1.7** Transformers shall withstand, without injuries heating combined voltage and frequency fluctuations which produce the following over fluxing conditions.

- i) 125% for 1 Min.
- ii) 140% for 5 Sec.
- iii) Tenderer shall indicate 150% and 170% over voltage withstand time.

## **2.0 CONSTRUCTIONAL DETAILS:**

### **2.1 Types of Transformer :**

The Transformer shall be of 3-Phase, core type construction oil immersed and ONAN cooled and shall be suitable for outdoor service.

### **2.2 Core :**

- i) The core shall be constructed from high grade non-ageing cold-rolled grain oriented silicon steel laminations having high permeability and low hysteresis loss.
- ii) The core shall be provided with lugs suitable for lifting the complete core and coil assembly of the Transformer.
- iii) The maximum flux density in any part of the core and yoke at rated MVA and frequency at any tap shall such that under 10% over voltage conditions, it does not exceed 1.9 tesla.
- iv) The design of the magnetic circuit shall be such as to eliminate the occurrence of static discharged, development of short circuits paths itself or to the earth clamping structure and the production of flux components at right angles to the plane of laminations which may cause local heating.

### **2.3 Winding :**

- i) The winding shall be so designed that all coil assemblies of identical voltage rating shall be interchangeable and field repairs to the windings can be made easily. The coils shall be supported between adjacent sections by insulating space and the barriers,

tracing and other insulation used in the assembly of the winding shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings.

- ii) The Winding shall be so designed that all Coil Assemblies are of identical Voltage Rating for similar Transformers shall be interchangeable and field repairing to the Windings can be made readily without special equipments. The Coils shall be supported between adjacent stations by Insulating Spacers and the Barriers, Bracing and other Insulation used in the Assembly of the Windings shall be arranged to ensure free calculation of Coil and to reduce hot spots in the Windings. Coils shall be made up shaped and braced to provide for expansion and contraction due to temperature change, so as to avoid abscission of insulation and provide rigidity to resist movement and distortion caused by abnormal stresses. Adequate bracing shall be provided between the Coils and the Cores and between Low and High Voltage Coils. Each turn shall have additional protection against abnormal line conditions. The assembled Core and Winding shall be vacuum dried and suitably impregnated before removal from the Treatment Tank.
- iii) The Copper Conductor used in the Coil structure shall be best suited to the requirements and all permanent current carrying joints in the Winding and the Lead shall be welded or braced.
- iv) All threaded connections shall be provided with locking facilities. All Leads from the Winding to the Terminal Board and Bushings shall be rigidly supported to prevent injury from vibration. Guide Tubes shall be used wherever practicable.
- v) Star Connected HV & LV windings shall have graded insulation and full insulation as defined IS 2026. Insulation of the coils shall be treated with a suitable insulating compound to develop the full electrical strength of the winding. The insulation of transformer windings and connections shall be free from insulating composition which is liable to soften, ooze out, shrink or collapse but is non-catalytic and chemically inactive in the transformer during service.

#### **2.4 Tank and Tank Cover :**

- i) The Transformer tank and cover shall be fabricated from good commercial grade Carbon Steel of tested quality suitable for welding and of adequate thickness. The tank and the cover shall be preferably of welded construction. All seams, flanges, lifting lugs, braces and permanent parts attached to the tank shall be welded and where practicable they shall be double welded. All joints which may have to be opened from time to time in the course of operation shall be of a design which permits their “oil-tight” being made in reassemble easily. The tank shall be reinforced by stiffener of structural steel for general rigidity. The tank shall have sufficient strength to withstand without permanent distortion (i) Filling under vacuum, (ii) Continue internal gas pressure of 35 KN/M with oil at operating level and (iii) Mechanical shock during transportation.
- ii) Transformer tank shall be of the conventional type construction with an oil tight bolted flange joint near the base such that during inspection or maintenance it is possible to lift the upper portion of tank to provide access to the core and coils. Details of necessary facilities for handling the oil in such cases shall be listed by tenderer.

- iii) Suitable guides shall be provided for positioning the various parts during assembly or dismantling. Adequate space shall be provided between the core and the windings and the bottom of the tank for collection of any sediment.
- iv) Lifting lug shall be provided on all parts of the Transformer requiring independent handling during assembly or dismantling. In addition, the Transformer tank shall be provided with lifting lugs and bollards properly secured to the sides of the tank for lifting the Transformer complete with oil.
- v) The tank shall be provided with two suitable alloy or any other suitable materials lugs for the purpose of grounding.
- vi) The Transformer tank, fittings, radiators and all accessories shall be designed to withstand seismic acceleration as specified. Special steps shall be taken to prevent maloperation of Buchholz relay under such conditions.
- vii) All bolts and nuts used in the connections with the tank and fittings shall be galvanised.
- viii) As far as possible the Transformer tank and its accessories shall be designed without pockets where gas may collect.
- ix) The tank covers shall preferably be sloped to prevent retention of rain water and shall not distort when lifted.
- x) The tank cover shall be fitted with pockets at the position of maximum oil temperature at maximum continuous rating for bulbs of oil and winding temperature indicators. It shall be possible to remove these bulbs without covering the oil in the tank.
- xi) Bushing turrets, covers of inspection openings, thermometer pockets etc. shall be designed to prevent ingress of water into or leakage of oil from the tank.
- xii) All bolted connections shall be fitted with weather proof; not oil resistant, resilient gasket in between for complete oil tightness. If gasket is compressible metallic stopes / other suitable means shall be provided to prevent over-compression.
- xiii) At least two adequate sized inspection openings one at each end of the tank, shall be provided for easy access to bushing and earth connection. The handles shall be provided on the inspection cover to facilitate lifting.

## **2.5 Undercarriage:**

- i) The Transformer tank shall be supported on a structural steel base equipped with forged steel or cast steel single flanged wheels suitable for moving the complete Transformer filled with oil completely.
- ii) Jacking pads shall be provided. It shall be possible to change the direction of the wheels through 90<sup>0</sup> when the Transformer is lifted on jacks to permit movement of the Transformer both in longitude and transverse direction. Suitable locking arrangement shall be provided for wheels to prevent accidental movement of Transformer.

- iii) Pulling eyes shall be provided to facilitate haulage of the Transformer. Those shall be suitably braced in the vertical direction so that bending does not occur when the pull has a vertical component.
- iv) Suitable jacks for lifting the Transformer and for changing the plane for rotation of the wheels shall be provided.

### **2.6 Anti earthquake clamp device:**

The Transformer shall be rigidly mounted on wheels resting on rails gouged in concrete foundations. The complete Transformer shall be rigidly anchored through wheel assemblies to the foundations using anti-earthquake clamping and locking devices. Tenderer's scope of supply shall be included the requisite foundation bolts / clamping bolts and locking devices and all other accessory equipment.

### **2.7 Tap Changing Mechanism:**

Each transformer shall be provided with on load tap changing mechanism. This shall be designed suitable for remote control operation from switchboard in the control room in addition to being capable of local manual as well as local electrical operation with suitable interlock. The On Line Tap Changer (OLTC) shall include the following:

- i). An oil immersed tap selector and arcing switch for arc suppressing tap selector, provided with reactor or resistor for reduction of make & break arcing voltage and short circuits.
- ii). Motor driven mechanism.
- iii). Control and protection devices.
- iv). Local tap changer position indicator.
- v). Manual operating device.
- vi). Pressure relief device.
- vii). Remote Tap changer Control Panel (RTCC panel)

The on load tap changer shall be so designed that the contacts do not interrupt arc within the main tank of the transformer. The tap selector and arcing switch or arc suppressing selector switch shall be located in one or more oil filled compartments. The compartment shall be provided with a means of releasing the gas produced by the arcing. It shall be designed so as to prevent oil in the tap selector compartment from mixing with the oil in the transformer tank. A Buchholz relay shall be provided to indicate accumulation of gas and alarm thereof.

The tap changer shall be capable of permitting parallel operation with other transformer of the same type.

The transformer shall give full load output on all taps. The manual operating device shall be so located on the transformer that it can be operated by an operator standing at the level of the transformer track. It shall be strong and robust in construction.

The control scheme for the tap changer shall be provided for independent control of the tap changers when the transformers are in independent service. In addition, provision shall be made to enable parallel control also at times so that the tap changers will be operated simultaneously, when one unit is in parallel with another so that under normal condition the tap charger will not become out of step and this will eliminate circulating currents. Additional features like master, followers and visual indication during the operation of motor shall also be incorporated.

Necessary interlock blocking independent control when the units are in parallel shall be provided.

Under abnormal conditions such as may occur, if the contactor controlling one tap changer sticks, the arrangement must be such as to switch off supply, to the motor so that an out of step condition is limited to one tap difference between the units. Details of out of step protection provided for the taps should be furnished in the bid.

The contactors and associated gear for the tap change driving motors shall be housed in a local kiosk mounted adjacent to or on the transformer. The motor shall be suitable for operation with 3 ph, 415 Volts, 50 Cycles external power supply.

In addition to the above equipment, the supplier shall supply a separate panel for installation in purchaser's control room for remote operation with the following accessories.

- Raise and lower push Button switch.
- Remote tap position Indicator of digital type.
- Microprocessor based Annunciation
- Out of step relay and indication.
- Name-plate for each component. An alarm indication lamps showing tap changing in progress.
- Any other accessory required for satisfactory operation or required during detail engineering.

Complete particulars of the tap changing gear including the capacity of the motor shall be stated in the bid.

Tap changer shall be suitable for bidirectional power flow. The tap changer rating shall be more than maximum rated current of transformer.

**Manual control:**

The cranking device for manual operation of the OLTC gear shall be removable and suitable for operation by a man standing at ground level. The mechanism shall be complete with following:

- a) Mechanical tap position indicator which shall be clearly visible
- b) A mechanical operation counter
- c) Mechanical stops to prevent over-cranking of the mechanism beyond the extreme tap position
- d) The manual control considered as back up to the motor operated load tap changer control shall be interlocked with the motor to block motor start-up during manual operation. The manual operation mechanism shall be labeled to show the direction of operation for raising the HV terminal voltage and vice-versa

**Automatic Voltage Regulating Relays:**

The AVR relay shall be provided, if asked in particular bid, The scheme shall detect

- (i) failure of auxiliary supply
- (ii) failure of PT supply and
- (iii) failure of mechanism to complete the tap changing operation.

The relay shall have necessary contacts to be connected to the alarm & / or to the Annunciator available in the panel for visual and audible indication of the failure of trip circuit. The AVR relay shall be compatible to SCADA operation of any make.



**Remote Tap Changer Control Panel :**

The independent Control Panel be supplied with the transformer for being installed in the main control room which would contain all the remote controls for the OLTC controls and other indicating instrument like repeater dial or winding temperature indicator, tap position indicator, control for cooling equipment etc. The supplier shall furnish in addition to the equipment above the following accessories

- a) Raise and lower push button switch
- b) Auto Selector switch
- c) Remote tap position indicator with selsyn motors, other required devices.
- d) An indicating lamp showing tap change in progress.
- e) Name plate for each equipment
- f) Remote cooler control equipment.

All the necessary wiring shall be carried out in RTCC panel and schematic drawings shall be submitted with the technical bid and during detailed engineering for approval in duplicate.

- i) The Transformer shall be provided with an ON LOAD tap changing mechanism. This shall be designed suitable for remote control operation from switch boards in the control room in addition to being capable of local manual as well as local electrical operation with suitable interlocks.
- ii) The Transformer shall be provided with On Load Tap Changing arrangement as specified.
- iii) The Off Load Tap Changing Switch for the Transformer specified shall be 3 Phase Gang Operated suitable for simultaneous switching of similar Taps on the 3 Phase by operating an external wheel provided with an arrangement facilitating its operation from standing height above the ground level.
- iv) A Voltage and Tap position indicator for the "Tapping In Use" shall be provided at the External Operating Wheel and the arrangement shall be made for securing and pad locking the Switch in any of the working positions. The arrangement shall be such that no Padlock can be inserted unless the Contacts are correctly engaged and the Switch Set in position where no Open Circuit/Short Circuit is possible. A Warning Plate indicating that Switch shall be operated only when the Transformer is de energized shall be provided.

**2.8 Oil Preservation System:**

- i) Oil preserving equipment shall be conservator or expansion tank type. If the conservator or expansion tank type is provided the oil level in the conservator or expansion tank shall be above the level of the bushing flange.
- ii) The conservator tank shall have two filter valves one at the bottom at one end and the other at the top opposite end in addition to the valves specified in the accessories for the main tank. The conservator shall also have shut-off valve and a sump with a small



drain valve and sampling cock, the latter so arranged so as not to interfere with oil line. The oil level gauge shall be mounted on the conservator or expansion tank.

- iii) Each conservator vessel shall be fitted with a breather in which silica gel is dehydrating agent and designed so that :-
  - a) The passage of air is through the silica gel.
  - b) The external atmosphere is not continuously in contact with the silica gel.
  - c) The moisture absorption indicated by a change in colour of the tinted crystals can be easily observed from distance.
- iv) The Double Float Bucholtz Relay with Alarm and Trip Contacts suitably rated and suitable for 110V DC supply shall be provided with Shut Off Valve on the Conservator side. Necessary Piping shall be provided.
- v) Magnetic Oil Level Gauge with Low Level Gauge Alarm Contacts shall also be provided.

## **2.9 Bushing :**

- i) The Bushings shall have high factors of safety against leakage to ground and shall be so located as to provide adequate electrical clearance between bushings and grounded parts. Bushings of identical Voltage Rating shall be interchangeable. The Bushing shall be equipped with suitable Terminals of standard type and size and all external current carrying Contact Surface shall be Silver Plated adequately. The Insulation Class of the Neutral Bushing shall be properly coordinated with the Insulation Class of the Neutral of the Winding and the Voltage Rating should be clearly mentioned in the Offer. The Neutral shall however be brought out through a separate Bushing..
- ii) All main Winding and Neutral Leads shall be brought out through Outdoor Type Bushings which shall be located that the full Flashover Strength will be utilized and the adequate phase clearance shall be maintained.
- iii) Each Bushing shall be so coordinated with the Transformer Insulation that all Flashover will occur outside the Tank.
- iv) All Porcelain used in the Bushing shall be of the Wet Process, Homogenous and free from cavities or other flaws. The Glazing shall be uniform in colour and free from blisters, burn and other defects.
- v) The Bushings shall be of Porcelain.
- vi) All Bushings shall have Puncture Strength greater than the Dry Flashover Voltage.
- vii) Main Terminals shall be Solderless Terminals and shall be of the type and size suited for Fixing Standard Terminal Connectors.
- viii) Terminal Connectors for the 132kV side and 33kV side shall be provided suitable for ACSR 'Racoon' Conductor.
- ix) The space between Bushings must be adequate to prevent Flashover between Phases under all conditions of operation.

- x) Special Adjusting Horns shall be provided for all the H.V. Bushings.
- xi) The Tenderer is required to give the Guaranteed Withstands Voltages for the above and also furnish Calibration with different settings of the Coordination gap to the Purchaser to decide actual Gap Setting. Tenderer's recommendation are also invited in the this respect.

### **2.10 Provision of Current Transformer in L.V. side Neutral of Power Transformer**

In order to achieve Restricted Earth fault in star connected L.V. Side of Power Transformer, current transformer having following particulars shall have to be provided between neutral terminal and neutral bushing of L.V. side of 25 MVA Power Transformer.

#### **CT Particulars:**

- i) Type : Suitable for installation in L.V. side of Power Transformer for REF protection.
- ii) Ratio : 600/1A at Neutral
- iii) Accuracy Class : PS.
- iv) Knee Point Voltage  $V_k$  :  $V_k > 250$  volt
- v) RCT at 75 Deg. C at Lower & Higher Taps. : RCT  $< 4$  Ohm at 75 Deg.C
- vi) Magnetising Current at knee point voltage :  $< 30$  mA at VK

### **2.10 Center of Gravity :**

The centre of gravity of the assembled Transformer shall be as low as near the vertical centre line as possible. The Transformer shall be stable with and without oil. The location of the centre of gravity relative to track shall be clearly marked in the outline drawing.

### **2.11 Internal Earthing Arrangement:**

- i) **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 fixed potential.
- ii) **Earthing of core clamping structure** : Core clamping structure shall be earthed
- iii) **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 connection

### **2.12 Cooling Plan :**

- i) **General** : Radiators shall be so designed as to avoid pockets in which moisture may collect and shall withstand the pressure tests. The radiator tubes / fins shall be seamless, made of mild steel having as minimum wall thickness of approx. 1.2mm and

a clean bright internal surface free from dust and scale. They shall be suitably braced to protect them from mechanical shocks, normally met in transportation and to damp the modes of vibration transmitted by the active part of the transformer in service. Each cooler unit shall have a lifting eye.

- ii) **Radiator Valves :** The butterfly or similar metal valves shall be provided for isolating detachable radiator assembly. One cock each at the bottom of radiator stack shall be provided for draining oil from radiator stacks. Air release plug each at the top of radiator stack shall be provided for release of locked air from radiator stack. Removable blanking plates shall be provided to permit the blanking off the main oil Connection of each cooler.

Radiator fixing bands in top & bottom of radiators to be provided to minimise the vibration of the same.

### **2.13 Pressure Relief Device:**

Pressure relief device shall be provided of sufficient sizes for repeated release of any pressure that may be generated within the tank, and which might result in damage to the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure for transformer tank. Means shall be provided to prevent ingress of rain. It shall be mounted on the cover of the main tank and shall be designed to prevent gas accumulation. Spring loaded setting type Pressure Relief Valve having suitable opening Port hole according to the capacity of the transformers should be provided. The pressure relief valve should have provision of visual indication for opening of the valve and also Contract/Micro Switch arrangement for alarm/Tripping Function.

### **2.14. Gas Oil Operated (BUCHHOLZ RELAY):**

The gas and oil operated (Buchholz relay) when completely assembled and ready for mounting in service shall be subjected to the type of routine tests specified in IS:3637 (amended up-to-date).

### **2.15 Control Cabinet/Marshalling Box:**

One number sheet vermin proof, well ventilated and weather proof marshalling box of suitable construction shall be provided for the Transformer ancillary apparatus. The box shall be domed or sloping roof type. Interior or exterior of this marshalling box shall be suitably painted, ventilation louvers shall be provided on both sides of the marshalling box.

- i) The marshalling box shall accommodate the following equipments :-
- a) All indicating instruments shall be mounted in marshalling box having a glass window. This marshalling box should be mounted not more than 1600mm from the ground level.
  - b) In the marshalling box all control equipments for remote indications and contacts shall be provided. Terminal boards and gland plates for incoming and outgoing cable shall be suitably mounted in marshalling box.
  - c) Terminal boards and gland plates for incoming and outgoing cables.
- ii) All the above equipments except (c) shall be mounted on panel and back of panel Wiring shall be used for inter-connections.

- iii) To prevent internal condensation approved type of metal clad heaters shall be provided controlled by a suitable switch. In the marshalling box all the incoming and outgoing cables shall enter the kiosk from the bottom. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture. Provision shall be made for pin type socket with a switch and convenient outlet for 240V, single phase, 50Hz AC supply. Arrangement shall exist on the marshalling boxes for pad locking.

**2.16 Jointing and Gasket:**

- i) All gasket used for making oil tight joints shall be of proven materials such as guaranteed coke bonded with synthetic rubber.
- ii) Synthetic rubber, if used for gaskets and for joints shall be resistant to hot oil ageing.

**2.17 Cleaning and Painting:**

- i) Before painting and filling with oil all ungalvanised parts shall completely clean and free from rust, scale and grease and all external rough surface of castings shall be filled by metal deposition. The interior of Transformer tanks and other oil-filled chambers and internal structure steel works shall be cleaned of all scales and rust by sand blasting or other suitable method. These surfaces shall be painted with an oil resisting varnish of paint unexposed welds need not be painted.
- ii) Except for nuts, bolts and washers, which may have to be removed for maintenance purpose all external surfaces shall received a minimum of three coats of paint. The primary coat shall be of zinc chromate and applied immediately after cleaning. The second coat shall be an oil and weather resistant varnish of a colour distinct from the primary and final coat and shall be applied after the primary coat at site shall be given by coat paint which shall be corrosion resisting and non-facing and light grey in accordance with shade No. 631 of IS:5. The final coat shall be 20 micron and total thickness of all three coat shall be minimum 80 microns.
- iii) All interior surfaces of mechanism chambers and boxes except those which have received anti-corrosion treatment shall received three coats of paints which shall be applied to the thoroughly cleaned metal surfaces. The final coat shall be of light grey colour with anti-corrosion mixture.

**2.18 Accessories fitting:**

**a) Transformer shall be provided with the following accessories:-**

- i) Conservator with oil filling hole, cap and drain valve.
- ii) Magnetic type and gauge with low level alarm contacts of 5A, 110V DC.
- iii) Silicagel breather with oil seal - 2 Nos.
- iv) Buchholz relay with alarm and trip contacts of 5A, 110V DC and one shut off valve on conservator side size 80mm.
- v) Spring operated Pressure relief device.
- vi) Pocket on tank cover for thermometer.
- vii) Oil temperature indicator with maximum pointer and two electrical contact.
- viii) Winding temperature indicator with maximum pointer and 2 sets of contacts for ONAN
- ix) Valve
- a) Drain value with plug or blanking flange.
- b) 1 No. filter value at top of Transformer tank.

- x) 2 Nos. earthing terminals.
  - xi) Rating and diagram plate.
  - xii) Jacking pads.
  - xiii) Lifting bollards.
  - xiv) Air release device.
  - xv) Inspection cover.
  - xvi) Haulage lugs.
  - xvii) Flanged bi-directional type rollers with locking and bolting device.
  - xviii) Wiring upto marshalling box with PVC Copper Cables 660 / 110V grade.
  - xix) Tank mounted / floor mounted weather proof marshalling box for housing control equipment and terminal connections.
  - xx) Cooling Accessories:
    - a) Requisite number of radiator with top and bottom shut of valve, air release plug and drain valve.
    - b) For header mounted radiator 2 Nos. valve, one at top header and other at bottom header to be used for filtration and oil fitting.
    - c) Air release device.
- b) The equipment and accessories furnished with the Transformer shall be suitably mounted on the Transformer for ease of operation, inspection and maintenance and the mounting details shall be subjected to approval of the purchaser. All values shall be provided either with blind companion flanges or with pipe plugs for protection.
- c) Any other accessories or appliances recommended by the manufacturer for the satisfactory operation of the Transformer shall be supplied without any extra cost to the purchaser.
- d) **Rating Diagram & Property plate:**  
The following plates shall be fixed to the transformer tank at a suitable height so that the particulars could be read by standing at ground level.
- i) A rating plate bearing the data specified in the relevant clauses of IS: 2026 including figures of temperature rise of oil and winding and high voltage test values.
  - ii) A diagram plate showing the internal numbering of taps, tapping switch connection of windings and also the voltages vector relationship in accordance with IS:2026 and in addition a plan view of the transformer giving the correct physical relationship of the terminals. No load voltage shall be indicated for each tap. Details of C.T particulars in respect of phase, Neutral & WTI C.T.
  - iii) A property plate showing that the equipment belongs to Power & Electricity Department, Government of Mizoram with reference of purchase order.
- e) **Control Connections & Instrument wiring terminal Board and fuses:**  
All wiring connections, terminal boards, fuses and links shall be provided by the supplier suitable for tropical atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation and bared end of stranded wire shall be sweated together to prevent creepage of oil along the wire.
- i) There shall be no possibility of oil entering connection boxes used for cable or wiring.
  - ii) When 415V connections are taken through marshalling boxes, there shall be adequately reserved screened and 415V DANGER notice must be affixed to the outside of the marshalling boxes.

- iii) All panel wiring shall be in accordance with relevant IS. All wiring shall be of stranded copper of 660V grade and size not less than 2.5 Sq.mm.
- iv) All wires on panels and all multi-core cables shall have ferrules which bear the same number at both ends.
- v) All those points of inter-connection between the wiring carried out by separate contactors 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.
- vi) The same ferrule number shall not be used on wires in different circuit on the same panel.
- vii) Stranded wires shall be terminated with tinned terminal claw washers or crimped tubular lugs. Separate washers shall be used for each wire. The size of the washers shall be suited to the size of wire terminated. Wiring shall in general be accommodated on the sides of the box and the wires for each circuit shall be separately grounded. Back of panel wiring shall be arranged so that access of the connecting items of relays and other apparatus is not impeded.
- viii) Wire shall not be jointed or tied between terminal points.
- ix) Wherever practicable all circuits in which the voltage exceeds 125V shall be kept physically separated from remaining wiring. The function of each circuit shall be marked on the associated terminal boards.
- x) Where apparatus is mounted on panels all metal cases shall be separately earthed by means of copper wire or strip having across section of not less than 2.0 Sq.mm where strip is used the joints shall be sweated.
- xi) Multicore cable trails shall be so bound that each wire may be treated without difficulty to its cable.
- xii) All terminal boards shall be mounted obliquely towards rear doors to give easy access to terminations and to enable ferrule number to be read without difficulty.
- xiii) Terminal boards rows should be spaced adequately not less than 100mm apart to permit convenient access to wires and termination.
- xiv) Terminal boards shall be placed with respect to the cable gland (at a minimum distance 200mm) so as to permit satisfactory arrangement of multicore cable tails.
- xv) Terminal boards shall have pairs of terminal for incoming and outgoing wires. Insulating barriers shall be provided between adjacent connections. The height of the barriers and the spacing between terminals shall be such as to give adequate protection while allowing easy access to terminals shall be adequately protected with insulating dust proof covers.

- xvi) No live metal shall be exposed at the back of the material boards.
- xvii) MCB should be used instead of fuse for protection of circuit and device
- xviii) All MCB and links shall be labelled.

**2.19 Terminal Connector :**

- i) The bushing shall be provided with terminal connectors suitable for connections with bare ACSR Conductor of 14mm-20mm diameter.
- ii) All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be debarred and rounded off.
- iii) No parts of a clamp shall be less than 10mm thick.
- iv) All ferrous parts shall be hot dip galvanised conforming to IS:2633.
- v) For bimetallic clamps, copper alloy liner of minimum thickness of 4mm shall be supplied loose.
- vi) Flexible connectors shall be made from tinned Cu / Al sheets.
- vii) Size of terminal / conductor for which the clamp is suitable and rated current site conditions shall be embossed, ounced on each component of the clamp except hardware.
- viii) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- ix) Clamps shall be corona free and conform to IS:5561.

**2.20 Terminal Marking :**

Each terminal (including the neutral) shall be distinctly marked on both the primary and secondary sides in accordance with the diagram of connections supplied with the Transformer.

**3.0 TEMPERATURE RISE:**

Each Transformer shall be capable of operating continuously at normal rating without exceeding temperature limits as specified below. Transformers not complying with these requirements will not be accepted.

Type of Cooling Temperature Rise

- |            |           |
|------------|-----------|
| 1) Winding | ONAN 55°C |
| 2) Oil     | ONAN 45°C |

The Ambient Temperature are as follows :-

- |   |      |
|---|------|
| 1) Maximum                                    | 45°C |
| 2) Maximum Average Daily Ambient Temperature  | 35°C |
| 3) Maximum Average Yearly Ambient Temperature | 30°C |



**4.0 FREQUENCY :**

The Transformer shall be suitable for continuous operation with a frequency variation of  $\pm 3\%$  from normal of 50Hertz without exceeding the specified temperature rise.

**5.0 PARALLEL OPERATION :**

The Transformers as specified, of the same Voltage Rating shall operate satisfactorily in Parallel with each other when connected between High Voltage and Low Voltage Busbars.

**6.0 IMPEDANCES :**

Bidders shall indicate the Guaranteed Impedance and Tolerances and also the Upper and Lower Limits of Impedance which can be offered without any increase in the quoted price. Impedance shall include Positive and Zero Sequence and shall be expressed in terms of branches of the Star connected equivalent diagrams, all on the same kVA base and the range shall be given for each branch of the equivalent circuit in turn.

**8.0 INSULATING OIL :-**

8.1 The insulating oil shall conform to requirement of IS:335. No inhibitor in the oil shall be used.

8.2 Sufficient quantity of oil necessary for first filling of tank coolers and radiators at the proper level along with 10% extra oil for topping up shall be supplied in non-returnable container.

8.3 The supplier shall despatch the Transformer filled with oil or in an atmosphere of nitrogen. In former case necessary arrangement shall be ensured by the supplier to take care of pressure drop of nitrogen during transit and storage till completion of oil filling during erection. A gas pressure testing valve with necessary pressure gauge and adopter valve shall be provided.

**9.0 TEST**

**9.1 Routine Test :**

All the routine test in accordance with IS:2026 / IEC shall be conducted. These tests shall strictly conform to IS:2026 / IEC and its latest amendment no tolerance other than those specified in IS / IEC shall be accepted. These test shall be witnessed by the representative of the purchaser at the expense of the tenderer.

**9.2 Additional Routine Test :**

The following additional routine test shall also be carried out on each Transformer :-

- a) Magnetic circuit test.
- b) Oil leakage test.

All tank and oil filled compartments shall be tested for oil tightness by being completely filled with air or oil of a viscosity not greater

**9.3 Test on Accessories:**

Auxiliary wiring in all equipment connected there to shall be subjected to a test voltage of 2kV at 50Hz for one minute.



#### 9.4 Further Tests :

The Purchaser reserves the right to have reasonable tests carried out at his own expense either before despatch or at site to ensure that the Transformer complies with the requirement of this specification.

#### 9.5 Test on OLTC:

The various test (routine and type) as stipulated in the IEC 60214 (as amended upto date) shall be carried out.

Type test certificate copies of oscillogram as called for in IEC 60214 shall be furnished by the supplier.

#### 9.6 Test Report :

After all tests have been completed four certified copies of each test report shall be furnished. Each report shall comply the information :-

- a) Calculating values of regulation at unity, 0.9, 0.8 lagging and 0.8 leading power factor.
- b) Calculated values of positive, negative and zero phase sequence impedance of three phase bank.
- c) Calculated values of efficiency of Transformer at 50%, 75% and 100% of rated capacity at 1.0 and 0.9 power factor.

#### 10.0 EARTHING TERMINAL :

Two earthing terminals capable of carrying the full amount of lower voltage short circuit current of transformer continuously for a period of 5 Second Provision 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 condition

#### 11.0 TEMPERATURE INDICATING DEVICES :

Oil temperature indicator with two electrical contacts for alarm and trip purposes and with repeater for remote indication, shall be provided with anti vibration mounting. The oil temperature indicator shall be housed in the marshalling box.

The winding temperature indicator with two electrical contacts (mercury switch or latest technology) for alarm & trip purposes and with repeater for remote indication shall be provided with anti vibration mounting. The winding temperature indicator shall be housed in the marshalling Box. The Oil and Winding temperature indicator should be of renowned make preferably of "Perfect Control" or "Pecimeasure". The scale on the dial of the thermometer should be 0 Deg.C to 150 Deg.C. The angular displacement of thermometer should be 270 Deg. The signaling contact of WTI & OTI shall be set to operate at the following temperature:

OIL	:	Alarm-80 deg. C, Trip -90deg. C
WINDING	:	Alarm-85 deg. C, Trip -95deg. C

#### 12.0 RATED VOLTAGE OF OPERATING DEVICE :

Rated voltage for indicating & operative device shall be 110 volts D.C. and 240 volts A.C. with variation as specified in the relevant I.S.

**13.0 FOUNDATION :**

The tenderer shall furnish foundation plan of the transformer showing the fixing arrangement of the transformer so that the purchaser may be able to finalise the foundation drawings.

**14.0 LOSSES :**

Standard of losses at 75 Deg C will be as follows :

No load loss : 17 KW  
 Full load loss at rated full load current at 75 Deg C : 130KW

The bidder shall state the transformer losses Viz (Core) and Copper loss. The iron loss (no load loss) in kW at rated voltage and at rated frequency, and load losses (Copper loss) in kW at rated full load capacity and at rated voltage and frequency shall be guaranteed at 75 Deg C.

**15.0 TECHNICAL PARTICULARS :-**

- |     |   |   |                         |
|-----|---|---|-------------------------|
| 1.  | Type.   | Outdoor, 3-Phase Power Transformer.   |                         |
| 2.  | Rated capacity (MVA).   | 25 MVA  |                         |
| 3.  | System frequency.   | 50Hz.   |                         |
| 4.  | Type of cooling.  | ONAN  |                         |
| 5.  | Short circuit level.  | 25KA for 2 Sec.   |                         |
| 6.  | Transformer ratio at Normal tap.                                | 132/33kV  |                         |
| 7.  | Connection.   | HV Star with neutral directly earthed.<br>LV star with neutral directly earthed.                            |                         |
| 8.  | Connection symbol.  | YNyn0.  |                         |
| 9.  | Overload capacity.  | As per IS:6600 upto a load 150%.  |                         |
| 10. | Tap change gear.  |   |                         |
|     | i) Type.  | On load Remote & Manual operated.   |                         |
|     | ii) Location.   | At HV winding.  |                         |
|     | iii) Tap range.   | +10% to -10% in 16 equal steps.   |                         |
|     | iv) Operation.  | Local manual and Remote operation.  |                         |
| 11. | Percentage impedance at 75% and at principal tap.               | 10.0 %  |                         |
| 12. | Tolerance on percentage impedance voltage at principal tapping. | ± 10%   |                         |
| 13. | Terminals.  |   |                         |
|     | i) LV terminal.   | Line and neutral ends - 36kV solid porcelain or oil communication bushing no arcing horn shall be provided. |                         |
|     | ii) HV terminal.  | Line end - 145kV oil filled condenser bushings with test taps.  |                         |
| 14. | Rated insulation level.   |   |                         |
|     | i) Rated lightning impulse withstand (kV peak).                 | HV 650  | LV 170                  |
|     | ii) One minute power frequency withstand test voltage (kV rms). | HV 275  | LV 75                   |
| 15. | Parameter of bushing  | <b>HV</b>   | <b>LV &amp; Neutral</b> |
|     | i) Rated voltage (kV).  | 145   | 36                      |

ii)	Current rating (Amp).	800	1000
iii)	Lightning impulse withstand voltage (kVp).	650	170
iv)	One minute power frequency withstand voltage (kV rms).	275	75
v)	Creepage distance (mm)	3625	900
vi)	Tan delta	As per IS:2099	
vii)	Partial discharge level	As per IS:2099	
16.	Minimum clearance in air.		
i)	Phase clearance in air (mm)	HV 1220.	LV 350
ii)	Phase to body (mm).	HV 1050	LV 320 Neutral 190
17.	Noise level.	As per NEMA standard TR-I.	
18.	Cooling equipment.	1-100% tank or separately mounted cooling system consisting of radiation	
19.	Maximum permissible temperature rise. Temperature rise of top oil measured by thermometer ( <sup>0</sup> C) should be IS:2026		
21.	Rail gauge.		
i)	Shorter axis	Two rails with 1676mm gauge.	
ii)	Longer axis	Two rails with 1676mm gauge.	

**SCHEDULE OF GUARANTEE TECHNICAL PARTICULARS**

*(To be furnished and signed by tenderer)*

1. Name and Address of the Manufacturer :
2. Country of Origin :
3. Applicable standard
4. Maximum continuous rating (in MVA) :
5. No load voltage ratio at Normal (Nominal) tap (in kV/kV) :
6. Rated frequency (in Hz) :
7. Number of phases :
8. Type of Cooling :
9. Connections
  - (i) H.V. Winding :
  - (ii) L.V. Winding :
10. Vector Symbol :
11. Tappings
  - (a) Tap Range (in %) :
  - (b) Number of steps :
  - (c) Variation of voltage in each step (in kV) :
  - (d) No load voltage in HV and LV side in each tap (in kV/kV) :

Tap No	Voltage in HV (in kV)	Voltage in LV (in kV)
1		
2		
3		
4		
5		
6		
7		
8		
9(N)		
10		
11		
12		
13		
14		
15		
16		
17		

12. (i) Temperature rise under normal operating condition above ambient temperature  
(a) Top oil (in Degree C) :  
(b) Windings (in Degree C) :  
(ii) Maximum hot spot temperature of Copper windings (in Degree C) :
13. Magnetising current referred to H.V. at rated frequency  
(a) at 90% rated voltage : (in Amps) :  
(b) at 100% rated voltage : (in Amps) :  
(c) at 110% rated voltage (in Amps) :
14. Power factor of magnetizing current at 100% rated voltage & frequency :
15. No load current at rated voltage and Rated frequency (in Amps) :
16. No load loss (iron loss) in KW at rated frequency and voltage  
(a) at Lowest tap :  
(b) at normal tap :  
(c) at highest tap :
17. Load loss (Copper loss) in KW at 75 Deg. C. at Rated output and frequency  
(a) at Lowest tap :  
(b) at Normal tap :  
(c) at highest tap :
18. Percentage Voltage Regulation at full load at 75 Deg.C  
(a) at unity power factor :  
(b) at 0.8 power factor lagging :
19. Efficiencies at 75 Deg.C (in percentage)  
a) at full load (i) at unity power factor :  
(ii) at 0.8 power factor lagging:  
(b) at  $\frac{3}{4}$  full load (i) at unity power factor :  
(ii) at 0.8 power factor lagging:  
(c) at  $\frac{1}{2}$  full load (i) at unity power factor :  
(ii) at 0.8 power factor lagging:
20. Impedance voltage on rated MVA base at rated current and frequency for the Normal tapping 75 Deg.C. (in percentage) :
21. a) Reactance voltage at rated current and frequency for the normal tapping at 75 Deg.C. (in percentage) :

- b) Resistance voltage at rated current and frequency for the principal tapping at 75 Deg.C. (in percentage) :
- 22 Withstand time without injury for three phase dead short circuit at terminal (in seconds) :
- 23 Short time current rating for short circuit with duration
  - a) H.V. winding (in K. Amps) :
  - b) L.V. winding (in K Amps) :
  - c) Duration (in seconds) :
- 24 Permissible overloading with time :
- 25 Core
  - i) Type :
  - ii) Flux density of Core at normal tap
    - a) at 100% rated voltage at 50 Hz (in Tesla) :
    - b) at 110% rated voltage at 50 Hz (in Tesla) :
  - iii) Thickness of core lamination (in mm) :
  - iv) Type of insulation between core laminations :
  - v) Core bolt withstand Insulation (in kV rms for 1 min) :
  - vi) Approximate area of Cross Section of Core limb (in sq.mm.) :
  - vii) Material of Core clamping plate :
  - viii) Thickness of Core clamping plate (in mm) :
  - ix) Insulation of Core clamping plate :
  - x) Describe location/Method of Core grounding:
- 26 Positive Sequence Impedance between HV & L.V. winding on rated MVA base at rated Current and frequency at 75 Deg.C. winding temperature
  - i) At Normal tapping (in percent) :
  - ii) At lowest tapping (in percent) :
  - iii) At highest tapping (in percent) :
- 27 Zero Sequence Impedance at reference temperature of 75 Deg.C at Normal tap (in percent) :
- 28 Details of windings
  - i) Type of Winding
    - (a) High Voltage :
    - (b) Low Voltage :
- 29 Winding conductor
  - i) Material of the winding conductor
    - (a) High Voltage :
    - (b) Low Voltage :
  - ii) Conductor cross sectional Area

- (a) High Voltage (in sq.cm) :
  - (b) Low Voltage (in sq.cm) :
- iii) Current density of windings at rated MVA

	At Normal Tapping	At lowest Tapping	At highest Tapping
High Voltage (Amp per Sq cm)			
Low Voltage (Amp per Sq cm)			

- iv) Insulating material used for
  - (a) High voltage winding :
  - (b) Low voltage winding :
- v) Insulating material used between :
  - (a) High voltage and low voltage winding:
  - (b) Low voltage winding and core :
- vi) Whether adjustable coil clamps are provided for H.V. & L.V. winding (if yes, details may be given) :
- vii) Type of Axial Coil Supports
  - (a) H.V. winding :
  - (b) L.V. winding :
- vii) Type of Radial Coil Supports
  - (a) H.V. winding :
  - (b) L.V. winding :

30. Current in the winding at rated MVA

	At Normal Tapping	At lowest Tapping	At highest Tapping
High Voltage (Amp)			
Low Voltage (Amp)			

31 Voltage per turn (kV per turn) :

	At lowest tapping	At normal tapping	at highest tapping
High Voltage (in Volt per turn)			
Low Voltage (in Volt per turn)			

32 Ampere turn (in MKS) :

33 Number of winding turns

	At Normal Tapping	At lowest Tapping	At highest Tapping
High Voltage			
Low Voltage			

34 Details of Tapchanger

- i) Number of steps :
- ii) Number of Plus taps :
- iii) Number of minus taps :

- iv) Position of normal taps on HV :
- v) Description of tap changing arrangement :

**35. ON-LOAD TAP-CHANGER**

- i) Manufacturer & Type No. :
- ii) Located in HV winding :
- iii) Range as % of nominal voltage :
- iv) Number of steps :
- v) Impulse withstand level :
- vi) 50Hz voltage withstand level(1 minute) :
- vii) Tap-changer motor rating :
- viii) Maximum Current Rating :
- ix) Method of separating tap change selector switch from the main tank oil :

**36. Bushing :**

		High Voltage	Low Voltage
i)	Make		
ii)	Type		
iii)	Applicable standard		
iv)	Insulation withstand test voltage		
	a) Lightning Impulse withstand test voltage (1.2 x 50 micro seconds in KV peak)		
	b) Power frequency withstand test voltage (in KV rms for 1 min)		
	1) Dry		
	2) Wet		
v)	Creepage distance		
	a) Total in mm		
	b) Protected in mm		
vi)	Minimum height of the bushing		

**37. Minimum clearance (in mm) :**

		In oil		In air	
		Between phase	Phase to ground	Between phase	Phase to ground
i)	HV				
ii)	LV				

**38 Particulars of Bushing & Neutral C.T.**

**CT at Neutral**

- i) Type :
- ii) Ratio :
- iii) Accuracy Class :
- iv) Knee Point Voltage :
- v) RCT at 75 Deg.C :
- vi) Magnetising Current at Knee Point Voltage :



- vii) Additional winding particulars of testing on the C.T. :
- viii) Short Time Rating :
- ix) Reference Standard :

39 Approximate weight of Transformer (in Kgs)

- i) Core with clamping :
- ii) Coil with insulation :
- iii) Core and winding :
- iv) Weight of oil :
- v) Haviest transport weight :
- vi) Overall weight :

40 Tank and fitting with accessories

- i) Untanking weight :
- vi) Oil required for first filling :
- vii) Total weight with Core, Winding, Oil Fittings:

41 Details of Tank

- i) Type of tank :
- ii) Approximate thickness of Sheet (in mm)
  - a) Sides :
  - b) Bottom :
  - c) Cover :
  - d) Radiators :
- iii) Vacuum recommended for hot oil circulation (in torr.) :
- iv) Vacuum to which the tank can be subjected without distorsion (in torr.) :
- v) Under carriage dimensions :
  - a) No. of bidirectional wheels provided :
  - b) Track gauge required for the wheels :

	Axis	
	Transverse	Longitudinal
Dimension of base channel(in mm x mm)		

- vi) Type of Pressure relief device and pressure at which it operates :

42 Conservator

- i) Total volume (in Litres) :
- ii) Volume between the highest and Lowest visible oil level (in litres) :

43 Transformer Oil

- i) Applicable standard :
- ii) Total quantity of oil (in Litres) :

- 44 Radiator :
- i) Number of Radiator Bank :
  - ii) Number of tubes/fins in each radiator Bank :
  - iii) Thickness of tubes/fins (in mm) :
  - iv) Overall dimensions (in mm) :
    - a) Length :
    - b) Breadth :
    - c) Height :
  - v) Type of mounting :
  - viii) Vacuum withstand capability :

- 45 Buchholz Relay :
- i) Make :
  - ii) Type :
  - iii) Number of float contacts :

46. Temperature indicator

		Oil Temperature Indicator	Winding temperature Indicator
i)	Make		
ii)	Type		
iii)	Permissible setting for alram & trip		
iv)	Number of contact		
v)	Current rating of each contact		

47. Approximate overall Dimensions (in feet)
- a) Length (should not more than 19 ft 6 inch) :
  - b) Breadth :
  - c) Height :
  - d) Minimum height of bottom most protion of bushing from bottom of base channel :

48. Winding resitance (in ohm)

a) H.V Side

Sl No	Phase	At lowest tapping	At normal tapping	at highest tapping
1	R to Y			
2	Y to B			
3	R to B			

b) L.V Side

- i) r to n :
- ii) y to n :
- iii) b to n :

49 Minimum clearance height for lifting tank cover (in mm):

SIGNATURE OF THE TENDERER  
WITH COMPANY'S SEAL

**FORM OF BANK GUARANTEE**

*(In lieu of Contract/Performance Guarantee Form).*

To,

The Engineer-In-Chief,  
Power & Electricity Deptt.,  
Govt. of Mizoram, Aizawl.

In consideration of the Engineer-in-Chief, Power & Electricity Deptt., Govt. of Mizoram, Aizawl (Hereinafter called 'the Purchaser', the expression of which shall, unless repugnant to the subject or context, include his successors and assigns) having agreed under the terms and conditions of order No..... Dated .....made between Power & Electricity Deptt.,Govt. of Mizoram, and M/s .....(hereinafter called 'the said contract') to accept a Deed of Guarantee as herein provided for Rs. .... (Rupees .....) only from a Nationalised or Scheduled Bank in lieu of the Contract Performance Guarantee to be made by the Supplier or in lieu the deduction to be made from the Supplier's bills, for the due fulfilment, by the said Supplier, of the terms and conditions contained in the said Supply order No.....we, the ..... Bank and having its registered office at ..... (hereinafter referred to as 'the said Bank') do hereby undertake and agree to indemnify and keep indemnified the Power & Electricity Deptt.,Govt. of Mizoram from time to time to the extent of Rs. .... (Rupees .....)only i.e 10% of the total Supply value against any loss or damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt.,Govt. of Mizoram by reason of any breach or breaches by the said Supplier of any of the terms and conditions and to unconditionally pay the amount claimed by the Purchaser on demand and without demur to the extent aforesaid.

2. We ..... Bank further agrees that the Purchaser shall be the sole judge of and as to whether the said supplier has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, costs, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt.,Govt. of Mizoram on account thereof and the decision of the Purchaser that the said supplier has committed such breach or breaches and as to the amount or amount of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by the Power & Electricity Deptt.,Govt. of Mizoram from time to time shall be final and binding on us.
3. We, the said Bank, further agrees that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said contract and till all the dues of the Purchaser under the said contract or by virtue of any of the terms and conditions governing the said contract have been fully paid and its claim satisfied or

discharged and till the Purchaser certifies in writing that the terms and conditions of the said contract and accordingly discharges this Guarantee subject, however, that the Purchaser shall have no claim under this Guarantee after the expiry of the equipment Guarantee period from the date of cancellation of the said contract, as the case may be, unless a notice of the claim under this Guarantee has been served on the Bank before the expiry of the said equipment Guarantee period.

4. The Purchaser shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or Indemnity, from time to time to vary any of the terms and conditions of the said contract or to extent time of performance by the said supplier to postpone from any time and from time to time any of the powers exercisable by it against the said supplier and either to enforce or for bear from enforcing any of the terms and conditions governing the said contract or securities available to the Purchaser and the said Bank shall not be released from its liability under these presents by any exercise by the Purchaser of the liberty with reference to the matters aforesaid or by reasons of time being given to the said supplier or any other forbearance, act or emissions on the part of the Purchaser or any indulgence by the Purchaser to the said supplier or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of so releasing the Bank from its such liability.
5. It shall not be necessary for the Purchaser to proceed against the supplier before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the Purchaser may have obtained or obtain from the supplier shall at the time when proceedings are taken against the Bank hereunder be outstanding or un-realised.
6. We the Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the Purchaser in writing and agree that any change in the Constitution of the said supplier or the said Bank shall not discharge our liability hereunder.

Dated this..... day of 201....

**For and on behalf of the Bank**

**The above Guarantee is accepted by me on behalf of P&E Department, Govt. of Mizoram,Aizawl**

**Engineer-in-Chief, P&E**

PRICE SCHEDULE

Sl No	Description	Unit	Provisional Quantity	Unit Rate (Inclusive of tax & F&I destination) (In Rupees)	TOTAL Amount (Inclusive of tax & F&I destination) (In Rs)
1	Design, Manufacture, Testing, Supply and delivery of 25MVA, 132/33kV Power transformer	Nos	2		
2	Testing and Commissioning Charge	Nos	2		
<b>TOTAL (Rs)</b>					

(Rupees.....) only