**Tender Enquiry No-** TPSODL/OT/2021-22/006 Date: 01-06-2021

**Work Description** - Rate Contract for Reconditioning of Power Transformers in TPSODL, Odisha.

## Corrigendum – 1

## Revised tender Calendar of events are as follows

| | | |
|---|---|---|
| (a) | Last Date of receipt of Tender Fee | 05.06.2021; 18:00 Hrs |
| (c) | Last Date of receipt of pre-bid queries, if any | 07.06.2021 up to 15:00 Hrs |
| (b) | Date & Time of Pre-Bid Meeting | Not Applicable |
| (d) | Last Date of Posting Consolidated replies to all the pre-bid queries as received | 12.06.2021 up to 18:00 Hrs |
| (e) | Last date and time of receipt of Bids | 19.06.2021 up to 16:00 Hrs |
| (f) | Date & Time of opening technical bids & EMD | 19.06.2021 up to 17:00 Hrs |
| (g) | Date & Time of opening of Price of qualified bids | Will be notified to the successful bidders through our website / e-mail. |

## Technical Specifications for Spares

1) **Specifications for Buchholz Relay, OSR and MOG for Power Transformer.**

2) **Specifications for OTI, WTI & Bushing for Power Transformer.**

3) **Specifications for Oil seal for Power Transformer.**

Regards

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(A Tata Power and Odisha Government Joint Venture)

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*Note-This document does not require signature*

## 1. SCOPE:

This specification covers the technical requirements of design, manufacture, test at manufacturer's works, packing & forwarding, supply and unloading of Buchholz's relay, Oil Surge relay(OSR) and magnetic oil gauge(MOG) to be used in different types of power transformers for efficient and trouble free operation .

## 2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian Standards and shall conform to the regulations of the local authorities:

IS 3637:1966: Specifications for gas operated relay.

## 3. CLIMATIC CONDITIONS OF THE INSTALLATION:

The material shall be suitable for following climatic conditions,

| | |
|---|---|
| 1. Maximum altitude above sea level | 1,000m |
| 2. Maximum ambient air temperature | 50℃ |
| 3. Maximum daily average ambient air temperature | 35℃ |
| 4. Minimum ambient air temperature | 0℃ |
| 5. Maximum relative humidity | 95% |
| 6. Average number of thunderstorm days per annum (isokeraunic level) | 70 |
| 7. Average number of rainy days per annum | 120 |
| 8. Average annual rainfall | 150cm |

9. Earthquakes of an intensity in horizontal direction - equivalent to seismic acceleration of 0.3g

10. Earthquakes of an intensity in vertical direction - equivalent to seismic acceleration of 0.15g

(g being acceleration due to gravity)

11 .Wind velocity: 300 km/hr, 200 km/hr and 160 km/hr.

Environmentally, some of the regions, where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will

frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas.

Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere

The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

### 4.1. GENERAL TECHNICAL REQUIREMENTS FOR BUCHHOLZ'S RELAY:

Buchholz Relays should be according to the following general technical parameters as mentioned in below table.

| S.No | Description | Unit | Requirements |
|---|---|---|---|
| 1 | Type of relay | | Magnetic reed switch type Buchholz relays suitable for nominal pipe bore of 80 mm with 2 sets of potential free contacts suitable for 48V to 220V DC. |
| 2 | No. of Switching systems | | 2 |
| 3 | Suitable for Transformer Rating | MVA | As per tender |
| 4 | Nominal Pipe Bore | mm | 80 |
| 5 | Type of Flange | | Round |
| 6 | Diameter of flange | mm | 185 |
| 7 | Diameter of bolt circle | mm | 145 |
| 8 | Number of the bolts | | 4 |
| 9 | Size of the bolts | | M16 |
| 10 | Flange Thickness | mm | 16 |
| 11 | Surge Test (TRIP ) | cm/s | 90 to 160 |
| 12 | Gas Volume (ALARM) | cc | 200 to 300 |
| 13 | Velocity Test | cm/s | 90 to 160 |
| 14 | Relay operating range: Oil Temperature | | 10℃ to 100℃ |
| 15 | Relay operating range: Oil Viscosity | | 65 to 75 centistokes at 10℃, 2 to 3.5 centistokes at 100℃ |
| 16 | Element Test | | With oil, at 1.75Kg/cm2 for 15 minutes, |
| 17 | High Voltage Test | | Shall be able to withstand 2000 V at 50 Hz for 1 minute |
| 18 | Insulation Resistance Test | | Shall be Greater than 10 Mega ohms with 500 V megger |
| 19 | Porosity Test | | With oil, at 1.5 kg/cm2 for 4 hours - There shall not be any leakage or mechanical damage |
| 20 | Mechanical Strength Test | | With oil at 8 kg/cm2 for 1 minute |
| 21 | Resistance of the Switch | | Not to exceed 0.1 ohm across the electrodes of magnetic switch |
| 22 | Cable entry in terminal box | | From bottom side |

### 4.2. GENERAL TECHNICAL REQUIREMENTS FOR OIL SURGE RELAY:

Oil Surge Relay should be according to the following general technical parameters as mentioned in below table.

| SNo. | Description | Unit | Requirements |
|---|---|---|---|
| 1 | Type of relay | | Magnetic reed switch type OSR suitable for 25 mm nominal pipe bore with 1 set of potential free contact to be used for 48V to 220V DC |
| 2 | No. of Switching systems | | 1 |
| 3 | Suitable for | | OLTC |
| 4 | Nominal Pipe Bore | mm | 25 |
| 5 | Type of Flange | | Square |
| 6 | Diameter of flange | mm | 78 square |
| 7 | Diameter of bolt circle | mm | 72 |
| 8 | Number of the bolts | | 4 |
| 9 | Size of the bolts | | M10 |
| 10 | Flange Thickness | mm | 6 mm |
| 11 | Surge Test (TRIP ) | cm/s | 70 to 130 |
| 12 | Velocity Test | cm/s | 70 to 130 |
| 13 | Relay operating range: Oil Temperature | | 10℃ to 100℃ |
| 14 | Relay operating range: Oil Viscosity | | 66 to 75 centistokes at 10℃, 2 to 3.5 centistokes at 100℃ |
| 15 | Element Test | | With oil, at 1.75Kg/cm2 for 15 minutes, |
| 16 | High Voltage Test | | Shall be able to withstand 2000 V at 50 Hz for 1 minute |
| 17 | Insulation Resistance Test | | Shall be Greater than 10 Mega ohms with 500 V megger |
| 18 | Porosity Test | | With oil, at 1.5 kg/cm2 for 4 hours - There shall not be any leakage or mechanical damage |
| 19 | Mechanical Strength Test | | With oil at 8 kg/cm2 for 1 minute |
| 20 | Resistance of the Switch | | Not to exceed 0.1 ohm across the electrodes of magnetic switch |
| 21 | Cable entry in terminal box | | From bottom side |

**General Technical Requirements for Magnetic Oil Gauge (MOG):**

MOG technical parameters should be according to the below mentioned specifications.

### 4.3. MAGNETIC OIL GAUGE (MOG):

Magnetic Oil Gauge (MOG) technical parameters should be according to the below mentioned specifications

| General Technical Requirements for MOG: | | | |
|---|---|---|---|
| **Sno** | **Description** | **Unit** | **Requirements** |
| 1 | Mounting Pad Diameter | Mm | 150 |

| | | | |
|---|---|---|---|
| 2 | Electric Switch | | Two no's Micro Switches / Mercury switch |
| 3 | Contact Rating | | 5 Amps 240V AC, 0.25 Amp 220V DC. |
| 4 | Switch Operation | | Normally open, closes when oil level drops to near empty condition. Switch recovers automatically on rising of oil level |
| 5 | Mounting of indicator | | Vertical |
| 6 | Dial Marking | | Maximum, Minimum, 1/4, 1/2 & 3/4 |
| 7 | Movement of float arm | | In the plane perpendicular to seating face |
| 8 | Conservator Dia | Mm | 900 mm |
| 9 | Air cell in conservator | | Yes |
| 10 | Switches for | | Low Oil level Alarm, High oil level Alarm. |
| 11 | Color | | Black marking with white/yellow background. |
| 12 | Readable from transformer base level | | Yes |
| 13 | Cable disconnecting facility at top of MOG to facilitate testing of MOG | | Yes |
| 14 | Mechanical Protection degree | | IP55 |
| 15 | Suitable for transformer rating | MVA | As per tender requirement |
| 16 | Packing | | Supplier shall ensure that the equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner so as to protect the equipment from damage in transit. |
| 17 | Marking | | The unit shall be appropriately marked as "PROPERTY OF TP SOUTHERN ODISHA DISTRIBUTION LTD. BERHAMPUR "and with the name of the vendor, Manufacturer type / serial no. and year of manufacturing at suitable location. |
| 18 | Warranty | | 2 years from the date of purchase of Transformer. In case any defects are found, the vendor shall replace the product free of cost. |

## 5.GENERAL CONSTRUCTIONS:

### 5.1. Buchholz Relay:

A double float type Buchholz relay shall be provided. Any gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent potential free contracts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

One double float gas detector relay (Buchholz relay) with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure complete with shut off valves

between Relay and Conservator Tank flange-couplings to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve. The installation shall be weather proof to avoid any water seepage inside the relay. The cable entry should be from bottom end of Buchholz relay instead from side. Marking of Magnetic reed type switches shall be available on Buchholz Relay.

Buchholz Relays should be according to the following general technical parameters as mentioned in below table.

**5.2. Magnetic Oil Gauge:**

One magnetic-type oil-level gauge each in Main Tank and OLTC Tank with low and high level alarm contacts for main tank MOG and low level alarm for OLTC tank MOG and a dial showing minimum, maximum and normal oil levels. The gauge shall be readable from the transformer base level. It should have cable disconnecting facility at top of MOG, to facilitate testing of MOG. Along with MOG, prismatic type oil level indicator (glass window) shall also be provided on conservator.

## 6.TESTS:

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the TP Southern Odisha Distribution Ltd. /his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the Joint and Termination Kits in addition to others specified in IS/IEC standards.

Type Test
a) Porosity test
b) High voltage and insulation resistance test
c) Elements test
d) Gas Volume test
e) Loss of oil and surge test
f ) Mechanical strength test
g) Velocity calibration test

Routine Tests
a) Porosity test
b) High voltage and insulation resistance test
c) Elements test
d) Gas Volume test
e) Loss of oil and surge test

Acceptance Tests
a) Visual Inspection
b) Porosity test
c) High voltage and insulation resistance test
d) Elements test

e) Gas Volume test
f) Loss of oil and surge test
f ) Mechanical strength test
g) Velocity calibration test

**1. Dial Type Thermometers for Oil (OTI):**

A dial-type indicating thermometer of robust pattern mounted on the side of the transformer at a convenient height to read the temperature in the hottest part of the oil and fitted with alarm and trip contacts and contacts for switching in and switching out the cooling system at predetermined temperatures.

**2. Winding Temperature Indicator (WTI):**

In one winding of each phase as described below:

a) It shall be indicating type, responsive to the combination of top oil temperature and winding current, calibrated to follow the hottest spot temperature of the transformer winding.

b) The winding temperature detector shall operate a remote alarm in the event the hottest spot temperature approaches a dangerous level and in the case of ONAN (Oil Natural and Air Natural) Thus WTI shall have 4 independent NO contacts for alarm and trip and cooler control.

3. Equipment for remote winding and oil temperature Indicators including these to be installed in the Tata Power-DDL's control room shall be provided. Pocket with heater coil and CT for RTD for winding hot spots shall be provided.

4. For purpose of remote recording and data acquisition system, top oil temperature detector along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals with PT-100 type of sensors.

5. Tap changer indicator of OLTC along with suitable transducer and other necessary devices to provide two sets of 4-20 mA signals along with one set of 1-16K resistance output shall be provided.

6. All digital outputs for remote annunciation/control/DAS shall be provided with two changeover (NO) contacts for alarm condition and two changeover (NO) contacts for trip condition. The OTI & WTI shall be provided with micro switches, instead of mercury switches for alarm and trip purpose. All the interconnected wiring between TJB, Marshalling box and OLTC etc. shall be done by the bidder and schematics drawings of the same shall be supplied.

7. One magnetic-type oil-level gauge each in Main Tank and OLTC Tank with low and high level alarm contacts for main tank MOG and low level alarm for OLTC tank MOG and a dial showing minimum, maximum and normal oil levels. The gauge shall be readable from the transformer base level. It should have cable disconnecting facility at top of MOG, to facilitate testing of MOG. Along with MOG, prismatic type oil level indicator (glass window) shall also be provided on conservator.

**Bushing**

i) All porcelain used in bushings shall be homogeneous, non-porous, uniformly glazed to brown colour and free from blisters, burns and other defects.

ii) Stress due to expansion and contraction in any part of the bushing shall not lead to deterioration.

iii) Bushing shall be designed and tested to comply with the applicable standards.

iv) Bushing rated for 400A and above shall have non-ferrous flanges and hardware.

v) Fittings made of steel or malleable iron shall be galvanized

vi) Bushing shall be so located on the transformers that full flashover strength will be utilized.

Minimum clearances as required for the BIL shall be realized between live parts and live parts to earthed structures.

vii) All applicable routine and type tests certificates of the bushings shall be furnished for approval. viii) Bushing shall be supplied with bi-metallic terminal connector/ clamp/ washers suitable for fixing to bushing terminal and the Employers specified conductors. The connector/clamp shall be rated to carry the bushing rated current without exceeding a temperature rise of 550 C over an ambient of 500 C. The connector/clamp shall be designed to be corona free at the maximum rated line to ground voltage.

ix) Bushing of identical voltage rating shall be interchangeable.

x) The insulation class of high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the low voltage winding.

xi) Each bushing shall be so coordinated with the transformer insulation that all flashover will occur outside the tank.

xii) The extended bushing bus bars shall be used for termination of 11 KV cables. LV busing shall be housed in completely sealed metallic enclosure.

xiii) Sheet steel, weather, vermin and dust proof cable box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch, water- tight hinged and padlocked door of a suitable construction shall be provided with each transformer to accommodate 11 KV cables etc. The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification. Padlock along with duplicate keys shall be supplied for marshaling.

1. Bushings provided by the bidder shall be as per IS2099-1986. 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. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying contact surfaces shall

be plated, adequately. The insulation class of the high voltage neutral bushing shall be properly co-ordinate with the insulation class of the neutral of the high voltage winding.

2. All main winding leads shall be brought out through outdoor type bushings as specified which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall be realized.

3. Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank.

4. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The insulation (porcelain) shall be without any joint up to 145kV class. The glazing shall be uniform in colour and free from blisters, burns and other defects. Stresses due to expansion and contraction in any part of the bushing shall not lead to deterioration.

5. Bushings rated for 72.5kV and above shall be of the oil filled condenser type with a central tube and draw-in conductor which shall be connected to the connector housed in the helmet of the bushings. The pull through lead shall be fitted with a gas bubble deflector.
Condenser type bushings shall be equipped with following:
a) Provision for power factor, dissipation factor and tan delta testing without disconnecting main leads.
b) Stress rings and lower end shields.
c) Current transformers shall be provided, if specified and the bushing shall be so arranged that it can be removed without disturbing the current transformers and secondary terminals.
d) Bushing turrets shall be provided with vent pipes which shall be connected to route any gas collection through the Buchholz relay.

6. All oil filled bushing shall be provided with prismatic type oil gauge with red colored float inside the gauge for oil level indication. The oil gauge glass shall be so designed that it shall give satisfactory service (without melting/cracking or bulging) at specified site conditions, throughout the life of transformer/bushing. It shall not turn opaque during the service.

7. In case of oil communicating type bushing (for 66kV, 33kV & 11kV), venting screw of the hollow stud, shall be provided with Teflon gaskets, to avoid oil leakage problem through the same. Angle of inclination to vertical for any bushing shall not exceed 30 deg. All bushings shall have puncture strength greater than the dry flash-over value.
8. Main terminals shall be solder less terminals, and shall be of the type and size specified in the drawings. The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation.

9. The Bidder shall give the guaranteed withstand voltages for the above and also furnish a calibration curve with different settings of the co-ordination gap, to the Tata Power-DDL to decide the actual gap setting. Bidder's recommendations are also invited in this respect.

10. The following routine tests shall be carried out on all bushings in the presence of TPSODL representative, in addition to any other specified in the IS:

a) Visual examination

b) One minute dry withstand test

c) Oil tightness test

d) Partial discharge test (Applicable on 66 kV only)

e) Test for capacitance and power factor, dispassion factor and tan delta (on CT only) measurement.

11. The bushings shall have a link type isolating facility for tap for maintenance tests viz. power factor measurement etc. (Terminal shall be provided for the measurement of power factor and tan delta).

12. Bushing shall be as per the approved make only. All Type test report should be submitted along with bid.

## 1. SCOPE:

This specification covers the technical requirements of design, manufacture, test at manufacturer's works, packing & forwarding, supply and unloading of 'O' shaped ring type oil seal to be used in different type of transformer for making oil tight joints at stores/site for efficient and trouble free operation.

## 2. APPLICABLE STANDARDS:

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian Standards and shall conform to the regulations of the local authorities:
a) IS 3347: Part 1 : Sec 2 : 1979 Dimensions for Porcelain Transformer Bushings for Use in Lightly Polluted Atmospheres - Part 1 : Up to and Including 1 Kv - Section 2 : Metal Parts.
b) IS 3347 : Part III : Sec 2 : 1982 Dimensions for Porcelain Transformer Bushings for Use in Lightly Polluted Atmospheres - Part III : 17.5 kV Bushings - Section 2 : Metal Parts.
c) IS 4253: Part II: 1980 Specification for cork composition sheets - Part II: Cork and Rubber.

## 3. CLIMATIC CONDITIONS OF THE INSTALLATION:

The material shall be suitable for following climatic conditions,

1. Maximum altitude above sea level 1,000m
2. Maximum ambient air temperature 50℃
3. Maximum daily average ambient air temperature 35℃
4. Minimum ambient air temperature 0℃
5. Maximum relative humidity 95%
6. Average number of thunderstorm days per annum (isokeraunic level) 70
7. Average number of rainy days per annum 120
8. Average annual rainfall 150cm
9. Earthquakes of an intensity in horizontal direction - equivalent to seismic acceleration of 0.3g
10. Earthquakes of an intensity in vertical direction - equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)
11. Wind velocity: 300 km/hr, 200 km/hr and 160 km/hr.

Environmentally, some of the regions, where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas.

Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere

The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

**4. GENERAL TECHNICAL REQUIREMENTS:**

| S. No | Description | Units | Requirement |
|---|---|---|---|
| 1. | Material | | The oil seal consists of Acrylo Nitrile Butadiene Rubber with additives |
| 2. | Physical Properties | | |
| a | Hardness | RHD | 70±5 |
| b | Tensile Strength (min) | Mpa | 10.0 |
| c | Elongation at Break (min) | % | 250 |
| d | Compression set at 70℃ for 24 hrs. (max) | % | 25 |
| 3. | Ageing in Transformer oil at 100℃ for 72 hrs. | | |
| a | Volume change | % | 15 |

**5. GENERAL CONSTRUCTIONS:**

Oil seal provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects on oil seal when it is continuously in contact with hot oil. The Oil seal provided in between transformer bushing rod and tank ,The material shall be neoprene rubberised oil resistant cork sheets conforming to type C as per IS:4253, Part III to maintain the seal at extremes of operating temperature. Oil seal shall be weatherproof.

This specification covers the requirements of Nitrile Butadiene Rubber used as oil seal material in the form of 'O'rings, cords, flat strips, sheets & other moulded gaskets etc. used for Transformers & Electrical Industries. The material withstands temperatures in the range of -4 to +120ºC.

The material of oil seal shall be free from defects such as blisters, holes, bubbles, cracks, inclusions, flow marks etc. and given smooth finish.

Oil resistant nitrile rubber made from vulcanized butadiene/acrylonitrile rubber compound having a hardness of 65 to 70 IRHD.

| Description | Dimensions (mm) | | |
|---|---|---|---|
| | Outer Dia. | Inner Dia. | Height |
| Oil seal For LT bushing rod 10 to 100 KVA | 22 | 12 | 11 |
| Oil seal for 11 KV HT Bushing rod | 30 | 12 | 18 |
| Oil seal for LT bushing rod 250&400 KVA | 32 | 20 | 13 |
| Oil seal for LT bushing road 630 KVA Trf | 45 | 30 | 16 |
| Oil seal for LT bushing rod 1000 KVA Trf | 60 | 42 | 20 |

**6. TESTS**:

Following Routine/Acceptance tests for oil seal should be done as per relevant IS.

a) Material.
b) Hardness.
c) Tensile Strength.
d) Elongation at Break.
e) Compression set at 70℃ for 24 hrs.
f) Ageing in Transformer oil at 100℃ for 72 hrs.

**7. TYPE TEST CERTIFICATES**:

The bidder shall furnish the type test certificates of the oil seal for the tests as mentioned as above as per the corresponding standards. All the tests shall be conducted by NABL Accredited laboratory as per the relevant standards. Type test should have been conducted in certified Test Laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPSODL.

**8. WARRANTY:**

Warranty of the oil seal shall be 2 years from the date of purchase. If any defects found on product within warranty period the BA is liable to replace the product free of cost.

**Picture of Oil seal in below:**