

Installation, Maintenance and Storage Guide

Oil-impregnated paper
insulated Oil to Oil bushing
Up to 170 kV 3150 Amp.

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0. Important safety notes:

Read this manual carefully and follow all safety regulations at work.

Test tap should be in closed condition during operation. Keeping the test tap cap/cover open can result into fatal high voltage appearing on test tap.

Always ensure that the power supply is switched off and high voltage terminal is earthed before doing any service or fitment/connection with bushing.

Do not remove Oil filling plug as it will temper the hermetic seal of bushing and hence will affect the performance of bushing.



Work on bushings may only be performed by qualified persons. Only materials provided by YASH must be used.



National code of **safety** procedures and specific regional or local safety rules and regulations, safe working practices and good judgment must be used by the personnel when installing, operating, maintaining and disposing of this equipment.



Caution Strong electromagnetic fields can occur along the bushings. People with pacemakers may not go near!
Sensitive technical devices must be protected by appropriate measures.



Caution Do not work on systems that might be under High-voltage!

1. Design description:

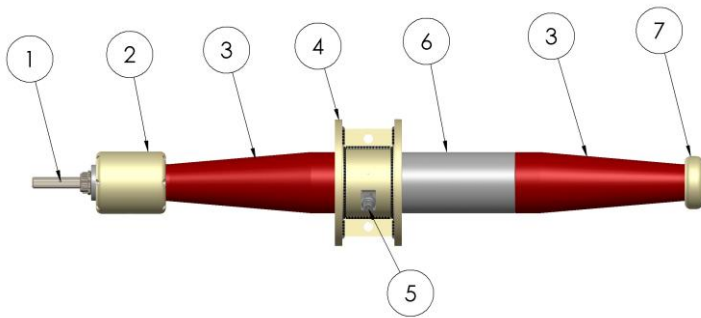


Figure 1:Design Description

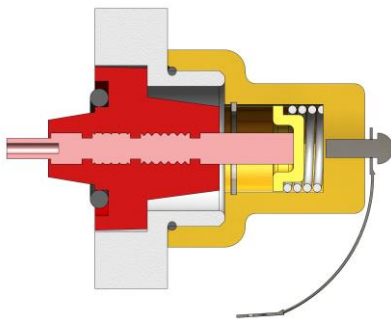


Figure:2 Test tap detail

Sl.	Part	Material
1.	HV terminal	Brass / Copper
2.	Conservator	Aluminum
3.	Epoxy insulator (2 nos.)	Epoxy
4.	Mounting flange	Aluminum
5.	Test tap	-
	Test tap housing	Aluminum
	Test tap bush	Epoxy
	Test tap cover	Brass
	O-ring	Viton
6.	Flange Extension	Aluminum
7.	Electrode	Aluminum

Bushing construction

- 1.1 The Bushing is designed to meet the requirements of **IEC-60137:2017** and ambient conditions thereof. The bushing is designed to operate for Oil – Oil application.
- 1.2 The bushing is self-contained with OIP Condenser core. The Condenser core is built by winding Insulating Kraft paper on center pipe/conductor with Aluminum grading foils inserted intermediately between paper layers in order to achieve uniform voltage and electrical field distribution.
- 1.3 The standard design consists of TEST TAP for measurement of Capacitance and (dielectric dissipation factor) Tan Delta. A cable is soldered on to the last layer of conducting foil of condenser & is crimped to the test tap stem to form TEST TAP. The

test tap lead is embedded in an epoxy molded bush to insulate it all around from mounting flange. The test tap stem/stud is connected to mounting flange by means of a spring loaded test tap cover.

- 1.4 The bushing is housed in Epoxy insulator, mounting flange & conservator.
- 1.5 Hermetic sealing: It is a sealing in which oil is prevented from communication with ambient air (atmosphere) so as to ensure healthy insulation throughout service life of bushing. This is achieved by above explained N₂ gas cushion, filled with positive pressure. This feature ensures the bushing as maintenance free equipment.
- 1.6 Oil is used as insulating media for impregnation of the condenser core as well as for cooling. The oil complies with IEC 60296.
- 1.7 The entire bushing assembly is held together by pre-stressed spring assembly in the conservator of the bushing. Spring assembly compensates the effect of change in length of central tube/stem due to temperature variation and maintains required sealing pressure on entire housing assembly.

1.8 Routine Testing at YASH test Lab:

- All routine tests on bushings are conducted in accordance to IEC 60137:2017.
- After complete bushing assembly, the bushing is subjected to tightness test to ensure no oil leakages.
- Further, each bushing is subjected to a final electrical routine test. The test is made at room temperature with both end of bushing immersed inside test tank simulating the service condition.
- The Capacitance and Tan δ are measured in ascending & descending voltage steps up to the rated system voltage.
- Measurements for internal partial discharge (PD) are made after dry power frequency withstand voltage. Dry power-frequency voltage is maintained for one-minute duration.
- All routine tests test results of bushing are reported to customer by YASH standard test certificate with each supply lot.

2. Operating conditions:

- | | |
|-------------------------|-------------------------------|
| 2.1 Application | : Oil to Oil |
| 2.2 Ambient temperature | : -20 to + 40 °C |
| 2.3 Oil Temperature | : ≤ 60 °C above ambient. |
| 2.4 Altitude of site | : Not applicable |
| 2.5 Mounting angle | : As per GAD. |

Special requirements are guaranteed in GA dwg and supersedes above data.

3. Unpacking and handling:



Attention – transport damage.

Obvious damage to carrier must be acknowledged to YASH as soon as possible.

- 3.1 Open the packing case carefully so as to preserve for re-use. The bushing is to be lifted using eye bolts (not part of supply) on the flange.
- 3.2 While erecting, care shall be taken to rest the bushing on soft bedding for preventing cracks or damage to any parts.

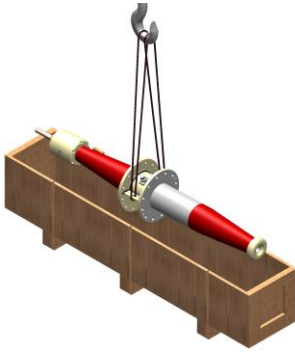


Figure 3: Lifting bushing from wooden box

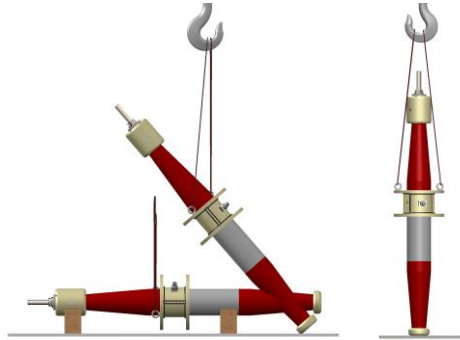


Figure 4: Make bushing vertical

4. Do's and Don'ts before erection:

4.1 Visual Examination checks:

- 4.1.1 Bushing to be examined thoroughly for any damages incurred during transport viz. visible oil leakage from any of bushing part etc. If any of such damages noticed, bushing should not be used for commissioning purpose and should be reported to YASH HIGHVOLTAGE immediately.
- 4.1.2 **Accessories mounting**
 - 4.1.2.1 Bushing with single flange design can be delivered with a Remote-test-tap connection (UHF coaxial cable and connector assembly) for Bushing test -tap extension outside of turret. Pls refer instructions of Remote-test-tap for more details.

4.1.3 Electrical tests: Capacitance & Tan Delta Measurement:

4.1.3.1 Capacitance C_1 , C_2 and Tangent delta measurement of the received bushing to be carried out and compared with factory test results.



Attention: The measurements should be done only if the power supply is switched-off. After the measurements, the cap must be closed again to ensure earthing of Test Tap, to avoid failure of bushing.

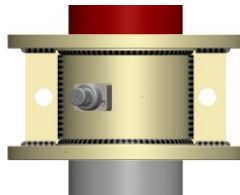


Figure 5: Earthing of test tap.

4.1.3.2 If the measured value of capacitance is found to be higher or lower than 1% of value mentioned in Routine Test report, YASH HIGHVOLTAGE is to be consulted immediately and bushing must not be used till verified and cleared by YASH.

4.1.3.3 If the measured value of $C_1 \tan \delta$ varies more than 0.1% from the submitted routine test report or found to be greater than $0.007(\text{absolute value})/0.7\%$, YASH HIGHVOLTAGE is to be consulted immediately and bushing must not be used till verified and cleared by YASH.

Special Note: Bushing must not be energized before the given value limits of Capacitance & $\tan \delta$ are achieved in site testing.

5. Dos & Don'ts before commissioning/energizing:

5.1 Before commissioning/energizing the bushing, a standing time of 72 hours is recommended in the position in which Bushing is designed to operate.

5.2 Before commissioning, inspect bushing once again for any abnormality as explained in visual checks (4.1).

Lift the bushing vertically up & slowly lower it into transformer turret. Care must be taken so as to avoid impact of bushing on transformer tank while lowering.

Mounting bolts to be appropriately tightened to seal the transformer as per the transformer manufacturer's Instruction manual.



Attention: Ensure that "THIS SIDE UP" arrows are always perpendicular to ground level. Failing to do so, may lead to electrical failure of the bushing.

5.3 Recommended torque values are tabulated below.

Bolt size	M12	M16	M20
Torque for mounting bolts in (N-m)	30	40	50

⚠ Attention: Check earthing! Check firm earthing connection of Bushing flange. Because inadequate earthing may lead to total failure of the system or damage to the bushing!

6. Terminal connections:

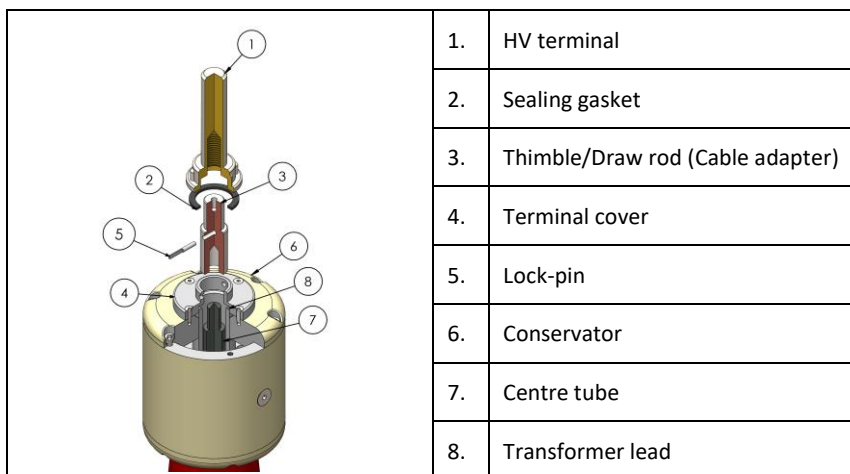


Figure-B1: General assembly of thimble/draw rod with air end terminal

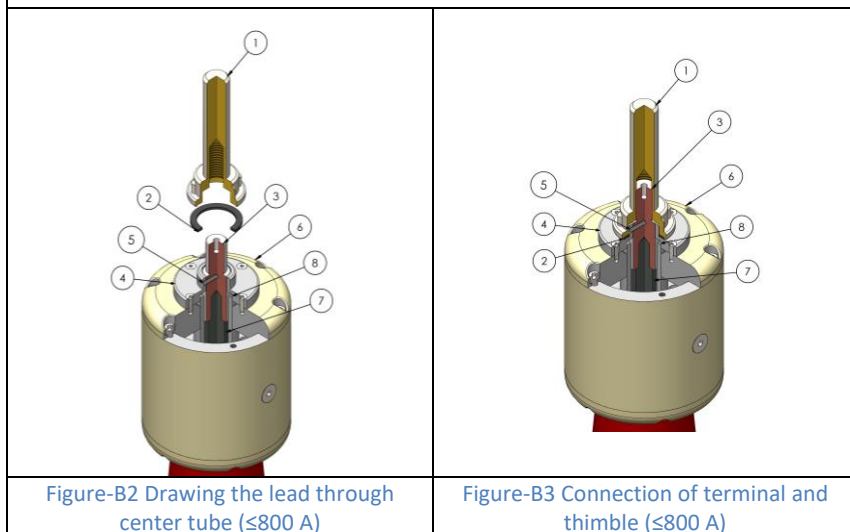


Figure 6: Terminal connection

- 6.1 For bushing with rated current upto 800 A, thimble is provided with bore for ease of brazing. Thimble design can be customized upon request.
- 6.2 For bushing with rated current 1250 A, draw rod is provided. Refer GAD for more details.
- 6.3 For bushing with rated current >1250 A, solid stem type bushings are provided with solid palm, suitable for direct connection with transformer lead at transformer end.
- 6.4 *Cable end terminal connection*: Hand tighten the terminal manually till fully possible on thimble/draw rod/solid stamp of the bushing as per applicable type of bushing. After this, rotate and fix the terminal further using spanner by max ½ half to ¾ turn.
Note: Spanner to be strictly applied on base portion of terminal as shown above.



Do not use any tool/tackles on contact surface to tighten the terminal.

The type of connection shall be of such arrangement which does not exert torsional force on the terminal during service. At maximum rated current, the bushing current carrying parts and other metal parts will take a temperature of about 10 °C above the Oil temperature. Significantly higher temperatures, especially at lower current loading, can be a sign of bad connections.



The contact surfaces of the bushing are electroplated; hence do not use emery or any abrasive articles to clean. Wipe clean with a lint free cloth using suitable cleaning agent.



Attention In order to maintain a contact pressure, the terminals should be properly tightened. Failure to perform a proper connection may result in overheating.

7. Final checks before energizing of Bushing:

- 7.1 Measurement of Capacitance & Tan Delta (As per cl 4.1.3)
- 7.2 Visual Examination checks of bushing (As per cl 4.1.2)
- 7.3 Flange earthing is recommended with $\geq 50 \text{ mm}^2$ copper braided wire, to avoid spark between high voltage potential & earth potential under normal service operation.
- 7.4 Effectiveness of test tap earthing by means of fully closing TEST TAP CAP/COVER.
- 7.5 Properly fixed HV terminal connection (As per cl 6)
- 7.6 Waiting time before energizing (As per cl 5.1)
- 7.7 Visual inspection (As per cl 4.1.1 and 4.1.2).

8. Repacking and storage:

8.1 The original wooden case of the bushing shall be retained and stored in dry condition.

Storage:

- 8.1.1 The bushing must be stored in same position as supplied.
- 8.1.2 Storage place should be clean, dry & adequately ventilated, such that bushing remains dry. Stacking of bushing is not recommended to avoid damage to packing case in long term & hence to bushing.

9. Routine checks and maintenance:

9.1 Bushing is self-contained & hermetically sealed, hence is practically maintenance free. However periodic cleaning & checking as explained below should be practiced.











DANGER!!!! *No work at all can be performed on bushing, while it is energized or not earthed."*

- 9.2 Capacitance & Tan Delta measurement and records as per procedure explained in cl. 4.1.3 must be carried out at regular intervals (Recommended every six months).
- 9.3 For the reference, initial reading recorded before commissioning should be considered as base. The next values of test results are to be compared with these results.
- 9.4 Any variation in C_1 Capacitance values more than 1% of base value should be reported immediately to YASH HIGHVOLTAGE.

Any variation in C_1 Tan Delta more than 0.1% of previously recorded value (6 monthly) should be reported immediately to YASH HIGHVOLTAGE.

- 9.5 **The test results depend on the measurement method, temperature, air pressure and humidity. For better comparability of 'capacitance' and 'tangent delta', the influence of the ambient temperature should be essentially taken into consideration.**
- 9.6 **NOTE: On completion of service period of Bushing, it can be disassembled and components can be recycled or disposed as per the local regulations of the region.**
Details of part given in design description.

DISTINGUISHED PRODUCT RANGE

			
OIP bushings with Porcelain /Polymer housing upto 170kV	LV Oil Insulated Polymer Bushings upto 36kV 3150 A	LV OIP bushings Upto 4000 A	Retrofit/Replacement of reputed make bushings
			
Oil filled High-current bushings Up to 16000 Amps	OIP High-current bushings Upto 20000 Amps	Retrofit High-current bushings	OIL TO OIL OIP bushings Upto245 kV

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