

Installation, Maintenance and Storage Guide

Oil-impregnated paper
insulated Wall through Bushing

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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.



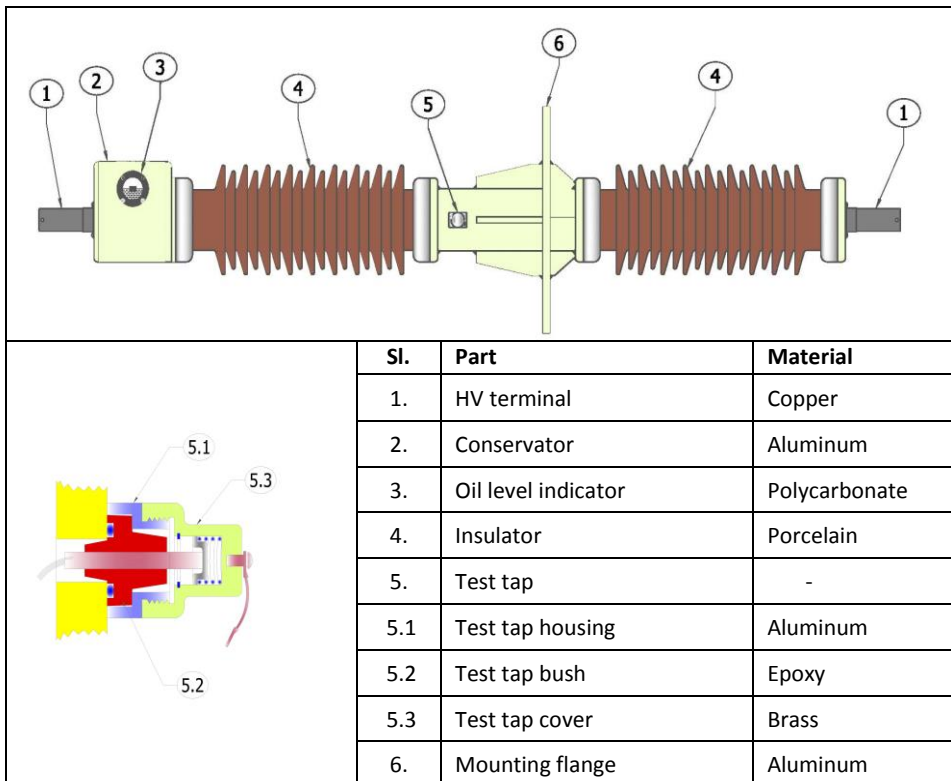
Caution Strong electromagnetic fields can occur along the bushings. People with pacemakers may not go near!

Sensitive technical devices must be protected by appropriate measures.



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

1. Design description:



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 air – air 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 porcelain insulator- indoor and outdoor, mounting flange & conservator.
- 1.5 Oil level: The annular space inside the bushing housing is filled with transformer oil up to Oil level glass and space above oil level is evacuated and flushed with Nitrogen (N₂) gas, which works as cushion to compensate volumetric changes in oil due to temperature variation on account of site ambient and current flow during Bushing in service.
- 1.6 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.
- 1.7 Oil is used as insulating media for impregnation of the condenser core as well as for cooling. The oil complies with IEC 60296.
- 1.8 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.
- 1.9 **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 bushing connected on stand to 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 | : Indoor-Outdoor (Air to Air) |
| 2.2 Ambient temperature | : -20 to + 40 °C |
| 2.3 Oil Temperature | : ≤ 60 °C above ambient. |
| 2.4 Altitude of site | : ≤ 1000 m. |
| 2.5 Mounting angle | : Horizontal. |
- Special requirements are guaranteed in GA dwg and superceeds above data.

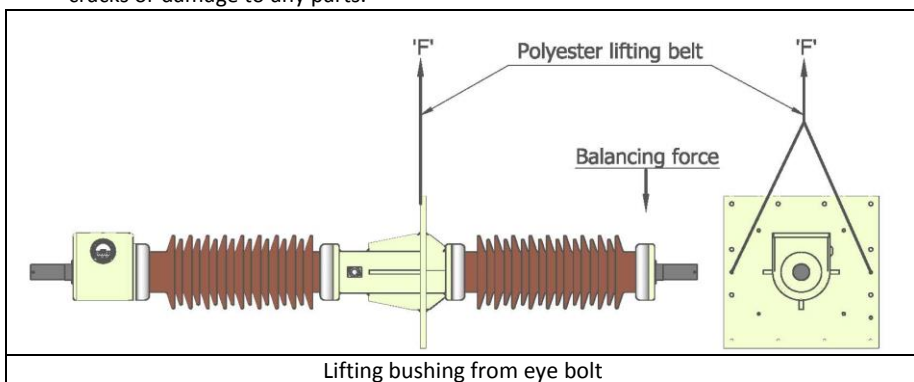
3. Unpacking and handling:



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.



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. crack/chip off of Insulator, 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 Presence of Oil level in bushing to be checked through oil level sight glass. Oil should be visible in oil level glass by position of oil level float or prismatic indicator.

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 measuring connection may only be used if the power supply is disconnected. After the measurements, the cap must be closed again to ensure earthing of Test Tap, if not done will result in failure of bushing.

4.1.3.2 If the measured value of capacitance is found to be higher or lower than 10% 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 24 hours is recommended.*

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


Lift the bushing carefully and pass through the hole in the wall and match the mounting holes with the mounting bolts.



Conservator




Mounting flange

 **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:** Fasten the flange to the mounting structure in wall and connect the flange to earth potential. Check earthing! Inadequate earthing may lead to total failure of the system or damage to the bushings!


6. Terminal connections:


Air end terminal connection: Hand tighten the air end terminal till fully possible.

After this, rotate and fix the air end terminal further by rotating it using 8 mm dia hole.

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

At maximum rated current, the bushing outer terminal normally takes a temperature of about 45 to 55 °C above the ambient air. Significantly higher temperatures, especially at lower current loading, can be a sign of bad connections.

 **Caution** 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 Verification of oil level inside 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 fitted HV terminal connection (As per cl 6)

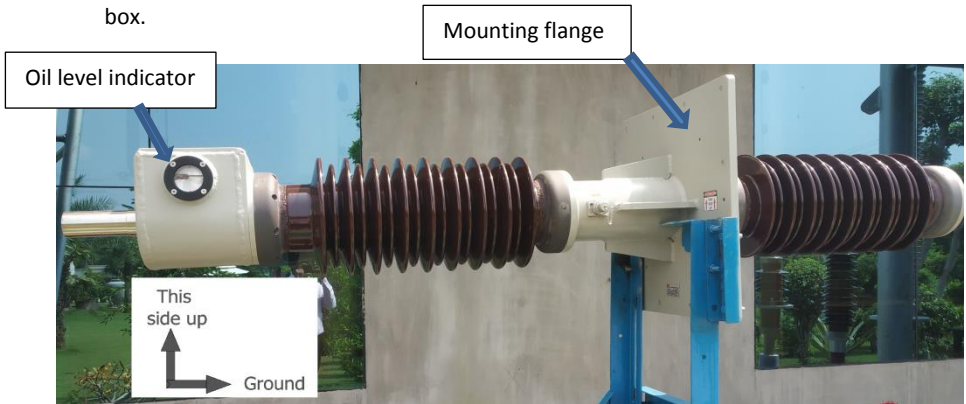
7.6 Waiting time before energizing (As per cl 5.1)

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.**

8.2 It is recommended to repack the bushing in original packing case only. Packing should be done as per original packing scheme i.e. covering of Air end insulator, Terminal assembly etc. using layered foam sheet or other appropriate cushioning to avoid any impact damage to these parts. Oil indicator position should be facing the side wall of packing case, i.e. 90 degree rotated from top view when bushing placed inside wooden box.



Storage:

8.2.1 The bushing must be in horizontal position at all times.

8.2.2 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 & 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 Periodic cleaning of insulator- indoor and outdoor must be done in order to remove deposited dust particles & foreign particles.
- 9.3 Capacitance & Tan Delta measurement and records as per procedure explained in cl. 4.1.3 must be carried out at regular intervals (Recommended at least six months per year).
- 9.4 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.
- 9.5 Any variation in C_1 Capacitance values more than 10% 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.
- 9.6 **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**
- 9.7 **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	Fibre-glass cylinder for test equipment and transformers Upto 1800 mm dia, 3 metre length

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