

Type A bushings

Instructions for installation, maintenance, and storage

This document contains general procedures to be followed from the time bushings are received until they are put into operation.

General description

Type A bushings are designed for application on transformers. Porcelain is used as the major insulation, and the single-piece porcelain is bottom end connected to the apparatus to insulate the conductor from the grounded mounting surface.

Type A bushings are available with voltage ratings from 1.2 to 34.5 kV. Bushings rated 600 amperes and lower have draw-lead conductors which allow the bushings to be removed without disturbing connections inside the transformer. Fixed conductor bushings are available in current ratings through 18,000 amperes.

The fixed conductor bushings are center clamped with spring washers or multiple spring mechanisms at the bottom end. This construction provides a pressure tight seal and develops maximum strength in the porcelain.

Safety information

Keep this document available to those responsible for the installation, operating, and maintenance of the bushing. The installation, operation, and maintenance of a bushing present numerous unsafe conditions, including, but not limited to, the following:

- High pressures
- Lethal voltages
- Moving machinery
- Heavy components

Specialized procedures and instructions are required and must be adhered to when working on power transformers. Failure to follow instructions could result in severe personal injury, death, and/or product or property damage.



Additionally, all applicable safety procedures such as OSHA requirements, regional and local safety requirements, safe working practices, and good judgment must be used by personnel when installing, operating, and/or maintaining such equipment.

Safety, as defined in this document, involves two conditions:

- Personal injury or death
- Product or property damage (includes damage to the bushing or other property, and reduced bushing life.)

Safety notations are intended to alert personnel of possible personal injury, death or property damage. They have been inserted in the instructional text prior to the step in which the condition is cited. The safety notations are headed by one of three hazard intensity levels which are defined as follows:

- Danger - immediate hazard which will result in severe personal injury, death, or property damage.
- Warning - hazard or unsafe practice which could result in severe personal injury, death, or property damage.
- Caution - hazard or unsafe practice which could result in minor personal injury, or property damage.

Receiving and unpacking

When a bushing is received, examine any damage incurred during shipment. Inspect the surface of the porcelain for small breaks or cracks. If damage or rough handling is evident, file a claim with the transportation company and immediately notify ABB.

Exercise care in opening the shipping container to prevent damage to the porcelain insulators. As each bushing is

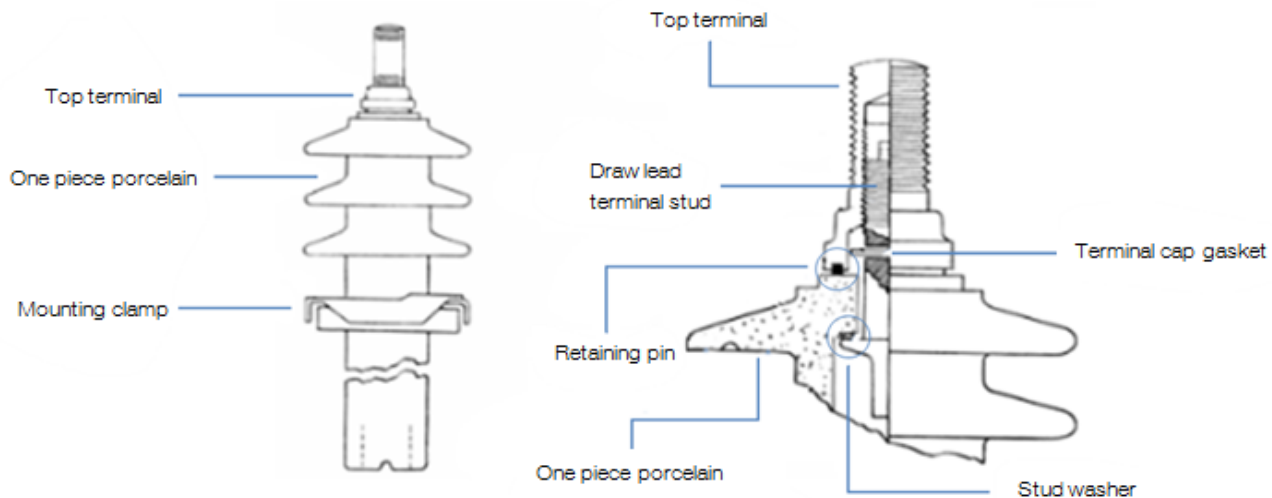


Figure 1 - Type A bushing (600 amperes and below)

unpacked, wipe clean of all dust, grease, oil or particles of packing material with a dry cloth. Inspect the bushing for damage such as cracked porcelain or damaged threads.

Storing

Store the bushing in a clean, dry place in the shipping crate. Particular care should be taken to keep dust and dirt out of the inside of the bushing. For long term storage, suitable protection should be provided for the terminals and mounting hardware. The gasket surface on the underside of the mounting flange should be heavily greased to protect it from rust and corrosion.

Type A features

The draw-lead bushing has a pin connected terminal stud. Standard bushings rated up through 2,500 amperes use a loose, multi-piece mounting clamp (see Figure 3). Standard bushings rated 3,000 amperes and above have an epoxy cement flange. A fixed conductor bushing up to 3,000 amperes for cover or side-wall mounting is not sealed at the bottom end, allowing oil from the transformer to circulate in the bushing.

The Type A bushing has satisfactory radio influence voltage characteristics under normal operating conditions. The electrical characteristics comply with ANSI requirements. The construction is simple and sturdy and the Type A bushing has an excellent service record.

Installation

Type A bushings are shipped ready for installation. An apparatus manufacturer may ship the bushing completely installed, eliminating the requirement for installation in the field. If a draw-lead bushing is removed from the transformer for shipment, the top hardware and mounting hardware may be removed from the bushing and packed separately. When installing a bushing, tighten the mounting bolts a fraction of a turn at a time, working progressively in a crisscross pattern

until all of the bolts are uniformly tight. This must be done to prevent unequal clamping and possible damage to the porcelain support or the mounting flange. Tighten the bolts sufficiently to seal the bushing to the mounting flange. The torque values listed below will provide adequate gasket compression for sealing on all Type A bushings.

Size of bolt (inch-thread)	Torque ft-lbf (N-m) ¹
1/2 - 13	25 (34)
5/8 - 11	30 (41)
3/4 - 10	35 (48)

¹ Torque values for mounting bolts should not be exceeded

Draw-lead bushings

The draw-lead terminal stud for a low current bushing is included as an integral part of the bushing. The flexible draw-lead cable is provided by the transformer manufacturer. The terminal stud is either brazed or crimped on to the draw-lead cable. Remove the terminal cap, retaining pin, and stud washer. Assemble the stud washer onto the terminal stud. Pass a wire or cord down through the tubular porcelain and attach it to the terminal stud on the draw-lead. Lower the bushing into position while pulling the draw-lead up through the porcelain. Pin the terminal stud into position. Coat the terminal cap gasket with a thin film of light oil; then position the gasket in the terminal cap. Tighten the terminal on the stud to compress the gasket, thus sealing the bushing.

On a bushing of older design, the stud is brought into position with a sealing nut. Remove the terminal cap and sealing nut (the stud is already removed) from the top end of the bushing. After positioning the terminal stud in the porcelain, assemble the gasket and sealing nut on the stud. Screw on the nut tightly to compress the gasket and seal the nut. The draw-lead bushing uses a multiple-piece clamp, illustrated in Figure 3 for mounting on the transformer. The clamp does not require cement.

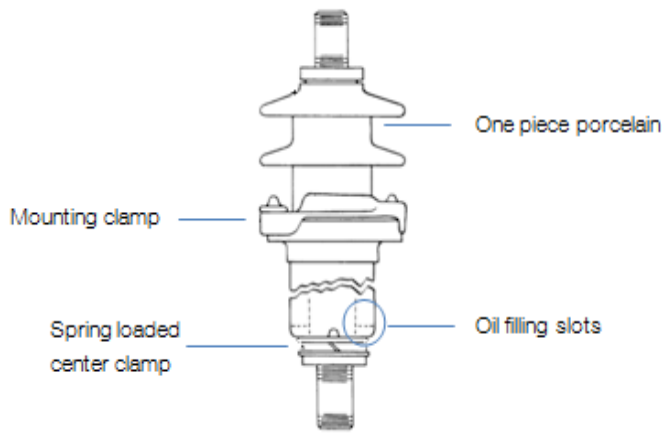


Figure 2 - Type A bushing with fixed conductor (2,000 amperes)

Fixed conductor bushing

A cover or side-wall bushing up to 3,000 amperes, with a fixed conductor, is not sealed at the bottom (inboard) end. Insulating oil from the transformer is permitted to enter the bushing when it is installed and operating. Threaded clamping members at the bottom end are assembled to seal the top (outboard) end of the bushing with a gasket and to load the porcelain in compression.

Fixed conductor bushings rated 3,000 amperes or more have epoxy bonded supports and gasket-to-porcelain seals. Sometimes a clamping ring is attached with epoxy and then bolted to a mounting support plate. Thin washers or shims are used between the clamping ring and the support plate. These are installed at the factory.

Do not alter the position of the washers; otherwise, leaks may occur. Bushings with fixed conductors should be bolted to the transformer prior to making bottom and top end terminal connections.

External line connections

Connections from a bus to the top end of a bushing should be made securely to avoid loosening in service which would cause damage to bushing gaskets. There should be sufficient flexibility in the connections to prevent mechanical stresses from expansion, contraction, and wind sway. Long spans of unsupported conductor should be avoided.

Terminal connectors should be of ample size to keep the bushing terminal temperature below 70 °C at rated current. The use of even more generously sized connectors is recommended to minimize bushing overheating during possible overloads. Do not loosen the top terminals when installing the line terminal connectors.



Figure 3 - Typical mounting clamp and cushion for bushings rated <2500A

!Caution

Before applying vacuum to a transformer, be certain there is sufficient slack in the external line connections to the bushing to allow for bushing movement caused by flexing of the transformer cover and/or walls. Failure to relieve this stress at the bushing connection may result in damage to the bushing seals and loss of oil. Loss of oil will cause an electrical failure.

Maintenance

Porcelain is the major insulation in Type A bushings and requires little maintenance other than cleaning when operated under very dirty conditions. Inspection should be made regularly for cracked porcelains which could contribute to oil leakage, especially on self-filling, side-wall mounted bushings or on bushings used with transformers equipped with an oil expansion tank above the cover level.

Nameplate data

Nameplate data is of special importance in answering questions about bushings. All requests will be expedited if the factory is furnished with the serial number, the functional style number, version number, and the year of manufacture as stamped on the bushing nameplate.

At a minimum, the factory should be provided with the serial number of the bushing in question.

Field repair

Any repair of Type A bushings should be done in the factory because of the danger of contamination to the insulation when the seal is broken. In addition, the very high vacuum and clamping pressure require the use of equipment not usually available in the field. Any damage to a bushing, which might make repair either desirable or necessary, should be reported to the factory.

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