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Bushing Replacements for Power Transformers

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Power transformer bushings are critical components in electrical power systems as they allow for the flow of electrical power from the power stations and renewable energy sources through the transformers to the distribution networks and to customers.

As vital components, it is recommended that transformer bushings be monitored, inspected and tested on a regular basis as bushing failures can result in expensive transformer failures.

Several investigations of transformer failures have been done in the past, e.g. by CIGRE Transformer Reliability Survey reference WG A2.37 dated April 2012.

According to these investigations bushing failures caused 17% of transformer failures.

Unplanned power outages due to transformer failures may affect the reliability and availability of your system and ultimately your customers and revenue, especially if you do not have a spare transformer readily available.

Keeping all components of a power transformer in good operating condition is key to maintaining and extending its life.



Bushing Replacements for Power Transformers



Reasons to replace Transformer Bushings

During routine maintenance and inspection of power transformers, several critical aspects are checked on the bushings. Based on the results of this inspection, the condition of the bushings is assessed.

The main reasons a bushing must be replaced are:

- Increase in Power Factor / Capacitance / PD above manufacturer's recommended values
- Loss of oil or identified oil leak
- Presence of combustible gasses in the bushing oil
- Damaged bushing

Other factors to consider in determining whether to replace a bushing include:

- Inadequate bushing specification or technology for your application
- Older style bushing which do not allow for installation of on-line monitoring sensors

Special Considerations

- Outdated / changed technical specification or obsolete standards
- Unusual operating conditions and renewable energy / special applications
- Demanding load profiles under abrupt changes in operating and ambient temperatures
- Bushing air side termination with rigid bus connection

Selecting Replacement Bushings

Thousands of bushings are replaced every year and the Siemens bushing portfolio includes the right bushing to replace legacy bushings from GE, Westinghouse, Ohio Brass, Lapp, ABB, McGraw Edison and Trench.

Consult Siemens for other bushings of other brands and types.

When replacing bushings connected via draw lead cables, Siemens bushings are the best option offering custom and innovative adapter solutions to fit most configurations

and conform to the existing draw lead studs with no or minimal changes to the draw lead cable.

When replacing bushings in high-seismic zones or near the ocean where air-borne pollution and salinity are considered extra heavy, Siemens offers bushings with composite insulators. These bushings are ideal for these locations as they are stronger than bushings with porcelain insulators and provide better performance in heavy pollution.

Available Bushing Technologies

Siemens provides several technology options for power transformer bushing replacements, depending on application, ambient conditions, voltage class and rated current:

- Oil Impregnated Paper (OIP)
- Resin Impregnated Paper (RIP)
- Resin Impregnated Synthetic (RIS)

Consult with Siemens for the most suitable technology for your application.

Key Parameters for Bushing Replacements

Refer to the figure on the next page for critical dimensions, as per IEEE C57.19.01 Section 4.

- Suitable bushing technology
- Current rating equal or greater than existing bushing
- Turret, tank cover and CT opening allowance
- Static shielding requirements and tank clearances
- Lower length "L" dimension
- Lower end diameter "Dmax"
- Bottom connection configuration A, R.
- Flange mounting BCD and number of holes
- Air side height and air clearance requirements
- Mounting angle to vertical
- Top terminal configuration, A, R.



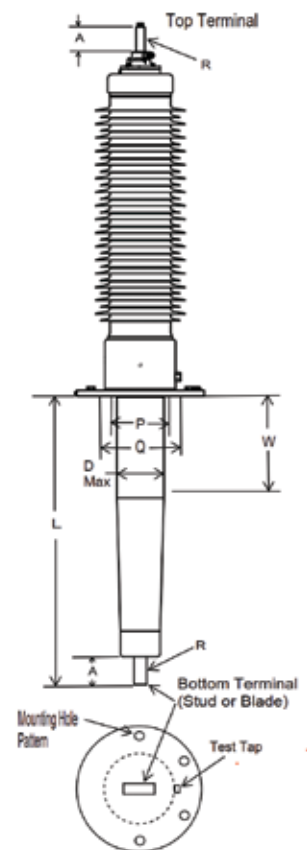
Why Siemens?

Siemens has supplied high voltage equipment for the energy sector for more than 100 years. Safety, performance, quality, reliability and innovation are among Siemens' top priorities.

In addition to being a global technology leader in power transformer manufacturing, Siemens provides complete life-cycle transformer services and additional bushing-related services such as capacitance and power factor testing; oil sampling and DGA; condition assessment and replacement through our U.S.-based transformer services group. Our solutions provide:

- Shorter lead times for IEEE / ANSI and customized replacement bushings
- Slimmer lower-end bushing designs to fit narrow openings through covers and CTs on most cases, without internal modifications
- Innovative dry-type and OIP bushing options most suitable to your application
- Access to support from transformer and bushing experts for the evaluation of bushing condition
- Expert advice on troubleshooting, test results and DGA sample analysis
- Expert support on selecting the correct bushing technology
- Extensive portfolio that includes the full range of IEEE bushings with ratings from 25 kV through 800 kV system voltages
- Safety-oriented factory trained project engineer and field service crew available for bushing replacement operations

This makes Siemens your partner of choice for electrical power transmission and distribution solutions of today and for the development of your new technology solutions of tomorrow.



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