

POBR-g



Condenser Bushing 72.5 kV-420 kV Oil-to-g³ Gas Application Resin Impregnated Paper Bushing

POBR-g bushings are capacitance-graded, resin-impregnated paper (RIP) dry-type bushings designed for power transformers. They are intended for direct connection to g³ gas-insulated switchgear (GIS) and can be installed in any orientation in compliance with the latest editions of IEC 60137 and IEC 62271-211.

The design, components, and manufacturing technology of these RIP bushings ensure an expected service life of 30 years under normal operating conditions. As a dry-type solution, POBR-g bushings offer significant advantages over conventional oil- or gas-filled bushings, particularly regarding safety, environmental protection, and maintenance requirements.

Manufacturing of Capacitance-graded Bushings

The main electrical insulation consists of a condenser core made of a continuous sheet of pure dried crepe paper and aluminum foils wound around a conductor rod/tube made of aluminum or copper, designed according to Customer specification.

- The paper is pre-dried by heated cylinders and infra-red rays during the winding process, which is fully automated, and computer controlled. The water content is reduced to less than 1%.
- During the winding stage, the aluminum foils are inserted coaxially between paper layers to create a co-centric cylindrical condenser core.
- The graded bushing technology assures a uniform distribution of the electrical field
- between high voltage conductor and earthed parts such as the main aluminum flange used for fitting on the transformer and the test tap used to earthing the last layer.
- The wound condenser core is placed in an autoclave to achieve the final drying phase and to be fully impregnated with resin under vacuum.
- The result is a solid core, mechanically robust and thermally class E (120°C) according to IEC standard.

Manufactured in Sesto San Giovanni, Milano, Italy, the machining and shaping of the core is completely automated and computer-controlled to ensure high quality.



Decarbonization Through Innovation

- POBR-g SF₆-free bushings are part of our GRiDEA portfolio of solutions designed to accelerate the decarbonization of the grid
- Partial discharge free
- g³ gas mixture's Global Warming Potential (GWP) reduced by 99% compared to traditional SF₆ gas, helping utilities meet strict decarbonization targets.
- Seamless "Drop-in" Replacement: These bushings maintain the same footprint and dimensions as legacy SF₆ models. This allows for an easy ecological transition without requiring substation redesigns.
- Uncompromised Performance: They deliver the exact same high-level electrical insulation and operational reliability as SF₆ even at low ambient temperatures (down to -25°C).

Standards

- IEC 60137
- IEC 62271-211

Key Benefits

- Partial discharge free
- Low tan-δ < 0.35%
- Installation in any position
- Long lifetime and high reliability
- Maintenance-free
- Gas tight reliable solution
- High product flexibility



GE VERNOVA

POBR-g Bushings Main Features

Resin Impregnated Paper Bushing

- Oil-to-g³ Gas
- Resin Impregnated Paper
- Installation in any position
- Dimensions of flange and gas terminals in accordance with IEC 62271-211 standards
- Partial discharges < 5pC at 1.5 Um/V3
- Power factor tap grounded through the cap
- Flange made of corrosion-free aluminum
- Execution with fixed and solid conductor

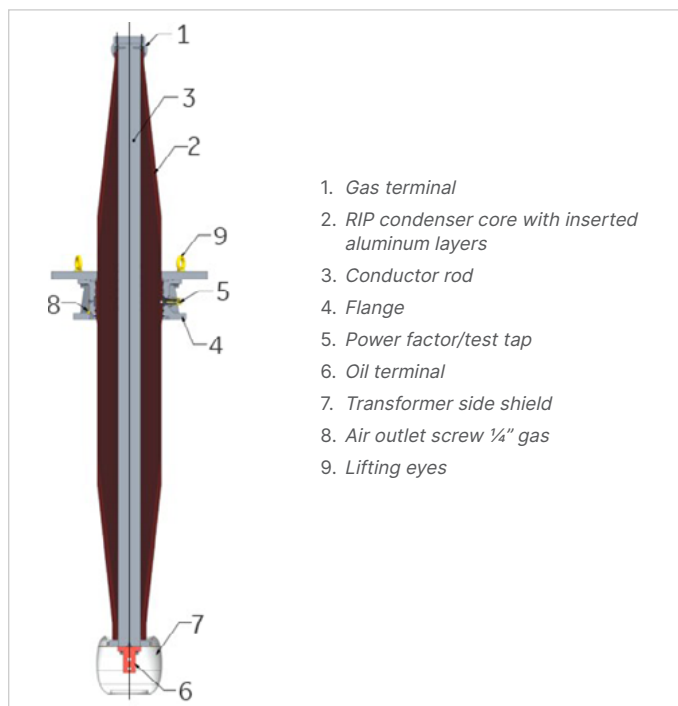


Fig. 1: POBR-g, typical cross section

Bushing Designation POBR-g.145.650.800

CODE	DESCRIPTION
P	Condenser bushings ('P' from the Italian word 'Passante')
OB	Oil to g ³ type
R	Resin Impregnated Paper (RIP)
145	Rated voltage in kV
650	BIL in kV
800	Rated current in A

Nameplate

Each bushing is provided with a nameplate, containing complete electrical data and the serial number, in accordance with the requirements of IEC Standards.

The aluminum nameplate is secured to the flange with rivets.

	GE VERNOVA	N.	PASSANTE-VILLA
PASSANTE-BUSHING-TRAVERSEE-DURCHFUEHRUNG			
TYPE			
⊕	STD REF.	50-60Hz	⊕
Um	kV	BIL/SIL/AC kV	Ir A
C1	pF	C2 pF	P.F. % AT 10kV/20 °C
°	kg		

Fig. 2: Nameplate

Oil-to-g³ gas

Bushings rated from 72.5 kV to 420 kV are equipped with, flange and gas side terminal entirely designed in accordance with IEC Standard Publication 62271-211.

The terminal is made of aluminum or copper.

The transformer side is shielded by an electrode made of aluminum alloy to increase the dielectric strength in the oil for secure connection between the transformer winding lead and the bushing terminal.

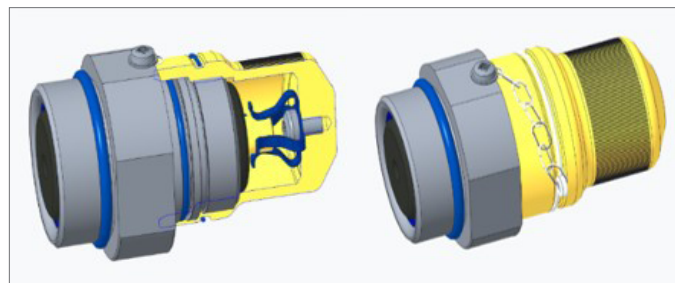


Fig. 3: Power factor tap

Gaskets

Gaskets are XIIR, a halogenated butyl rubber with X = Cl or Br, o-ring type. They are compatible with all g³ and SF₆-free solutions

Bushing internal parts are carefully protected with a sealing system against the influence of external contamination.

For special requirements, such as low temperatures (down to -55°C), special gaskets are provided. The gaskets are highly controlled before assembling.



Fig. 4: Eyebolt for lifting

Metal Surface Treatment

All metal bushing surfaces are made of aluminum alloy with high resistance in industrial environment, with high humidity content and aggressive atmosphere, like offshore with high salinity.

The tapping (includes both) surface finish avoids any corrosion throughout lifetime and allows for easy removal and fixing of cover in service.

Any special finishing or final painting are the customer's option.

Flange

The flange is made of aluminum casting and is equipped with the following accessories:

- Power factor/test tap (tested at 2 kV for 60 s)
- Air outlet screw (1/4" gas outlet plug)
- Lifting holes

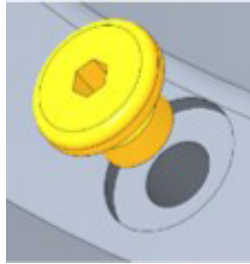


Fig 5: Air outlet screw 1/4" GAS

Electrical test

The bushings are tested according to the latest edition of IEC 60137 – "Insulated bushings for alternating voltage above 1000 V". Upon request it is possible to carry-out electrical test according to other relevant standards.

Mechanical test

The gas side and metal parts are tested in accordance with the most stringent international standards to ensure a proper resistance to gas pressure. The flange is designed to support the mechanical stress due to the double connection, GIS from one side and transformer on the other side. The design is made in compliance with IEC 62271-211 standards. Furthermore, the bushings successfully passed tests on shaking table to ensure adequate withstand (a proper strength) to earthquakes and short circuits forces.

Packing – Transportation

POBR-g bushings are normally shipped in the horizontal position in cases of three (for voltages up to 170 kV). Terminals and exposed parts are wrapped in polyethylene bags to apply an additional protection from ambient contamination such as dust and moisture and any transport damage. A special protection is used for the oil side electrode.

Long Term Storage Accessories

For long term storage and upon request the bushings are equipped with protective tank filled with nitrogen to protect the condenser core against any damage and moisture absorbing. (and humidity). The crate can also be equipped with shock indicator, (as well) on request.

Assembling

The RIP condenser core and main flange are assembled in highly controlled environment to avoid moisture and contamination of the RIP surface during production.



Fig. 6: Long term storage RIP bushings

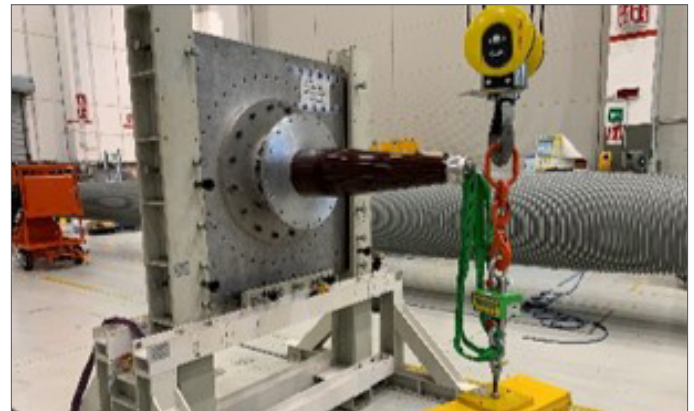


Fig. 7: Cantilever Test

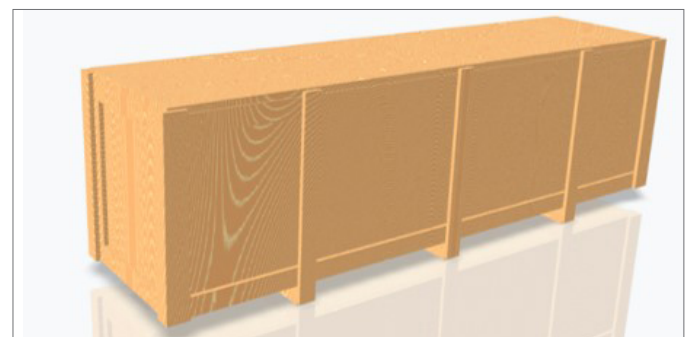
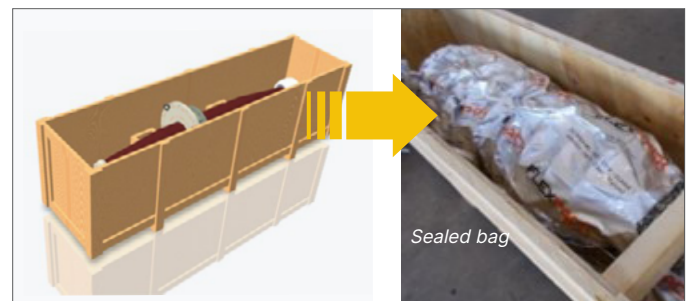
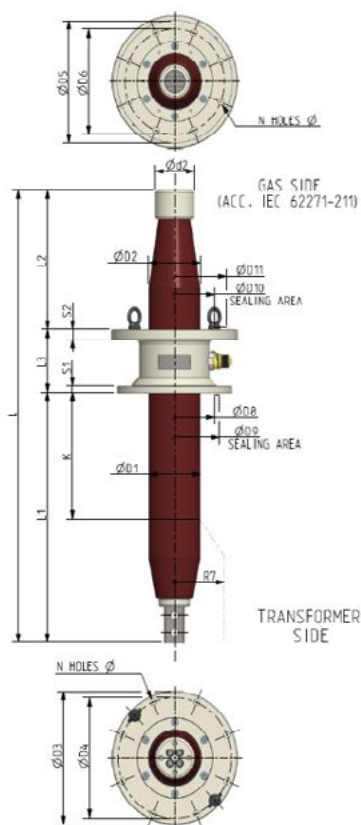


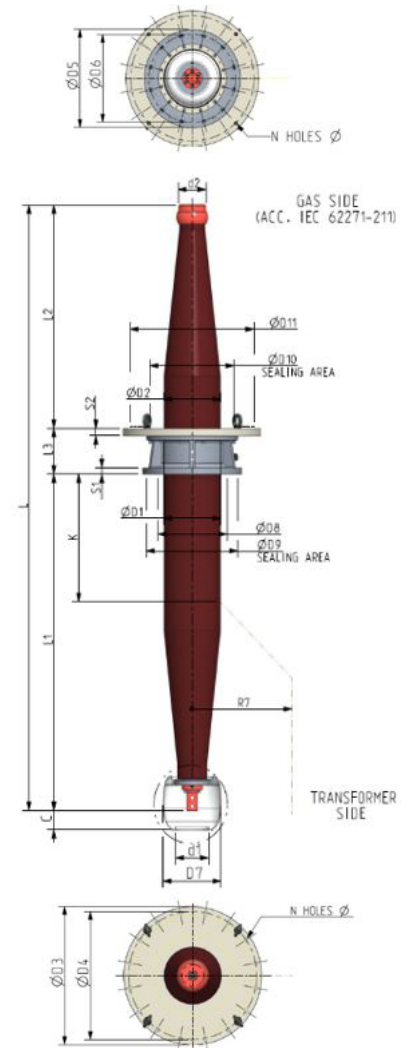
Fig. 8: Packaging - transportation

POBR-g Range from 72.5 to 420 kV: Ratings/Dimensions

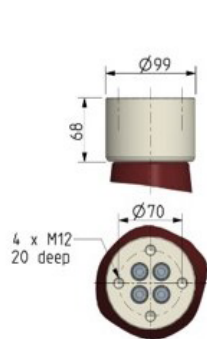


CONDENSER BUSHING, OIL - g' FOR TRANSFORMERS	RATED VOLTAGE	RATED CONTINUOUS CURRENT	RATED LINE TO EARTH VOLTAGE	DRY POWER-FREQUENCY VOLTAGE	DRY LIGHTNING IMPULSE (BIL)	SHORT TIME RATING FOR 2S (AS PER IEC 60137)	CANTILEVER WITHSTAND LOAD	MAX OPERATING PRESSURE	C	D1	D2	D1	D2	D3	D4	D5	D6	D7
TYPE/ Voltage[kV]/ Current Range [A]	kV	A	kV	kV	kVp	kA	N	kPa gauge	mm									
POBR-g/72.5/ 1600-3150	72.5	1600	42	155	325	62.5	2000	700	0	0	99	130	130	315	285	290	250	0
		2500	42	155	325	62.5	2000											
		3150	42	155	325	78.75	4000											
POBR-g/123/ 1600-3150	123	1600	91	255	550	62.5	3150	700	42	165	99	155	155	335	305	335	290	220
		2500	91	255	550	62.5	4000											
		3150	91	255	550	78.75	4000											
POBR-g/145/ 1600-3150	145	1600	84	305	650	62.5	3150	700	42	165	99	155	155	335	305	335	290	220
		2500	84	305	650	62.5	4000											
		3150	84	305	650	78.75	4000											
POBR-g/170/ 1600-3150	170	1600	98	365	750	62.5	4000	700	42	165	99	155	155	335	305	335	290	220
		2500	98	365	750	63	5000											
		3150	98	365	750	78.75	5000											
POBR-g/245/ 1600-3150	245	1600	142	505	1050	62.5	4000	700	42	165	139	202	202	565	535	450	400	220
		2500	142	505	1050	62.5	5000											
		3150	142	505	1050	78.75	5000											
POBR-g/420/ 1250-2500	420	1250	242	750	1550	62.5	5000	700	91	166	139	285	285	690	640	500	450	291
		2500	242	750	1550	62.5	5000											

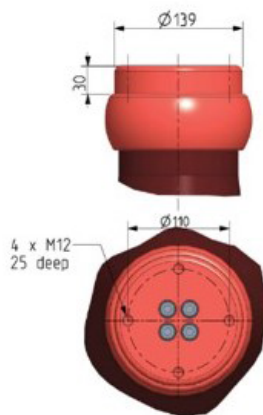
CONDENSER BUSHING, OIL – g ³ FOR TRANSFORMERS	RATED VOLTAGE	RATED CONTINUOUS CURRENT	D8	D9	D10	D11	S1	S2	R7	L	L1	L2	L3	K	N° OF HOLES GAS SIDE	N° OF HOLES OIL SIDE	CONNECTION OIL	HOLES OIL TERMINAL
TYPE/ Voltage[kV]/ Current Range [A]	kV	A	mm												N x mm	N x mm	mm	N x mm
POBR-g/72.5/ 1600-3150	72.5	1600								772	292			0	n8 d16	n8 d16	45X85	2 d18
		2500	205	265	220	280	16	25	125	1072	592	329	150	300				
		3150								1272	792			500				
POBR-g/123/ 1600-3150	123	1600								1210	498			0	n8 d16	n8d16	45X85	2 d18
		2500	205	265	220	280	20	25	235	1510	798	520	150	300				
		3150								1710	998			500				
POBR-g/145/ 1600-3150	145	1600								1263 1563 1863	551 851 1151			0 300 500	n8 d16	n12d16	45X85	2 d18
		2500	205	265	220	280	20	25	235	1263 1563 1863	551 851 1151	520	150	300 500				
		3150								1263 1563 1863	551 851 1151			0 300 500				
POBR-g/170/ 1600-3150	170	1600								1263 1563 1863	551 851 1151			0 300 600	n8 d16	n12d16	45X85	2 d18
		2500	205	265	220	280	20	25	260	1263 1563 1863	551 851 1151	520	150	300 600				
		3150								1263 1563 1863	551 851 1151			0 300 600				
POBR-g/245/ 1600-3150	245	1600								1686 1986 2286	724 1024 1324			0 300 600	n16 d16	n12d20	45X85	2 d18
		2500	270	370	450	510	20	35	350	1686 1986 2286	724 1024 1324	770	150	300 600				
		3150								1686 1986 2286	724 1024 1324			0 300 600				
POBR-g/420/ 1250-2500	420	1250								2337 2637 2937	981 1281 1481			0 300 600	n16 d20	n12 d23	48X80	2 d18
		2500	360	420	420	620	30	35	500	2337 2637 2937	981 1281 1481	1050	215	0 300 600			48X80	2 d18



Gas Side Interface (GIS)



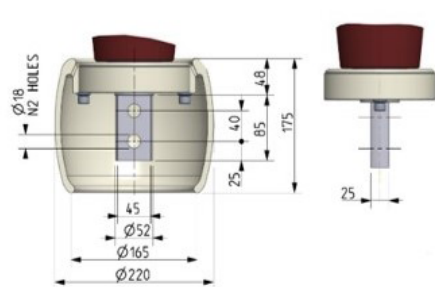
Type 1: 72.5 - 170 kV



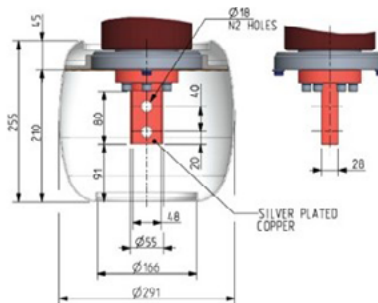
Type 2: 245 - 420 kV



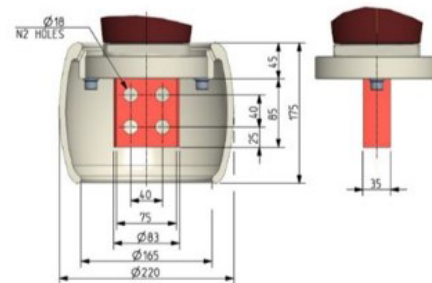
Transformer Side



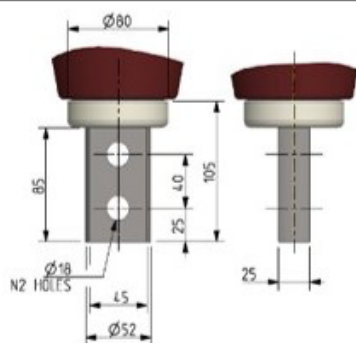
Fix - conductor
n2 holes 123 - 245 kV



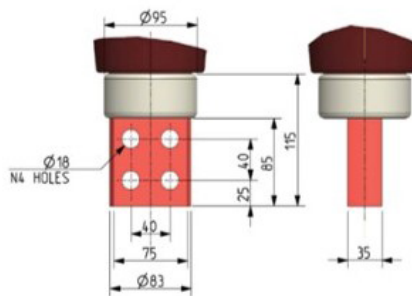
Fix - conductor
n2 holes 420 kV



Fix - conductor
n4 holes 123 - 245 kV



Fix - conductor
n2 holes 72.5 kV



Fix - conductor
n4 holes 72.5 kV





Manufacturing Site: GE Grid Solutions, Sesto San Giovanni, Milan, Italy

For more information, visit
gevernova.com/electrification

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