

PNO HEAVY CANTILEVER LOAD



Condenser Bushing 36 kV-1100 kV Oil-to-Air Applications Oil Impregnated Paper Bushing

PNO Bushings are capacitance graded bushings with Oil Impregnated Paper core. Design, Components and manufacturing technology of OIP Bushings promote an average lifetime in excess of 30 years under normal operating conditions.

GE Vernova Bushings – your Partner of choice

GE Vernova, a company you can trust to harness your power. Following the acquisition of Passoni and Villa in 2008, former Alstom Grid now GE Vernova's Grid Solutions business offers a wide range of condenser bushings for AC and DC applications. Our partner acknowledges us as one of the most reputable and reliable Bushing manufacturers in the world.

A Wealth of Benefits

We have pioneered in Bushing Technology with our combined experience and expertise over nine decades.

Heavy Cantilever Load PNO bushings are capacitance graded bushings with an oil impregnated paper core. They meet IEC 60137 Standards for insulated bushings for alternating voltages above 1000 V. They are designed for use in power transformers and can be installed up to a maximum of 45° inclination off the vertical (up to and including 420 kV) or 30° (550 kV to 1100 kV).

Seismic Solutions

Seismic solutions can be provided on request against specific site requirement and relevant standards.

Bushings to suit specific requirements

- Bushings in accordance to IEEE C57.19.01 with special flag dimensions available on request.
- Bushings in accordance to NF C52-062 including special power factor tap , flags available on request.
- Bushings for replacement with adaptation and interchangeability available on request. Specific terminals , lugs and counter flange can be provided.
- Bushing with higher altitude above 1000M are available on request.



Key Benefits

- Compact, Robust and Reliable design.
- Partial discharge-free up to rated nominal voltage
- Excellent mechanical strength
- Class A Insulation
- Low dielectric losses ($\tan\delta \leq 0.4\%$)
- Suitable for Ester Oil immersion media.
- Suitable for low temperature of -50DegC
- PNO bushings are designed to withstand heavy cantilever loads (level 2 IEC 60137).

Minimal Maintenance

- Measurement of $\tan\delta$ and capacitance is recommended as part of maintenance check
- Oil Level Check

Test Standards

- Bushings conform to IEC-60137
- Bushings conforming to IEEE C57.19.01 / NF C52-062 standard are also available.



GE VERNOVA

PNO Bushings: Main Features

PNO Bushings Main Features

IEC Standard Condenser Bushings for Heavy Cantilever Loads

- Range 36 kv to 1100 kV (50/60 Hz)
- Current up to 3150 A (higher current upon request)
- Oil-Impregnated Paper
- Air side: porcelain insulator or composite insulator
- Oil side: epoxy resin insulator (36 kV to 420 kV) or porcelain insulator (550 kV to 1100 kV)
- Partial discharge: max. 5 pC at 1.5 Um/3
- Provided with power factor tap (voltage tap upon request), air draining plug and oil side shield
- Draw lead for 1000 A to 1600 A, Draw rod for 1250 A -1600A Bottom connection for 1250 to 3150 A application
- Head made of metal oil reservoir and level gauge
- Flange made of cast aluminum alloy
- Standard angle of installation max. of 45° off vertical (up to and included 420 kV) or max. 30° off vertical (550 kV to 1100 kV)

Other installation angles available on request

Bushing Designation PNO.145.650.1250

CODE	DESCRIPTION
P	Condenser bushings ('P' from the Italian word 'Passante')
N	Normal
O	Oil Impregnated Paper (OIP)
145	Rated voltage in kV
650	BIL in kV
1250	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/IEEE requirements.

The aluminum nameplate is secured to the flange with rivets and carries the following information.

	GE VERNOVA	N.	
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

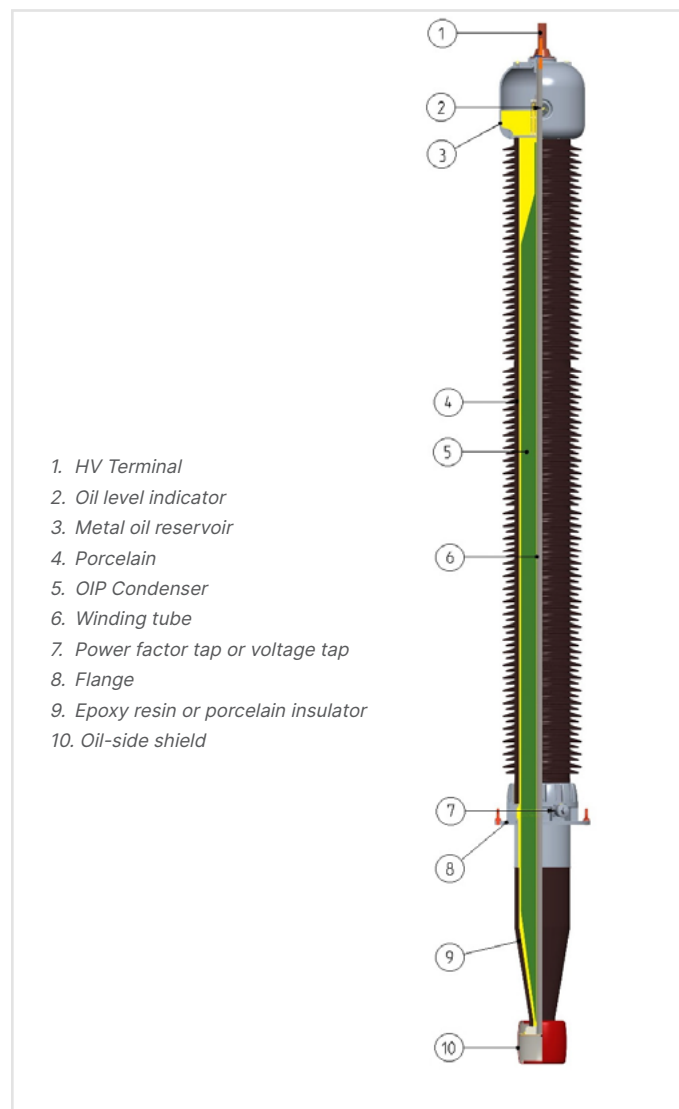


Fig. 1: PNO Bushing Typical Cross Section

Key Features

Manufacturing

The main electrical component is the condenser body, manufactured using a continuous sheet of pure kraft paper, wound around a central conductor tube or rod. During the winding process, the paper is dried by heated cylinders in order to reduce its water content to 1% maximum. A series of aluminum foils are coaxially inserted between the layers of the paper, to achieve the best possible distribution of the radial and longitudinal electrical gradients between the central tube and the flange, which is grounded. The condenser core is manufactured by computer-controlled winding machines, with subsequent machining to achieve the final shape. After winding, each bushing is individually assembled and placed into an oven and processed under vacuum for the appropriate period of time. Each bushing is then impregnated with mineral oil, which has been degassed and processed so that it has a maximum water content of 3 ppm. Each bushing is placed under pressure to insure thorough impregnation and to test that it is properly sealed. After impregnation, the bushing is head filled with a nitrogen cushion. This process is an automatic and computer controlled process.

Air Side

The air side insulator is made of brown porcelain, grey porcelain or composite insulator (resin fiberglass envelope covered by silicone sheds) are available on request. The typical creepage distance is suitable for very heavy polluted atmospheres. The shed configuration is an alternating type: short-long shed. This is the most effective solution, proven by salt spray tests. The shed profile complies with IEC 60815 - 1986 recommendations. A single piece porcelain or multiplepiece porcelain, in order to meet standards or special requirements, is used for bushings. Multiple pieces are glued using epoxy resin, without use of gaskets and the final porcelain is considered as a single piece (it passes tests IEC 60233- 1974, clause 6 tests).

Flange

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

- Lifting holes
- Power factor tap, tested at 2 kV for 60 s and/or voltage tap, upon request
- Buchholz relay connection: 1/2" gas outlet plug
- Oil sampling plug

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.

Power factor tap and voltage tap surface finish avoids any corrosion throughout lifetime and allows for easy fixing and unscrewing in service. Further finishing or final painting are the customer's option.

Top Terminal

Standard bushing top terminal is made of aluminum without any surface treatment. Upon request, it can be supplied in tinned

or silvered copper. Draw lead or draw rod type bushings (rated current up to 2000 A) have a removable top terminal. This terminal is connected to the copper inner terminal lug or the draw rod by means of multi-blade contacts and is secured to the bushing head by screws. In bottom connected bushings, the inner non-removable rod also acts as the top terminal.

Head and Oil Level Indication

The metal components of the head are made of a cast aluminum alloy. Bushings have a metal head reservoir and a prismatic glass oil level indicator to verify proper oil level.



Fig.3/4: Lifting of the Bushings



Fig 5: Air outlet screw

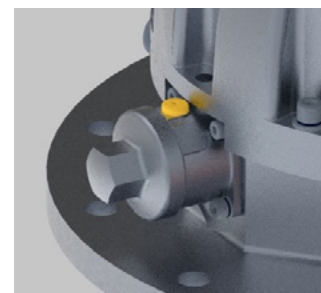


Fig. 6: Voltage tap (On request)

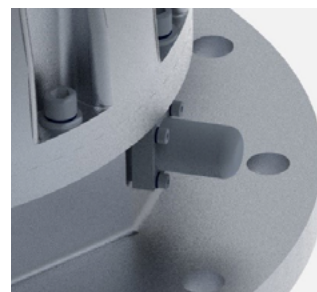


Fig. 7/8: Power factor tap



Fig. 9: Removable top terminal



Fig. 10: top terminal conductor

Oil-Side

The oil side envelope is made of a molded epoxy resin, for bushings up to and including 420 kV, or porcelain, for bushings from 550 kV to 1100 kV. This resin is a two-part compound consisting of a resin base and a hardener; the filler material is quartz sand. The epoxy resin envelope permits shapes, thickness and dimensional tolerances not possible with porcelain. Under flange sleeve length for CT accommodation, different from standard, is available upon request. In this case, the grounded part is obtained by means of a metallic tube or directly by the last metallic layer inside the condenser body.

Oil-Side Shield

The bottom end of the bushing is shielded by a proper deflector, made of aluminum alloy. It is designed to reduce the electric field stress in oil and to screen the connection between the lead coming from the transformer winding and the bushing itself. The shield can be moved upwards.

Assembling

The coupling between air side porcelain and metallic parts of the head is made by means of springs or Belleville washers placed into the head of the bushings. The coupling between the air side porcelain and the flange is realized using quick setting monocalcic-aluminized type cement (fig. 6). All cemented surfaces potentially in contact with the external environment are silicone sealed.

Gaskets

Made of Viton®, a fluorocarbon rubber elastomer (FPM), o-ring type. They are compatible with all the fluids they are in contact with (bushing impregnating mineral oil and transformer with mineral / ester oil). Air side gaskets are carefully protected by means of a sealing against influence of polluting weather elements.

For special requirements such as low ambient temperatures (down to -55°C) special O-rings are used.

Arcing Horns

Adjustable arcing horns are available upon request. The upper arcing horn is fixed by means of one screw used to secure the top terminal, while the bottom one is fixed on a proper threaded flange hole.

Insulating Fluid

The impregnation is made with a top quality inhibited super grade mineral oil, fully complying to standards IEC 60296 and ASTM. D3487, with the following outstanding characteristics:

- High dielectric strength (> 70 kV / 2.5 mm)
- Very good low temperature properties (pour point typically <-60°C)
- Low viscosity even at the lowest temperatures
- Very good oxidation stability
- Extremely good heat transfer

Transformer Oil

The transformer oil must have a water content less than 15 ppm for voltage up to 145 kV and less than 10 ppm for 145 kV and above rated voltage. Its dielectric strength must be higher than 60 kV, according to IEC 60156.

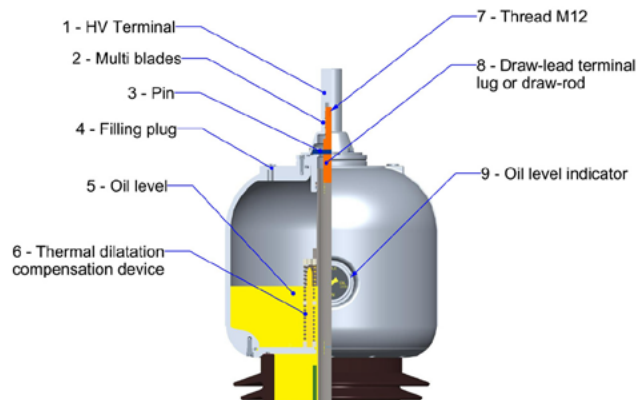


Fig. 11

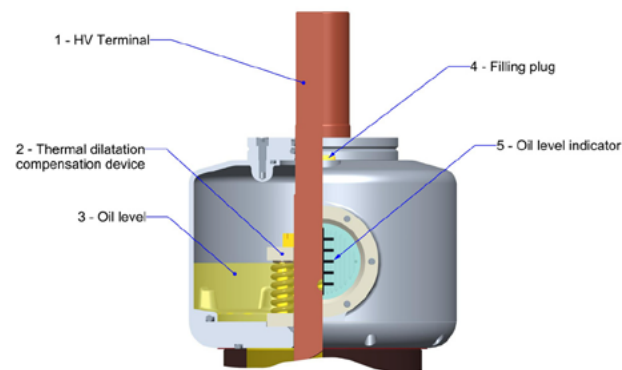


Fig. 12

Tests

All bushings have electrical characteristics and are tested in compliance with the latest edition of IEC 60137 Standards:

Insulated bushing for alternating voltages above 1000 V and main national Standards.

Type Tests

Measurement of dielectric dissipation factor (tan delta), capacitance and partial discharge quantity before and after the series of type tests:

- Tests of tap insulation
- Dry or wet power-frequency voltage withstand test
- Dry lightning impulse voltage withstand test (BIL)
- Dry or wet switching impulse voltage withstand test (SIL) for bushings rating 245 kV and above
- Thermal stability test for bushings with U_m greater than 300 kV
- Temperature rise test
- Verification of thermal short-time current withstand
- Cantilever load withstand test
- Tightness test
- Verification of dimensions

Routine Tests

- Tests of tap insulation
- Dielectric dissipation factor (tan delta), capacitance and partial discharge quantity measurement
- Dry lightning impulse voltage withstand test (BIL), when prescribed
- Dry power-frequency voltage withstand test
- Measurement of partial discharge quantity
- Tightness test
- Tightness test at the flange
- Visual inspection and dimensional check

Packing & Transportation

After tests and before packing, the bushing is cleaned of any oil and or dust. Thanks to a special device to prevent the diffusion of the nitrogen cushion out of the head and into the lower end of the bushings, each bushing can be packed and shipped secured in horizontal position. This insures minimal crate dimensions and reduced transportation costs.

Proper protection is used for oil side shields. Bushings up to and including 170 kV are normally shipped in crates containing three pieces.

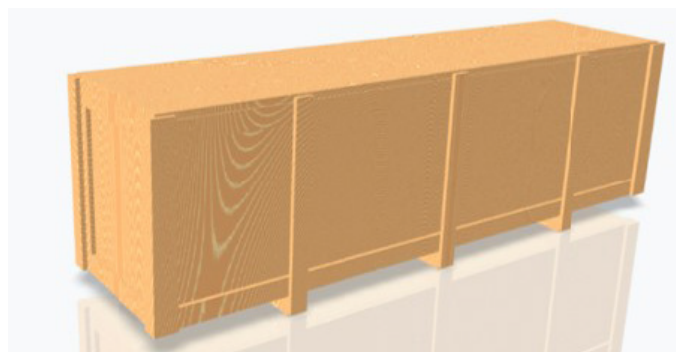


Fig. 13: Packaging - transportation

PNO Range from 36 kV to 1100 kV: Ratings/Dimensions

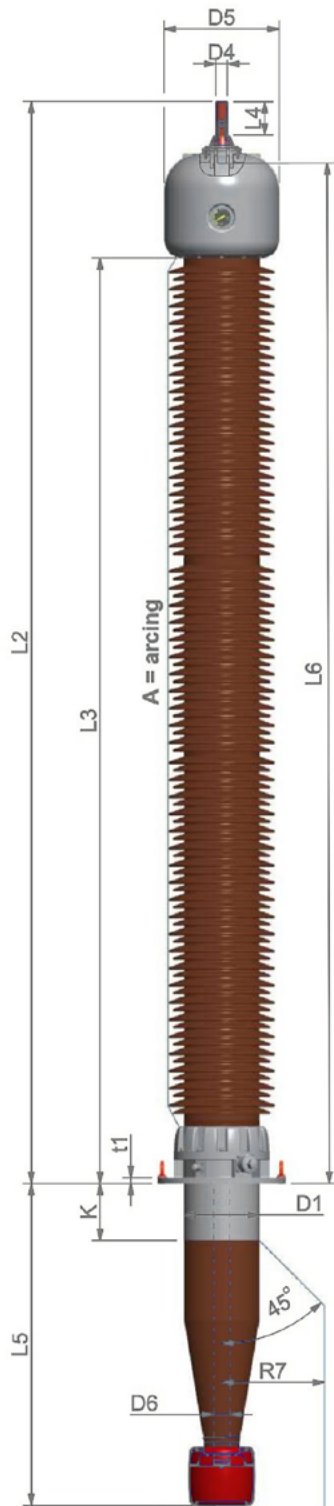


Fig. 14

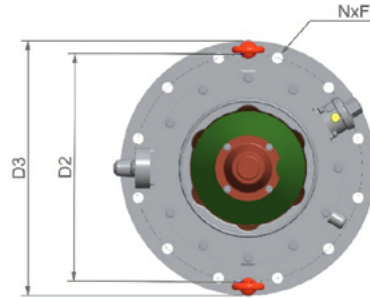


Fig. 15

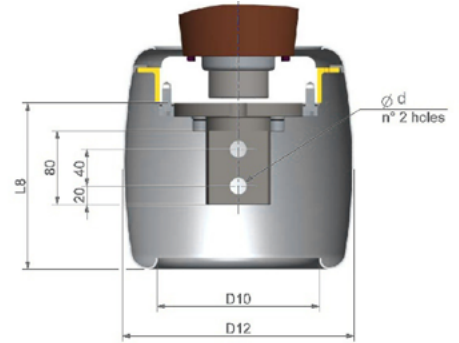


Fig. 20

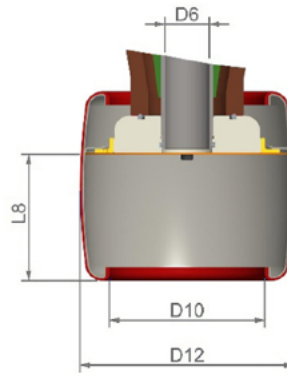


Fig. 16

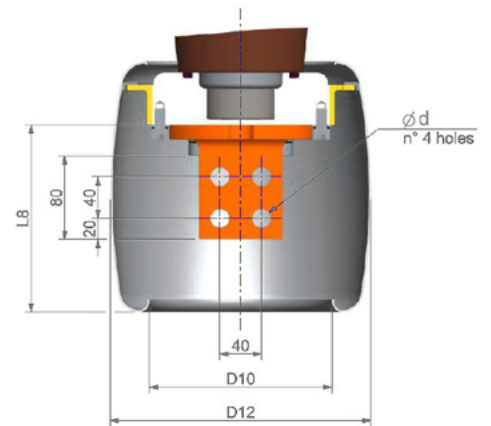


Fig. 21

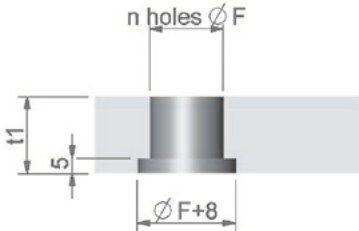


Fig. 17

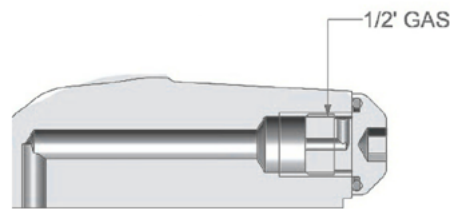


Fig. 18

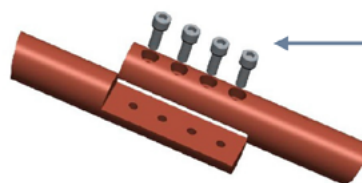


Fig. 19

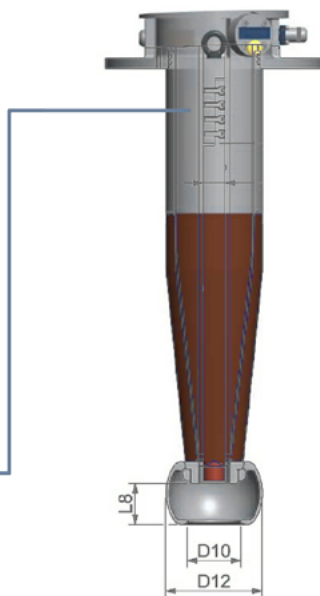


Fig. 22

PNO Bushings 36 kV to 1100 kV

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		NOMINAL SYSTEM VOLTAGE	RATED LINE-TO-EARTH VOLTAGE	DRY LIGHTNING IMPULSE (BIL)	RATED CONTINUOUS CURRENT	POWER FREQUENCY WITHSTAND VOLTAGE (FOR 60 s) DRY/WET	WET SWITCHING IMPULSE WITHSTAND	DRAW LEAD CONNECTION	DRAW ROD CONNECTION	BOTTOM CONNECTION	MINIMUM NOMINAL CREEPAGE DISTANCE	MINIMUM ARCING DISTANCE	CANTILEVER WITHSTAND LOAD	MAX OPERATING ALTITUDE	SHORT TIME RATING FOR 2 s (AS PER IEC 60137)	SHORT TIME RATING FOR 1 s/3 s
Type / Voltage [kV] / Current Rnage [A]		kV	kV	kVp	A	kV	kV				mm	mm	N	Meter	kA	kA
36.170	1000	36	21	170	1000	77/70	-	X			1520	441	1250	1800	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X			2000		62.5	88/51
	3150				3150					X			3150		78.75	111/64
52.250	1000	52	30	250	1000	105/95	-	X			1850	556	1600	1800	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X	2868	801	2500	3500	62.5	88/51
	3150				3150					X			3150		78.75	111/64
72.5.325	1000	72.5	42	325	1000	155/140	-	X			2550	706	2000	1000	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X	2868	801	4000	2000	62.5	88/51
	3150				3150					X					78.75	111/64
100.450	1000	100	57	450	1000	205/185	-	X			3300	925	2000	1000	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X			3150		62.5	88/51
	3150				3150					X			4000		78.75	111/64
123.550	1000	123	71	550	1000	255/230	-	X			4010	1081	3150	1000	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X	4720	1272	4000	2000	62.5	88/51
	3150				3150					X					78.75	111/64
145.650	1000	145	84	650	1000	305/275	-	X			4910	1331	3150	1000	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X	5600	1507	4000	2100	62.5	88/51
	3150				3150					X					78.75	111/64
170.750	1000	170	98	750	1000	355/325	-	X			5623	1521	4000	1000	25	35/20
	1250				1250				X						31.25	44/26
	1600				1600					X					40	57/33
	2500				2500					X	6460	1710	5000	2000	62.5	88/51
	3150				3150					X					78.75	111/64

PNO Bushings 36 kV to 1100 kV (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		NOMINAL SYSTEM VOLTAGE	RATED LINE-TO-EARTH VOLTAGE	DRY LIGHTNING IMPULSE (BIL)	RATED CONTINUOUS CURRENT	POWER FREQUENCY WITHSTAND VOLTAGE (FOR 60 s) DRY/WET	WET SWITCHING IMPULSE WITHSTAND	DRAW LEAD CONNECTION	DRAW ROD CONNECTION	BOTTOM CONNECTION	MINIMUM NOMINAL CREEPAGE DISTANCE	MINIMUM ARCING DISTANCE	CANTILEVER WITHSTAND LOAD	MAX OPERATING ALTITUDE	SHORT TIME RATING FOR 2 s (AS PER IEC 60137)	SHORT TIME RATING FOR 1 s/3 s
Type / Voltage [kV] / Current Rnage [A]		kV	kV	kVp	A	kV	kV				mm	mm	N	Meter	kA	kA
245.1050	1250	245	142	1050	1250	355/325	-	X			9350	2440	4000	1000	31.25	44/26
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
300.1050	1250	300	173	1050	1250	505/460	850	X			9350	2440	4000	1000	31.25	44/26
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
362.1300	1600	362	209	1300	1600	560/-	950	X			10170	2706	4000	1000	40	57/33
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
420.1425	1600	420	242	1425	1600	695/-	1050	X			12340	3270	4000	1400	40	57/33
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
420.1550	1600	420	242	1550	1600	750/-	1175	X			14360	3780	4000	1200	40	57/33
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
550.1675	1250	550	318	1675	1250	750/-	1175	X			14350	3801	4000	1300	31.25	44/26
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
550.1080	1250	550	318	1800	1250	870/-	1300	X			16110	4260	4000	1000	31.25	44/26
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
550.1800	1250	550	318	1800	1250	870/-	1300	X			17880	4701	4000	1600	31.25	44/26
	2000				2000					X			5000		50	71/41
	3150				3150					X					78.75	111/64
800.2100	1250	800	462	2100	1250	970/-	1425			X	24808	6410	4000	1000	31.25	44/26
	2500				2500					X			5000		62.5	88/51
1100.2400	2500	1100	635	2400	2500	1200	1950			X	40355	9540	11000	1000	62.5	88/51

Note: For ratings not listed, please contact us.

PNO Bushing 36 kV to 1100 kV Dimensions

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d
Type / Voltage [kV] / Current Range [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm		
36.170	1000	Draw Lead	441	100	185	225	40	148	35	100	NA	NA	765	526	80	180	NA	0	35	14	6	16	-	-
																425		300	39					
																670		500	42					
	1250	Draw Rod	441	100	185	225	40	148	35	100	NA	NA	765	526	80	180	NA	0	39	14	6	16	-	-
																425		300	45					
																670		500	50					
	1600	Bottom Connection	441	100	185	225	40	148	NA	100	NA	NA	820	526	125	265	NA	0	48	14	6	16	Fig. 20	2×18
																510		300	54					
																755		500	60					
	2500	Bottom Connection	441	130	250	290	60	206	NA	100	NA	NA	864	526	125	352	NA	100	55	16	6	16	Fig. 20	2×18
																552		300	61					
																752		500	66					
	3150	Bottom Connection	441	130	250	290	60	206	NA	100	NA	NA	864	526	125	352	NA	100	84	16	6	16	Fig. 20	2×18
																552		300	93					
																752		500	108					
52.250	1000	Draw Lead	556	100	185	225	40	148	35	100	NA	NA	940	701	80	267	NA	0	47	14	6	16	-	-
																517		300	50					
																717		500	52					
	1250	Draw Rod	556	100	185	225	40	148	35	100	NA	NA	940	701	80	267	NA	0	56	14	6	16	-	-
																517		300	58					
																717		500	60					
	1600	Bottom Connection	556	100	185	225	40	148	NA	100	NA	NA	986	701	125	367	NA	0	67	14	6	16	Fig. 20	2×18
																617		300	70					
																817		500	72					
	2500	Bottom Connection	801	145	290	335	60	206	NA	160	NA	NA	1309	966	125	380	NA	0	103	19	12	16	Fig. 20	2×18
																680		300	105					
																880		500	109					
	3150	Bottom Connection	801	145	290	335	60	206	NA	160	NA	NA	1309	966	125	380	NA	0	117	19	12	16	Fig. 20	2×18
																680		300	130					
																880		500	138					

PNO Bushing 36 kV to 1100 kV Dimensions (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d
Type / Voltage [kV] / Current Rnage [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm		
72.5.325	1000	Draw Lead	706	100	185	225	40	148	35	140	NA	NA	1090	851	80	367	NA	100	57	14	6	16	-	-
																567		300	61					
																767		500	65					
	1250	Draw Rod	706	100	185	225	40	148	35	100	NA	NA	1090	851	80	367	NA	100	68	14	6	16	-	-
																567		300	72					
																767		500	76					
	1600	Bottom Connection	706	100	185	225	40	148	NA	140	NA	NA	1145	851	125	467	NA	100	77	14	6	16	Fig. 20	2×18
																667		300	82					
																867		500	89					
	2500	Bottom Connection	801	145	290	335	60	206	NA	160	NA	NA	1309	966	125	380	NA	0	103	19	12	16	Fig. 20	2×18
																680		300	105					
																880		500	109					
	3150	Bottom Connection	801	145	290	335	60	206	NA	160	NA	NA	1309	966	125	380	NA	0	117	19	12	16	Fig. 20	2×18
																680		300	130					
																880		500	138					
100.450	1000	Draw Lead	925	130	250	290	40	206	35	175	70	130	1365	1090	80	475	50	100	105	19	8	16	-	-
																675		300	110					
																875		500	115					
	1250	Draw Rod	925	130	250	290	40	206	35	175	70	130	1365	1090	80	475	50	100	110	19	6	16	-	-
																675		300	118					
																875		500	126					
	1600	Bottom Connection	925	130	250	290	40	206	NA	200	145	200	1420	1090	125	550	110	100	134	19	8	16	Fig. 20	2×18
																750		300	142					
																950		500	150					
	2500	Bottom Connection	925	175	290	335	60	300	NA	200	165	220	1518	1140	125	570	130	0	174	22	12	15	Fig. 21	4×13
																770		300	183					
																970		500	192					
	3150	Bottom Connection	925	175	290	335	60	300	NA	200	165	220	1518	1140	125	570	130	0	205	22	12	15	Fig. 21	4×13
																770		300	215					
																970		500	225					

PNO Bushing 36 kV to 1100 kV Dimensions (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d
Type / Voltage [kV] / Current Rnage [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm			
123.550	1000	Draw Lead	1081	130	250	290	40	206	35	200	70	130	1521	1246	80	475	50	100	105	19	8	16	-	-
																675		300	110					
																875		500	115					
	1250	Draw Rod	1081	130	250	290	40	206	35	200	70	130	1521	1246	80	475	50	100	119	19	8	16	-	-
																675		300	127					
																875		500	135					
	1600	Bottom Connection	1081	130	250	290	40	206	NA	230	145	200	1576	1246	125	550	110	100	134	19	8	16	Fig. 20	2×18
																750		300	142					
																950		500	150					
	2500	Bottom Connection	1272	175	290	335	60	300	NA	230	165	220	1865	1487	125	570	130	0	174	22	12	15	Fig. 21	4×13
																770		300	183					
																970		500	192					
	3150	Bottom Connection	1272	175	290	335	60	300	NA	230	165	220	1865	1487	125	570	130	0	205	55	12	15	Fig. 21	4×13
																770		300	215					
																970		500	225					
145.650	1000	Draw Lead	1331	145	290	335	40	206	35	225	70	130	1771	1496	80	525	50	100	130	19	12	16	-	-
																725		300	135					
																925		500	140					
	1250	Draw Rod	1331	145	290	335	40	206	35	225	70	130	1771	1496	80	525	50	100	145	19	12	16	-	-
																725		300	150					
																925		500	155					
	1600	Bottom Connection	1331	145	290	335	40	206	NA	230	165	220	1827	1496	125	620	130	100	162	19	12	16	Fig. 20	2×18
																820		300	170					
																1020		500	178					
	2500	Bottom Connection	1507	175	290	335	60	300	NA	230	165	220	2099	1722	125	520	130	0	193	22	12	15	Fig. 21	4×13
																820		300	206					
																1020		500	215					
	3150	Bottom Connection	1507	175	290	335	60	300	NA	230	165	220	2099	1722	125	520	130	0	225	22	12	15	Fig. 21	4×13
																820		300	240					
																1020		500	251					

PNO Bushing 36 kV to 1100 kV Dimensions (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d
Type / Voltage [kV] / Current Rnage [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm		
170.750	1000	Draw Lead	1521	145	290	335	40	206	35	225	70	130	1961	1686	80	525	50	0	140	19	12	16	-	-
																825		300	145					
																1025		500	150					
	1250	Draw Rod	1521	145	290	335	40	206	35	225	70	130	1961	1686	80	525	50	0	160	19	12	16	-	-
																825		300	170					
																1025		500	176					
	1600	Bottom Connection	1521	145	290	335	40	206	NA	230	165	220	2017	1686	125	720	130	0	170	19	12	16	Fig. 20	2×18
																920		300	180					
																1120		500	186					
	2500	Bottom Connection	1710	175	290	335	60	300	NA	230	165	220	2305	1925	125	920	130	300	240	22	12	15	Fig. 21	4×13
																1120		500	250					
	3150	Bottom Connection	1710	175	290	335	60	300	NA	230	165	220	2305	1925	125	920	130	300	240	22	12	15	Fig. 21	4×13
																1120		500	250					
245.1050	1250	Draw Lead	2440	200	400	450	40	300	55	350	110	200	3035	2665	80	730	85	0	315	22	12	23	-	-
																1030		300	330					
																1330		600	345					
	2000	Bottom Connection	2440	200	400	450	60	300	NA	350	175	250	3041	2665	125	830	180	0	373	22	12	23	Fig. 21	2×18
																1130		300	390					
																1430		500	407					
	3150	Bottom Connection	2400	200	400	450	60	300	NA	350	175	250	3041	2665	125	830	180	0	375	22	12	23	Fig. 21	2×18
																1130		300	400					
																1430		500	410					
300.1050	1250	Draw Lead	2440	200	400	450	40	300	55	350	110	200	3035	2665	80	730	85	0	315	22	12	23	-	-
																1030		300	330					
																1330		600	345					
	2000	Bottom Connection	2440	200	400	450	60	300	NA	350	175	250	3041	2665	125	830	180	0	373	22	12	23	Fig. 21	2×18
																1130		300	390					
																1430		500	407					
	3150	Bottom Connection	2400	200	400	450	60	300	NA	350	175	250	3041	2665	125	830	180	0	375	22	12	23	Fig. 21	2×18
																1130		300	400					
																1430		500	410					

PNO Bushing 36 kV to 1100 kV Dimensions (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d	
Type / Voltage [kV] / Current Rnage [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm				
362.1300	1600	Draw Lead	2706	220	400	450	40	380	60	400	175	250	3416	2941	80	1215 1515	180	300 600	480 490	22	12	23	-	-	
	2000	Bottom Connection	2706	220	400	450	60	380	NA	400	175	250	3442	2941	150	1215 1515	180	300 600	512 530	22	12	23	Fig. 21	2×18	
	3150	Bottom Connection	2706	220	400	450	60	380	NA	400	175	250	3442	2941	150	1215 1515	180	300 600	512 530	22	12	23	Fig. 21	4×18	
	420.1425	1600	Draw Lead	3270	250	450	500	40	380	60	460	210	290	4000	3525	80	1310 1510	170	300 600	625 645	25	12	24	-	-
		2000	Bottom Connection	3270	250	450	500	60	380	NA	460	210	290	4027	3525	150	1310 1510	170	300 600	660 680	25	12	24	Fig. 21	2×18
		3150	Bottom Connection	3270	250	450	500	60	380	NA	460	210	290	4027	3525	150	1310 1510	170	300 600	660 680	25	12	24	Fig. 21	4×18
420.1550	1600	Draw Lead	3780	250	450	500	40	380	60	500	210	290	4510	4035	80	1310 1510	170	300 600	700 720	25	12	24	-	-	
	2000	Bottom Connection	3780	250	450	500	60	380	NA	500	210	290	4537	4035	150	1310 1510	170	300 600	740 760	25	12	24	Fig. 21	2×18	
	3150	Bottom Connection	3780	250	450	500	60	380	NA	500	210	290	4537	4035	150	1310 1510	170	300 600	740 760	25	12	24	Fig. 21	4×18	
	550.1675	1250	Draw Lead	3801	340	500	560	40	500	60	550	210	290	4666	4051	80	1406 1706	170	300 600	1000 1034	25	12	24	-	-
		2000	Bottom Connection	3801	340	500	560	60	500	NA	550	210	290	4701	4051	150	1406 1706	170	300 600	1042 1080	25	12	24	Fig. 21	2×18
		3150	Bottom Connection	3801	340	500	560	60	500	NA	550	210	290	4701	4051	150	1406 1706	170	300 600	1042 1083	25	12	24	Fig. 21	4×18
550.1800	1250	Draw Lead	4261	340	500	560	40	500	60	550	210	290	5126	4511	80	1571 1871	170	300 600	1100 1135	25	12	24	-	-	
	2000	Bottom Connection	4261	340	500	560	60	500	NA	550	210	290	5161	4511	150	1571 1871	170	300 600	1155 1185	25	12	24	Fig. 21	2×18	
	3150	Bottom Connection	4261	340	500	560	60	500	NA	550	210	290	5161	4511	150	1571 1871	170	300 600	1160 1185	25	12	24	Fig. 21	4×18	
	550.1800	1250	Draw Lead	4701	340	500	560	40	500	60	550	210	290	5566	4951	80	1571 1871	170	300 600	1240 1285	25	12	24	-	-
		2000	Bottom Connection	4261	340	500	560	60	500	NA	550	210	290	5602	4951	150	1571 1871	170	300 600	1221 1265	25	12	24	Fig. 21	2×18
		3150	Bottom Connection	4261	340	500	560	60	500	NA	550	210	290	5602	4951	150	1571 1871	170	300 600	1225 1268	25	12	24	Fig. 21	4×18

PNO Bushing 36 kV to 1100 kV Dimensions (Cont'd)

CONDENSER BUSHING OIL-AIR, FOR TRANSFORMERS		TYPE OF CONNECTION	A	D1	D2	D3	D4	D5	D6	R7 (MIN)	D10	D12	L2	L3	L4	L5	L8	K	WEIGHT	T1	NO. OF HOLES	F	BOTTOM TERMINAL	BOTTOM TERMINAL N X DIA d
Type / Voltage [kV] / Current Range [A]			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg	mm	N	mm		
800.2100	1250	Bottom Connection	6410	525	711	780	60	700	NA	650	230	400	7390	6715	125	2140	235	600	3080	30	12	32	On Request	-
	2500		6410	525	711	780	60	700	NA	650	230	400	7390	6715	125	2140	235	600	3080	30	12	32	On Request	-
1100.2400	1250	Bottom Connection	9540	745	1100	1200	80	500	NA	850	220	500	11020	10160	125	2490	340	380	7570	35	36	32	On Request	-



Bushings Manufacturing Site:

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