ZDVolt
智达电气

ZDTHPO

—Type P&O™ II High Current Transformer Bushings
—ANSI/IEEE Standard C57.19.04
—15kV-34.5kV
—6000A-20000A

(Appendix: IEC Standard Type P&O™ II Bushings)

JIANGSU ZHIDA HIGH VOLTAGE ELECTRIC CO., LTD

Jiangsu Zhida High Voltage Electrical Co., Ltd, doing business as (D/B/A) ZDVolt, specializes in advanced high-voltage solutions, including transformer bushings, GIS and breaker bushings, substation post insulators, and bushing/instrument current transformers. Its products are engineered for exceptional reliability and high performance.

Founded in 2003, ZDVolt is a privately held company with hundreds of patents. Its high-voltage bushing product line supports ratings up to 1000 kV and complies with IEC and ANSI/IEEE/CSA standards. ZDVolt's transformer bushings are available in OIP, RIP, RIS, SEC™, and P&O™ series. The company maintains an annual manufacturing capacity of approximately 30,000 bushings and bushing-type current transformers, with average 1-5 months lead times.

By the end of 2025, ZDVolt has installed more than 200,000 high-voltage bushings worldwide (including over 80,000 OIP bushings), including China, the United States, and Europe. Its patented "Porcelain & Oil" (P&O™) technology is the only field-proven, commercially available thermosiphon bushing solution in the industry, with over 10,000 installations.

ZDVolt operates fully integrated manufacturing facilities supported by a dozen in-house testing laboratories. These capabilities enable the production of key components such as porcelain using enhanced isostatic cold pressing, composite insulators, windings, metal parts, and fiberglass. ZDVolt also manufactures its patented BambuX™ composite insulators.

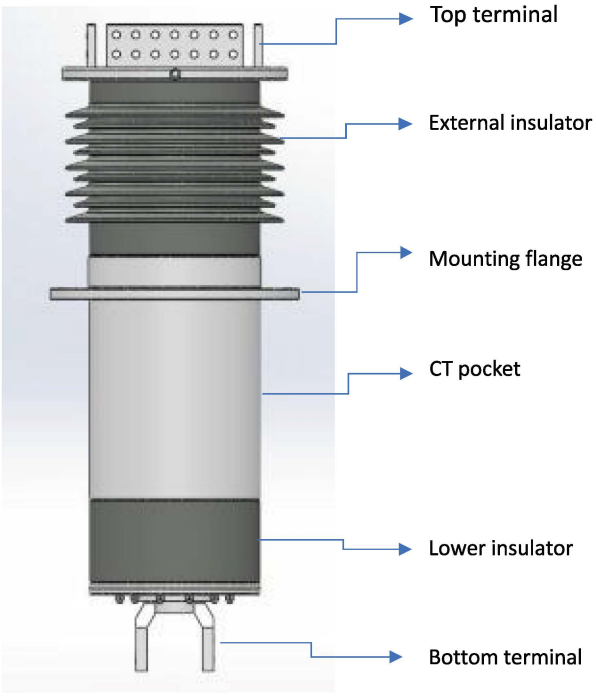
ZDVolt holds valid ISO 9001 (Quality), ISO 14001 (Environment), ISO 45001 (Occupational Health & Safety), GOST, UL, and ISO/IEC 17025 laboratory accreditations.

ZDTHPO – High current bushings designed for IEEE standard bushings.

ZDTHPO is a series of P&O™ II (high current) bushings developed by ZDVolt Company, with dimensions and electrical performance in accordance with IEEE Std. C57.19.04-2018 and IEEE Std. C57.19.00-2023. Its voltage and current ratings fully cover the standard rated levels. As a specialized non-condenser bushing, it is protected by ZDVolt's patented technology. During service, the internal cavity of the bushing shall be filled with transformer oil. Key characteristics of this bushing type include simplified installation, maintenance-free operation, enhanced structural safety, improved heat dissipation, superior electrical performance (with no partial discharge under withstand voltage), and optimized cost-effectiveness. The external insulator is made of high-strength porcelain, with a light gray glaze in accordance with ANSI standards; brown glaze is also available as an option.

Bushing structure

1. Top terminal: Connected to enclosed busbar, constructed of copper , silver-plated.
2. External insulator: High-strength porcelain, gray glaze. Standard specific creepage distance: 54 mm/kV (heavy pollution class).
3. Mounting flange: Aluminum alloy; no test tap provided.
4. CT pocket: Aluminum alloy, designed for current transformer (CT) installation.
5. Lower insulator: Porcelain, gray glaze.
6. Bottom terminal: Tinned Copper



Bushing electric performance

All the bushings are tested in accordance with IEEE Std. C57.19.00-2023.

Design test

--Leak test
--Cantilever strength
--Full-wave lightning-impulse withstand voltage
--Chopped-wave lightning-impulse withstand voltage
--Rated frequency wet withstand voltage (900-kV BIL and below)
--Dry switching-impulse withstand voltage
--Rated frequency dry withstand test with partial discharge measurement
--Temperature rise
--Verification of nameplate markings

Routine test

--Leak test
--Rated frequency dry withstand with partial discharge measurement
--Verification of nameplate markings

Higher electric performances than ANSI standard requirements.

Higher electric performances	PD at 2 times L-G voltage
IEEE Std. C57.19.04-2018	50pC
ZDVolt level	5pC

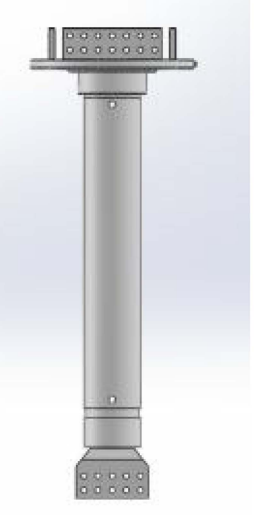
Bushing characteristics

Dimensions and ratings

ZDTHPO bushings cover rated voltages from 15kV to 34.5kV and rated currents from 6000A to 20000A in accordance with IEEE Std. C57.19.04.

Conductor

The top and bottom terminal are welded together with the central conductor. All the conductor parts are made of copper. The surface of the top terminal is silver plated and the bottom terminal is tinned. There are holes in the conductor. The transformer's oil will fill in the center of the conductor to dissipate heat.



Insulation structure

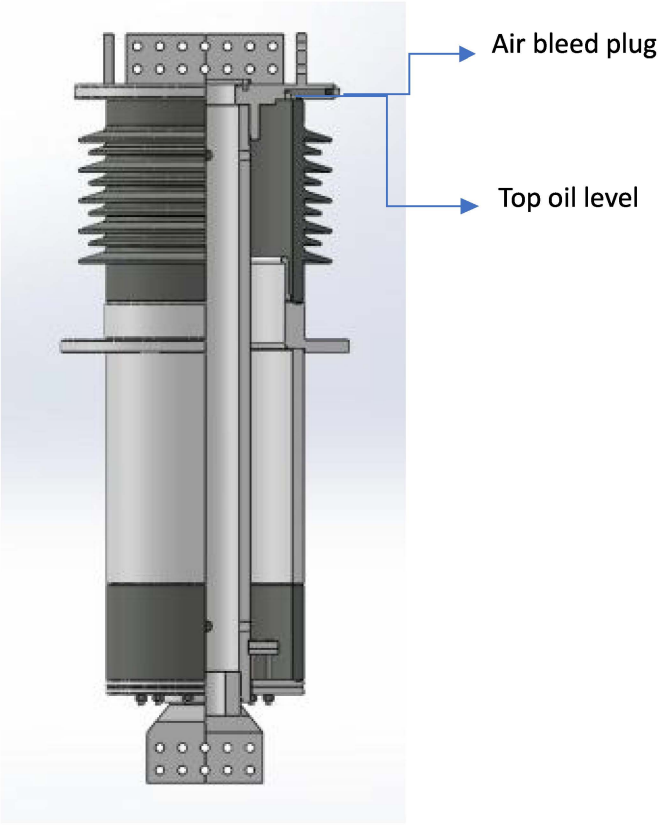
ZDTHPO is a series of P&O™ II bushings. P&O™ bushings are divided into two types--Type P&O™ I& II according to rated current. The current rated at 8000A and below is called Type P&O™ I, the current rated above 8000A is called Type P&O™ II. These two types bushings have similar insulation structure.

P&O™ type bushings are non-condenser type, with no test taps on the flange. They are referred to as "solid" or "oil-filled" bushings in relevant standards. Their insulation performance depends primarily on transformer oil; thus, the space between the porcelain and conductor must be fully filled with transformer oil during operation. The bushing itself contains no oil. An air bleed plug is provided at the top of the bushing to ensure the internal space of the porcelain is fully filled with oil.

The relative permittivity of porcelain is approximately three times that of oil, so most of the voltage is borne by the oil. Only adequate oil clearance between the conductor and flange is required to achieve the specified insulation level.

Compared with conventional OIP bushings, P&O™ bushings have multiple advantages:

1. The bushing cavity is connected to the transformer, maintaining stable operating pressure and reliable sealing performance.
2. The conductor forms an oil path, providing excellent heat dissipation and effectively reducing product temperature rise.
3. The unique shielding structure in the flange ensures partial discharge < 10pC under power frequency withstand voltage.



Attention:

When using, pay attention to filling the inner cavity of the porcelain with transformer oil until the oil is released from the vent hole.

Bushing service condition

Ambient temperature

Temperature range: –40°C to +40°C. Minimum temperature affects the selection of the sealing gasket material.

Ambient temperature	Sealing gasket material
≥-30℃	Viton rubber
< -30℃	Fluorosilicone rubber

Note:

1, Special temperature must be emphasized in the order document.

2, If maximum ambient temperature exceeds 40°C, it is best to choose the higher current grade.

Mounting angle

The bushing is typically installed vertically. If inclined installation is required, the bushing's bleed plug position needs be set at the top of the bushing.

High anti-corrosion area

Most of the bushing metal parts are made of copper& aluminum alloy, which have high corrosion resistance. For areas below C5 level, no special treatment is required, while for areas at C5 and above, special painting treatment is required.

High pollution area

ZDTHPO bushing's porcelain designed for extra heavy pollution class (USCD: 54 mm/kV), So it can satisfy high pollution area. If the customer needs higher pollution level, ZDVolt can also specially design for it.

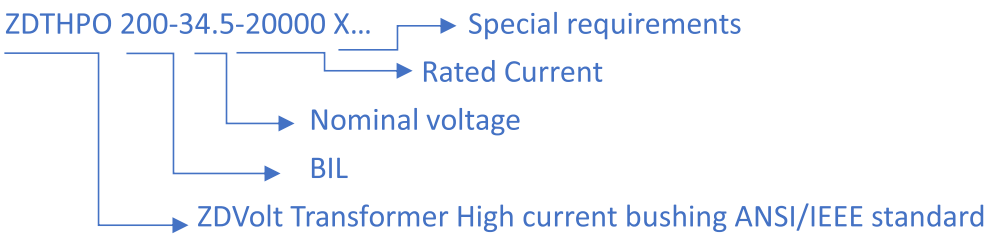
Nameplate sample

Each bushing is equipped with a stainless steel nameplate. It contains all the electric data , Serial No. and all the information in accordance with ANSI standard.

Style No. and catalog No.

The bushing is designated by both style number and catalog number. The style No. determines the bushing's type, BIL, voltage and current. The catalog No. determines the unique of the bushing including the dimension and structure. Usually, for special requirements that affect the dimension and structure of the bushing, some letters will be added after the Catalog No. to indicate specific meanings. IEEE std. bushing is strictly unique, we add the letters after the style No. as well for special requirements.

Style No. example:

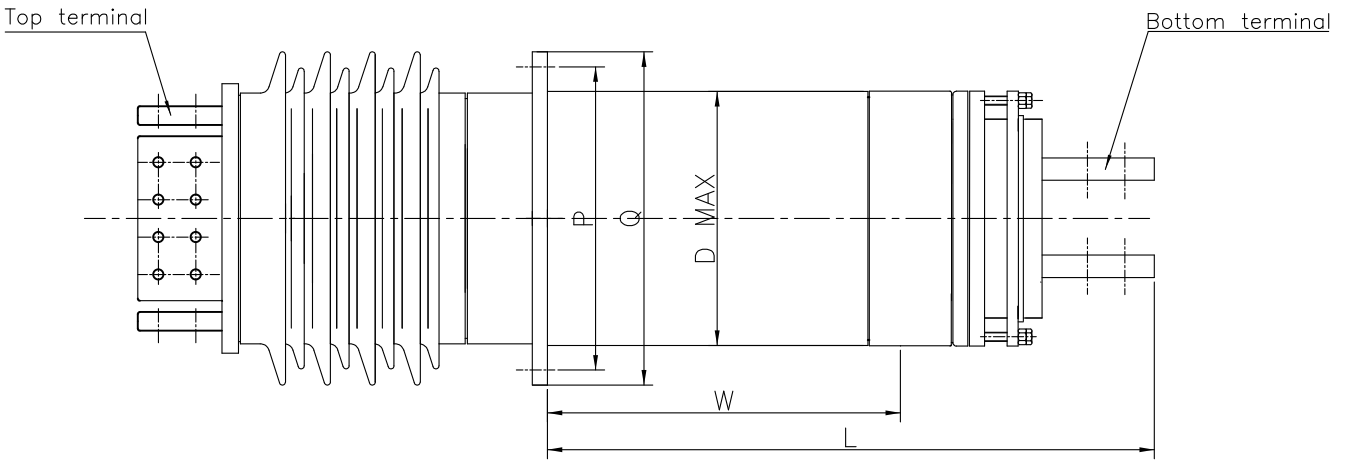


Special requirements		Style No.	Catalog No.
Standard name		ZDTHPO 200-34.5-20000	HPO034200
High altitude/high pollution area		ZDTHPO 200-34.5-20000 H	HPO034200H
Low temperature	Below -30℃	ZDTHPO 200-34.5-20000 L	HPO034200L
Other special requirements		ZDTHPO 200-34.5-20000 S1..	HPO034200S1....

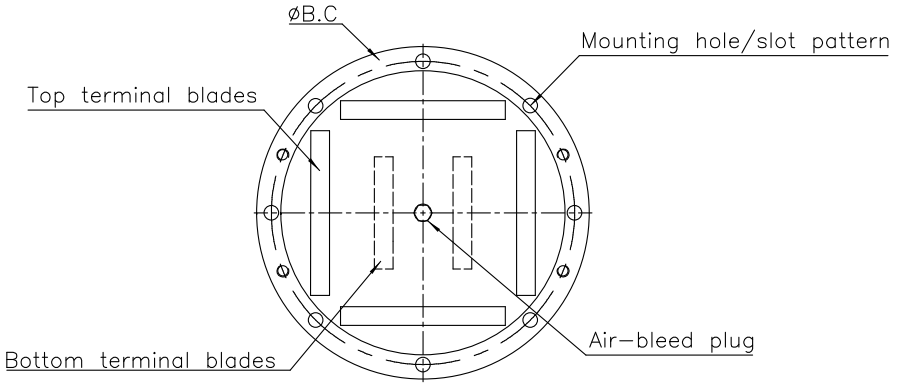
ZDVolt solution

- ZDVolt has sufficient replacement experience, replacing various types of bushings in the industry, not limited to IEEE Std.
- Short delivery time and high compatibility.

ZDTHPO range from 15 to 34.5kV ratings& dimensions

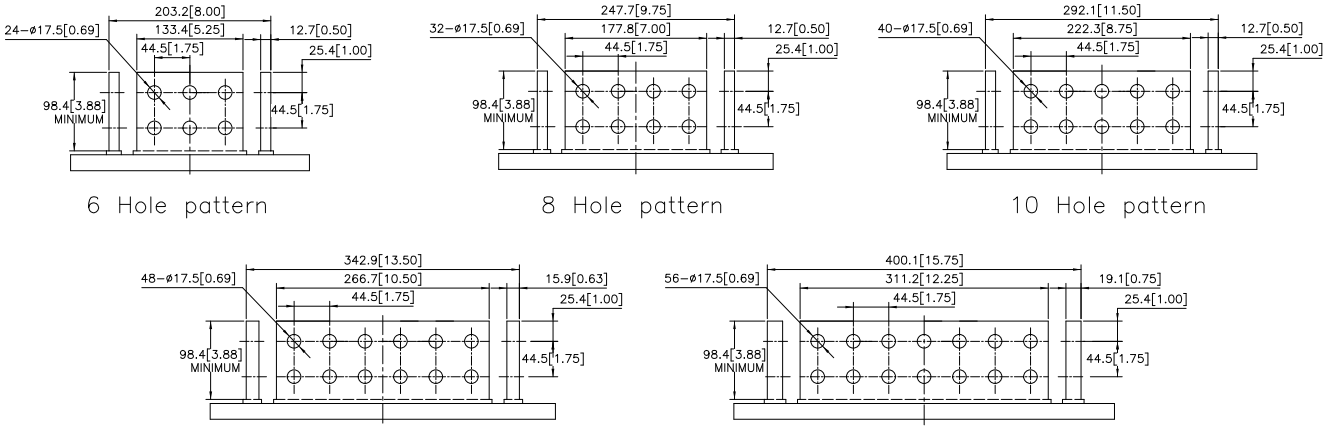


Bushing diagram,side view
(Details of design may differ for each manufacturer)



Bushing diagram,top view showing relative alignment of top and bottom blades and mounting hole pattern

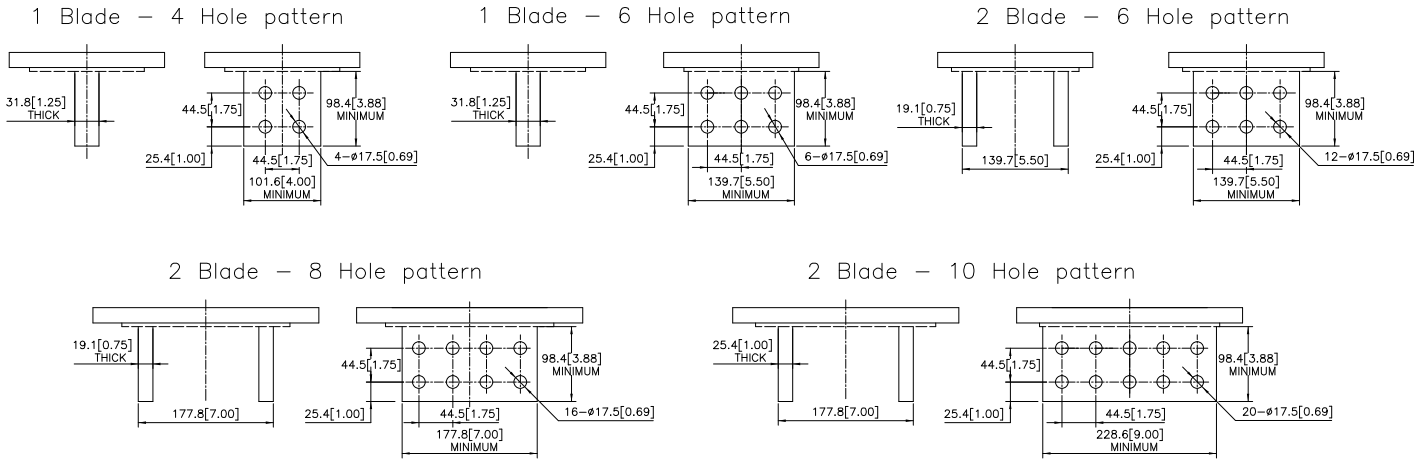
FIGURE 1



Primary units for dimensions are in millimeters followed by inch units in parentheses

Top terminal details

FIGURE 2



Primary units for dimensions are in millimeters followed by inch units in parentheses

Botttom terminal details

FIGURE 3

Table 1 –Electrical Insulation Characteristics for Bushings (Nominal System Voltage 15 kV to 34.5 kV)

BIL (kV)	Nominal voltage (kV)	Rated maximum line to ground voltage (kV)	Creepage distance (mm)		Withstand tests				
					60Hz		Lightning impulse		
			mm	in	1min AC (Dry,kV)	10s AC (Wet,kV)	Full wave BIL(kV)	Chopped vave BIL(kV)	SIL (kV)
110	15	10	468	18	50	45	110	126	92
150	25	16	780	30	60	50	150	175	125
200	34.5	22	1080	41	80	75	200	230	166

Table 2-Dimensions of bushings(nominal system voltage 15KV)

Style No.	Catalog No.	Rating			Bottom End			Terminal details			Flange gasket space		Flange(Figure 1)		
		Um (kV)	BIL (kV)	Ir (A)	Length below flange(L)	CT length(W)	Oil end diameter Max(D)	Length above flange Maximum	Top terminal (Figure2)	Bottom terminal (Figure 3)	Inside diameter Maximum(P)	Outside diameter Maximum(Q)	Holes N0.	Hole size	B.C.
ZDTHPO 110-15-6000	HPO015060	15	110	6000	800 (31.50)	533 (21.00)	248 (9.75)	660 (26.00)	4/6	1/4	251 (9.88)	302 (11.88)	6	22 (0.88)	337 (13.25)
ZDTHPO 110-15-7500	HPO015075	15	110	7500	800 (31.50)	533 (21.00)	248 (9.75)	660 (26.00)	4/6	1/6	251 (9.88)	302 (11.88)	6	22 (0.88)	337 (13.25)
ZDTHPO 110-15-10000	HPO015100	15	110	10000	800 (31.50)	533 (21.00)	300 (11.81)	660 (26.00)	4/8	2/6	315 (12.38)	372 (14.63)	8	22 (0.88)	400 (15.75)
ZDTHPO 110-15-12000	HPO015120	15	110	12000	800 (31.50)	533 (21.00)	360 (14.17)	660 (26.00)	4/10	2/6	372 (14.63)	438 (17.25)	12	22 (0.88)	470 (18.5)
ZDTHPO 110-15-14000	HPO015140	15	110	14000	800 (31.50)	533 (21.00)	360 (14.17)	660 (26.00)	4/10	2/6	372 (14.63)	438 (17.25)	12	22 (0.88)	470 (18.5)
ZDTHPO 110-15-16000	HPO015160	15	110	16000	800 (31.50)	533 (21.00)	400 (15.75)	660 (26.00)	4/12	2/8	406 (16.00)	495 (19.5)	12	22 (0.88)	533 (21.00)
ZDTHPO 110-15-18000	HPO015180	15	110	18000	800 (31.50)	533 (21.00)	400 (15.75)	660 (26.00)	4/12	2/8	406 (16.00)	495 (19.5)	12	22 (0.88)	533 (21.00)
ZDTHPO 110-15-20000	HPO015200	15	110	20000	800 (31.50)	533 (21.00)	400 (15.75)	660 (26.00)	4/14	2/10	406 (16.00)	495 (19.5)	12	22 (0.88)	533 (21.00)

Appendix： IEC 60137 Standard bushings

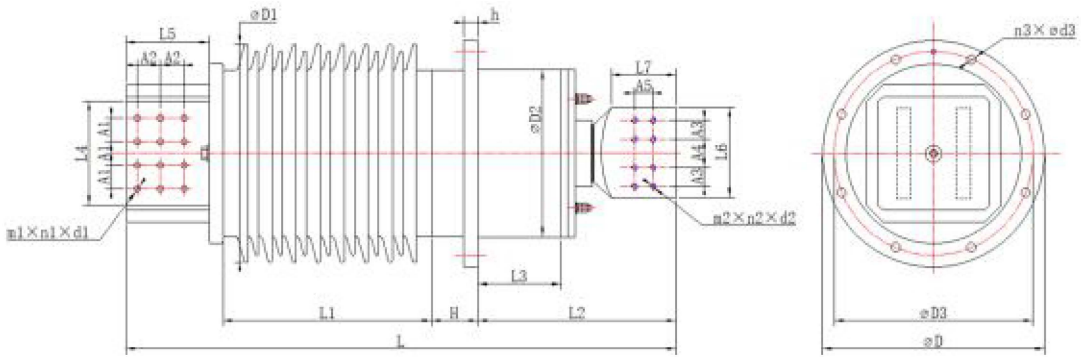
Bushing type specification

B F W-Um /Ir-4

- Pollution level:4 represents the SCD 31mm/kV, equal to USCD "E" level 53.7mm/kV
- Rated current
- The maximum voltage of the bushing
- Anti-pollution type
- Flange type bushing
- Transformer bushing

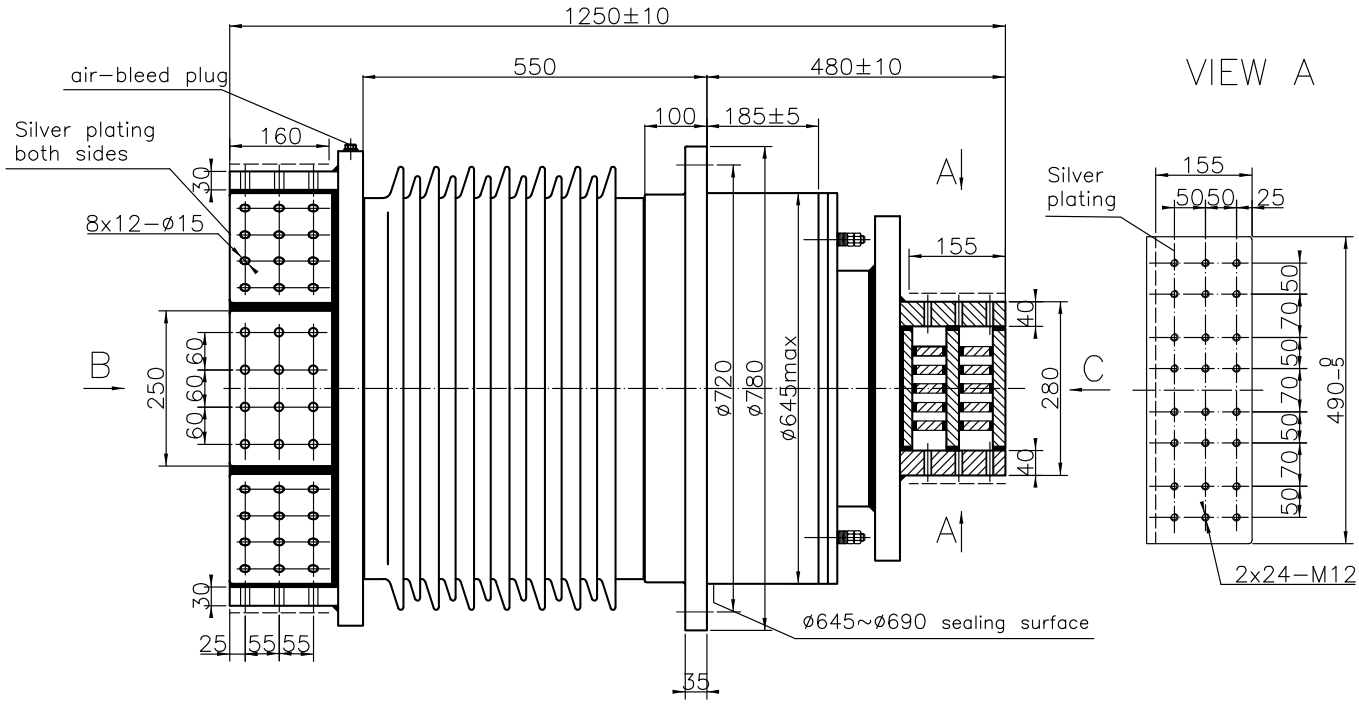
Electric performance

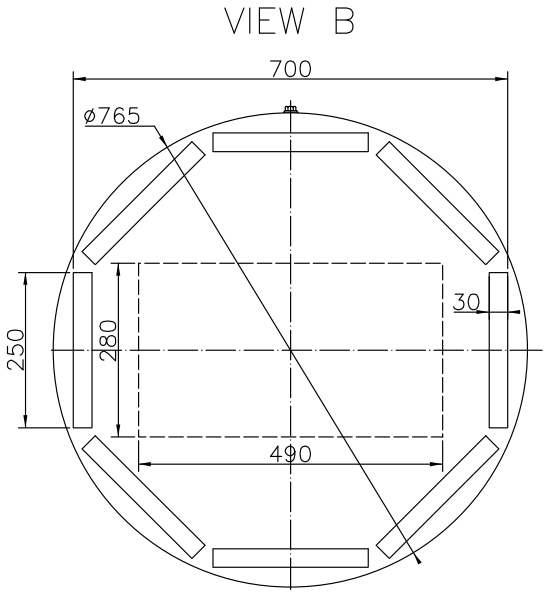
No.	Um	BIL (kV)	AC (dry, kV)	AC (wet, kV)	Partial discharge at Um
1	24	125	55	50	< 10pC
2	36(40.5)	170(200)	77(95)	70(80)	< 10pC

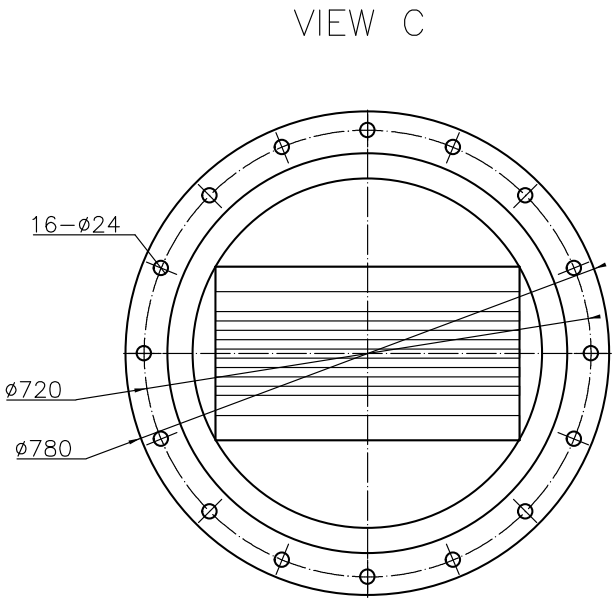


CODE	TYPE	Um	Ir	L	L1	D1	Flange						Oil end dimension			Outer terminal							Inner terminal							
							D	D3	n3	d3	H	h	L2	L3	D2	L4	L5	A1	A2	m1	n1	d1	L6	L7	A3	A4	A5	m2	n2	d2
2051.7	BFW-24/12000-4	24	12000	835	275	390	415	385	8	14	60	25	345	100	275	200	130	50	40	4	9	M12	150	122	50	50	60	2	6	18
2052.15	BFW-24/16000-4	24	16000	940	300	445	444	405	8	20	110	25	340	110	340	220	165	50	50	4	12	14	150	122	50	50	50	2	6	18
2053.5	BFW-24/20000-4	24	20000	995	300	445	444	405	8	20	110	25	380	110	340	220	180	40	40	4	12	14	170	150	55	55	50	2	6	18
4051.3	BFW-40.5/12000-4	40.5	12000	1120	450	460	480	430	8	20	100	25	415	185	355	200	130	50	40	4	9	14	150	122	50	50	50	2	6	18
4052.5	BFW-40.5/16000-4	40.5	16000	1180	450	460	480	430	8	20	100	25	420	185	355	220	180	50	50	4	12	14	150	122	50	50	50	2	6	18
4053.1	BFW-40.5/20000-4	40.5	20000	1190	450	460	480	430	8	20	100	25	430	185	355	220	180	50	50	4	12	14	190	140	40	60	40	2	8	M12

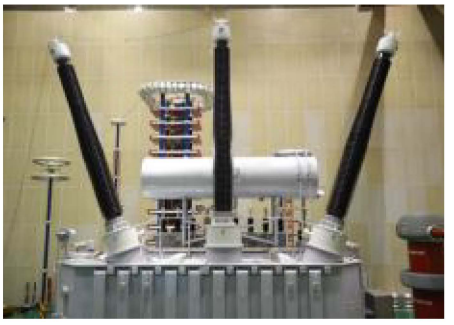
TYPE: BFW-40.5/31500-4
CODE: 4055.2
(Aluminum conductor)







72.5-252kV OIP Bushings

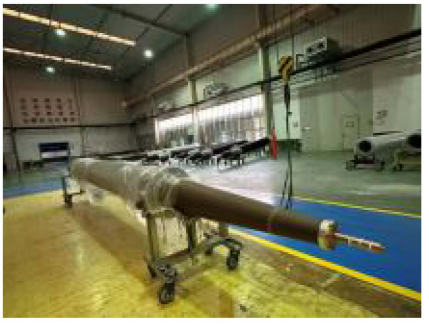


550kV OIP Bushings

145kV RIP Bushings

550kV RIP Bushings

±800kV SF_6 HVDC Bushing



±400kV RIP DC Bushing

Type P&O I

Type P&O II

SEC bushings

Oil-Oil/Gas RIP bushings

GIS/GCB SF_6 Outlet Bushings

Turret with BCTs

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L13282)

Jiangsu Zhida High Voltage Electric Co., Ltd. Test Center

(Legal Entity: Jiangsu Zhida High Voltage Electric Co., Ltd.)

Ultra-High Voltage Building and 2/F., Transformer Building, No.285, Longchang Road, Economic Development Zone, Jurong, Zhenjiang, Jiangsu, China

is accredited in accordance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule forms an integral part of this certificate.

Effective Date: 2025-01-24

Expiry Date: 2026-04-09

Signed on behalf of China National Accreditation Service for Conformity Assessment:

CNAS Accreditation

±2400kV DC system

1650kV Power frequency system

4000kV Lightning impulse system

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