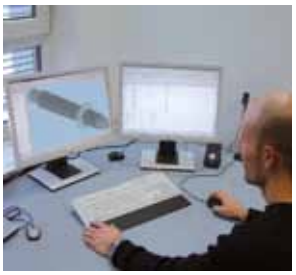
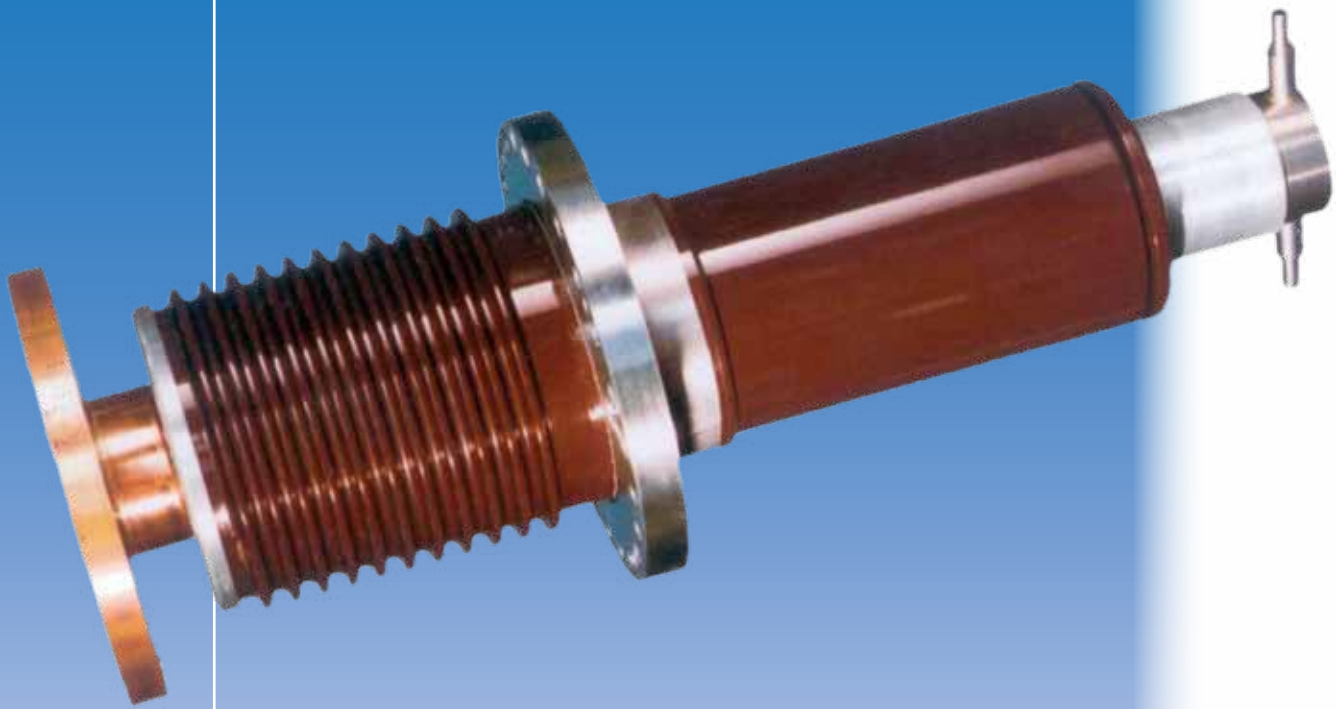
Generator High Voltage Bushings
up to 36 kV
up to 50kA
according to all standards
or customer specification

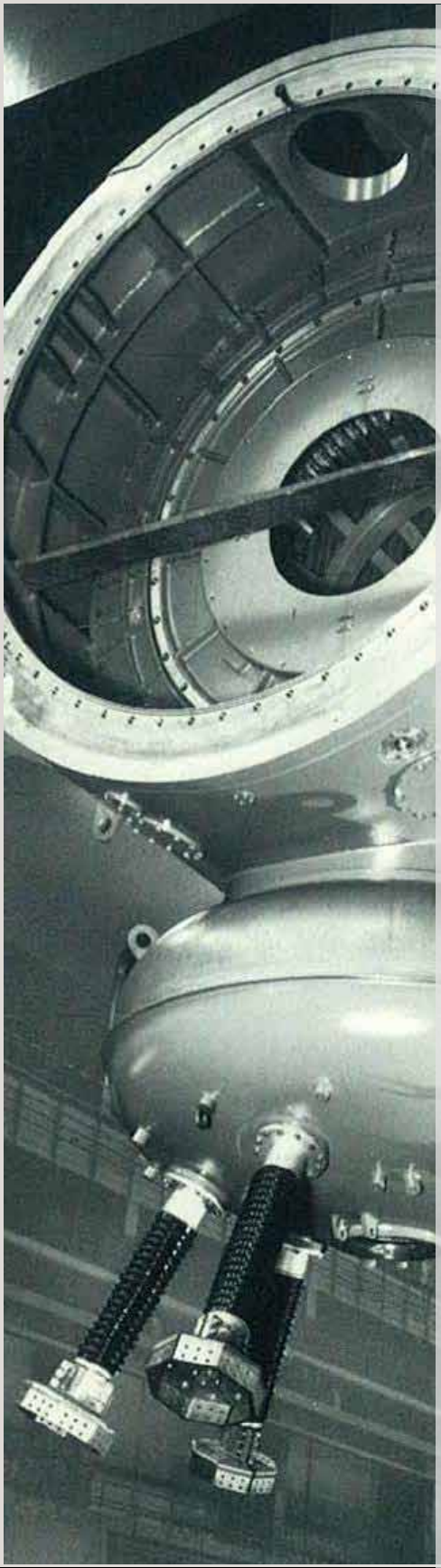


TRENCH



High voltage bushings for Generator



Application:

Generator bushings are used for leading the current induced in the stator-windings through the pressurized, hydrogen-gas tight, earthed generator housing.

➢ **Trench RIG technology**
(Resin Impregnated FiberGlass)

The active part consists of a solid core, made of fiberglass reinforced epoxy resin, impregnated under vacuum.

- Low partial discharge and power loss factor
- Excellent behavior in temperature
- High resistance to mechanical stress

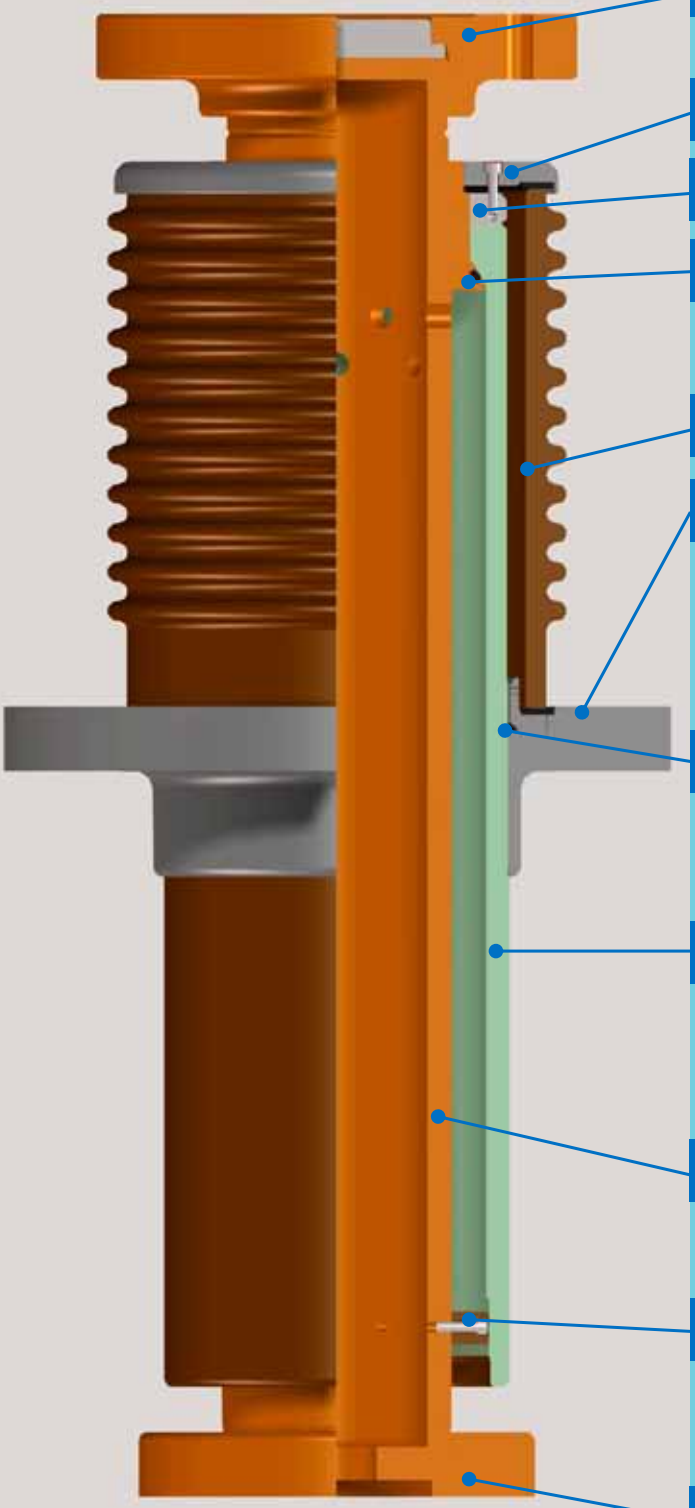
Features:

- ✓ **Experience in bushing manufacture for more than 40 years.**
- ✓ **More than 10.000 Generator bushings in service.**
- ✓ **Easy interchangeability with old bushing existing designs, dimensions may be chosen in order to secure direct interfacing with all generator designs.**
- ✓ **Excellent long term stability due to extremely low partial discharge and power loss factor (PD ≤ 10 pC at 1.05 Ur / √3 ; Tanδ ≤ 0.060 at 1.05 Ur / √3)**
- ✓ **Epoxy resin tube providing high impact resistance and excellent behavior in temperature (Class F = 155°C)**
- ✓ **Paint cover on the active part : no real utility of porcelain mounting (porcelain on request)**
- ✓ **Flange made of aluminum (non magnetic steel on request)**
- ✓ **Very good mechanical static and vibrations withstand.**
- ✓ **Proven high electrical withstand against impulse test.**
- ✓ **Tightness is guaranteed by O-rings : no leakage due to pressure in the bushing.**
- ✓ **Fast and easy maintenance of our bushings during refurbishment of the generator, also after 20 years of service.**

Certified ISO 9001

Certified ISO 14001

High voltage bushings for Generator



Design

1 **Air side connection**

Copper with silver plated connecting area

2 **Cover (when porcelain)**

3 **Tightening nut**

4 **O-ring**

Ensure the tightness between in- and out-side of the bushing.

5 **Porcelain insulator (on request)**

6 **Flange**

Mounting flange made of corrosion-free aluminum alloy (or non-magnetic stainless steel on request). Glued-shrunk on the insulation tube and machined to ensure an excellent seal between the bushing and the generator housing.

7 **O-ring**

Redundant O-ring to ensure tighness between flange and tube i.e. gas side and air side of the bushing

8 **Active part / Insulation tube**

Active part made out of fiberglass reinforced epoxy resin with one earthed layer foil to control the electrical field radially and axially.
Temperature class F (155°C)

9 **Copper conductor**

Copper conductor made out of oxygen free copper (acc. to EN 13600/13601)

10 **Guiding/Centering ring**

The centering ring maintains the insulation tube centered with the copper conductor and allows coaxial thermal expansion without stress.

11 **Gas side connection**

Copper with silver plated connecting area

High voltage bushings for Generator

Design

The main conductor (9) is made out of oxygen free copper (acc. to EN 1600/13601) with silver plated connecting areas. The supporting insulation tube (8) is a vacuum impregnated, glassfiber reinforced epoxy resin (temperature class F : 155°C). Both parts are assembled at the air side through a tightening cone including an O-ring gasket (4). A tightening nut (3) ensures a gastight immobilization of the whole assembly.

The space between the conductor and the insulating tube is filled with the hydrogen gas of the generator. The gas pressure in the bushing increases the pressure on the tightness gasket (4). The insulation tube is supported at the gas-end by a guiding disc (10) which allows the current lead to expand in both directions without stressing the gasketing area (4). The active part is not in contact with the conductor and will age very slowly.

The fixing flange (6) is made out of antimagnetic metal. It is glued-shrunk onto the insulation tube. An O-ring (7) ensures the tightness between both parts. Depending on the voltage, the insulating tube is electrically graded in order to grant a homogeneous field distribution.

The material is, up to a large extend, impervious to humidity and needs no additional protection while used in dry or moderately humid places. For unfavorable climatic conditions or heavily polluted environment, the insulation tube may be protected by a glazed and grooved porcelain (5) at the air side. This porcelain is not pressure-stressed by the hydrogen gas, and in case of breaking, it can be interchanged without removing the bushing from the generator.

Standards

TRENCH Generator Bushings are specified and tested according to latest IEC 60137, DIN 48124, ANSI/IEEE or customer specification.

The dimensions depend on the specified rated and test values. The dimensions may be chosen in order to secure direct interfacing with all generator designs.

The current load is depending on cooling medium temperature, pressure and flow, as well as on connection design, to be defined between the buyer and the manufacturer.

Designation

Example :

V R P H 25 / 60 - 12.6

V Insulator body of glassfiber

R with tubular conductor

S with profile conductor

F Liquid cooled

P if with Porcelain

H Gastight (H2, etc)

Ur (kV) Nominal voltage

Up (kV) Test voltage 50/60Hz, 1min

I (kA) Rated current

Natural cooled – up to 19 kA

Service and cooling conditions as per DIN 48124, part.1 in vertical to horizontal service position.
Connecting areas silver plated ≥5µm ; Rated voltage up to 36 kV.

Standard	Nominal Voltage (kV)	Phase to earth Voltage (kV)	Test Voltage (kV) 50/60 Hz, 1 min	Impulse Voltage (kV) 1.2/50µs
IEC 60137	12	7	28	75
	17.5	11	38	95
	24	14	50	15
	36	21	70	170
DIN 48124	14.5	9.2	45	95
	19.1	12.1	59	120

Examples :

Designation	Rated Voltage kV	Test voltage 50/60 Hz, 1min. kV	Impulse voltage 1,2/50 µs kV	Rated Current kA	Standard
VSH 17.5/45 N100x185	17,5	45	95	--	DIN 48124-1
VSH 17.5/45 N120x185	17,5	45	95	--	DIN 48124-1
VSH 17.5/45-7000	17,5	45	95	7	IEC 60137
VSPH 24/50-5000	24	50	125	5	IEC 60137
VRH 19/59 N140x550	19	59	120	--	IEC 60137
VRH 20/61.5-12.5	20	61.5	125	12.5	IEC 60137
VRH 21.5/57 N100x85	21.5	57	120	5.5	IEC 60137 / DIN 48124-1
VRPH 25/60-6.6	25	60	150	6.6	IEC 60137

VSH 17.5/45 N100x185

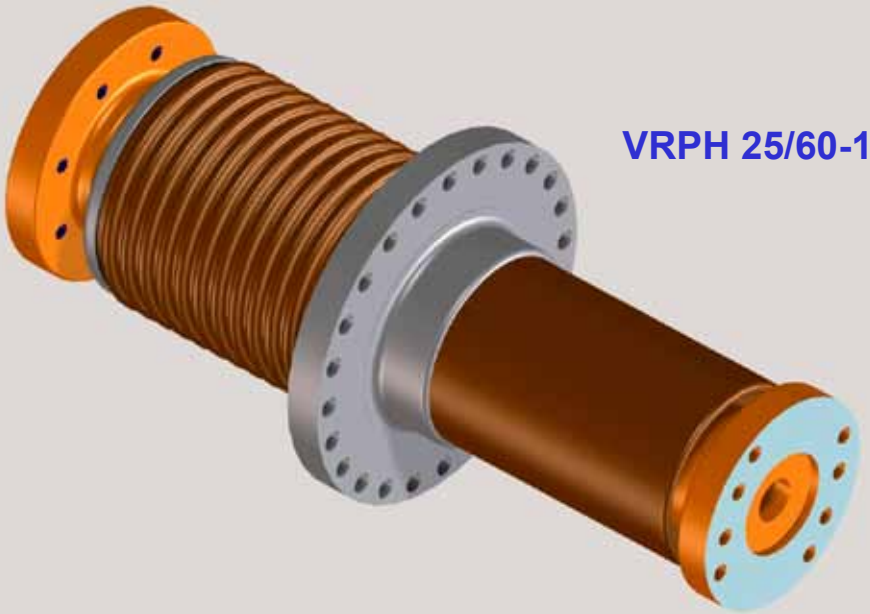
Gas cooled – up to 35 kA

Current load depending on the coolant gas temperature and speed, as well as on the connection design, to be defined between the buyer and the manufacturer
Connecting areas silver plated ≥5µm ; Rated voltage up to 36 kV.

Standard	Nominal Voltage (kV)	Phase to earth Voltage (kV)	Test Voltage (kV) 50/60 Hz, 1 min	Impulse Voltage (kV) 1.2/50µs
IEC 60137	17.5	11	38	95
	24	14	50	15
	36	21	70	170
DIN 48124	19.1	12.1	59	120
	24.5	15.6	75	150
IEEE	34.5	22	80	200

Examples :

Designation	Rated Voltage kV	Test voltage 50/60 Hz, 1min. kV	Impulse voltage 1,2/50 µs kV	Rated Current kA	Standard
VRH 16/38-10	16	38	95	10	IEC 60137
VRH 17.5/45 N120x430	17.5	45	95	7	IEC 60137
VRH 18.8/54-15	18,8	54	95	15	DIN 48124-3
VRH 19.1 G -110x185	19,1	59	120	--	DIN 48124-3
VRH 19.1/54-15	19,1	54	95	15	IEC 60137
VRPH 21/65-16	21	65	125	16	IEC 60137
VRH 23.3 GC120x570	23.3	72	145	--	IEC 60137 / DIN 48124-3
VRPH 25/60-35	25	60	150	35	IEC 60137
VRH 26/79.5-31	26	79.5	159	31	IEC 60137 / DIN 48124-3
VRPH 27/82.5-25	27	82.5	170	25	IEC 60137



VRPH 25/60-12.6

Liquid cooled - up to 50 kA

Current load depending on the temperature, flow rate and guidance of the coolant, as well as on the connection design, to be defined between the buyer and the manufacturer
Connecting areas silver plated ≥5µm ; Rated voltage up to 36 kV.

Standard	Nominal Voltage (kV)	Phase to earth Voltage (kV)	Test Voltage (kV) 50/60 Hz, 1 min	Impulse Voltage (kV) 1.2/50µs
IEC 60137	24	14	50	15
	36	21	70	170
DIN 48124	24.5	15.6	75	150
	27.8	17.7	85	170
IEEE	34.5	22	80	200

Examples :

Designation	Rated Voltage kV	Test voltage 50/60 Hz, 1min. kV	Impulse voltage 1,2/50 µs kV	Rated Current kA	Standard
VFH 23.1 LC-120Mx600	23.1	71	142	--	IEC 60137
VFH 24/73.5-33	24	73.5	170	33	IEC 60137
VFH 24.5 LC-120Mx650	24.5	75	150	--	IEC 60137 / DIN 48124-2
VFPH 25/60-34	25	60	150	34	IEC60137
VFH 27/82.5 LC-150Mx800	27	82.5	170	36	DIN48124-2
VFH 27.8 LC-120Mx455	27.8	85	170	--	IEC 60137 / DIN 48124-2
VFH 30/75 LC120Mx610	30	75	150	--	IEC 60137 / DIN 48124-2
VFPH 30/80-35	30	80	200	35	IEC 60137
VFH 36/76.5-43	36	76.5	170	43	IEC 60137
VFH 36/82.5-47	36	82.5	170	47	IEC 60137

VFH 36/76.5-43

Product Range

Bushings for

- Power Transformers up to 550 kV, 5000A
- High Current Application up to 52 kV, 40kA
- Transformer to SF6 connection up to 550kV
- Gas-insulated Switchgear (GIS) up to 800 kV, 6000A
- Generators up to 36 kV, 50kA
- Railways
- Buildings , Wall up to 245 kV, 5000A
- Bushings according Standard IEC 60137
- Bushings according to customer's special specification

Quality

At Trench quality is a way of life.
Trench quality assurance complies with the most stringent standards of ISO 9001 and ISO 14001.

Certified by AFAQ since 1994

TRENCH

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