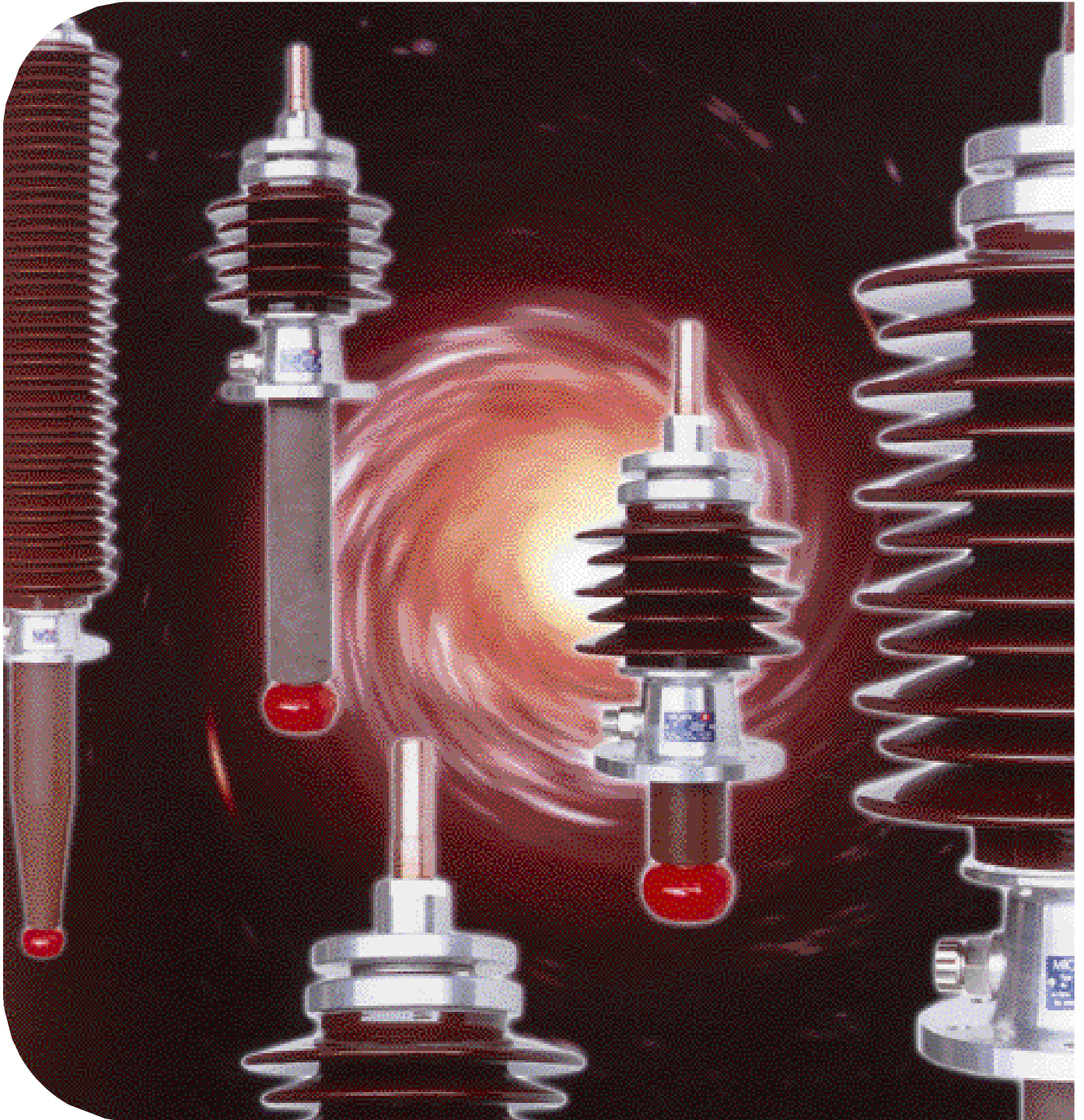


PORIP

Transformer Bushings with Porcelain Insulator

24-170 kV Type RTKF



Bushings

MICAFIL

RIP

For more than 40 years we at Micafil have been successfully developing and implementing under vacuum Resin Impregnated Paper technology for high voltage bushings. We are proud of our leading position in this technology, practice proven, well known and accepted worldwide. The base of more than 50.000 RIP bushings in operation speaks for itself. Here are main advantages of RIP technology:

High technical standard

- low dielectric losses ($\tan \delta < 0,35 \%$)
- partial discharge free up to double service voltage
- excellent mechanical strength
- high thermal strength (class E, 120°C)
- check and maintenance free

Solid body

- dry, oil-free
- fire resistant
- environmental friendly
- pressure-free, explosion resistant
- high earthquake and vandalism withstand
- damaged bushings are highly suitable for emergency service
- any position (vertical to horizontal) during storage, handling and in operation allowed

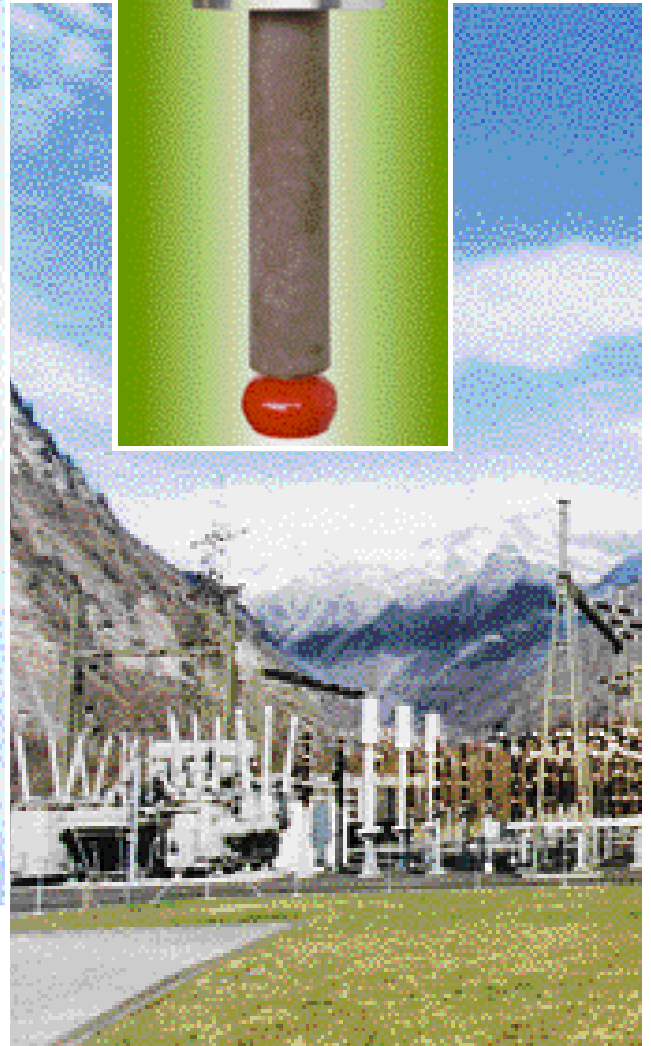


Application

Micafil Resin Impregnated Paper bushings of type PORIP are designed for application on oil filled transformers, covering the nominal voltage range from 24kV to 170kV. They are used to connect transformer winding leads with overhead lines or air-insulated bus ducts. The CT spaces of 0 and 300mm are available as a standard, other lengths on request. The very short bushing's lower part allows space saving transformer design.

Routine testing

Each bushing is routine tested before leaving the factory. The tests, either according to IEC or IEEE Standard, include partial discharge, $\tan \delta$ and capacitance measurement, as well as power frequency voltage withstand test. The test tap is also tested.



Design

RIP – Active Part

The main insulation of the bushing is a dry, solid, Resin Impregnated Paper – RIP insulation, with aluminium foils inserted. In order to optimise the electrical field in axial and radial direction, the size, exact position and number of foils are computer calculated. The paper body is vacuum dried, impregnated with epoxy resin and cured. This process was developed by Micafil 40 years ago and constantly

improved, having today the most advanced process. The result is a high quality insulation system. High mechanical strength, low tan δ and partial discharge free bushings up to double service voltage are only some of the main advantages PORIP bushings have. The RIP body is oil and gas tight.



Flange, Head and Outdoor Insulator

After fixing the aluminium flange onto the body, the porcelain insulator and the aluminium head are assembled. The space between the RIP body and the insulator is filled with the special, compressible dry filler MICAGEL. Such bushing is completely dry, allowing installation in any position, down to horizontal. There is no need for oil level gauge.

Outdoor porcelain insulator has alternating sheds and a specific creepage distance of 31mm/kV. The brown colour is standard.

All bushings have on the flange two M12 holes for handling and/or earthing.

Conductor and Terminals

For current lower than 1000A draw lead application is selected. The copper cable bolt is shown in Fig. 7. The cable bolt is fixed to the bushing's head and can be connected to the transformer leads by brazing or soldering. This bolt acts as the bushing's top terminal, enabling the perfect connection between leads and overhead line. On the top of each cable bolt there is a deaeration screw.

For current higher than 1000A removable copper conductor could be used. This type of bushing is not shown in this brochure, please contact Micafil for more information.

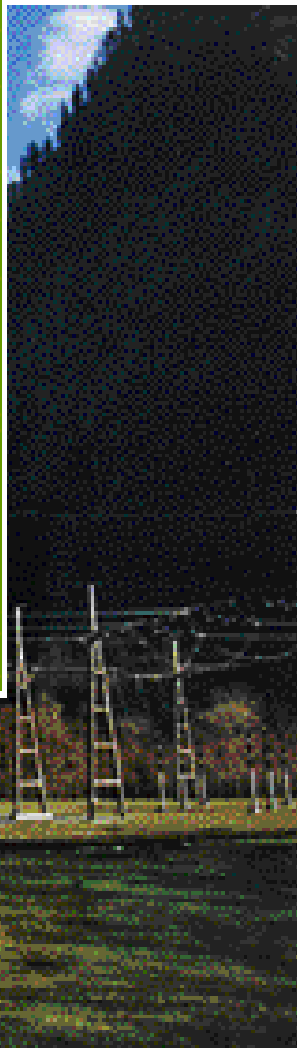
All bushings are equipped with electrical shield on the bottom side. See Fig. 5 and 6. The aluminium shield is epoxy resin insulated.

Accessories

Test Tap

Each bushing is equipped with a standard test tap. The test tap is connected to the outmost aluminium layer and is automatically earthed, Fig. 9. Each test tap is tested with 3kV, 50Hz, for 1 minute.

For a testing purpose the cap must be unscrewed and female-female pin adapter used. Such an adapter is available from Micafil.



Type RTKF	IEC				IEEE / ANSI				Arcing distance	Creepage distance	CT space L6	Weight	Current (A)				Thermal short time current, 2s, I _{th}
	Rated voltage U _r	U _r / √3	Test voltage 1min, U _p	BIL 1.2/50μs	System voltage	U _r / √3	Test voltage 1min, dry/wet U _p	BIL 1.2/50μs					Max. operating current with copper cable area (mm ²)	185	240	300	
RTKF 24-150/1000 T	24	14	50	125	25	16	60/50	150	255	745	0 300	22 25	710 650	850 800	940 860	1040 950	I _{th} (kA) = 0.07 x cable cross section (mm ²)
RTKF 36-200/1000 T	36	21	70	170	34.5	22	80/75	200	345	1120	0 300	24 27	680 630	800 730	900 820	1025 920	
RTKF 52-250/1000 T	52	30	95	250	46	29	105/95	250	450	1615	0 300	26 29	675 615	765 700	850 780	1010 900	
RTKF 72.5-350/1000 T	72.5	42	140	325	69	44	160/140	350	670	2250	0 300	46 49	645 590	735 670	820 750	1000 890	
RTKF 100-450/800 T	100	58	185	450	-	-	-	-	825	3100	0 300	72 75	590 530	675 630	740 675	880 805	
RTKF 123-550/800 T	123	71	230	550	92	73	185/155	450	1050	3815	0 300	85 88	590 530	675 630	740 675	880 805	
RTKF 145-650/800 T	145	84	275	650	138	88	310/275	650	1200	4495	0 300	104 110	540 495	645 590	720 660	860 800	
RTKF 170-750/800 T	170	98	325	750	161	102	365/315	750	1440	5270	0 300	180 195	535 490	630 570	715 655	850 800	

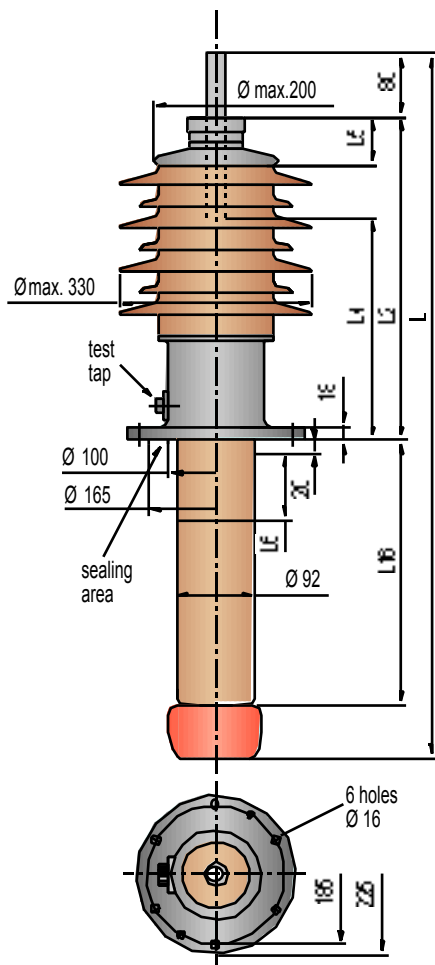


Fig.1

RTKF 24-, 36-, 52-, 72.5-

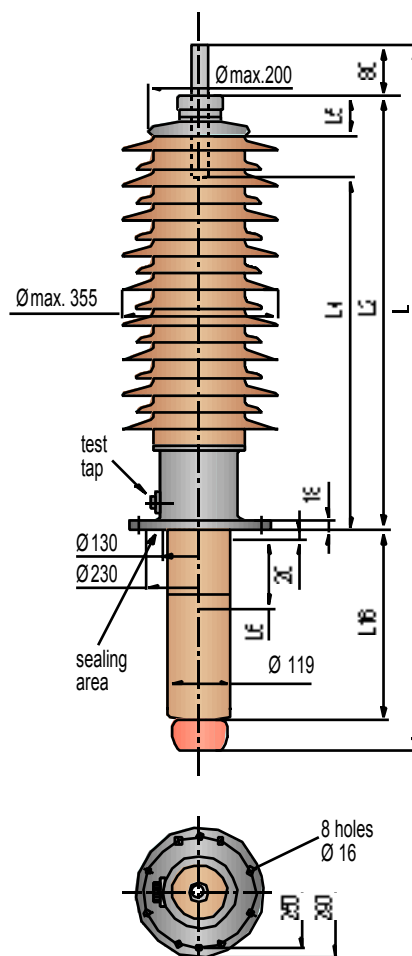


Fig.2

RTKF 100-, 123-

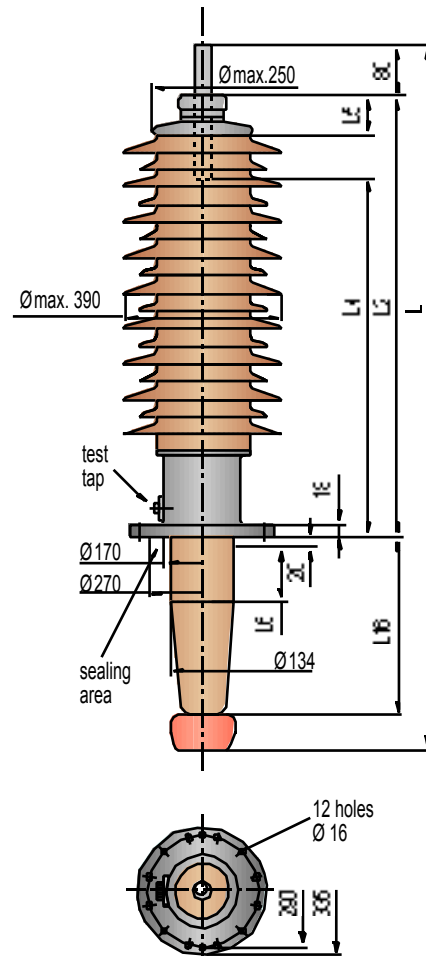


Fig.3

RTKF 145-

Dimensions (mm)								Type RTKF
Fig.	L	L16	L2	L4	L5	L6	L6	Fig.
1	665	120	405	230	95	0		5
1	965	420				300		
1	780	140	500	325	95	0		5
1	1080	440				300		
1	900	140	620	450	95	0		5
1	1200	440				300		
1	1165	175	850	675	100	0		5
1	1465	475				300		
2	1370	230	1000	840	100	0		5
2	1670	530				300		
2	1680	310	1230	1070	105	0		5
2	1980	610				300		
3	1910	360	1380	1220	105	0		6
3	2210	660				300		
4	2215	420	1625	1465	105	0		6
4	2515	720				300		

Technical Data and Dimensions

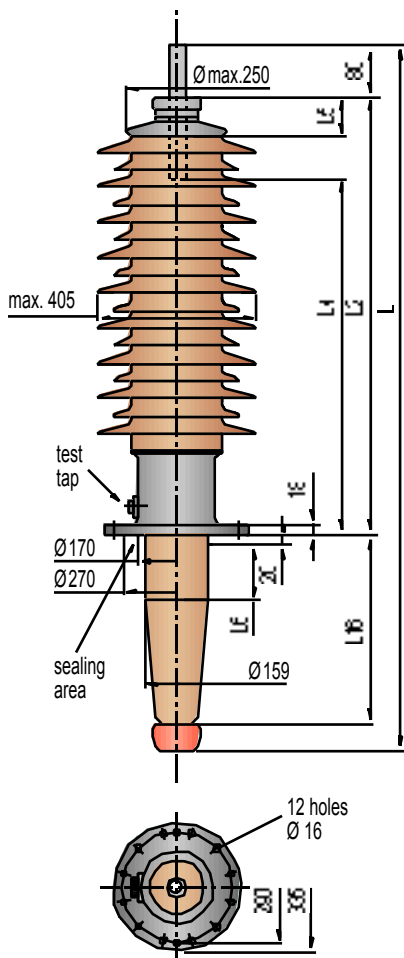


Fig.4
RTKF 170-

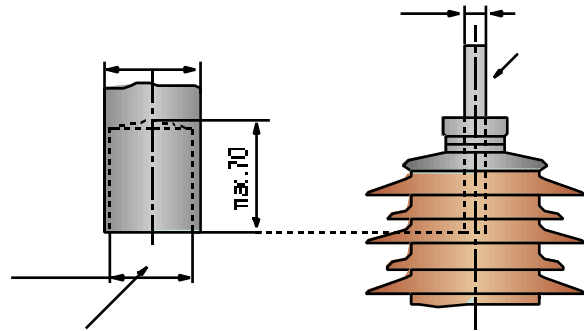


Fig.7
cable bolt

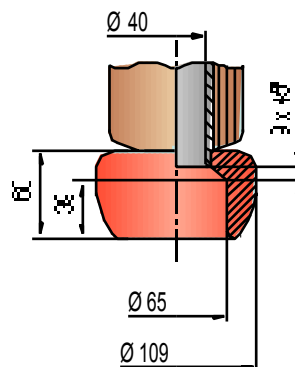


Fig.5
Electrical shield
for 24 - 123kV

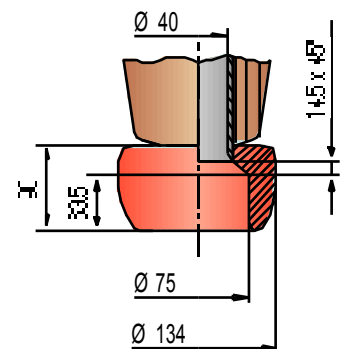
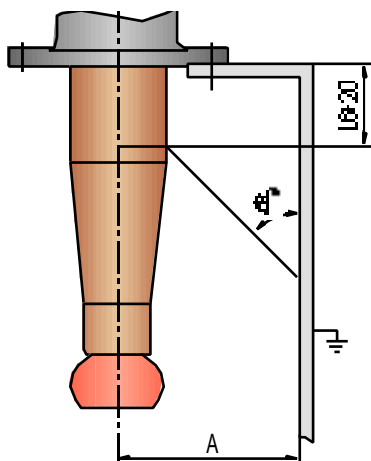


Fig.6
Electrical shield
for 145 and 170kV

Recommendation for Bushings Installation

Distance from bushing's lower part to the earthed parts depends on the shape of surrounding parts, as well as on quality and condition of the transformer oil. The recommended minimum distances (A) to be used under standard conditions are shown in Fig. 8.

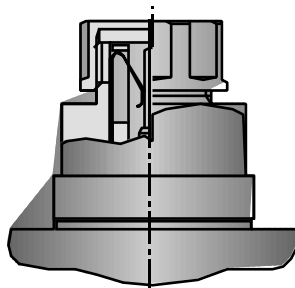
Fig. 8



Checking and Maintenance

One of the main advantages of dry PORIP bushings is that they are fully check/maintenance-free. If there is any problem on the transformer or in the network, the condition of the bushing can be checked by measuring $\tan \delta$ and capacitance of the bushing's active part, using the test tap.

Fig. 9
Test tap



Typ	Up (kV)	A (mm)
RTKF 24-, 36-, 52-	50-105	80
RTKF 72.5-	140	90
	160	100
RTKF 100-	185	115
	230	145
RTKF 123-	275	170
	310	200
RTKF 145-	325	210
	365	230

Our concept - your benefit



Type Designation

The example of nomenclature used to designate our PORIP bushings:

R T K F 123 - 550 / 800 T

Dry filling, MICAGEL

Rated current (A)

Lightning impulse voltage 1,2/50 μ s (kV)

Rated voltage (kV)

R = RIP bushing

T = Transformer application

K = kurz (in German = short lower part)

F = Freiluft (in German = outdoor)

Other Micafil Bushings

Besides the PORIP bushings described here, Micafil manufactures other transformer bushings, a wide range of bushings for SF6 insulated switch-gears, walls, apparatus, as well as fully customer-tailored bushings. Here our scope of supply:

Transformer bushings with nominal voltage up to 550 kV:

- Oil-Air bushings
24 - 550kV up to 5'000A
- Oil-Air high current bushings
17,5 - 52kV up to 40'000A
- Oil - SF6 bushings
52 - 765kV up to 4'000A
- Oil - Oil bushings
24 - 550kV up to 3'150A

We are also specialists for explosion-proof GIS bushings:

- SF6 - Air bushings
52 - 550kV up to 4'000A

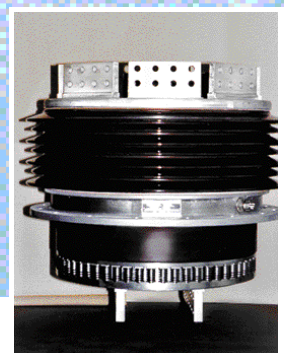
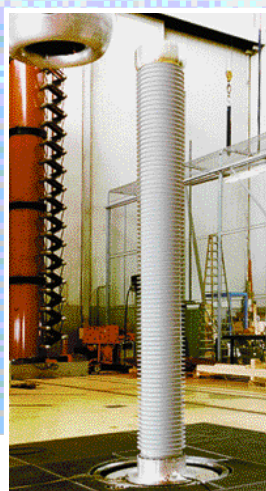
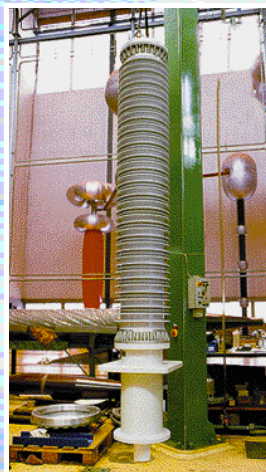
The possibility to install RIP bushings in any position gives them unique advantage as wall bushings:

- 24 - 362kV up to 4'000A

Mechanical strength and oil-free-solution make RIP technology ideal for railway bushings:

- 12 - 52kV up to 2'000A

If you have another wish and you need a **special solution**, come to us - we have the bushing for you.



We have done our best...



**... and we will
do our best.**

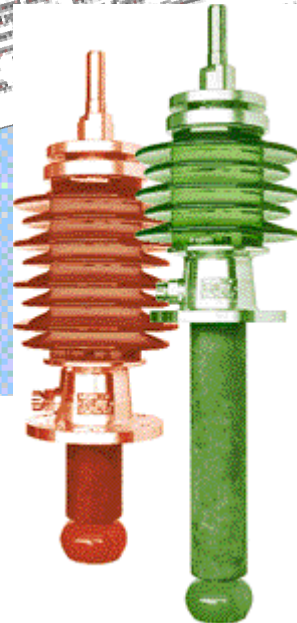
It's your choice.

For more information contact us

MICAFIL

Micafil Ltd.
Badenerstrasse 780
CH – 8048 Zurich
Switzerland
Phone +41.1.435 63 33
Fax +41.1.435 64 44
E-mail info@micafil.ch

or visit our homepage: www.micafil.ch



All information in this document is subject to change without notice and does not represent a commitment on the part of Micafil Ltd.