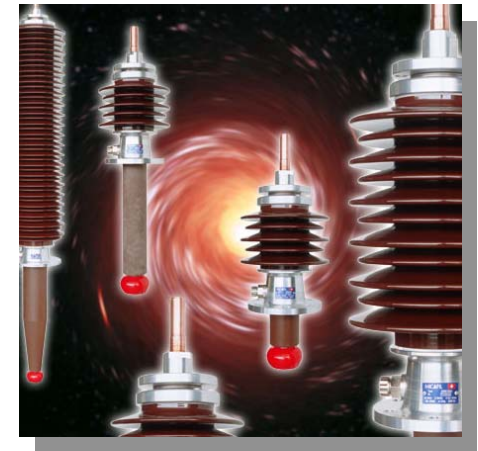
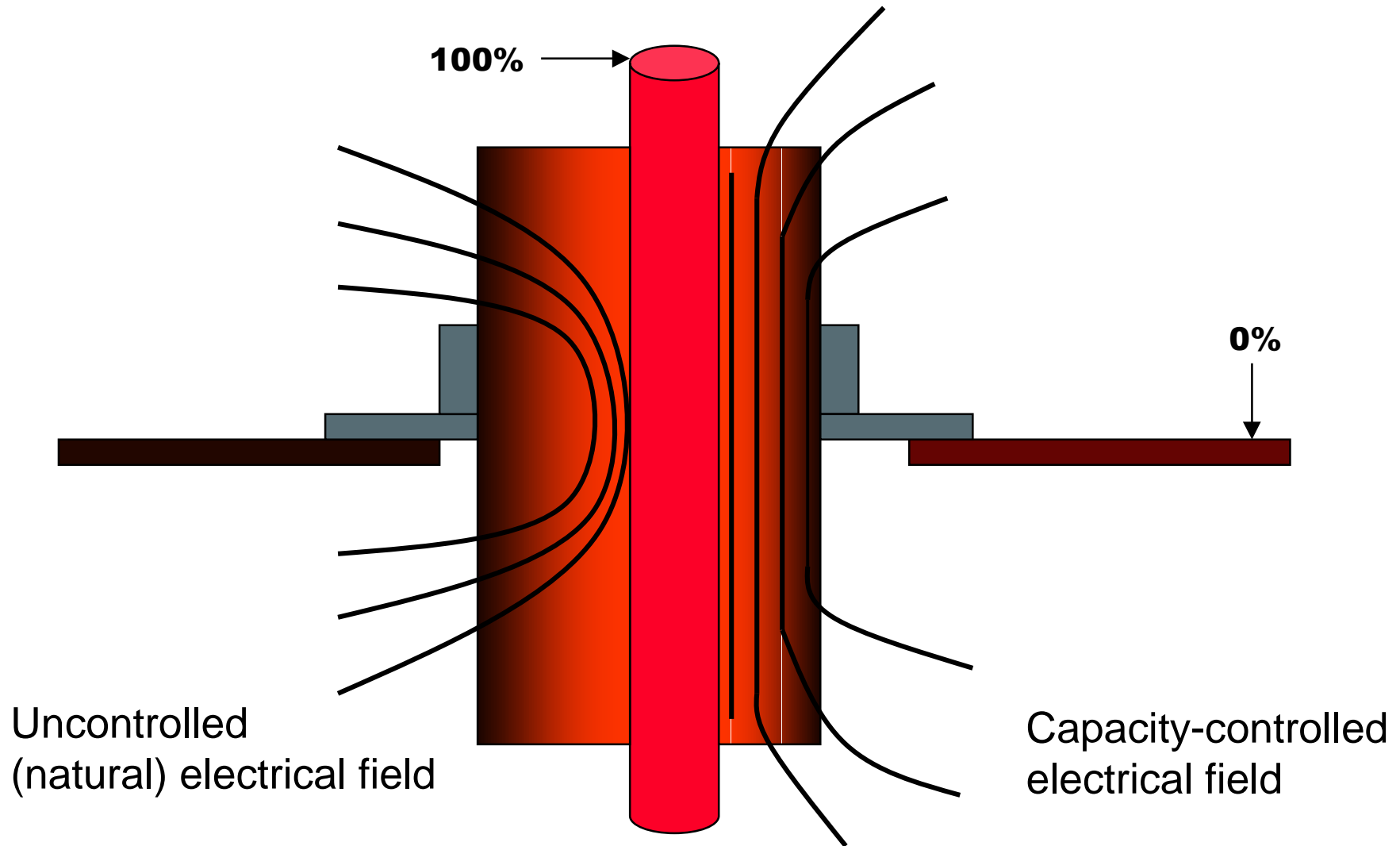


1 RIP Technology



Function of High Voltage Bushing

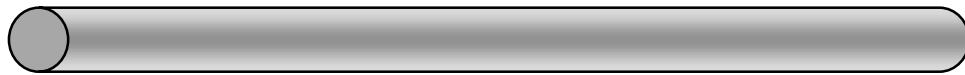


Bushings Main Insulation Systems

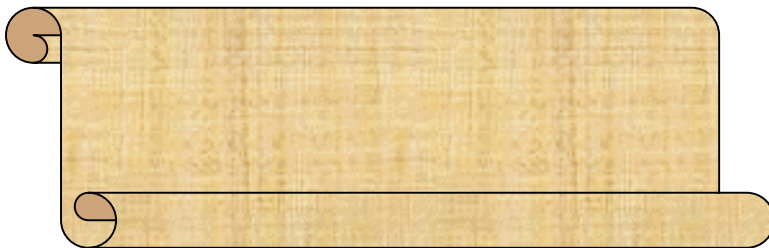
Type	O I P Oil Impregnated Paper	R B P Resin Bonded Paper	R I P Resin Impregnated Paper
Main Insulation	paper, oil impregn.	paper, resin bonded	paper, resin impreg.
Housing cover	yes, on both sides	no	no
Oil-expansion chamber	yes	no	no
Oil-gauge	yes	no	no
Gas-tight	yes	no, only oil-tight	yes
IEC max.			
Tan delta	< 0,007	< 0,015	< 0,007
PD	< 10 pC	< 250 pC	< 10 pC

OIL FILLED BUSHINGS
DRY BUSHINGS

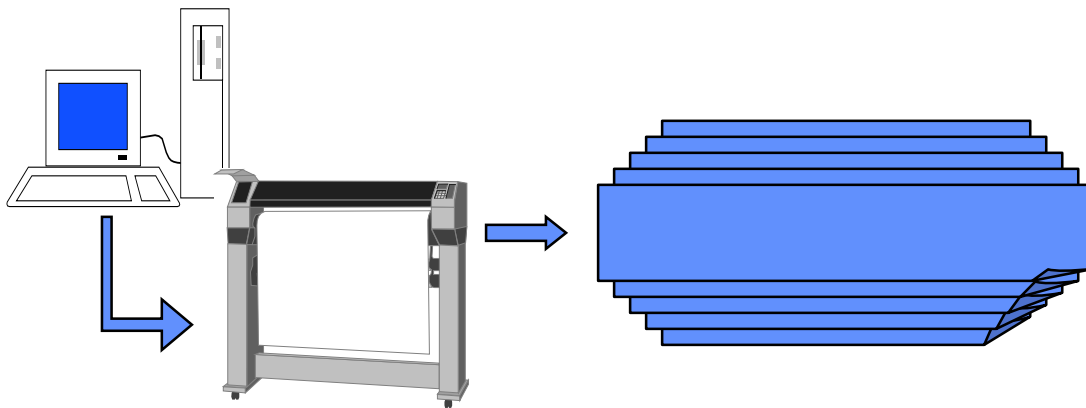
Production of R I P Bushings (1)



Conductor:
- Al, Cu,
- solid, tube



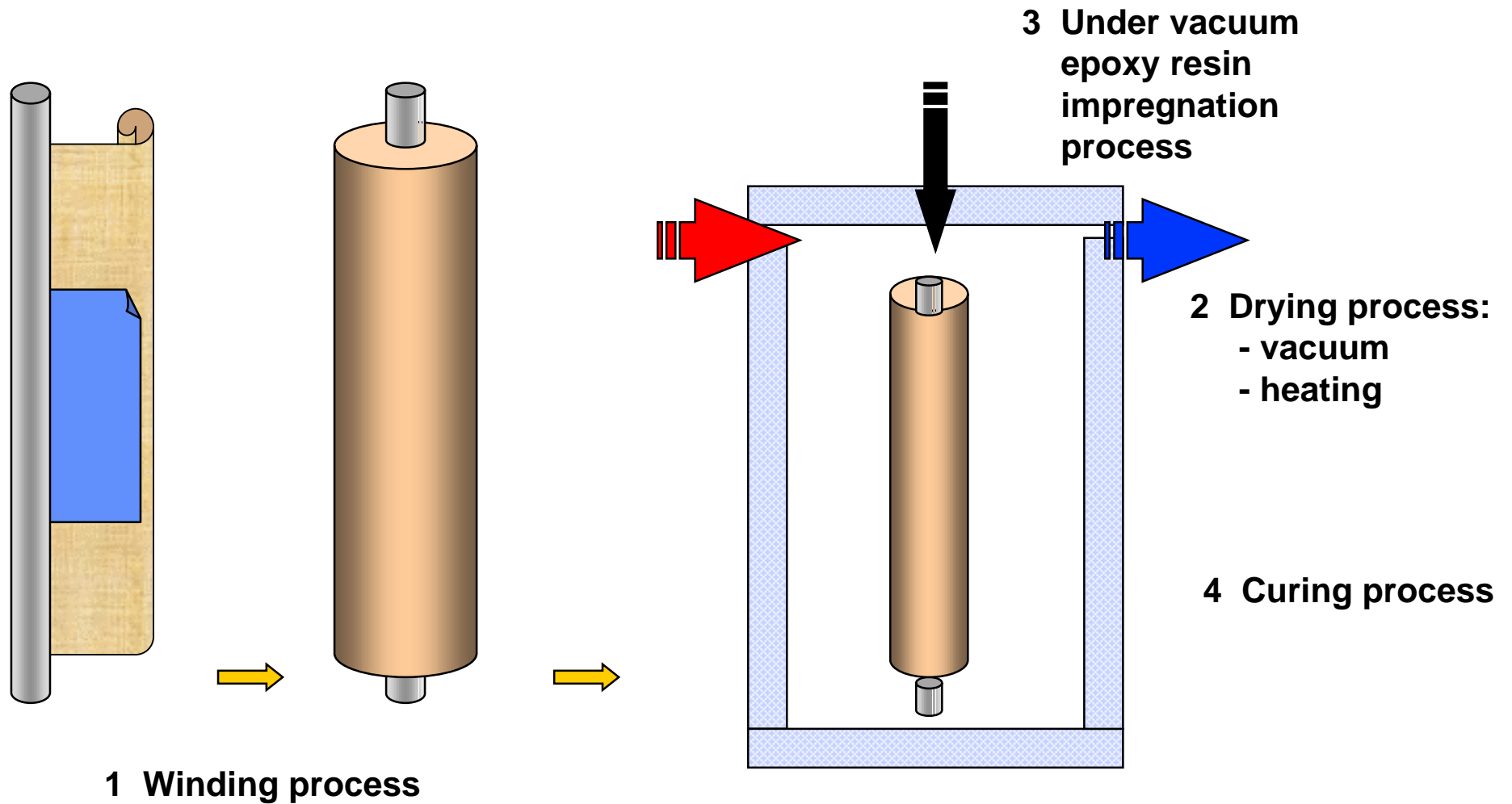
+
**Special
creep paper**



+
**Aluminium
foils**



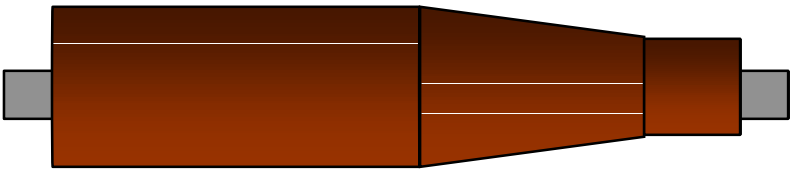
Production of R I P Bushings (2)



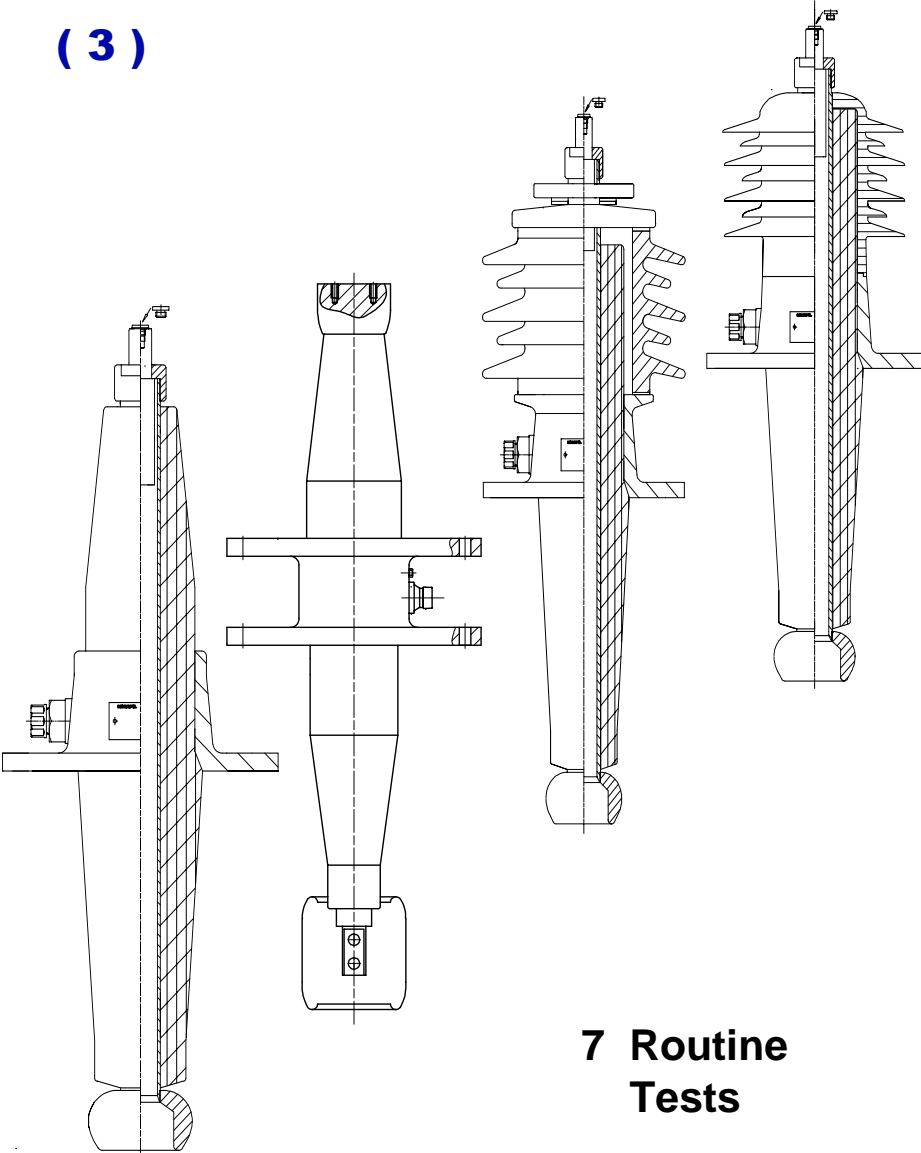
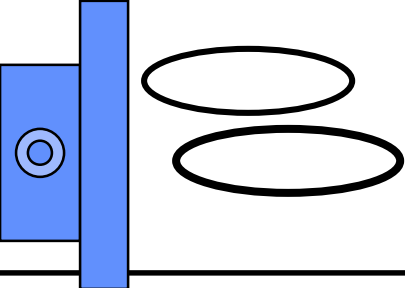
Production of R I P Bushings (3)



5 Machining



6 Assembly

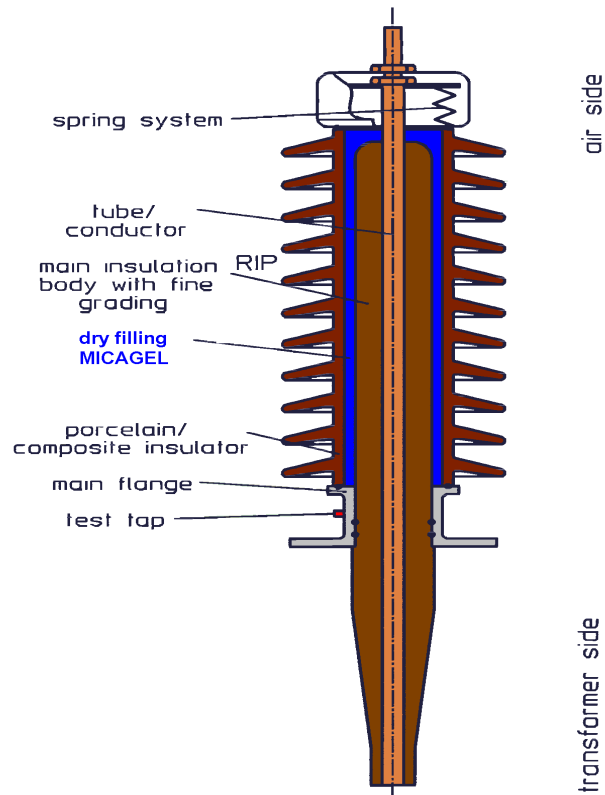


7 Routine Tests

RIP

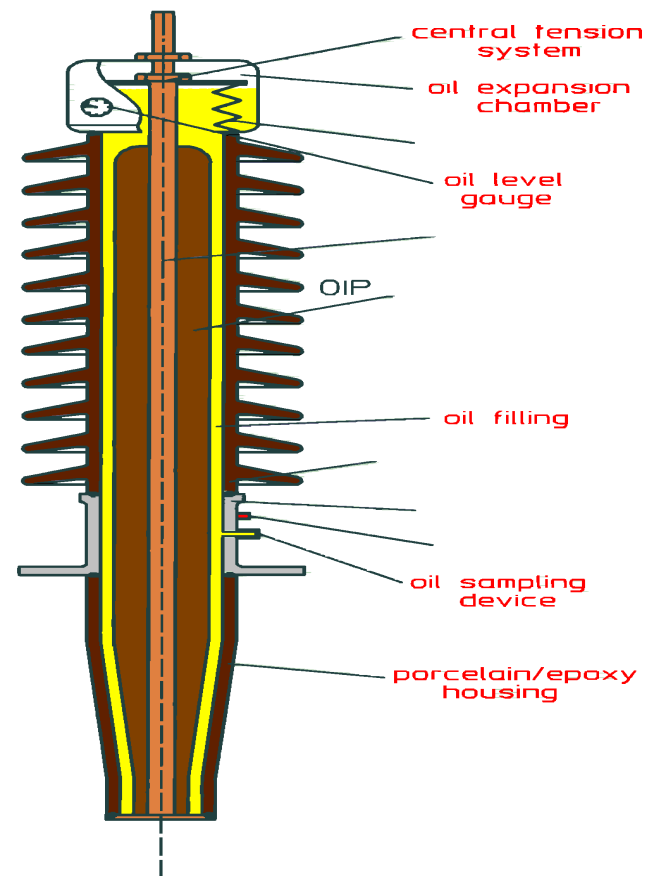
vs.

OIP Technology



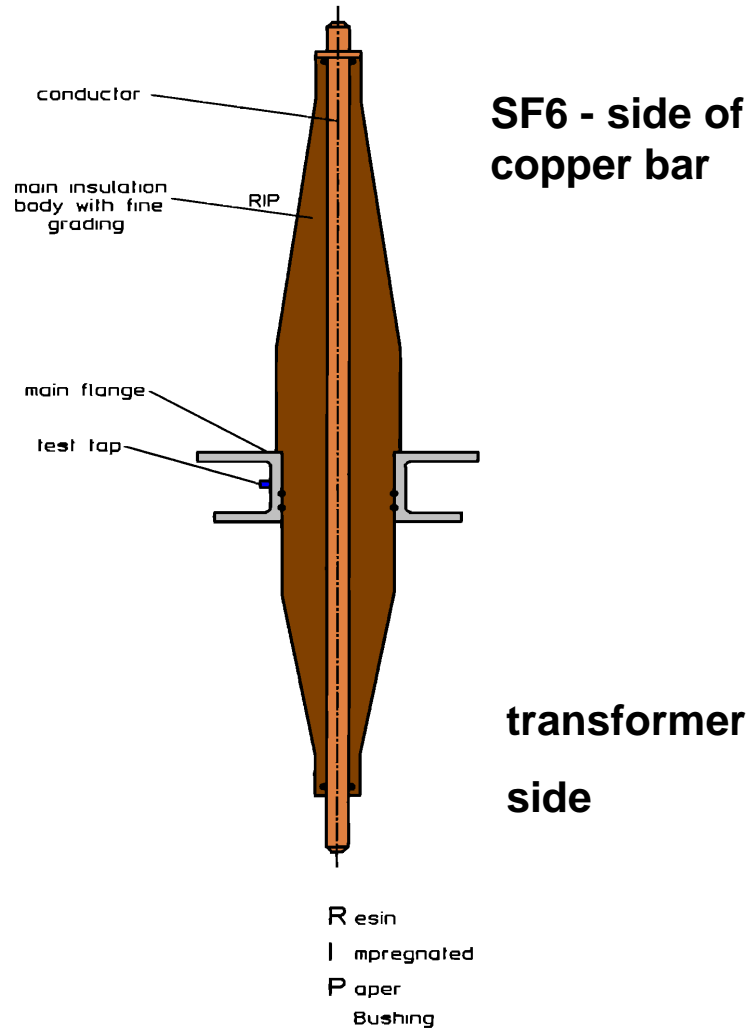
TRANSFORMER BUSHING

R esin
I mpregnated
P aper



O il
I mpregnated
P aper

RIP - Technology is today's state of the art



- ▲ Simple
- ▲ Small
- ▲ Reliable
- ▲ Safe
- ▲ Environmentally friendly

Resin Impregnated Paper - R I P Bushings

Main Advantages (1)



HIGH TECHNICAL STANDARD

- Low dielectric losses ($\text{tg } \delta < 0,35\%$)
- PD free up to double service voltage
- Excellent mechanical strength
- High thermal strength (class E, 120° C)



SUPERB IN DESIGN

- No porcelain shell, except for outdoor use
- Easy adaptable dimensions, customer-tailored bushings

Resin Impregnated Paper - R I P Bushings

Main Advantages (2)



STORAGE, INSTALLATION AND SERVICE: SIMPLE AND RELIABLE

- Each position allowed (vertical to horizontal)
- Dry, oil - free = simple in handling



ENVIRONMENTALLY FRIENDLY

- Pressure - free = explosion proof, fire resistant
- No pollution by outflowing oil

RIP - Technology: summary of main advantages

▲ High technical level

- excellent mechanical strength
- low dielectric losses
- partial discharge free up to the double rated voltage
- high thermal strength (120° C)

▲ Operation safe, service-friendly

- no damage risk on the bottom part
- no explosion risk with influence of the transformer
- gas tight
- heavy inflammable
- high operation safety also by damages of outer insulation
- no porcelain on transformer side

▲ Flexible in Design

- Adaptable on different transformer and plant constructions
- compact & robust
- no porcelain except for outdoor conditions
- silicon sheds possible
- any installation possible (vertical, horizontal)

▲ Environmental friendly

- oil free
- no explosion and fire risk through oil leakage
- no environmental risk through oil leakage
- maintenance friendly
- earthquake proof

R I P - Resin Impregnated Paper technology

vs.

O I P - Oil Impregnated Paper technology

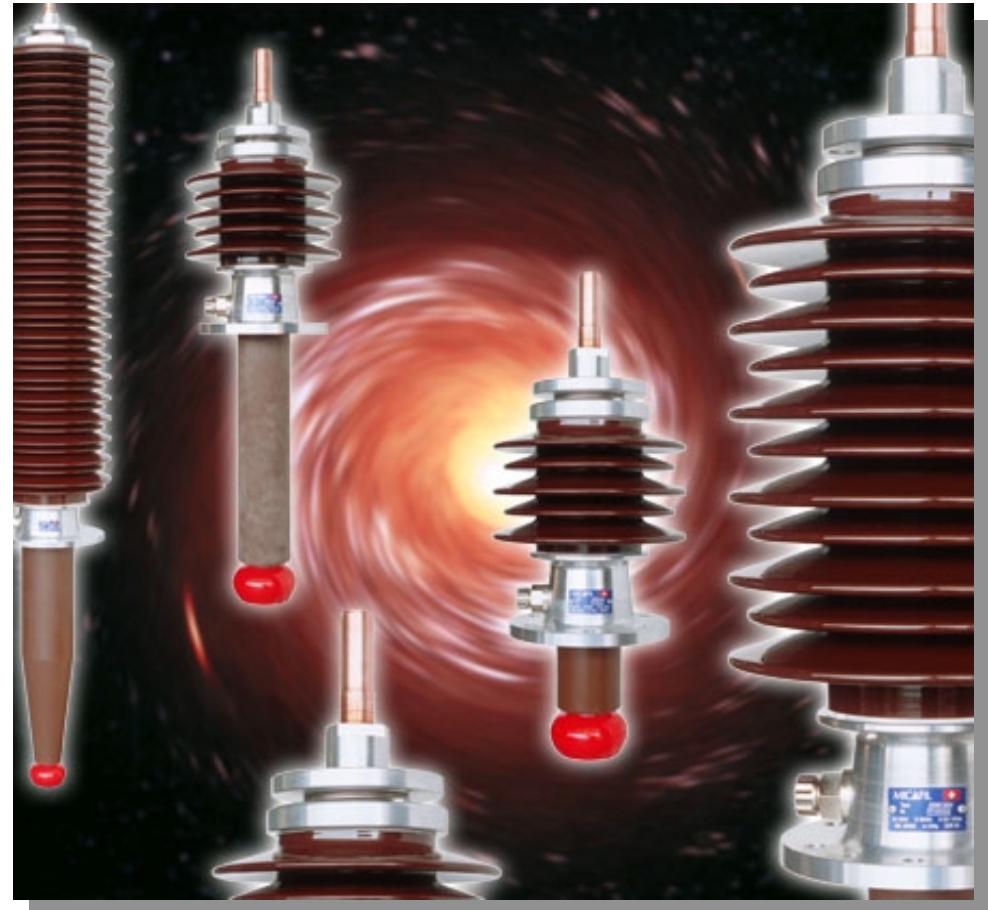
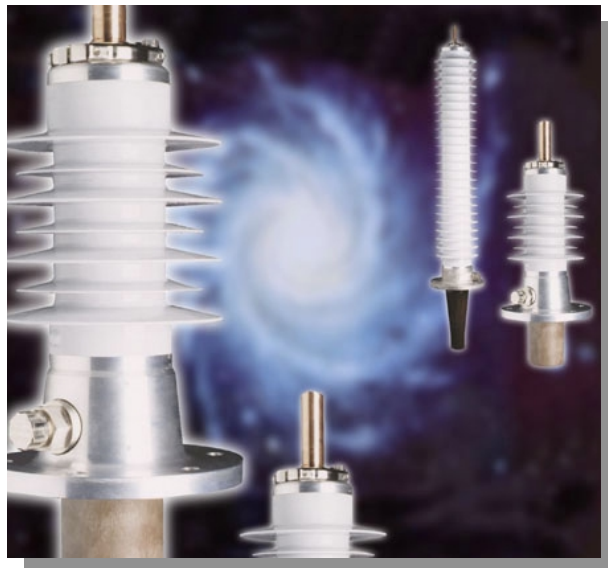
The following table shows comparison between two most common technologies in producing the bushings. The comparison is only qualitative with following notes: „+“ = very good; „o“ = moderate; „-“ = bad

FEATURE	R I P		O I P	
Partial Discharge free	very good	+	good	+
Tan δ	very good	+	very good	+
Porcelain housing	outdoor appl. only	+	always	-
Thermal strength	high, 120° C	+	105° C	o
Mechanical strength of main body	good	+	poor	-
Service position	each position allowed	+	restricted (special design for horiz.)	o
Assembly space in transformer	short	+	lower part with porcelain	o
Waiting time before testing	no waiting time	+	yes, because of oil	o
Transportation, handling, storage	simple, no limits	+	careful, limited position	-
Check points	check-free	+	oil pressure, oil level	-
Safety for staff and equipment	high, no pressure inside	+	moderate, over-pressure	o
Fire resistance	high	+	moderate	o
Environment	friendly, no oil	+	oil leakage possible	-
Emergency service if outdoor porcelain breaks	possible	+	not possible	-
Life time	more than 30 years	+	more than 30 years	+

NEW RIP Transformer Bushings



**GO WITH US AND GET
THE MAYOR ADVANTAGE
AGAINST YOUR
COMPETITION!!**



RIP - Technology for SF₆/Oil - Bushings

In modern metal enclosed switchgear SF₆-gas is used as an extinguishing and insulating medium, ensuring highest security standard for operating staff and residents, especially in most confined and dense populated areas.

As a result, today's space saving design requires excellent mechanical and electrical performance of all components involved.

Micafil's contribution to this world-wide development is its new product range of GARIP bushings. These have been designed for the direct single phase connection between power transformers and gas insulated switchgear (GIS) for rated voltages of 72.5 kV up to 550 kV.

Since more than 40 years Micafil AG produces high voltage bushings made with Vacuum Resin Impregnated Paper Technology (RIP).

We are proud of our leading position in this field, making available to our customers profound expertise in the latest state of the art technology, which is based upon more than 50000 RIP - bushings successful in operation.

The insulation body of the GARIP condenser bushing series consists of a robust and solid core, made of wound crepe paper and inserted aluminium foils for field control, carefully vacuum dried and subsequently impregnated with special epoxy resin.

The basic procedure for this new kind of manufacture was originally developed by Micafil AG in Switzerland already in 1958 and continuously improved in the course of four decades.

Advanced standardisation, highly skilled craftsmanship and computer-aided engineering guarantee today's most reliable and advanced insulation system for every voltage level.

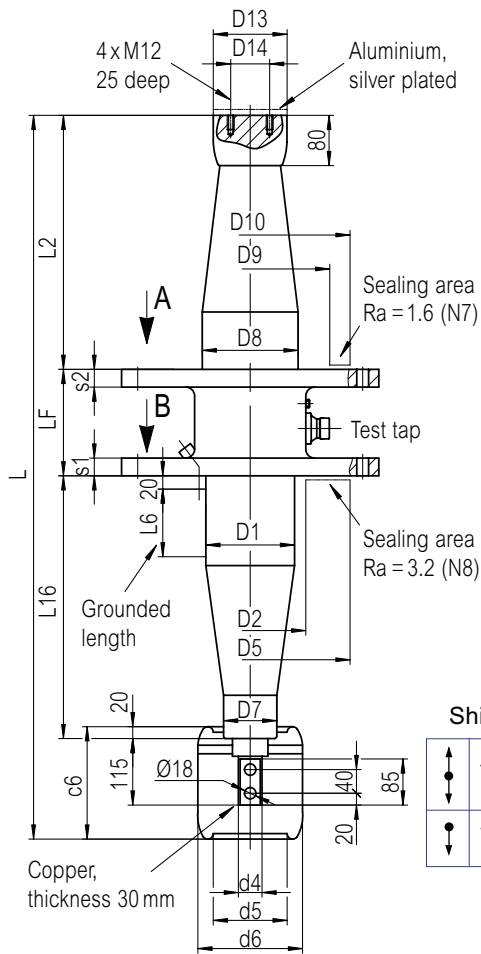
Main advantages of Micafil's RIP- technology

- Short delivery times
- Low dielectric losses ($\tan \delta \sim 0.35\%$)
- Partial discharge free up to double service voltage
- Fully dry, maintenance free
- Oil-free and environmental friendly
- Highest mechanical and thermal properties
- Robust design and vandalism resistant
- Option for any operating position
- Gas and oil tight
- Easy handling



Technical Data and Dimensions

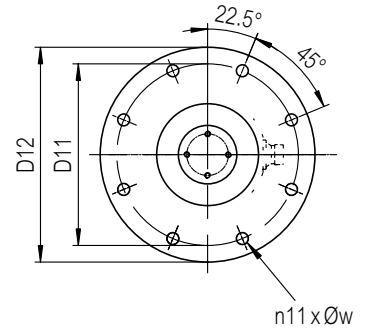
Dimension drawing



Flange dimensions for:

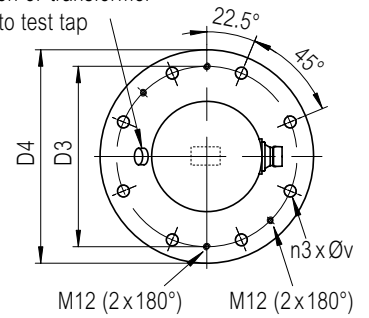
- RTKG 72.5-350 / 2000
- RTKG 72.5-350 / 2500
- RTKG 123-550 / 2000
- RTKG 123-550 / 2500
- RTKG 145-650 / 2000
- RTKG 170-750 / 2000

View A:
SF₆ side



De-aeration of transformer
opposite to test tap

View B:
Oil side



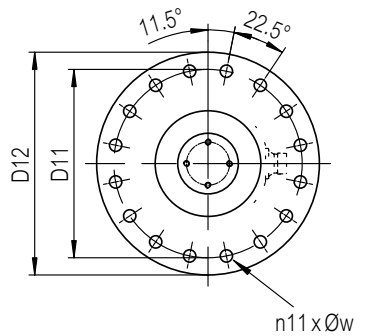
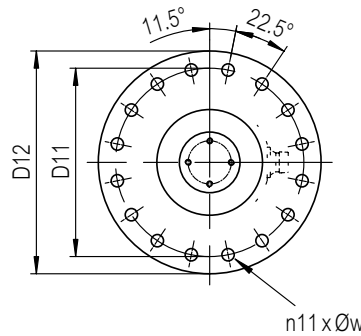
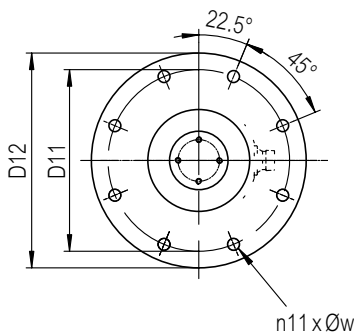
Flange dimensions for:

RTKG 170-750 / 2500

RTKG 245-1050 / 2000
RTKG 245-1050 / 2500

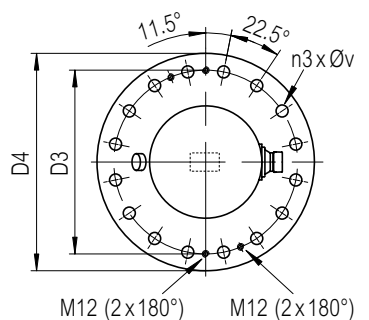
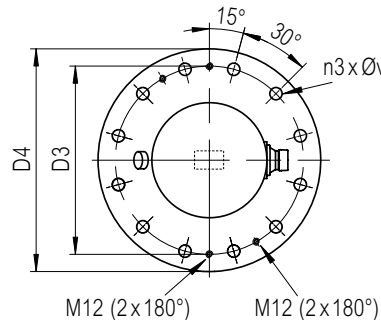
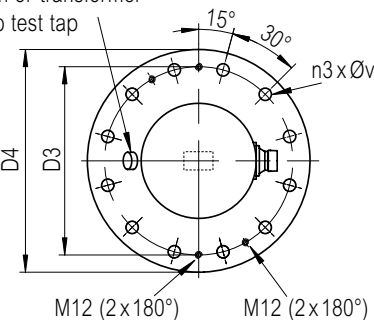
RTKG 362-1300 / 2000
RTKG 420-1550 / 2000
RTKG 525-1800 / 2000

View A:
SF₆ side



De-aeration of transformer
opposite to test tap

View B:
Oil side



General Informations

Conductor loading

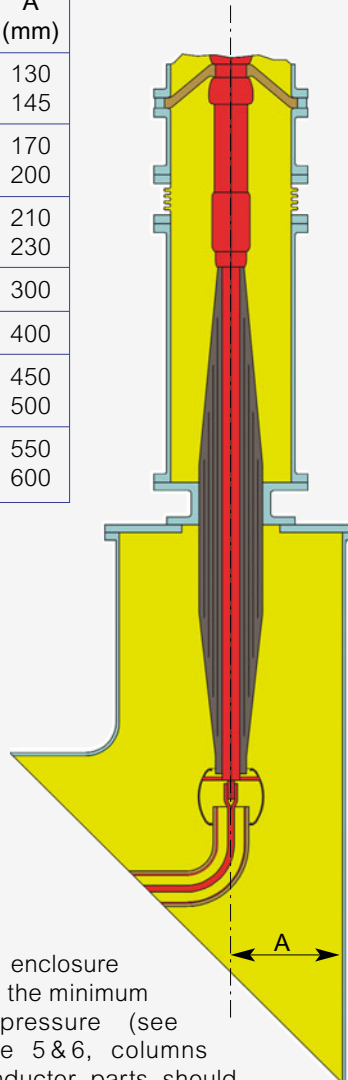
Rated current dependent on the bushing lower length (see "Technical Data" page 5 & 6, column 12). Bushings selected with I_r not less than 120% of the rated current of the transformer are considered to be able to withstand the overload conditions according to IEC Publication 60354 (Loading guide).

Recommendations for bushing installation

Transformer

The field strength in the oil on the surface of the shield insulation must be limited to values normal for insulated components. As a guideline minimum distances A to grounded transformer parts are given below:

Type RTKG	AC test voltage (kV)	A (mm)
123	185	130
	230	145
145	275	170
	310	200
170	325	210
	365	230
245	460	300
362	570	400
420	630	450
	680	500
525	750	550
	790	600



GIS

Observe the minimum enclosure diameter D_{GIS} as well as the minimum operating SF_6 -gas pressure (see "Technical Data" page 5 & 6, columns 17 & 18). Adjacent conductor parts should be well adapted to the bushing terminal.

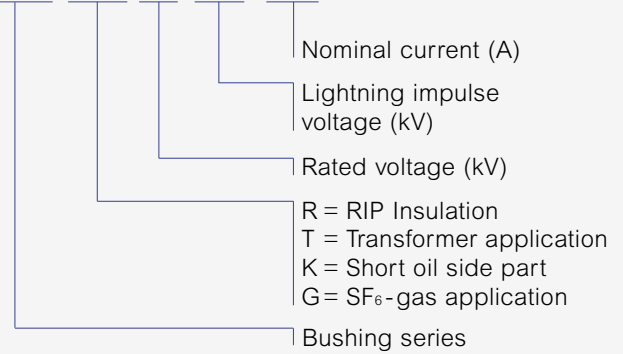
General

Because the bushing is completely dry it can be operated vertically or horizontally or in any position.

Type designation

The type designation is included in an overall system. An example of nomenclature used to designate our GARIP bushings:

GARIP RTKG 245-1050 / 2000



Testing of the bushing

Each bushing undergoes routine testing before leaving the factory, either according to IEC 60137 or IEEE C57.19.00.

The standard tests include:

- Tan δ , capacitance and partial discharge measurement
- Power frequency test
- Lightning impulse test (if applicable)
- Leakage test

Ordering particulars

When ordering please state:

- Type and catalogue no. see the table below
- CT space L6, see "Technical Data" page 5 & 6, column 20
- For 170 kV / 2000 A respective 245 kV / 2000 A only: choose the size of oil side shield depending on the transformer current; see "Technical Data" page 5 & 6, columns 26 & 27

Bushing type	Catalogue no.
GARIP RTKG 72.5-350 / 2000	HLJM 154484
GARIP RTKG 72.5-350 / 2500	HLJM 154964
GARIP RTKG 123-550 / 2000	HLJM 154504
GARIP RTKG 123-550 / 2500	HLJM 154514
GARIP RTKG 145-650 / 2000	HLJM 154524
GARIP RTKG 170-750 / 2000	HLJM 154534
GARIP RTKG 170-750 / 2500	HLJM 154544
GARIP RTKG 245-1050 / 2000	HLJM 154554
GARIP RTKG 245-1050 / 2500	HLJM 154564
GARIP RTKG 362-1300 / 2000	HLJM 154574
GARIP RTKG 420-1550 / 2000	HLJM 154584
GARIP RTKG 525-1800 / 2000	HLJM 154594