About ABB Micafil
Facts

Location	Zurich Switzerland
Employees	~ 200
Revenues 2008	85 MUSD
Production area	11’000 m^2
Export	> 80%

About ABB Micafil
History

1918	Micafil established in Zurich
1939	Production of laminated composites and casting resin
1946	380 kV Oil Impregnated Paper – OIP transformer bushings
1960	Development of Resin Impregnated Paper - RIP bushings
1970	Production of vacuum casted epoxy insulators
1972	Transformer bushings 1’200 kV, OIP
1993	Transformer bushings 420 kV, RIP & composite insulator
1996	RIP bushings for high temperature superconducting transformer
1998	420 kV HV cable joint, first worldwide
2008	550 kV SeismicRIP® bushings as per IEEE 693-2005 Standard
2009	1’000 kV GIS spacer insulators

Product portfolio
Transformer Bushing

Transformer bushings for
oil & gas insulated AC transformers

Applications	oil – air / SF6 – air high current oil – SF6 oil – oil
Voltage range	up to 550 kV
Current range	up to 35.000 A
Outdoor insulator	porcelain composite insulator

Product portfolio
GIS bushing

GIS bushings

Application	SF6 – air
Voltage range	up to 550 kV
Current range	up to 4.000 A
Outdoor insulator	porcelain composite insulator

Product portfolio
Wall bushing

Wall bushings

Applications	outdoor – outdoor outdoor – indoor indoor –indoor
Voltage range	up to 245 kV
Current range	up to 4.000 A
Outdoor insulator	porcelain composite insulator

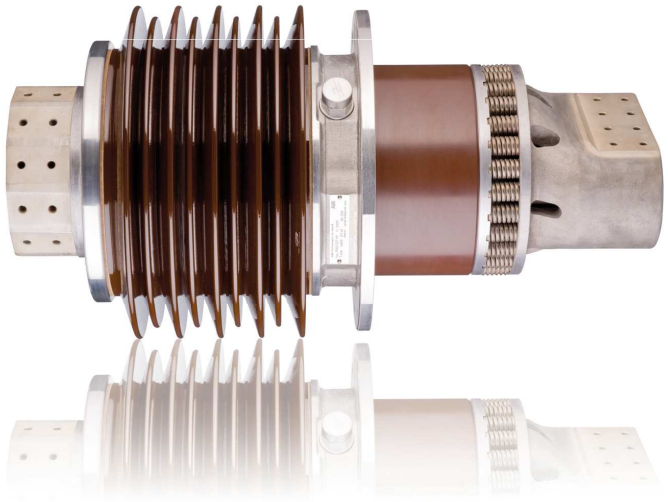
Product portfolio
Railway bushings

Railway bushings

Applications	
	roof bushings
Voltage range	up to 36 kV
Current range	up to 1.000 A
Outdoor insulator	porcelain
	composite insulator

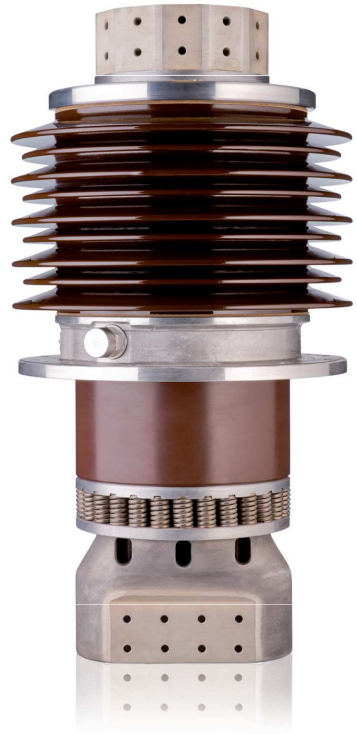
New HIRIP
Advantage

- No joints (welding / brazing) in the current path straight through design
- Smooth transition from the round hollow conductor to the parallel terminals reduces the electrical resistance
- The integrated terminal pads of the conductor guarantee a better current distribution in the aluminum conductor
- Integrated cooling ribs, mechanically protected
- Very large creepage distance of 1080mm
- High mechanical rigidity



New HIRIP
Series

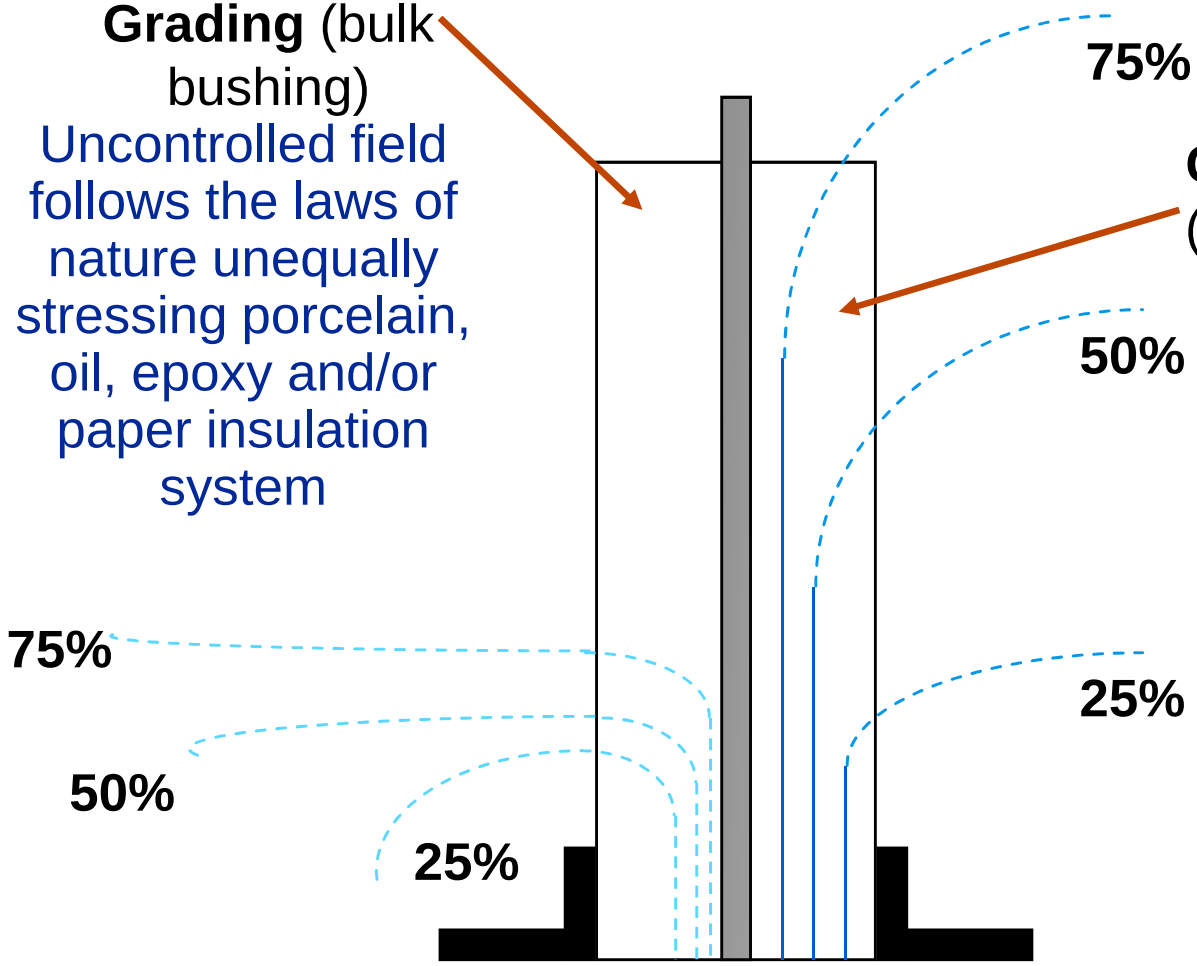
Typ	reference current
RTXF 36 – 200/7000	7‘000A
RTXF 36 – 200/11000	11‘000A
RTXF 36 – 200/15500	15‘500A
RTXF 36 – 200/22000	22‘000A
RTXF 36 – 200/26000	26‘000A
RTXF 36 – 200/37000	37‘000A



- By max. daily means 90°C oil and 70°C air temperature, frequency 50 Hz
- All available with C.T. extension on transformer side with L6 = 0 mm, 100 mm and 300 mm

Bushing Technologie
bulk bushing vs. condensor bushing

No Capacitive Grading (bulk bushing)
Uncontrolled field follows the laws of nature unequally stressing porcelain, oil, epoxy and/or paper insulation system



Capacitive Grading (condenser bushing)

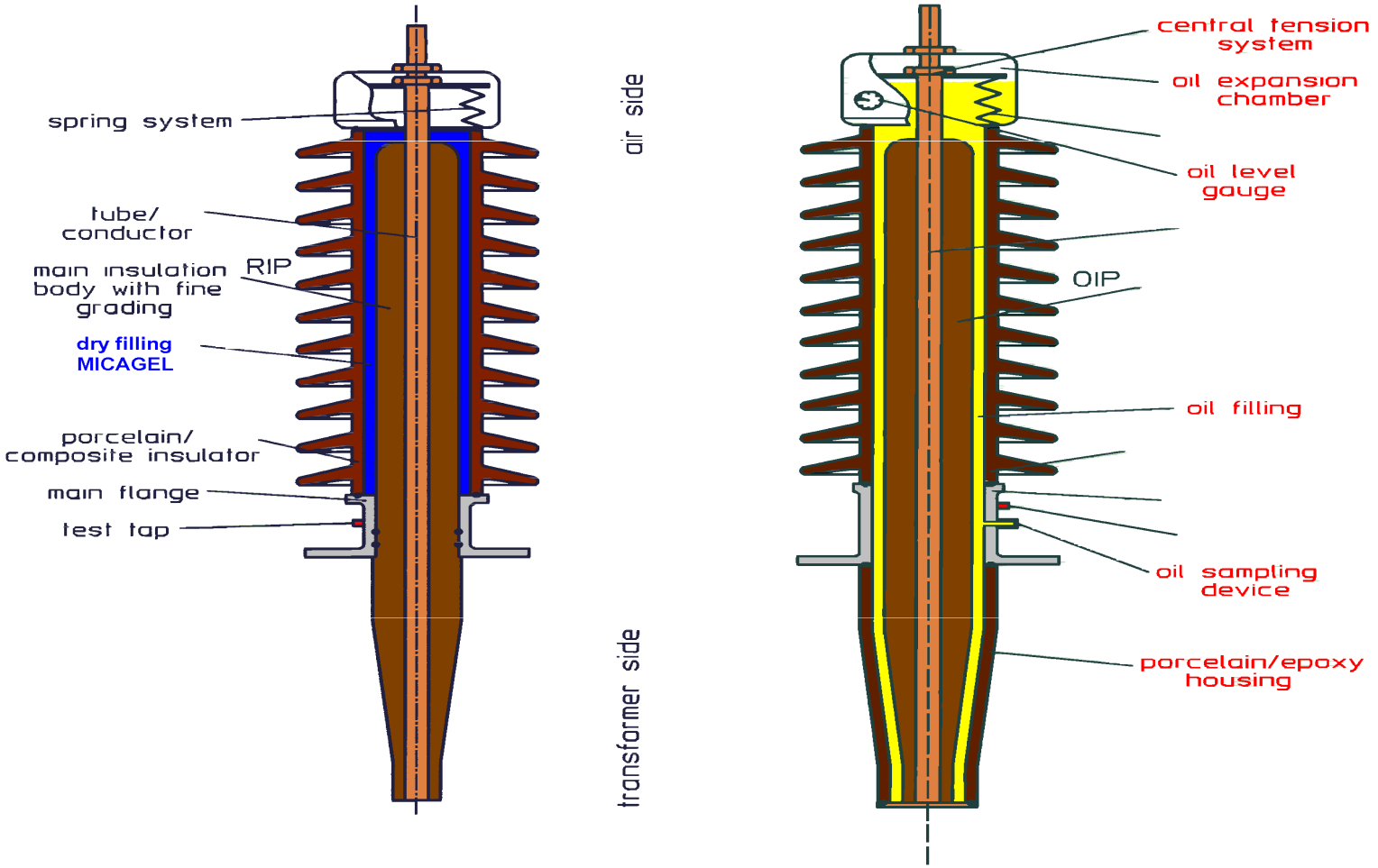
Field controlled by capacitive grading follows controlled contours making effective use of all insulation

Bushings Technologies

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 60137 IEEE C57.19.			
Tan delta	**< 0,007**	**< 0,015**	**< 0,007**
PD	**< 10 pC**	**< 250 pC**	**< 10 pC**

OIL FILLED BUSHINGS ⟷ **DRY BUSHINGS**

Bushing Technologie
RIP & OIP Technology



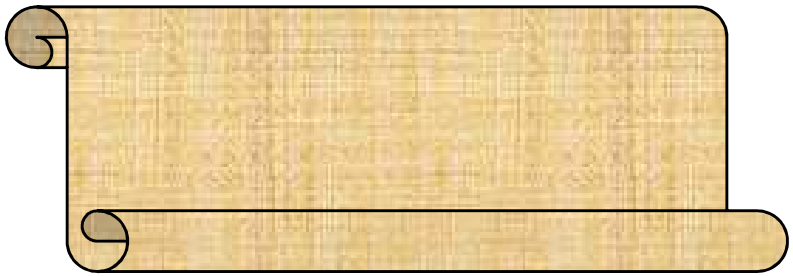
TRANSFORMER
BUSHING

R esin
I mpregnated
P aper

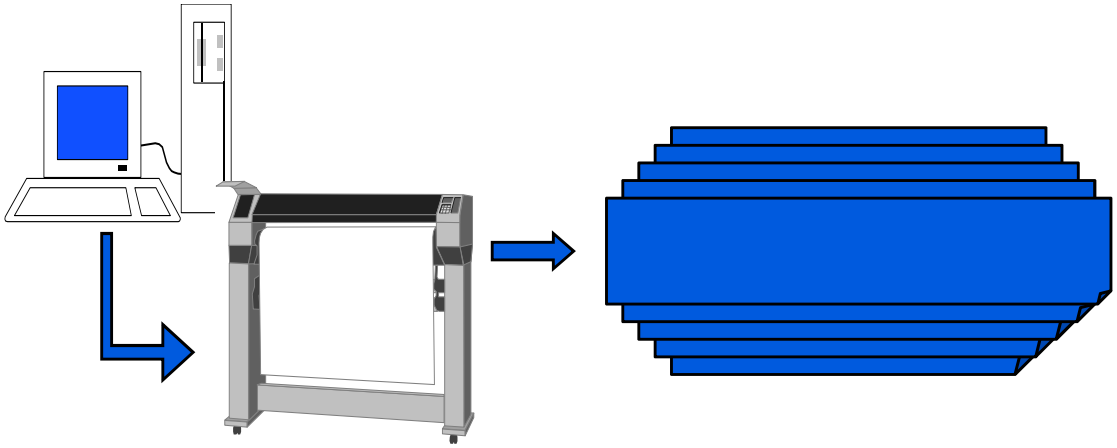
O il
I mpregnated
P aper

Production of R I P Bushings

Conductor:
- Al, Cu,
- solid, tube

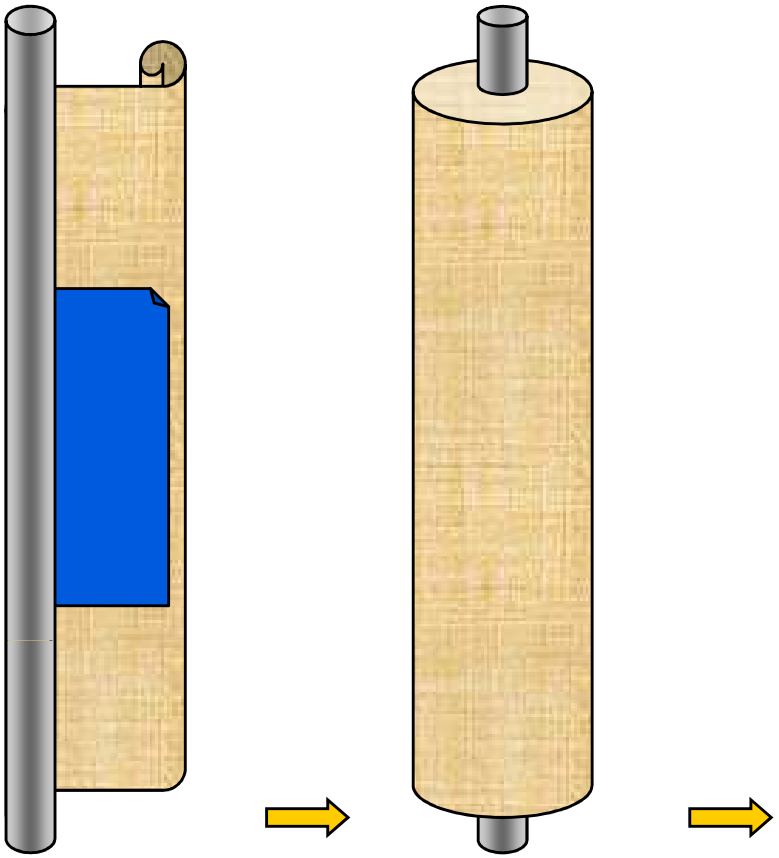


Special crepe paper



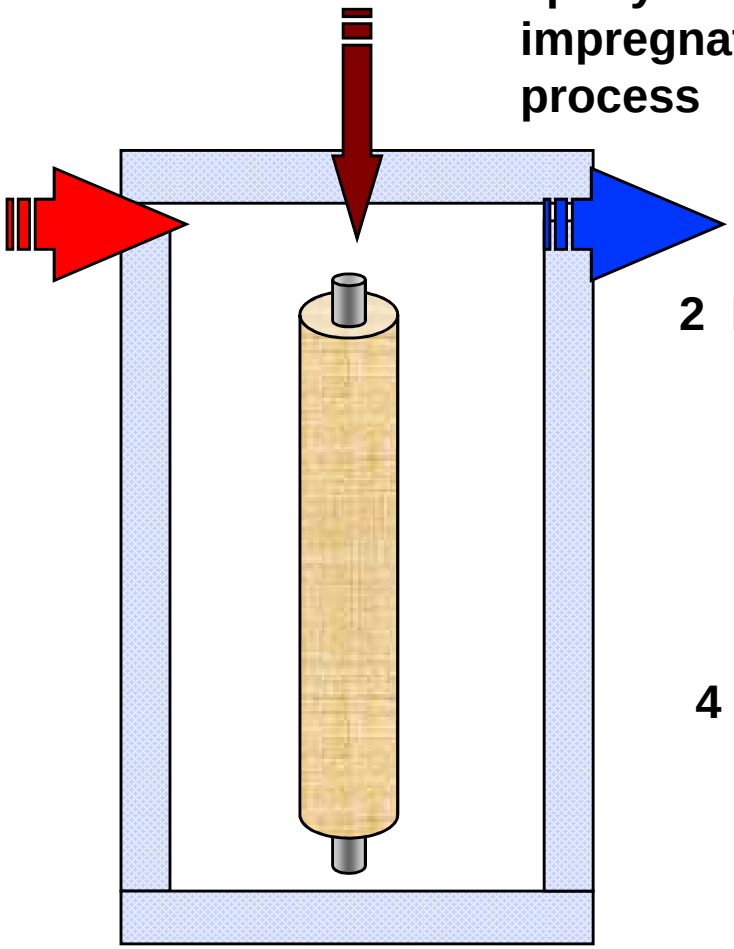
Aluminium foils

Production of R I P Bushings



1 Winding process

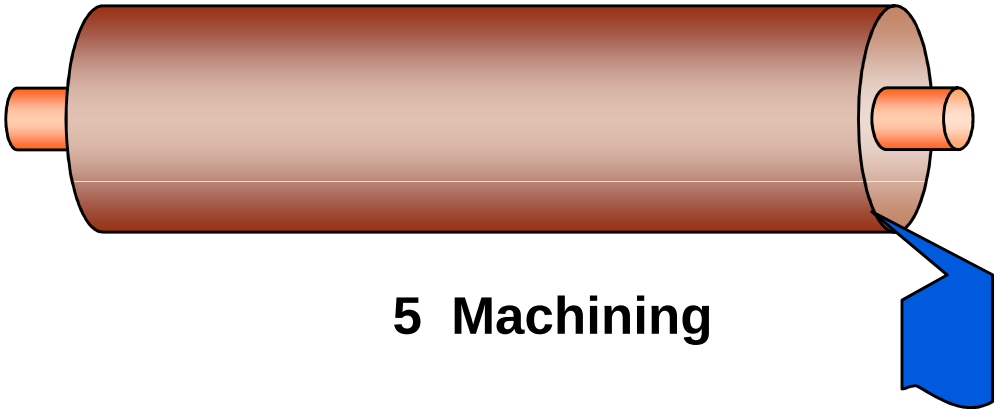
3 Under vacuum epoxy resin impregnation process



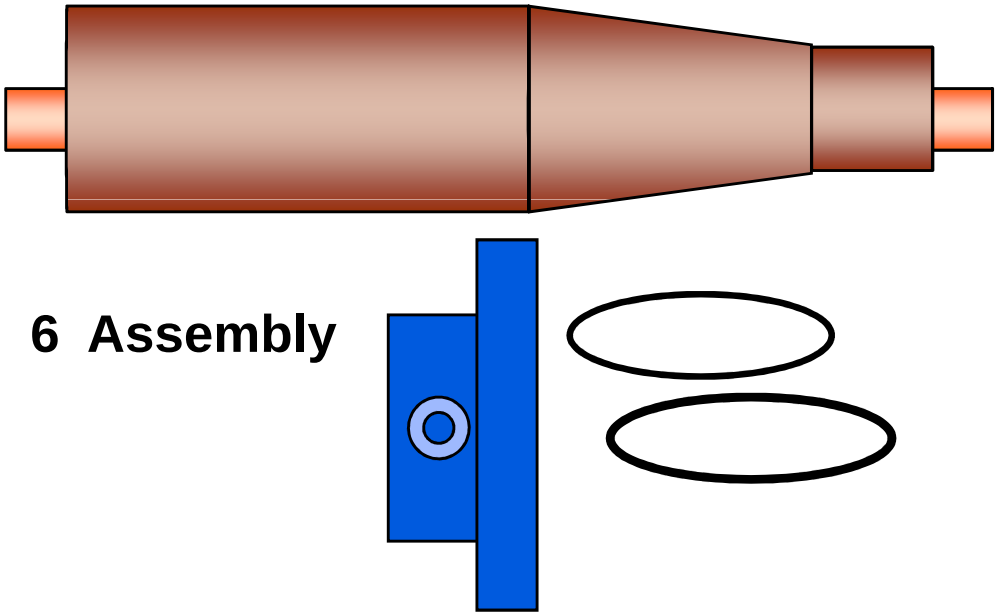
2 Drying process:
- vacuum
- heating

4 Curing process

Production of R I P Bushings



5 Machining



6 Assembly

R I P Bushings Main Advantages (1)

HIGH TECHNICAL STANDARD

- Low dielectric losses (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

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 out flowing oil

Advantages vs. Competitors

- Largest number of bushings in service worldwide

  (since 1926 more than 580‘000 produced Bushings)
- Experience in all three technologies (RBP, OIP, RIP)
- Our bushing are reliable (25 years and more)
- Flexible to produce different bushing versions
- customized solution
- Specialised in retrofit bushings (reproduction)
- Guarantee the 100% interchangeability
- 40 years experience with Resin Impregnated Paper
- 20 years experience with Composite Insulator

Bushings Technologies
High technical standard

IEC 60137 **tan δ** and **partial discharge**

Table 8 – Maximum values of tan δ and tan δ increase (see 9.1)

Type of bushing insulation	MICAFIL max. Values for Highest Operation Safety	Maximum value of tan δ	
		Value at 1,05 U_m / $\sqrt{3}$	Increase between 1,05 U_m / $\sqrt{3}$ and U_m [a]
Oil-impregnated paper	0,0035 / 0,0002	0,007	0,001
Resin-impregnated paper		0,007	0,001
Resin-bonded paper		0,015	0,004
Gas impregnated film		0,005	0,001
Gas		0,005	0,001
Cast or moulded resin		0,015	0,004
Combined		[b]	
Other		[b]	

[a] Not applicable to bushings where $U_m \leq 36$ kV.

[b] The supplier shall indicate the values.

Bushings Technologies
High technical standard

IEC 60137 **tan δ** and **partial discharge**

Partial discharge measurements before dielectric tests may be requested for information purpose only, and are not subject to guarantee.

Table 9 – Maximum values of partial discharge quantity (see 8.2 and 9.4)

Type of bushing insulation	MICAFIL max. Values for Highest Operation Safety	Maximum discharge quantity pC measured at		
		U_m [a]	1,5 U_m / $\sqrt{3}$ [b]	1,05 $U_m/\sqrt{3}$ and 1,1 $U_m/\sqrt{3}$ [e]
Oil-impregnated paper	2 pC	10	10	5
Resin-impregnated paper		10	10	5
Resin-bonded paper [c]		–	250	100
– with metal layers		[d]	[d]	300[c]
Gas-impregnated film		10	10	5
Gas		–	10	5
Cast and moulded resin		–	10	5
Combined			[d]	
Other			[d]	

Power and productivity
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