DURESCA®

Installation Instructions
Transformer Bushings DTOX

MOSER GLASER
Current and voltage – our passion

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Transformer Bushing Oil / SF6 application

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1 General

Read this manual carefully and follow all safety regulations at work.

1.1 Safety

Work on bushings may only be performed by qualified people.

Follow the safety instructions of the operating company.

For your safety, before any manipulation inform the responsible person about your action in the field.

Do not energize the bushing without a closed measuring tap.

Caution - Do not work on systems that might be under tension!

Follow below safety rules in the given order.

1 Verify that the system is off-line
2 Disconnect from the mains Secure against reconnection
3 Secure against reconnection
4 Carry out earthing and short circuiting
5 Provide protection from adjacent live parts

Not following these rules could cause death!

Caution - Strong electromagnetic fields can occur along the bushings. People with pacemakers may not stand near!

Sensitive technical devices must be protected by appropriate measures.

Only materials provided by MGC must be used (terminals, seals, shields, arcing horns…).

The sealing between the transformer and the bushing is out of Moser Glaser scope of supply.

1.2 Transport and Storage

The bushings are packed in wooden crates (Figure 1). Each bushing is packed individually in a plastic bag sealed with desiccant material and protected from moisture.

The crate should be free off any damage after delivery.

- On request, a shock indicator label can be fixed on the crate in order to check if the crate experienced a mechanical shock.

Transport damage

1. Visible damage must be reported on the counter signed delivery note at the reception of the goods.

2. Moser Glaser shall be informed with no delay if a damage is reported.

Bushings must always be protected from moisture.
Keep the protective foil until the installation.

Storage
The bushing must always be protected from moisture and permanently stored in a dry room.

Storage up to 6 months
Packed in protective foil with desiccant bag (Fig. 2)

Storage longer than 6 months and up to 24 months
Packed in protective aluminium foil with desiccant bag (Fig. 3)

Storage longer than 24 months
Oil-side protected in a tank filled with dry transformer oil (Fig. 4)

Figure 1: wooden crate

Figure 2: protective foil

Figure 3: protective aluminum foil

Figure 4: oil tank

2 Product description

The DURESCA transformer bushing type DTOX is used for transformer to SF6 applications.
It conducts the electrical current by a fix conductor to the cable box side connectors. It is characterised by a compact design and is partial discharge-free during service. The DURESCA transformer bushing is maintenance-free.

The DURESCA transformer bushing has a dry insulation of RIP (Resin Impregnated Paper). The insulation lies directly on the conductor or tube and consists of wrapped paper impregnated with special epoxy resin under vacuum. Conductive grading layers are embedded during the wrapping of the paper for an optimal distribution of the electrical field. This structure ensures the longest operational reliability and the highest human safety.

A dry insulation of RIS (Resin Impregnated Synthetic) is also available.

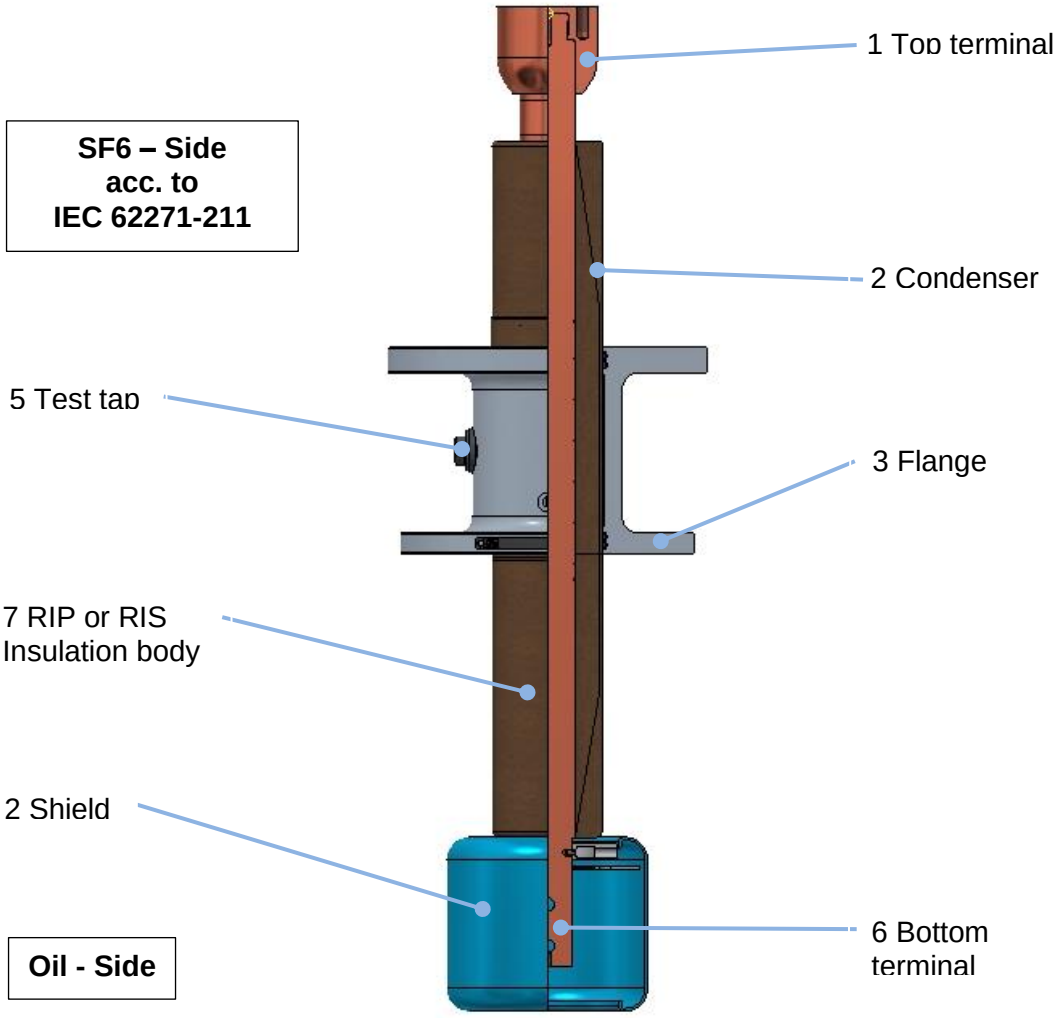


Figure 5: DURESCA transformer bushing type DTOX

3 Specifications

	Standard	Comments
Electrically		
Rated voltage U_m	-	see order confirmation
Max. current I_r (with 1.2 overload)	-	see order confirmation
Standard	IEC 60137 / IEEE C57.19.00	see order confirmation
Mecanically		
Bushing type	Dry fine graded condenser type	
Material of conductor	Electrolyte copper (Cu-ETP)	see order confirmation
Insulation	RIP Resin Impregnated Paper RIS Resin Impregnated Synthetic	
Material flange	corrosion free aluminium alloy	
Dimension	-	see layout drawing
Weight	-	see layout drawing
Wooden transport boxes	according ISPM 15 Standard (Standard packaging, seaworth)	(ISPM: International Standards for Phytosanitary Measures)
Application		
Permissible ambient temperature	-40 up to +40° C	other values on request see layout drawing
Application	Transformers connected to GIS	Oil / SF6
Oil temperature	Daily mean value 90°C, maximum value 100°C	
Immersion medium	Transformer side: Transformer oil SF6 side: SF6 or SF6/N_2	
Oil level below bushing flange	Max. 15mm	
Min. gas pressure	350 kPa absolute	other values on request
Mounting angle	0 to 90°	

4 Installation of the bushings

Caution

Do not work on installations that might be under tension!

4.1 Unpacking and lifting

Small bushing could be taken out of the crate by hand (for the weight, consult layout drawing).

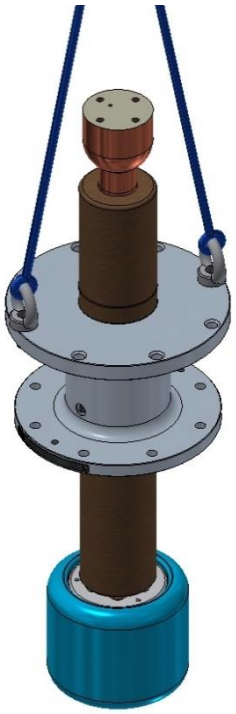
Bigger bushings are lifted by rope and lifting equipment.
For this purpose, eyebolts (Figure 6, not included) are attached. On the second side support by hand or lift using a sling.

If raising the bushing put protection pad underneath.

Attention Bushings must be handled with care. Bumps and shocks should be avoided and reported.

Damage to the bushings must be reported immediately to MGC.

Figure 7: Example of an eyebolt
(not in the scope of supply)

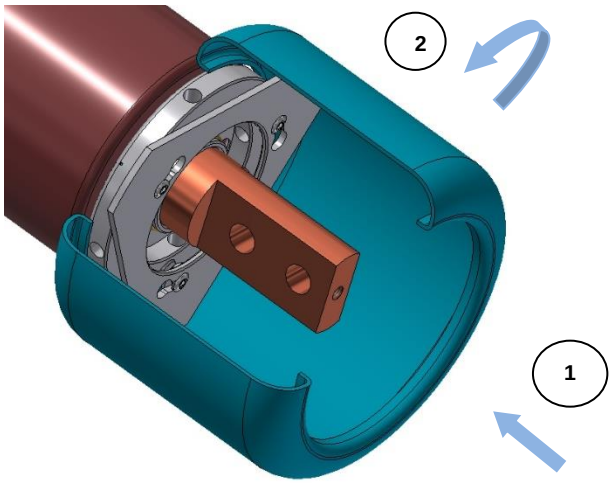
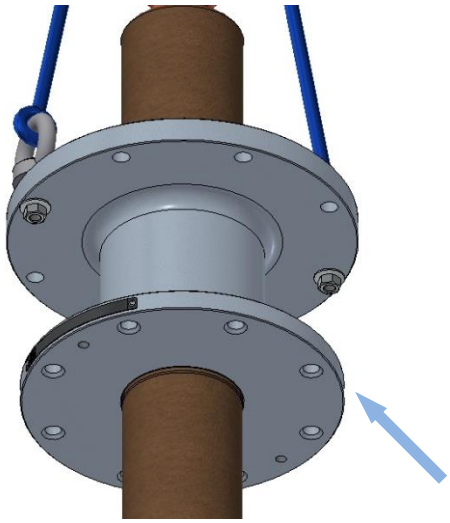
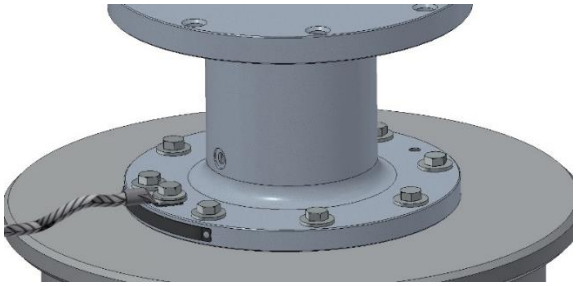


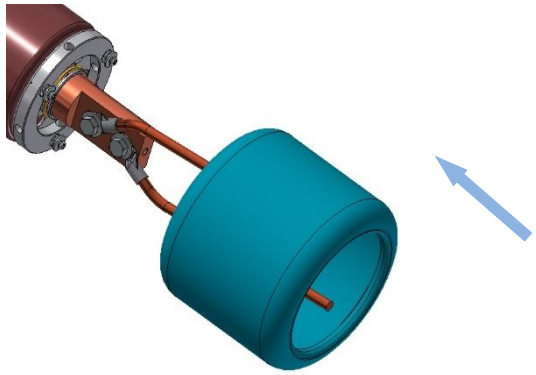
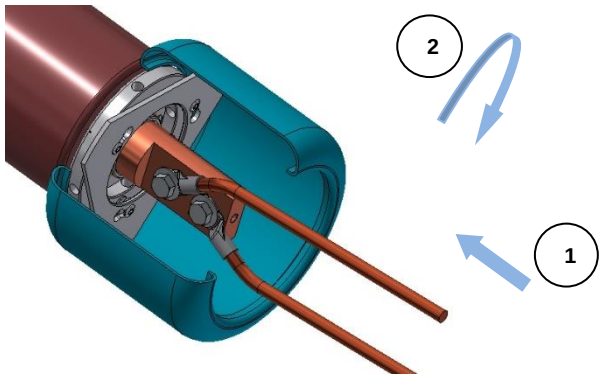
4.2 Installation of the bushing

Connection to the transformer:

Attention: Any shield damage (coating, geometry) must be reported to Moser Glaser with no delay.

DTOX bushings have always a Fix-Conductor. Bottom connected bushings require a man-hole in the turret for connecting the lead coming from winding.

	**1** Remove the electrode (if present) by unlocking the bayonet Push and turn counter clockwise. 
	**2** Remove the flange protection. Clean the sealing surfaces of the bushing and transformer. Make sure that everything is completely dry. Lift the bushing using eyebolts (Figure 6) and place in the right angle above the transformer on the designated place. Prepare the sealing surface and the sealing components on the transformer.
	**3** Tighten the bolts on the flange to the transformer. Make the earthing between the flange and the transformer, use the marked M12 threads.

	**4** Via manhole: Pull the transformer cable through the electrode and connect to the fixed conductor bolt
	**5** Install the shield Block the shield with the bayonet fitting Push and turn clockwise.

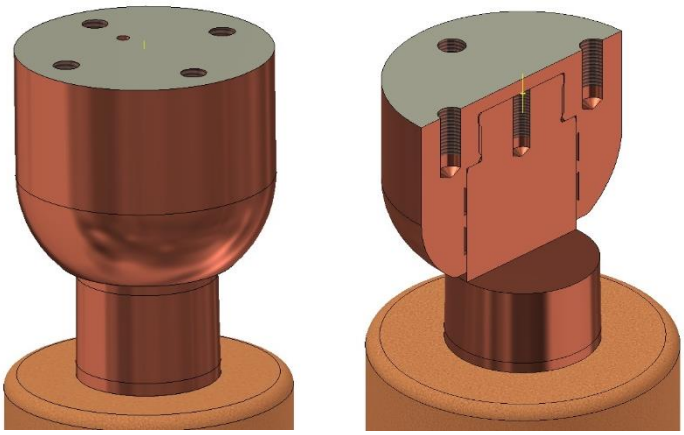
Connection to the SF6-side:

Attention SF6 side of the bushing must be protected from moisture prior to assembly into the SF6-Switchgear housing. A suitable packing and desiccant can be used.

The connection of the SF6 side is adapted to the SF6 equipment manufacturer. Proceed according to the rules in instruction of the GIS manufacturer.

Surfaces of RIP insulation and metallic parts in contact with SF6 have to be cleaned and complete free of oil, grease or dust.

O-rings and bolt for fixing the bushing are normally delivered by the GIS manufacturer.



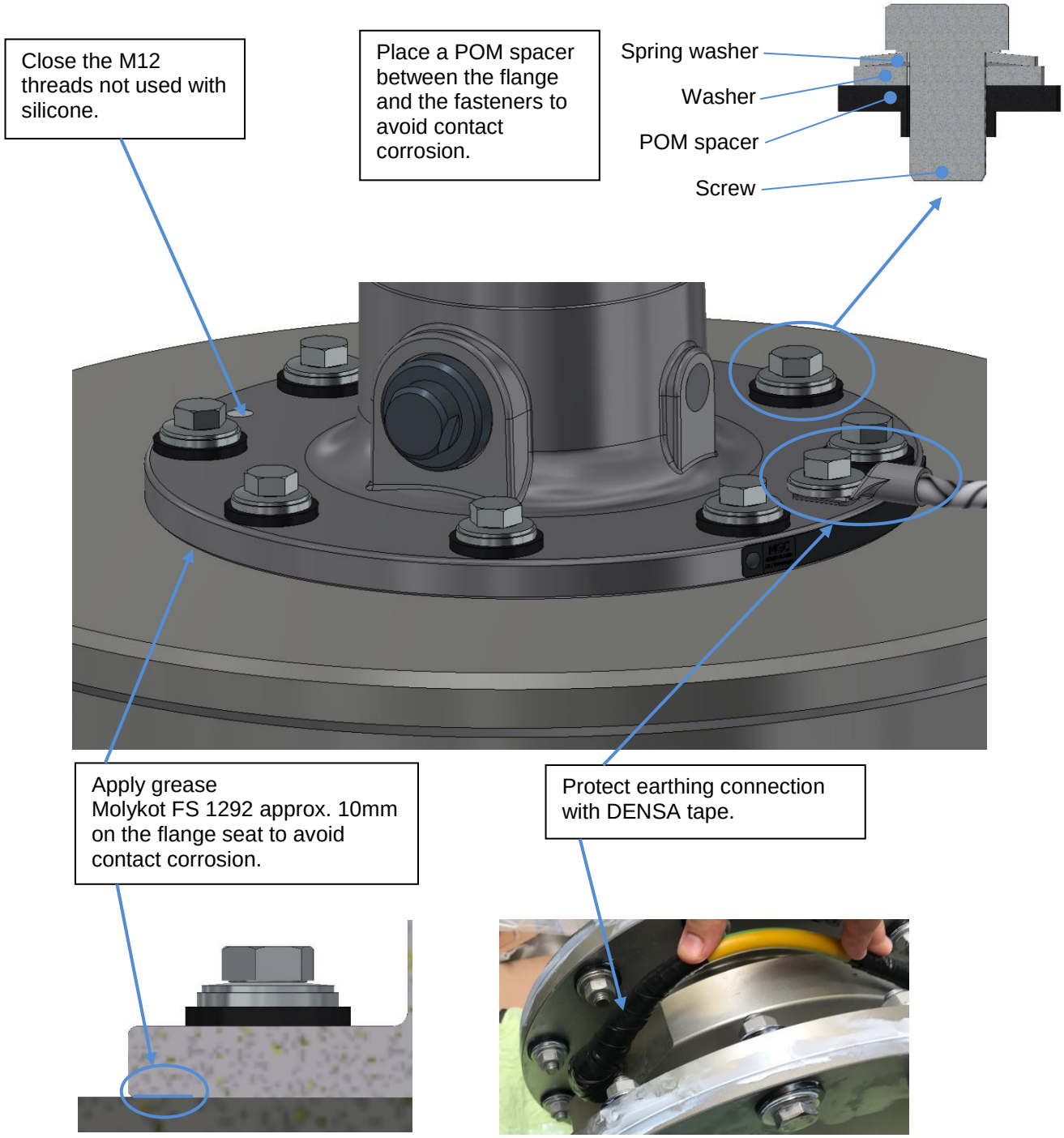
4.3 Accessories mounting:

Off Shore Application (C5-M) for double flange

MGC Moser Glaser has made investigations and performed tests according ISO 12944 and ISO 20340 to find the most efficient combination of products for heavy corrosive environment.

If you ordered a bushing for offshore application, the flange and the head of the bushing will be anodized, and the top terminal will be tin-plated.

Mounting recommendations for optimal lifetime of the bushing:



5 Check before energizing

After installation on the transformer, a waiting time of 24 hours and repeated air bleeding is required to avoid air bubbles on the insulating body which can cause flashovers or partial discharges.
Minimal oil level: up to bushing flange or if the transformer is not equipped with a conservator, minimum 1/3 of the CT extension has to be covered at any temperature**,** remaining volume being filled with dry nitrogen.

Check earthing

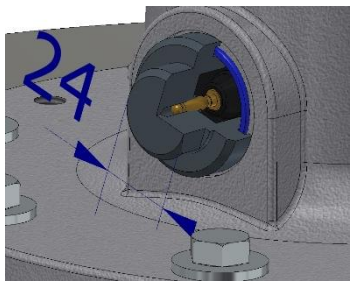
Inadequate earthing may lead to the failure of the installation and damage the bushings!

The test tap may only be used if the power supply is disconnected. After the measurements, the cap must be closed tight (30Nm).

To ensure safe operation, Moser Glaser recommends the following checks:

1. Tightness : between bushing / transformer tank, and the head sealing of the bushing
2. Tan Delta and capacity at the test tap (if possible)

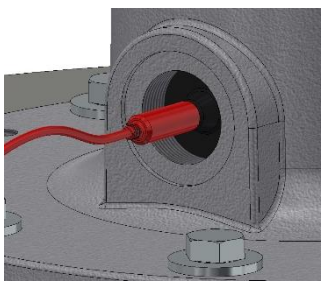
Measurement of the tan δ and capacitance



Use a flat spanner or spanner socket N24 to open the cap.

After the measurement, replace the cap and the o-ring. Torque 30Nm.

In operation, grounded



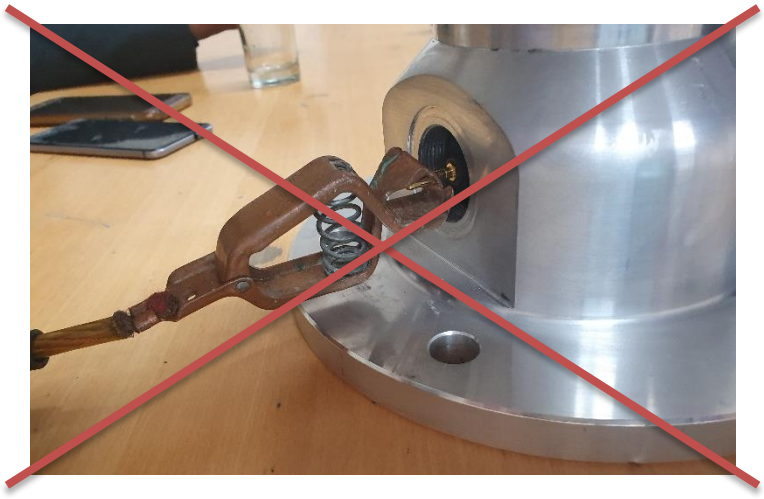
Connection: multilam pin ø4mm

use a banana jack to connect

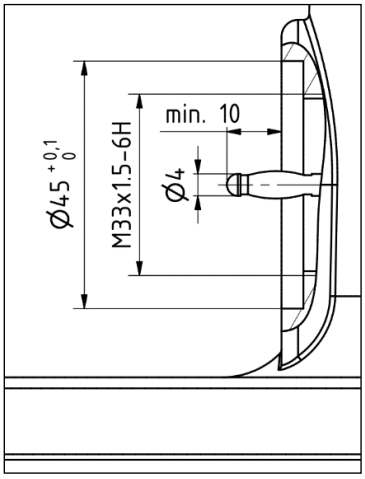
Measurement cable not included

Measurement position, not grounded

Do not use the crocodile clip



Dimension of the test tap



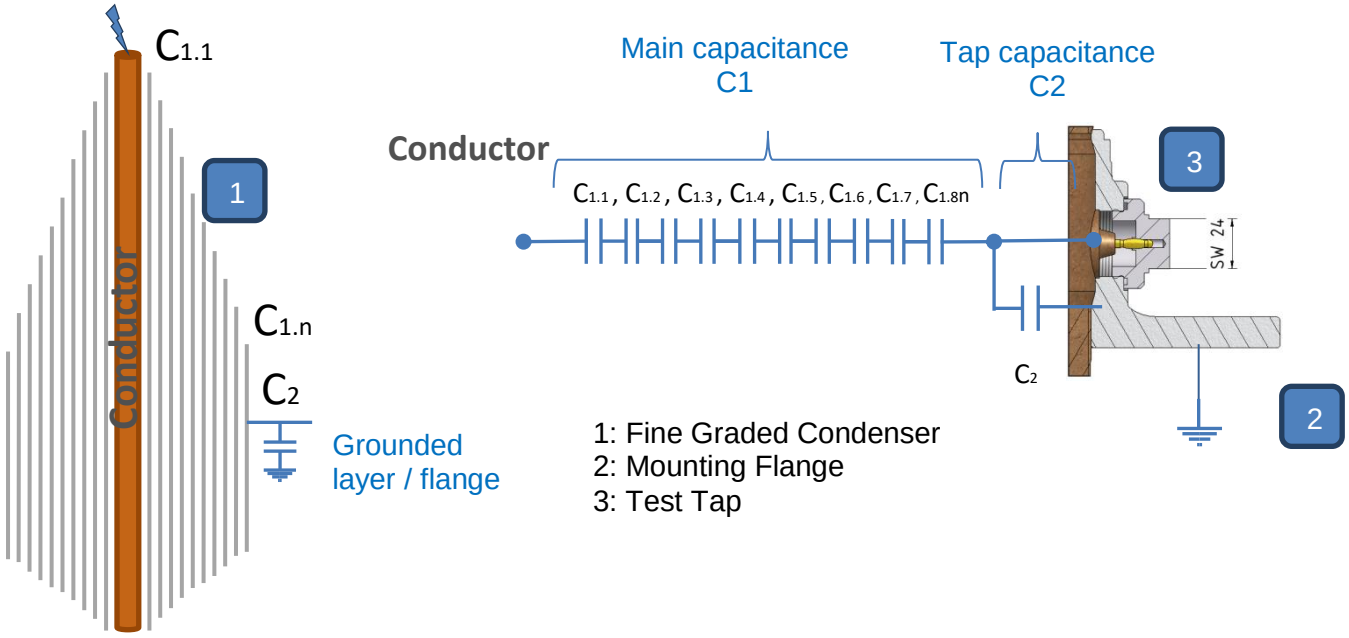


Figure 7: Principle of capacitance and Tan Delta measurement

Capacitances C1 and C2

The capacitance is defined by the geometry of the active part (position and length of the capacitive layers, size of the flange, …).

Following parameters can influence the value of capacitance:

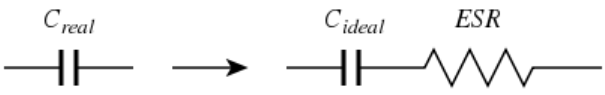
- Temperature: permittivity and then capacitance increase with increasing temperature
- Stray capacitances: presence of a current transformer, a transformer turret, an external corona shield, connections, distance to ground…

Values can therefore deviate from manufacture values:

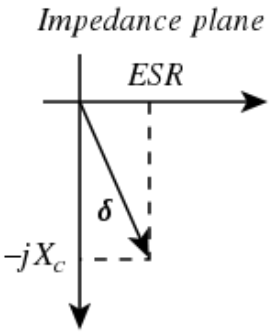
- For main insulation C1: up to 10%
- For test tap C2: up to 100%

Power factor / tan δ_1 (Main insulation) and tan δ_2 (Test tap)

The ideal bushing is a pure capacitance, but the real bushing is an ideal capacitance associated with a resistance. The loss factor is defined by the ratio between resistive and capacitive currents of the tested part:



ESR: Equivalent Series Resistance



How to limit tan δ_1

- Avoid moisture and dust to penetrate inside of the test tap (always close test tap with the original cap when not used)
- Pack the bushing in accordance with the expected use (short-term operation, long-term storage, …) → see Re-packing chapter
- Limit the exposition of the bushing to moisture (indoor storage, sealed packaging, …)
- Measure in the best conditions:
  - Outside of the wooden crate
  - Flange earthed but insulated from any other material (polystyrene, wood, …)

Importance of tan δ_2

- In operation, the last layer is earthed, so that C2 is shortened:
  - No dielectric losses
  - No dielectric stress
  - No partial discharge activity
- It is not recommended to use tan δ_2 for bushing diagnostic as this parameter is highly volatile especially with temperatures changes.

Following parameters can influence the value of tan δ:

- Moisture: humidity content decreases the resistance and therefore increase the tan δ
- Surface cleanness: any conductive part at the surface may lead to an increase of tan δ.
  By example: dusty silicone sheds, dusty or wet creepage distance (measurement in wooden crate)
- Temperature:
  With increasing temperature:
  - Tan δ_1 decreases (in temperature range 10…60°C)
  - Tan δ_2 increases

Values can therefore deviate from manufacture values:

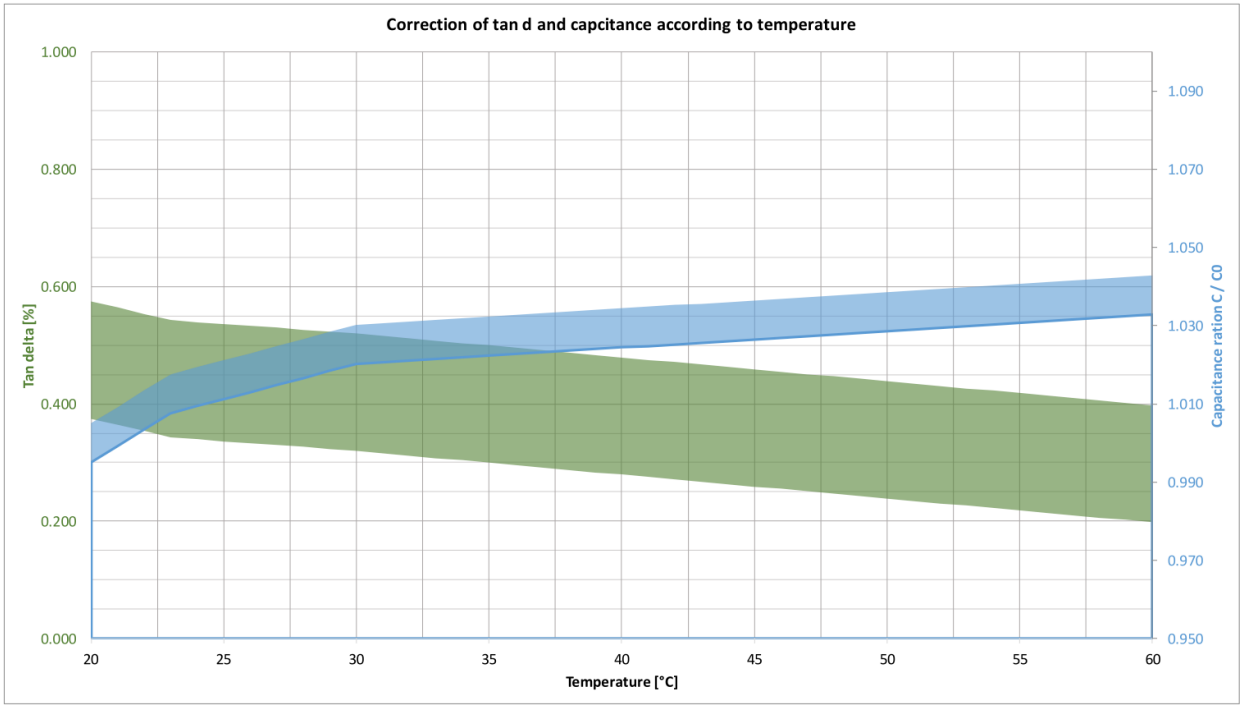
- For main insulation tan δ_1: -0.5…-1.0 %/K in range 10…60°C
- For test tap tan δ_2: up to 100%

Acceptance criteria:

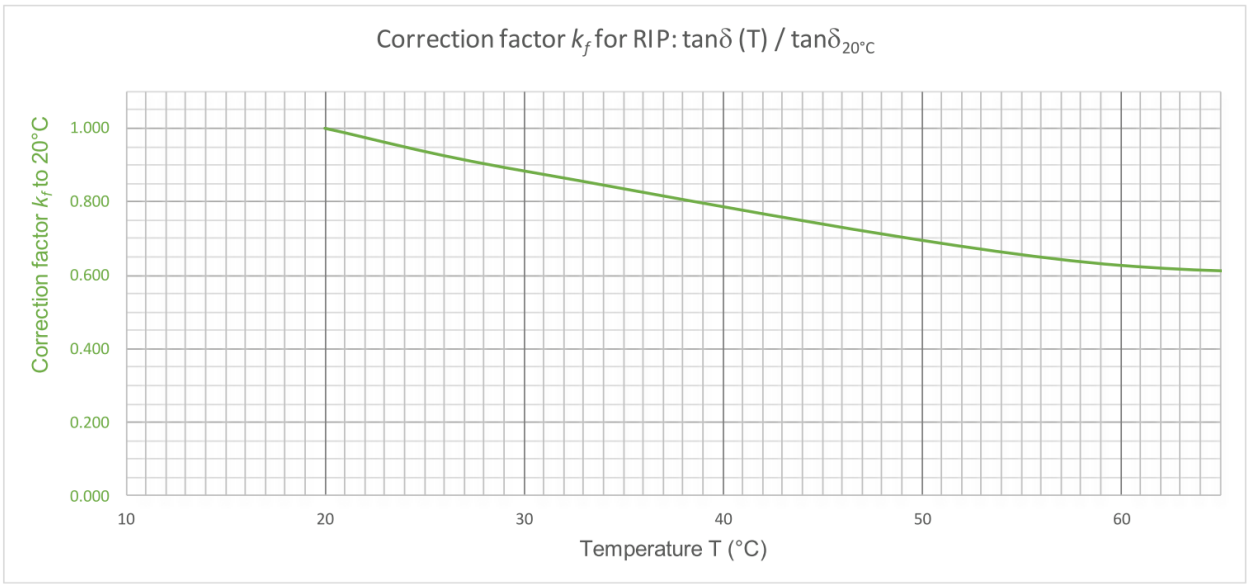
Capacity C1 :	Should not change more than 10% under the same test conditions as performed at Moser Glaser test lab.
Tan δ_1 :	For new bushings, should not exceed 0.7%, and should not change more than 0.10% between 1.05Um/√3 and Um.

The test results depend on the measurement method, temperature, air pressure and moisture. Make measurements at ambient temperature of 20°C for better comparability.

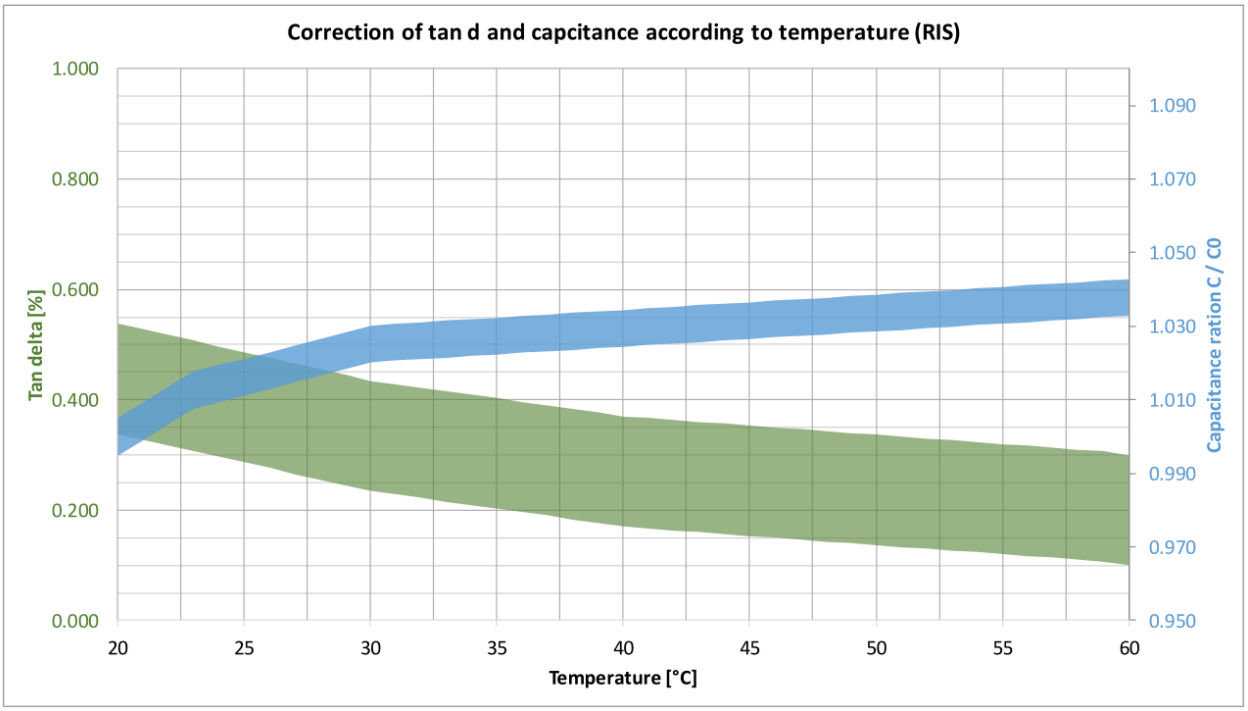
The following graph presents on-site acceptable values of loss factor tan δ and capacitance change at different bushing temperature for **RIP bushings**:



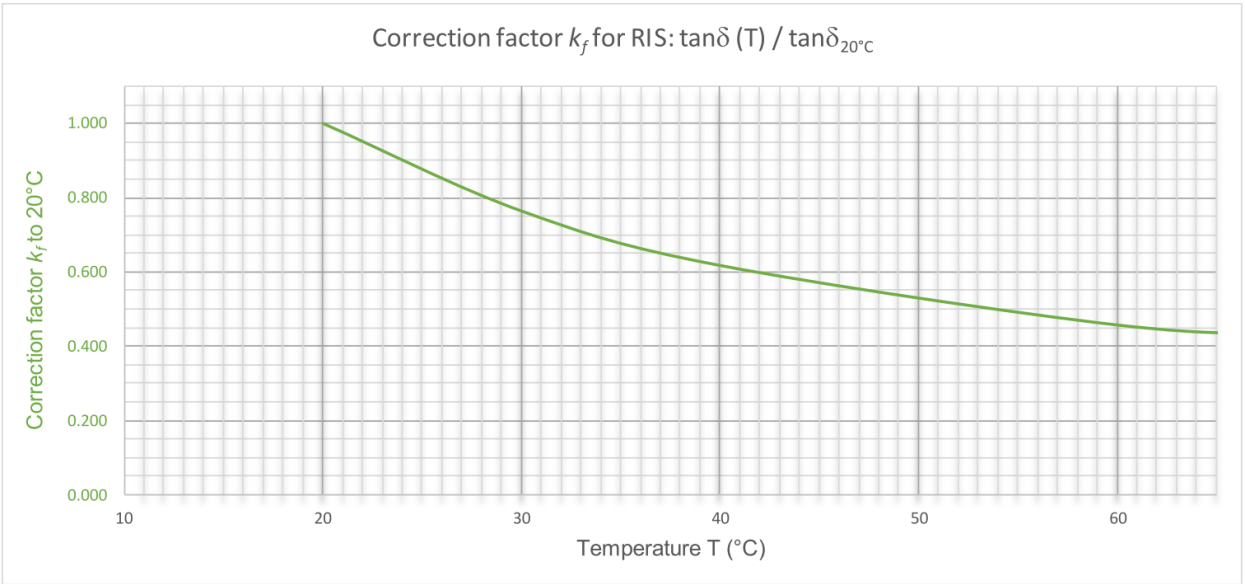
The curve below presents correction factor to calculate the loss factor tan δ at 20°C:
$(T) = kf \cdot \theta_{20°C}$



The following graph presents on-site acceptable values of loss factor tan δ and capacitance change at different bushing temperature for **RIS bushings**:

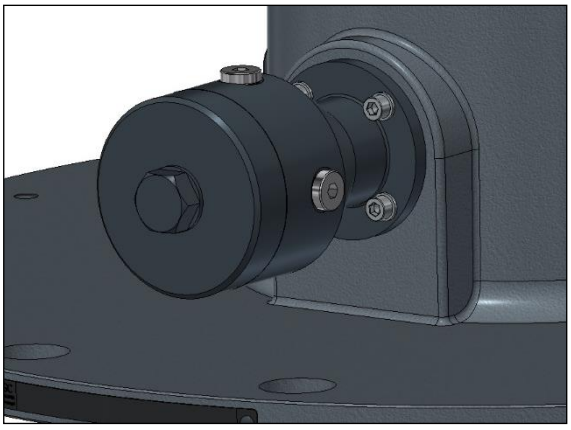


The curve below presents correction factor to calculate the loss factor tan δ at 20°C:
$(T) = kf \cdot \theta_{20°C}$

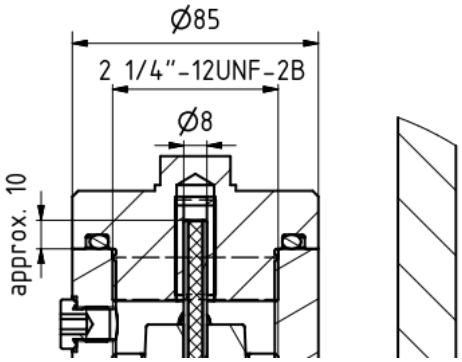


Contact Moser Glaser for the interpretation of results from measurement took in different conditions.

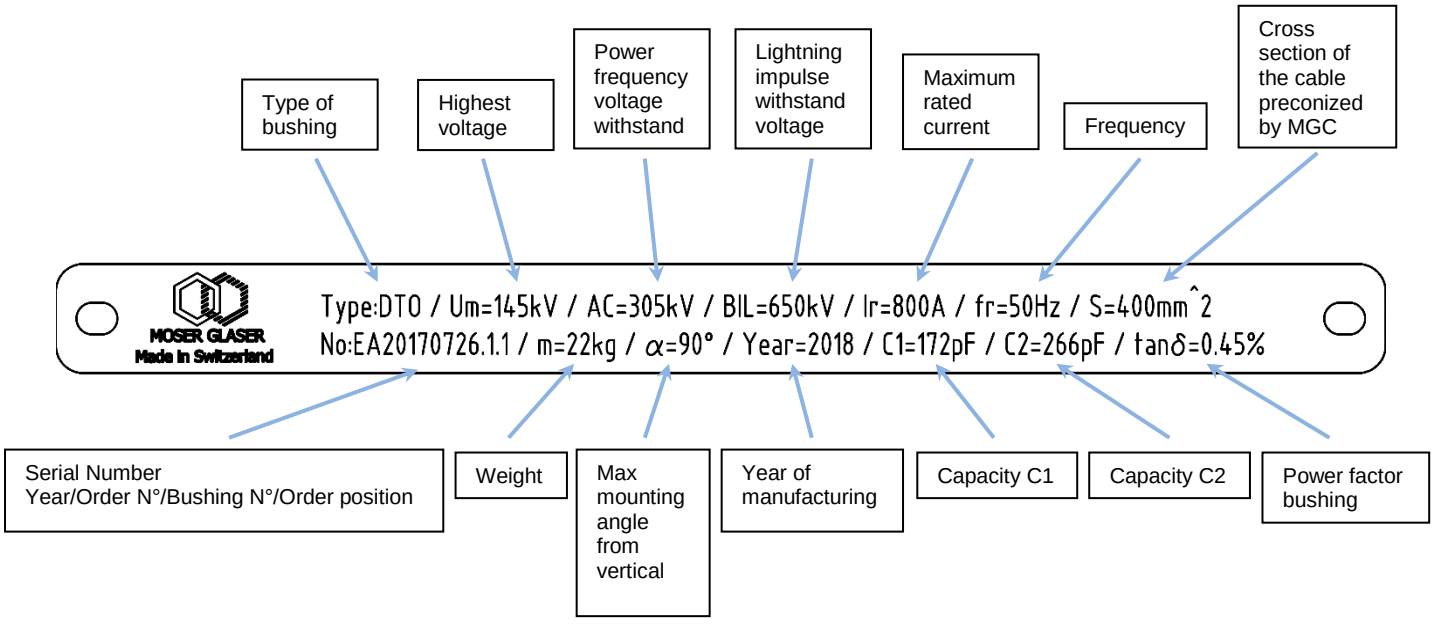
On request, the bushing could be supplied with a self-earthed test tap or a voltage tap



The voltage tap permits to measure the power factor and the capacitance of the bushing.



6 Nameplate



7 Maintenance

DURESCA bushings are maintenance free. If however a maintenance inspection is required by the plant, operator we recommend the following:

7.1 Capacity and Tan Delta measurements (see chapter 5)

Caution

Do not work on systems that might be under tension!

7.2 Recycling the bushing

The bushings are made with following components:

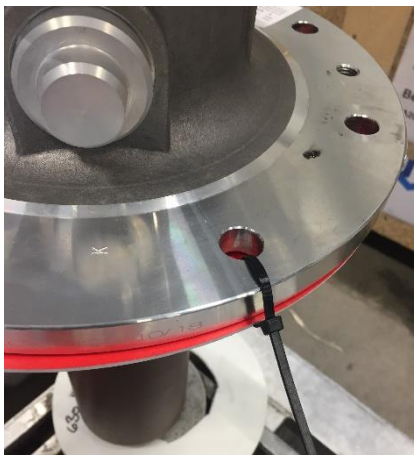
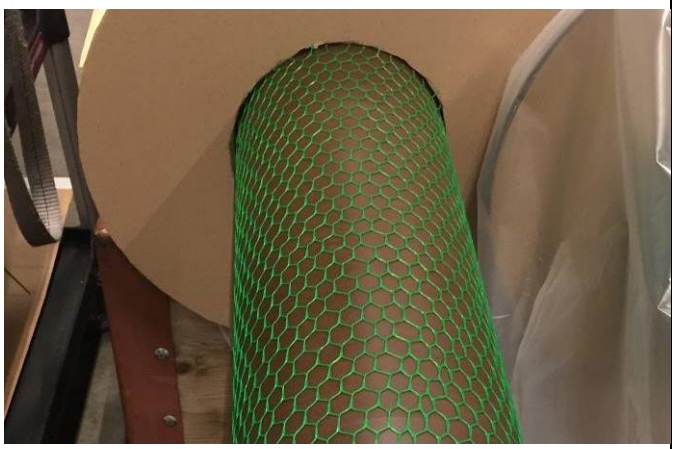
- Central tube or conductor made of aluminum or copper
- Active part made of resin impregnated paper or synthetic with aluminum foils
- Flange and head made of aluminum
- Cable bolt, split conductor made of copper
- Screws, bolts, pins, washer, covers, shields made of stainless steel or aluminum.

As most of these parts are fixed together, we preconize to cut the bushing in several parts.
None of the bushings contains any liquids.

8 Repacking of bushings

Use clean lifting slings to handle the bushing. Light bushings may be handled by hand.

All packing material originally delivered has to be reused.

	**1** If present, removable copper conductor has to be fastened on the bottom of the box
	**2** Place the protection disc below the flange to protect the flange and especially the sealing surface
	**3** Place the green net around the bottom part of the bushing

4

In case of a bushing with fix-conductor, protect the terminal and especially the contact surface

5

MGC recommend to pack at first in a separate bag the insulator then with a second bag the complete bushing.

Place at least one desiccant bag inside the bag containing the bushing, 6 months after the delivery replace it by a new one.

Remove the air from the bag and seal it

6

The bushing should be blocked against axial and radial movements with wooden rafters.

7

Electrode shield has to be protected with bubble wrap and packed in a card box

Others accessories have to be packed in a plastic bag fastened in the box

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or by flashing the QR Code