

	Topic	File name
Technical data	Busbars Duresca®	TD2015-03-E

Busbars Duresca®



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1. General

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

1.1 Safety



Work on busbars and earthing systems 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.



Caution - Do not work on systems that might be in operation!

Follow below safety rules in the given order.

- 1 Verify that the system is off-line
- 2 Disconnect from the mains
- 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 - Faulty earthing or open sleeve can be mortal!

This danger does not only exist in direct contact but can also occur in closeness by skip of a spark to the human body



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

Sensitive technical devices must be protected by appropriate measures.



Caution The sleeves are not protected against the ingress of explosive gases. Operating in such an environment is prohibited.

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1.2 Transport and Storage

The busbars and accessories are packed in wooden crates (Figure 1). 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.



Figure 1: shock indicators

In some cases, busbars can be directly packed on the truck trailer (Figure 5) or in a container (Figure 4).



Transport damage

- Visible damage must be reported on the counter signed delivery note at the reception of the goods.
- Moser Glaser shall be informed with no delay if a damage is reported

All material must be handled with care. Bumps and shocks are to be avoided. When lifting thin or long busbars it is absolutely important to use two belts and avoid sagging or twisting by its own weight as it might cause cracks in the insulation layer.



- Curved busbars are always to be raised with at least two belts to avoid unintentional twisting or tilting.

Busbars, bushings and fastening material may not be stored uncovered outdoor and must be protected all time long from moisture. The creepage distances of the busbars and sleeves (internal tube of the cylinder) must be kept free of dust and dirt.

Sleeves and busbar (contact areas) are delivered with protective covers against mechanical damage, dust and moisture.

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Attention

Do not remove protective covers from sleeves and busbars until immediately before assembly.



Additional actions against moisture have to be taken for storage longer than 1 month. Please contact Moser Glaser for further information



Figure 2: wooden crate



Figure. 3: Creeping distance protections



Figure. 4: container



Figure. 5: truck trailer

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2. Product description

The Duresca® busbar system

Duresca® is a fully-insulated, touch safe busbar system. The conductor is made up of a cylindrical aluminium alloy type EN AW-6101B T7, or of an electrolytic copper. The insulation lies directly on the conductor and consists of wrapped paper dried under vacuum and impregnated with epoxy resin. Conductive grading layers are embedded during the wrapping in the insulation for the electrical field control. An earth screen in copper of min. 50mm² is embedded in the insulation. It provides protection for the people and the installation in case of an exceptional earth fault.

At both ends of the insulation (towards the terminals of the busbars) the capacitive grading (grading length) ensures an optimal axial distribution of the field. At one side of the busbar the earth screen is passed to copper earthing ring. This earth terminal gets connected to the station earth when installing the busbars.

The single bars are manufactured in lengths up to 10 meters. For longer bus runs or by tight place conditions where only short pieces can be installed, the single busbars are joined together on site. The joints are flexible or rigid and are also electrically shielded by insulating sleeve. The single bars are custom made and their installation consists mainly of the easy assembly of standard components.

Duresca® busbars are available in two types:

Duresca® type DE

The insulation body is protected by a high quality corrugated tube in polyamide (PA12). Furthermore, the corrugation provides an increase of the creepage distance on the end of the busbar. The selected quality authorizes as well an indoor or outdoor use. The good behaviour in the severe climatic conditions was checked according to the ASTM Cd 2565 standard and tested in an independant laboratory. MGC has used this type of protection tube since 1987. Due to its high quality, the PA12 tube successively replaces all application areas of the metallic Duresca® DG busbars.

Duresca® type DG

In case of particular requirement the polyamid corrugated protection tube is replaced by an aluminum tube or at bow sections through a stainless steel corrugated tube. This particularly increases the mechanical protection of the busbar, long service life time in difficult operational areas can be guaranteed. Aluminum tubes and stainless steel tube are electrically connected, but, galvanically insulated against the earth layer by an insulating layer.

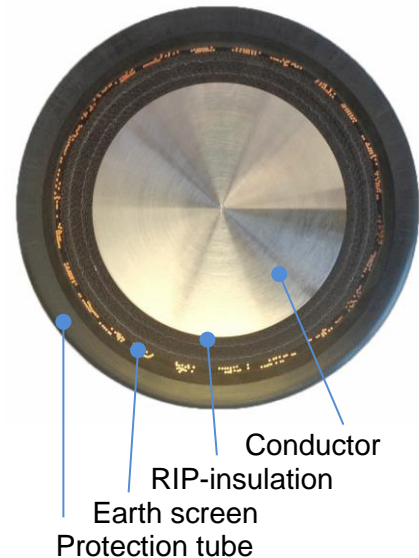


Figure 6: Cross section Duresca® busbar

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Sleeve (Cylinder)

The cylinders are mounted over the connections between two busbar pieces, fully insulate them and make the whole system touch safe. A distinction is made between non capacitive graded (up to 12 kV) and capacitive graded sleeves (above 12 kV).



Figure 7: Display model with cut busbars and sleeves

- **Insulated sleeve (up to 12 kV)**

The insulated sleeves consist of an insulating tube covered by an aluminum tube for mechanical protection. The aluminum tube is connected to the main earth to make the sleeve touch safe.

- **Duresca® sleeve (above 12 kV)**

The insulation of the Duresca® sleeves consists of wrapped paper dried under vacuum and impregnated with epoxy resin. For radial and axial electrical field control conductive layers are inserted in the insulation, which ensure an optimal repartition of field stress over the entire length of the sleeve.

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3. Earthing basics



Earthing must be executed according to corresponding MGC earthing diagram.

- Earthing diagram for DE-busbars ID111111
- Earthing diagram for DG- busbars ID222222
- Earthing diagram for individual project on request

3.1 Station earthing (customer supplied)

Providing a preferable low impedance earth connection is in the responsibility of the operator of the installation. This may be the earth of the power source (generator, transformer or switchgear housing).



Attention

If an insufficient earth connection is provided, the installation is not considered safe to touch. Moreover, it can damage the insulation over a longer period of time.

The number and position of the earthing points must be determined with MGC during the engineering design phase. If the busbars are extending several buildings, at least one earthing point per building has to be provided.

3.2 Arrangement of neutral point

The neutral point of a system is distinguished between

- low impedance earthing:
 - low current-limiting
 - low-resistance earth
 - solid neutral point

and

- high impedance earthing:
 - high current-limiting
 - insulated neutral point
 - resonance neutral point

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3.3 Earthing cable and guided type earth bar

The earthing points of the busbars and sleeves as well as mounting profiles, wall plates and covering boxes have to be earthed by connecting to the building earth.



Run earth cables as short as possible.



Devide the earthing into separate sections in case the busbar system extends over several buildings.

Preferably, a guided type earthing bar is performed parallel to the bus run. The earthing bar can be attached to the MGC double C-profiles. With low-impedance grounding a minimum distance of 0.5 m should be kept to the busbars (see Figure 8).

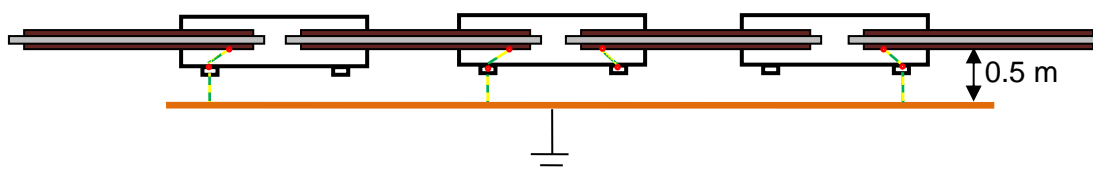


Figure 8: Guided type earth bar

The earth bar must be connected **only once** to the station earth otherwise earth loops are created

The recommendation is to have the earthing point in the middle of the busbar system. If the busbar system is connected to a gas-insulated switchgear, the earthing must be connected to it as close as possible.

If the busbars are extending several buildings, at least one earth bar per building has to be made.



Special case Low-impedance earthing (earth fault current 8 kA, 1s):

The maximal earth bar length should not exceed 40 m for 50mm² earth cable from the station earthing to the end of the earth bar, otherwise contact MGC.

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3.4 Earth loops

Alternating current flow generates an alternating magnetic field. Conductive loops close to this field do induce current which leads to undesirable heating.

Double earthing

To avoid earth loops (see figure 9) each element (busbar, sleeve, fastening, etc.) must be earthed only once. If necessary, install insulation elements. When connecting the fastenings to the building, make sure that the connection points are insulated. This is the only way to avoid unwanted double earthing.

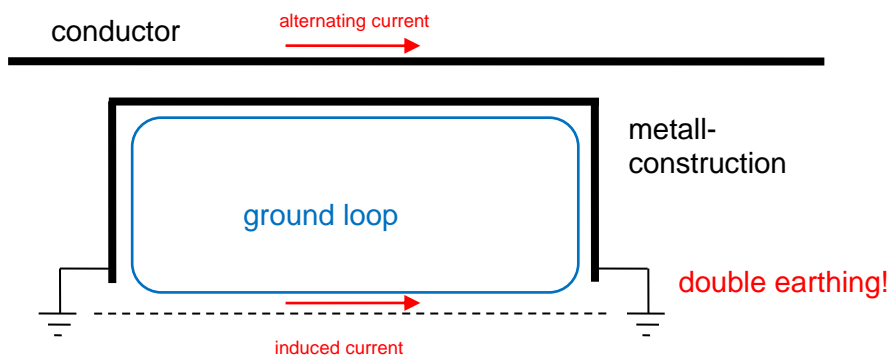


Figure 9: Double earthing leads to earth loops ☹️

Construction loops

Loops in metal constructions (see figure 10) need to be interrupted with insulating discs. This also includes existing metal constructions of the plant operator.

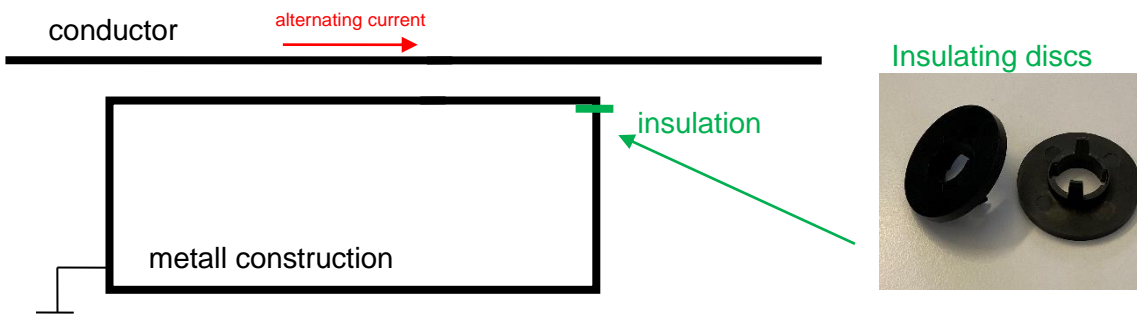


Figure 10: Loop in metal construction interrupted by insulation 😊

Missing insulation

Metallic parts must all be earthed to avoid floating potential. If not, partial discharges (PD) may occur, which lead to long-term material erosion and local hot spots. Partial discharges may disturb during on-site testing with PD measurement too.



Attention If a component is earthed more than once or insulating discs are omitted earth loops are the result!
(loops surfaces normal to the conductor direction are not critical)

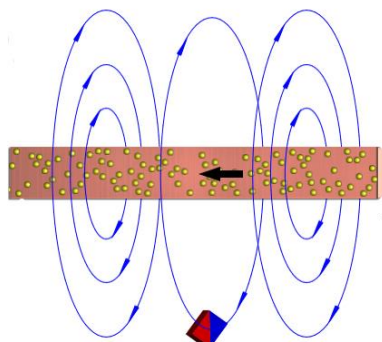


Each component (busbars, sleeves, fastenings, cover boxes etc.) made of conductive material must be earthed **once and only once**.

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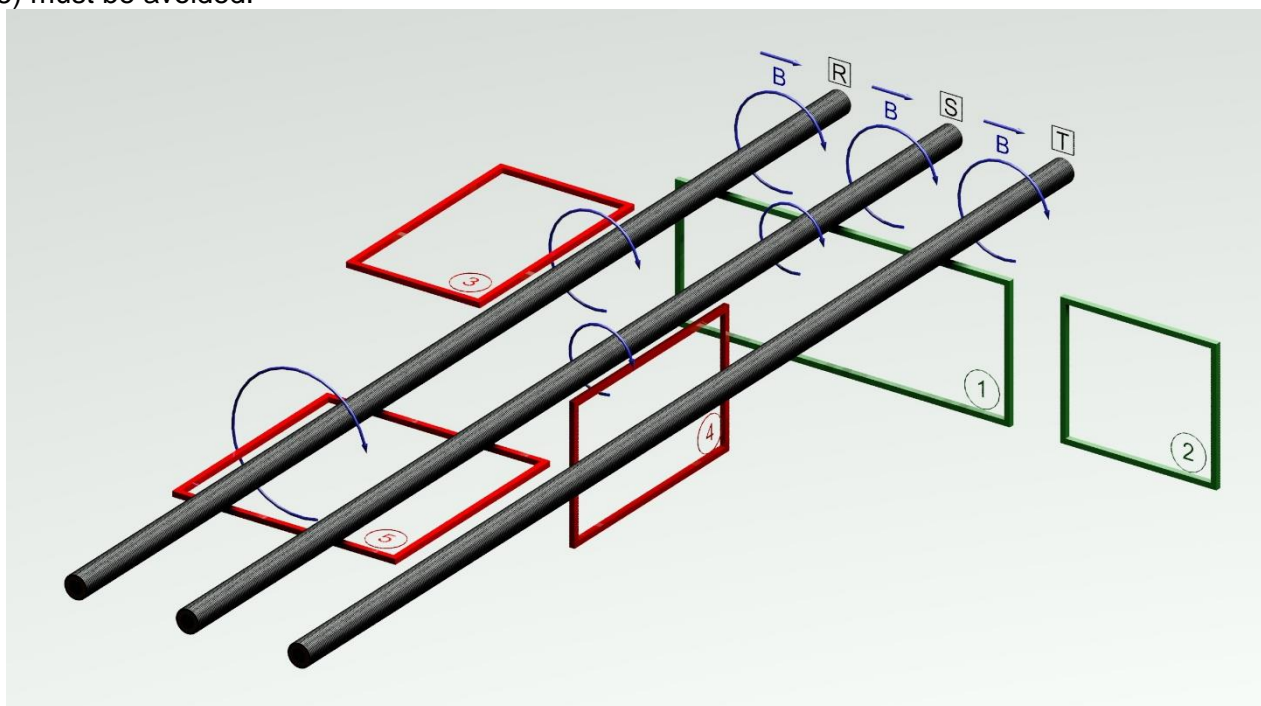
Application on Duresca® system:

A current flowing through a conductor produces a magnetic field around it, perpendicularly to conductor axis.



Therefore, the surroundings of Duresca® busbars are always submitted to an alternative (50 Hz or 60 Hz) magnetic field. As this cannot be avoided, exposed closed loops must not exist near to busbars.

Some loops, depending to their orientation regarding magnetic field direction, may be tolerated. The following sketch presents some loop configurations and they degree of exposition: green loops (Nr. 1 and 2) can be tolerated because parallel to magnetic field, whereas red loops (Nr. 3, 4 and 5) must be avoided.

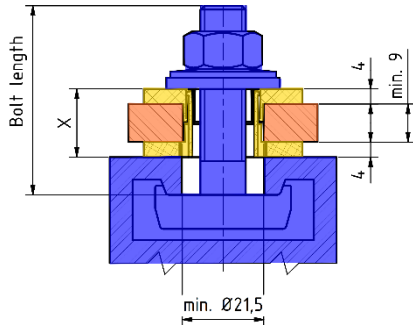


Attention: in case of bent busbars, each suspicious loop has to be checked to both busbar arrangements, before and after the curve!

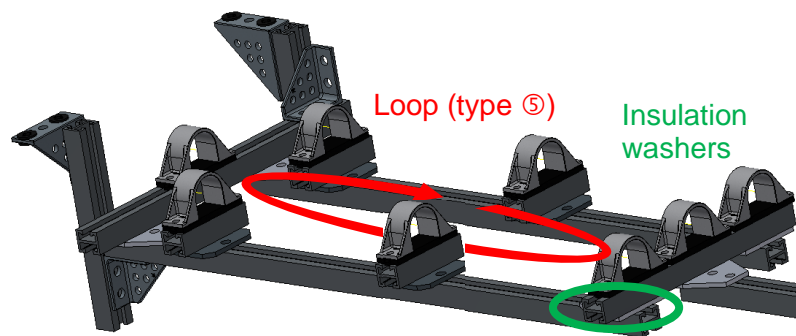
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Solution:

Each part should be connected only once to the main earthing conductor. For complex constructions with mechanical withstand requirements (like fastenings), several conductive part may need to be fastened to each other. The induced voltage ΔU is only a few Volts, so that a thin insulation in the loop avoids current to flow. For example, insulation washers (yellow/black) can be used in aluminium construction to insulate profile (violet) and console (orange).



Insulation washers as included in MGC delivery: presentation and assembly



Example of installation: insulation washers are required at 1 of the corners from rectangle loop

Note: In addition to loop effect, magnetic parts are also exposed to Eddie Currents when exposed to a magnetic field. This can only be solved by increasing distance to magnetic field source, i.e. Duresca® busbars. Please contact MGC for more details.

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4. Specifications

	Standard	Comments
Electrically		
Rated voltage U_m	-	see order confirmation
Power frequency withstand	-	see order confirmation
Dry lightning impulse voltage withstand	-	see order confirmation
Permissible earth fault current (insulation failure)	8kA during 1 second	other values on request
Cross-section earth layer	50mm ² (copper mesh)	other values on request
Mechanically		
Busbar type	DE 55 ... DE 192 or DG 60 ... DG 258	see order confirmation
Conductor material Al Conductor material Cu	EN AW-6101B T7 (AC041) Electrolyte copper (Cu-ETP)	see order confirmation
Protection tube DE	Polyamid (PA 12)	
Protection tube DG	Aluminum Stainless steel	
Outside diameter DE DG	55 ... 192 mm 60 ... 258 mm	corresponds to the type designation
Conductor diameter	30 ... 226 mm	see order confirmation
Busbar length	max. 10 m	
Busbar weight	-	see list of equipment
Application		
Permissible operation ambient temperature	-40 up to +40° C	other values on request
Permissible storage ambient temperature	-50 up to +60° C	other values on request
Altitude	up to 1000 masl	other values on request
Ingress protection busbars	IP 68	
Ingress protection sleeves	Standard sleeve IP 67 T-OFF sleeve IP 54	optional up to IP 68
Application	indoor / outdoor outdoor / indoor indoor / indoor outdoor / outdoor	

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5. Installation of busbars and sleeves



Only materials provided by MGC must be used (inclusive contact washers, contact grease and insulating discs).

5.1 Identification of parts

Description of List of equipment:

List of equipment

Order Number	group	Customer	Part list number
MGC Order no.	10	Customer name and Project name, station name, etc.	this list no. indicated in layout drawing

Level	Item	Part number	Description	material	weight	quantity	Res.
			Level 2 - Items indicated on layout				
			Level 3 - Items indicated on assembling group drawing				
			Level 4 - Items indicated on assembling group drawing				
			Level 5 -				
			Level				
2	1702	400.16.0475.B01	Fastening of DURESca busbars DE106 1702	assembling group	57,5	4 SZ	0
3	503	410.13.0004.B01	Fastening of the bars - für Schiene ø106	assembling group inside assembling group			
4	711	CC16340	Suspension screw M12x50	items inside assembling group			
4	810	CG46450	hexagonal nut M12 x 0,5 ISO 4035 / DIN 439 B	items inside assembling group			
4	826	CI47125	Washer ø13/ø30x3 stark	items inside assembling group			
4	838	CJ54120	spring washer ø13/ø28x1,5 SN 212745	items inside assembling group			
4	2353	414.13.0004.T01	Al-clamp ø106x60x225	items inside assembling group			
4	2379	416.13.0001.T04	Distance fishplate 60x15x225 ø106	items inside assembling group			
3	1350	462.13.0001.B01	Profil screw connection M12 Klemmlänge 1-10	assembling group inside assembling group			
4	710	CC16330	Suspension screw M12x40	items inside assembling group			
4	826	CI47125	Part number description: part number: 462.13.0001.B01 B04, etc. drawing number: 462.13.0001	items inside assembling group			
4	838	CJ54120	spring washer ø13/ø28x1,5 SN 212745	items inside assembling group			
3	1524	463.13.0007.B01	Mounting bolt M12 / 2 insulating disc Klemmlänge 1	assembling group inside assembling group			
4	805	CG23450	hexagonal nut M12 ISO 4032 / DIN 934	items inside assembling group			
4	827	CI47130	Washer ø13/ø36x4	items inside assembling group			
4	849	CI579	Part number description: part number: CG23450, etc... drawing number: single item, no drawing needed	items inside assembling group			
4	879	CF94		items inside assembling group			
3	2518	AC40500	Al-profile 50x60	single item inside assembling group			
3	2521	AC40500	Al-profile 50x60	single item inside assembling group			
3	2601	450.13.0007.T01	bracket 160	single item inside assembling group			
3	2670	451.13.0002.B01	Welding assembly with mounting strap P50x300	single item inside assembling group			
2	1703	400.16.0476.B01	Fastening of DURESca busbars DE106 1703		34,4	1 SZ	0
3	503	410.13.0004.B01	Fastening of the bars - für Schiene ø106		3,2	3 SZ	0

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All parts supplied by MGC can be identified by the Article- and Item-Number. This number is printed on a barcode label directly on the component or on the packaging for small parts such as screws.

Busbars and wall bushing do have a serial number additionally stamped on the terminal (flat pad or round conductor), usually on side near the earthing point



Sample: EA2019 . 0687 . 1 . 3

order from the year 2019 order number 0687 serial identification no 1 item no 3



Busbars do have two different numbers in the list of equipment:

Columnne “**Article Number**” = drawing number

Columnne “Remarks” = **Serial Number**

Sleeves do have the article number additionally stamped on the earthing lug.

Put the parts ready in the order in which they are to be installed, separated by unit (in case of several bus runs). Note the rules for transport under chapter 1.2.

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5.2 Unpacking and lifting

The Duresca® busbars can be packed in wooden crate, directly on a truck trailer or also in containers.

Small busbars could be taken out of the crate by hand.

For busbars with medium and heavy weight, use one sling, fixed at the gravity center.



Attention

Since the busbars have different sizes and shapes, especially concerning the bending angles, be careful when lifting the busbars as these can rotate on themselves..

For long busbars, use two slings to avoid any buckling of the material.



Curved busbars are always to be raised with at least two belts to avoid unintentional twisting or tilting.



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

Damage on the busbars must be reported immediately to MGC.



Attention

Do not use cutting tools to remove the protection foil as they might damage the silicone sheds.

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5.3 Fastening lifting

Preliminary assembly of the fastening

It is advised to pre-assemble the fastening and label them with the corresponding number. Note the fastening drawings and list of equipment. The AI-clamps do not have to be tightened as they have to be shifted again during the fastening of the busbar.



Marking of the busbar run

Prior to installation, the run of the busbars has to be transmitted from layout drawing to the building wall, floor or ceiling. It is usually sufficient to mark only the middle phase. Then the position of the individual fastenings including holes for anchor bolts have to be marked.



The fastenings are designed for static and dynamic loads. It is therefore important that the assembly and positioning take place according MGC layout drawing and detail drawings.

Insert the anchor bolts

The fastenings are fixed by anchor bolts. For porous brickwork adhesiv anchor bolts must be used. See also information on detail drawings or the manufacturer's instructions. Depending on the mounting height and weight of the busbars it can be helpful to use pulleys. For that reason additional anchor bolts can be placed and provided with ring nuts on requests.



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Installation of the fastening

Each fastening has to be electrically insulated from the wall, whatever the wall material. Use insulated disks like shown on above picture to ensure no contact between anchor bolts and fastening construction. Test this non-continuity to avoid further complicated investigations. The individual busbars are held in place by clamps at several points. For the installation of the sleeves, additional space for shifting the sleeve behind the high current connection, is required. It might be therefore necessary to skip a fastening or to place temporary at a different position until the sleeve has been finished.

Fastenings for DG type busbars are distinguished between “sliding” and “rigid”. The “sliding” clamps have an additional washer which allows linear expansion of the busbars due to temperature changes.



DG busbars: For control reason, mount the additional washer for “sliding” type clamp directly below the clamp so that it is visible from outside.

5.4 Installation of busbar (and sleeve)

Installation The busbar system must be installed according to MGC layout drawing and assembly drawings.

For all installation work, the country-specific regulations and requirements from other manufacturers for those components also must be respected.

All high current connections must be carried out according to the instructions indicated on the assembly drawings.



Attention Busbars must not be bent into shape for fitting inaccuracies!



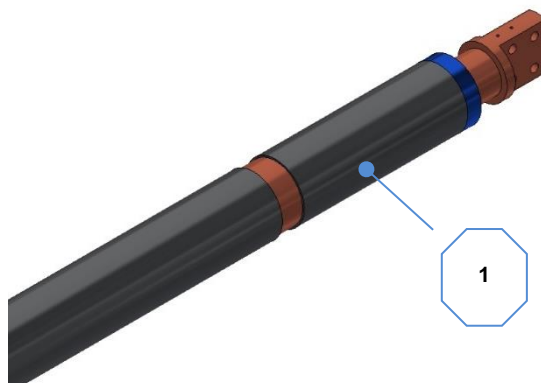
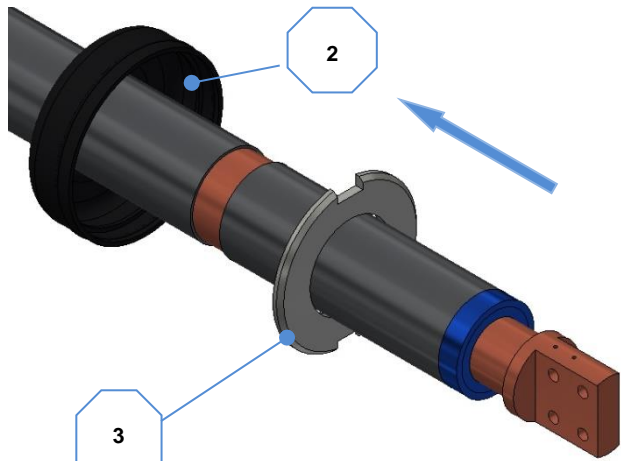
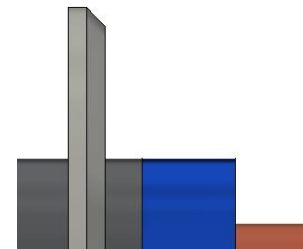
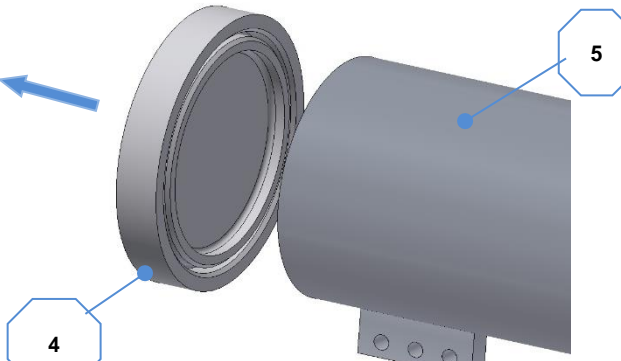
Attention Damaged components must not be installed! Damage must be reported immediately to MGC.



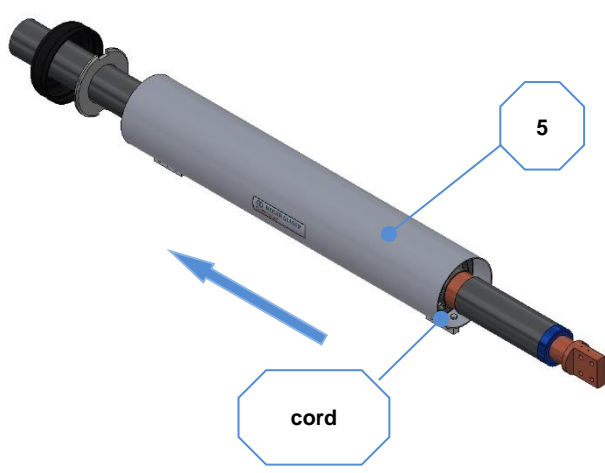
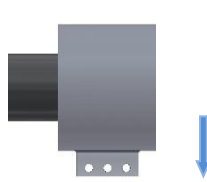
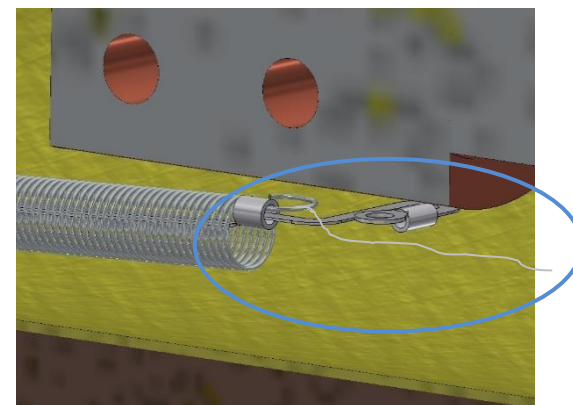
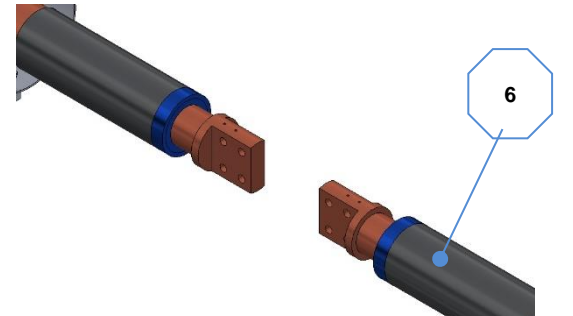
Busbars type DG: Protect the busbars with some cardboard while installing the sleeve as the red painted part may be easily scratched.

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5.4.1 Mounting of busbars and first step assembly for the sleeve

 <p>Diagram showing the first busbar (1) being installed into the sleeve. The busbar is a long, dark grey cylindrical component with a blue ring and a red terminal at one end. A blue dot points to the busbar, which is labeled with a circled '1'.</p>	<p>1 Install first busbar (1)</p>
 <p>Diagram showing the rubber bellow (2) and centering ring (3) being pulled over the busbar. The rubber bellow is a black ring, and the centering ring is a grey ring. A blue arrow points towards the busbar, indicating the direction of assembly. The components are labeled with circled '2' and '3'.</p>	<p>2 Pull the rubber bellow (2) and the centering ring (3) with chamfer inwards, over the busbar.</p>  <p>Cross-section diagram showing the rubber bellow and centering ring being pulled over the busbar. The busbar is a dark grey cylinder with a blue ring and a red terminal. The rubber bellow is a black ring, and the centering ring is a grey ring. A blue arrow points towards the busbar, indicating the direction of assembly.</p>
 <p>Diagram showing the dust cover (4) being removed from the sleeve (5). The dust cover is a grey ring, and the sleeve is a grey cylindrical component. A blue arrow points away from the dust cover, indicating its removal. The components are labeled with circled '4' and '5'.</p>	<p>3 Remove dust cover (4) from sleeve (5).</p>

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	<p>4</p> <p>Pull the sleeve (5) carefully over the busbar and protect with clean cloth from dust. The provisory cord should be placed on the “open side”. In case of horizontal mounting position, the earthing lug should be facing down. In case of small phase distance rotate the sleeve between 30° and 45°, to the normal position</p> 
	<p>5</p> <p>Duresca® sleeves (above 12 kV): inside of the sleeve the high voltage spring must show towards flat pads after pulling the sleeve on the busbar. If not, rotate the sleeve carefully until position is reached. The high voltage spring has to be installed after the high current connection and is described in section 5.4.4.</p>
	<p>6</p> <p>Install second busbar (6)</p>

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5.4.2 High current connection

There are flexible high current connections between busbar system and station unit (eg transformer, switchgear etc.) and within busbar system between individual busbars. They consist of braided or laminated copper connectors and the appropriate fastening material.

If at least one contact surface is of bare aluminum contact discs must be used to achieve the required ampacity and avoid long term oxydation.

contact surface Al/Al, Al/Cu, Al/Ag (silver), Al/Zn (tin)

⇒ **connection with contact discs**

contact surface Cu/Cu, Cu/Ag (silver), Cu/Zn (tin), Ag/Ag (silver/silver)

⇒ **connection without contact discs**



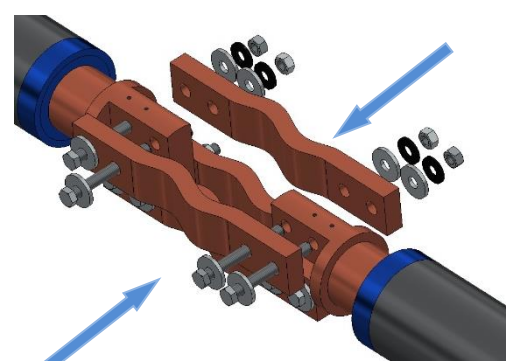
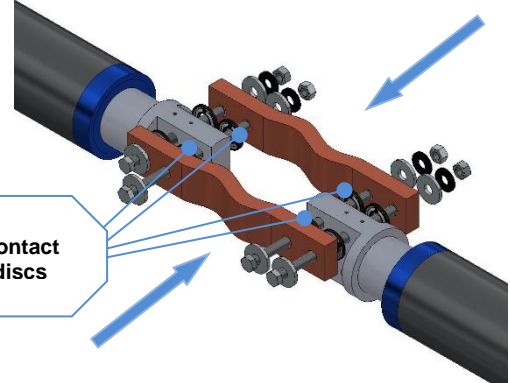
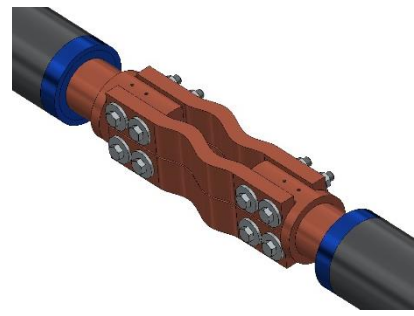
Using unsuitable material pairing will lead to long term contact corrosion and thus excessive heat can occur.



The high current connection must always be carried out according layout drawing (connection to unit) or drawing of sleeve (between busbars). Only materials provided by MGC must be used.

	<p>1</p> <p> Except for silver or tin plated connections</p> <p>Clean contact surface carefully with a 3M Scotch – Brite pad</p> <p>Remove metal dust with a clean cloth and grease the clean contact surface immediately with a thin layer of contact grease P1. (supplied by Moser Glaser)</p>
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 <p>2a without contact discs</p>  <p>2b with contact discs</p>	<p>2a) without Contact discs</p> <p>Mount screwing, pay attention to the order of the individual parts shown on the drawing (screw, washer, etc.)</p> <p>Screw head, washer, band, flat pad, band, washer, spring washer, nut.</p> <p>2b) with contact discs</p> <p>Mount screwing, pay attention to the order of the individual parts shown on the drawing (screw, washer, etc.)</p> <p>Screw head, washer, band, contact disc, flat pad, contact disc, band, washer, spring washer, nut.</p> <p>Coat fully both sides the slots of the Contact Discs with an thick layer (about 2mm thick of both sides) of KP contact protection grease P1 delivered. The concentric Ring with sharp edges of the disc, must be fulfilled completely with contact protection grease P1</p>
	<p>3</p> <p>Tighten screwing with torque wrench according table 1 or according drawing specification</p>

Metric thread	Torque [Nm]	Torque [ft.lb]
M5	4	2,9
M8	22	16,2
M10	43	31,7
M12	75	55,3
M16	120	88,5

Table 1: Torque for high current and high voltage spring screwing



Check the torque of the high current screwing after 20 minutes again. Screws which have this value of torque are ok. Screws having a torque value less than indicated must be tightened at the value indicated above.

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5.4.3 High current connection, mounting instruction flexible connector (round connector)

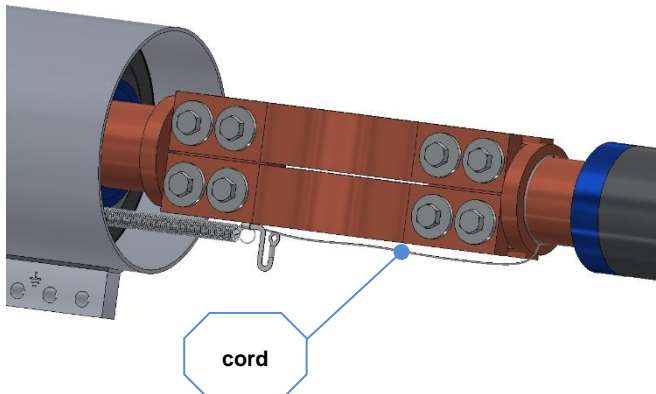
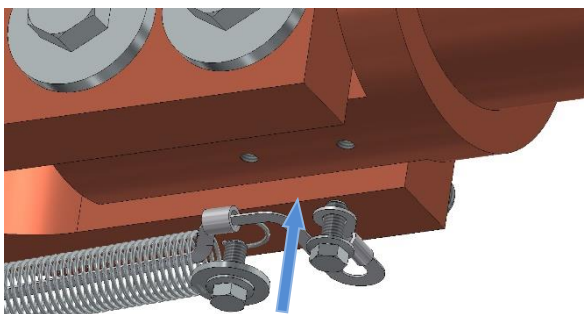
See additional instructions **SFV190143-001** (*see additional document*)



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5.4.4 High voltage spring connection (only above 12kV)

Duresca® sleeves (above 12 kV) have a high voltage spring inside the cylinder to connect the first grading layer inside the sleeve insulation with high voltage potential (busbar terminal).

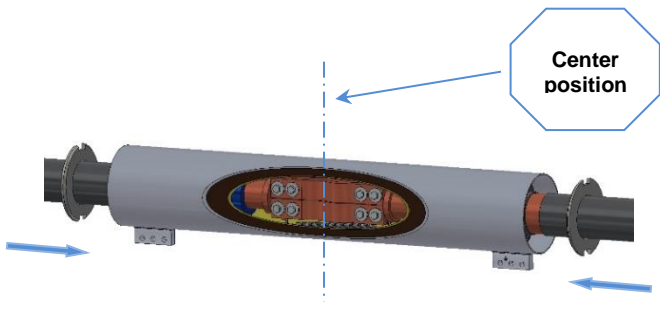
	<p>1</p> <p>This spring has to be pulled out of the cylinder by the provisionally fixed cord and attached to the flat pad of the opposite busbar so that the spring goes straight after closing the sleeve.</p>
	<p>2</p> <p>First, fix the spring with a M5 screw and washers like shown (left screw). Then, fix the flex also with a M5 screw and the washer like shown (right screw).</p>



Attention An incorrectly assembled high voltage spring can cause a flashover and thereby not only destroy the sleeve and the busbar, but also be dangerous for life.

5.4.5 Second step assembly for the sleeve

In case of vertical sleeve, mount the clamp jaw according sleeve drawing

	<p>1</p> <p>Pull sleeve over the high voltage connection to its center position and mount with centering rings according assembly drawing of the sleeve.</p>
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5.4.6 Earthing the busbars



Caution Do not work on busbars which are live and do not work on their earthing (see chapter 1.1).

	<p>1</p> <p>Duresca® busbars have a copper ring for capacitive earthing (≡ c) at one side.</p>
	<p>2</p> <p>Each busbar must be earthed on this copper ring with an earthing clamp. Mostly, the capacitive earthing is inside a sleeve and connected there.</p> <p>Torque for earthing clamp screwing: M10 = 16Nm / 11.1ft.lb</p> <p>Duresca® busbars type DG have, additionally to the copper ring, also the protection tube made of aluminum and / or stainless steel earthed. Since all parts of protection tubes are connected between each other, and tube has to be earthed at one point only. This point is marked on the assembly drawing with the characters ≡ m (earth metal parts).</p>

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Caution Faulty or missing earthing can be **mortal!**

This danger does not only exist in direct contact but can also occur in closeness by skip of a spark to the human body



DE type busbars (PA protection tube) are earthed on the copper ring ($\frac{1}{c}$).
 DG type busbars have an additional earthing on the metal protection tube ($\frac{1}{m}$).



Duresca® busbars are touch-safe in fully assembled and correctly earthed condition.

5.5 Check sleeve and installation according checklist

5.5.1 Checklist FL2011-6 and CL2015-03 (see additional documents)

Each sleeve has to be checked according checklist FL2011-6 and separate formular filled up. After installation, a final check according MGC checklist (CL2015-03) has to be performed.



To get full warrantee it is mandatory to send a completed and signed copy of checklist CL2015-03 and also each sleeve checklist FL2011-6 to MGC.

Checking the fastening for unwanted contact points

No unwanted contact point between fastening and station earth are acceptable in order to avoid earth loops. This is tested by disconnecting the earthing from the station earth and measuring the resistant with an ohmmeter at max. 50V DC. If the measured resistance is not > 100 MΩ, a contact point exists and has to be detected and insulated. After checking, the system with all metallic parts have to be connected again with the station earth!



Attention After checking, connect again with station earth!



Caution If a busbar has no earthing it can be **mortal!**

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5.6 Closing the sleeves



Hint It is recommended to wait with closing the sleeves definitely until the entire busbar system (busbar run) has been mounted. This makes it easier if any position have to be corrected. If the environment is very dusty, close the inside of the sleeve provisionally. For example with plastic foil..

Procedure

1. Check if all busbars are in the final position – correct if necessary
2. Check if the high voltage spring inside the sleeve is connected (see chapter 5.4.3)
3. Check the earthing of the busbar inside the sleeve (see chapter 5.4.5)
4. Clean the area where the electrical field is controlled with clean textile cloth
5. Open the vacuum packaging of the desiccant bags and put them in the sleeve between centerring and rubber below, see picture below
6. Make an Protokoll who closed the sleeve and at what time. A photo of the connected high voltage spring, the connected earth connection and the desiccant bag is recommended.
7. Close the sleeve with the rubber bellows

5.6.1 Dessicant bags

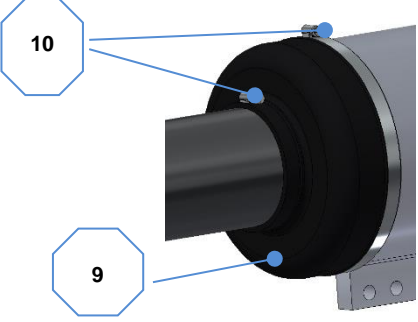
In each sleeve at least one desiccant bags must be inserted (see instruction on drawing of sleeve). The desiccant pack prevents ingress of moisture in the sleeve insulation.

	<p>1</p> <p>Put the desiccant bags with closed vacuum packaging into the sleeve. Wait until all other jobs have been done before you open the vacuum packaging. After opening the packaging, the sleeve must be closed within 30 minutes with the rubber bellows.</p>
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Attention Desiccant bags, which were longer than 30 minutes in an open state may not be used!

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	<p>2</p> <p>Close the sleeve on both sides with the rubber bellow (9) and the two hose clamps (10)</p> <p>Torque moment for the clamps: 4,5Nm (or 3,32 lbft)</p> <p>The system is IP67, no additional grease or sealing paste is required</p>
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5.7 Earthing of the metal protection tube ($\frac{1}{2} m$) – DG busbars only

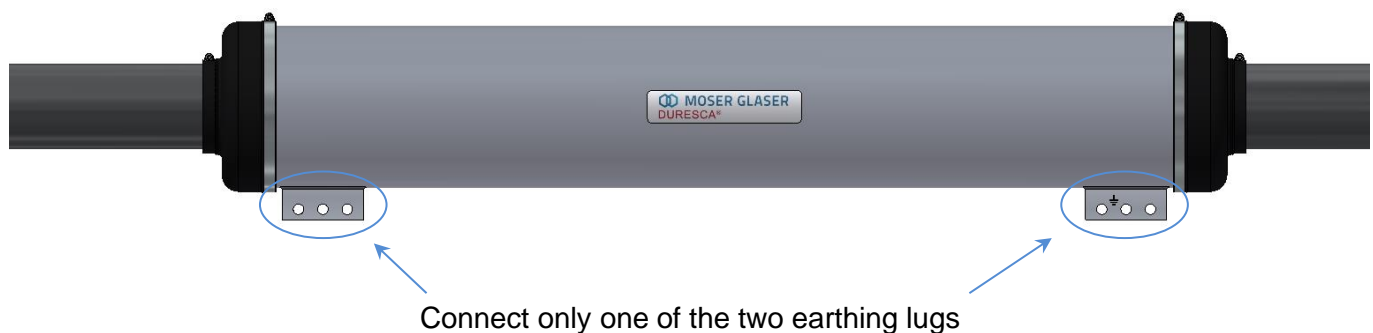
Duresca® busbars type DG have capacitive earthing ($\frac{1}{2} c$) **and** metal part earthing ($\frac{1}{2} m$). Since the protection tube made of aluminum and stainless steel forms one unit only one (additional) earthing clamp is required. A ring is free of coating and should be used to earth protection tubes. On the assembly drawing the side for the metal earthing is marked with $\frac{1}{2} m$.



See safety instructions on chapter 1.1

5.8 Earthing of the sleeve ($\frac{1}{2} z$)

The earthing of the sleeves must be carried out according to the assembly drawings. One earthing lug has to be connected, the second lug must **not** be used.



Procedure

1. Clean earthing lug with a 3M Scotch-Brite pad
2. Remove metal dust with a clean cloth
3. Grease the contact area immediately with a thin layer of contact grease P1
4. Connect maximum two cable lugs per screw – one on each side of the lug. Use additional holes on the same earthing lug, if more cables are required.

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Caution If a sleeve has no earthing it can be **mortal!**

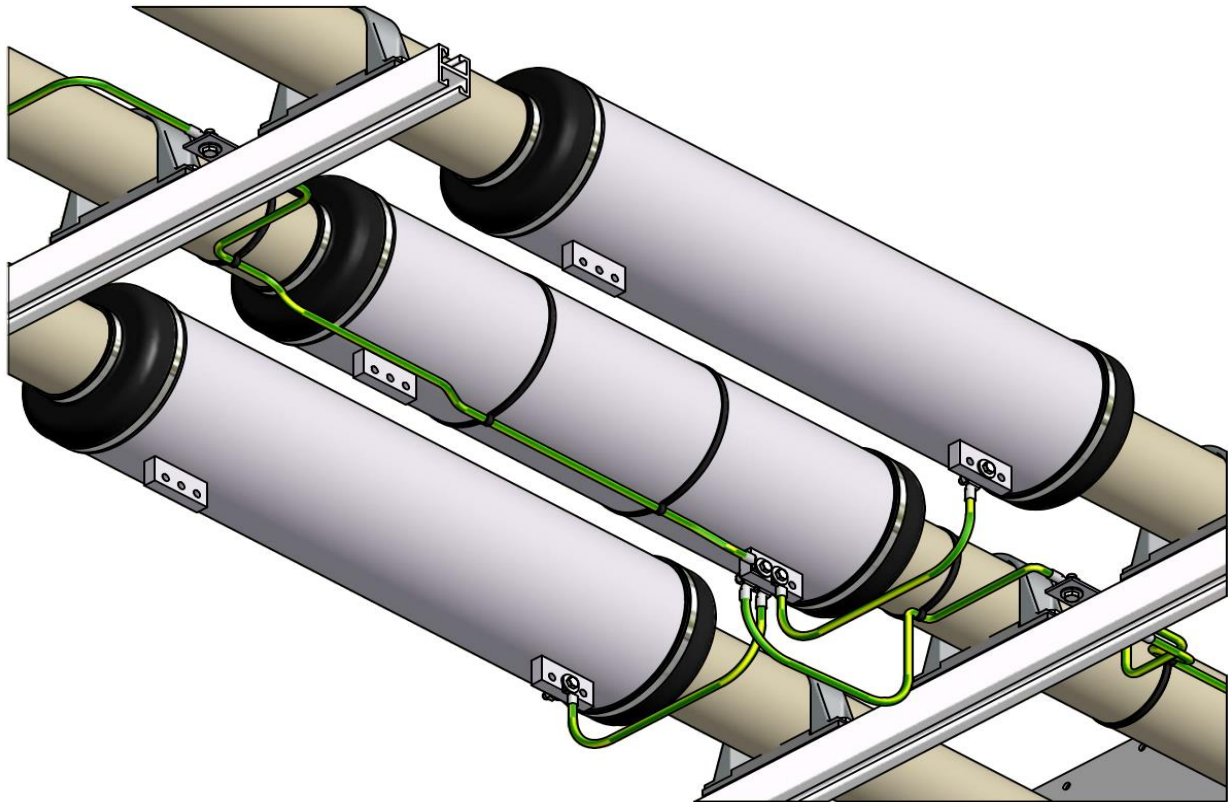


Figure 11: Earthing wiring of sleeves with earth lugs facing down, connected on **only** one side

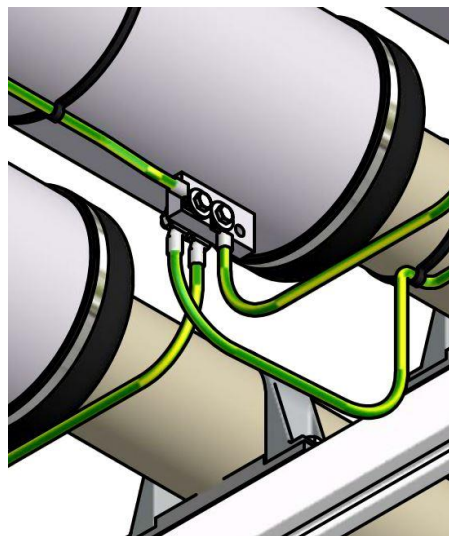


Figure 12: maximum two cable lugs are allowed per screw – one on each side

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5.9 Earthing of the fastening (≠ m)

Earth loops in fastenings in flow direction must be avoided (see also chapter 3.4). Insulation elements (insulating discs) specified on the fastening drawing must be used to interrupt loops.

Serial linking of elements is permitted, providing no earth loops occur. The earthing has to be made exclusively through earthing cable (standard 50mm²). Metal parts such as aluminum C-profiles must not be used as an earth conductor. Use provided tin-platted copper plates to connect main earthing cable with fastening profiles.

Checking the earthing of the fastening and optional components (≠ m)

Fastenings have to be checked using an ohmmeter for unwanted contact points to the station earth. The insulation value between fastening and station earth must be > 100 MΩ (test voltage max. 50V-DC) before connecting.

If there are unwanted contact points, locate them and correct according drawing. After testing, the earthing has to be connected to the station earth!



Caution All fastenings (including short circuit bridges between busbars) have to be earthed!

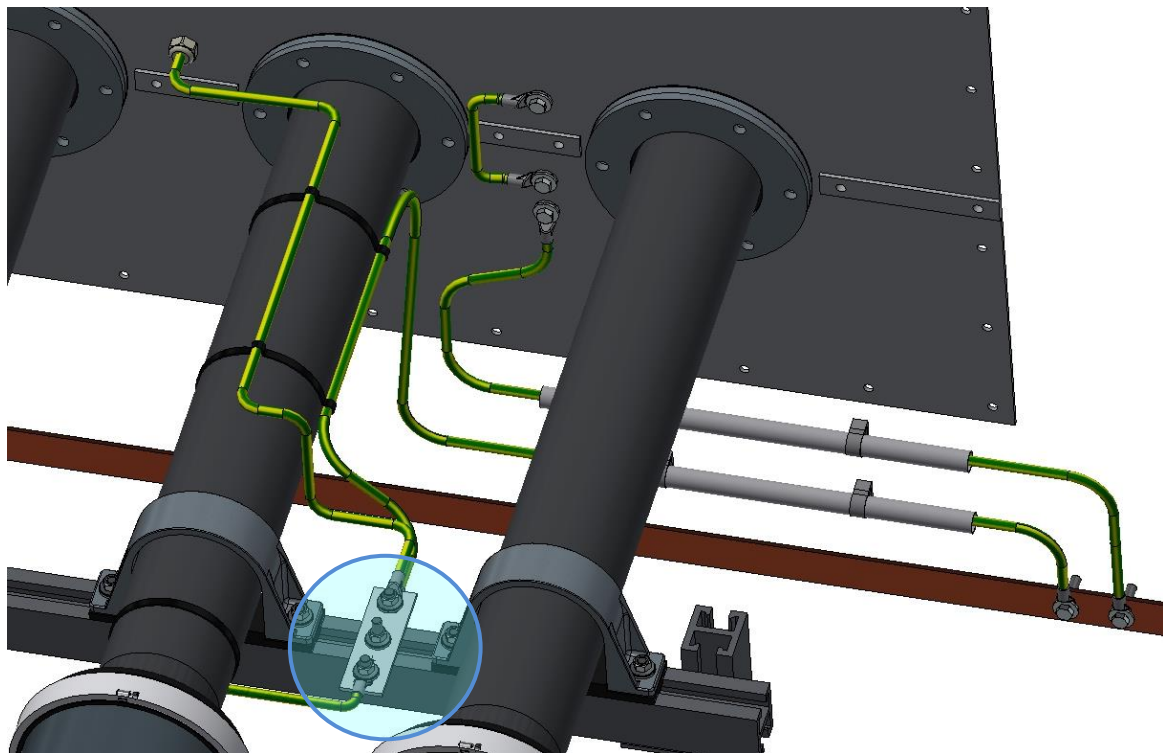


Figure 13: Fastening connected with earthing plates

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6. Installation of optional components

6.1 Installation of busbars with SF6 plugs



Before installation, each SF6 plug must be cleaned with a cleaning agent (ethanol) and fusselfree rag.



Before installation, read, check and follow the instructions of the switchgear manufacturer.

6.1.1 Siemens SF6 plug (Siemens 8DA / 8DB Switchgear)

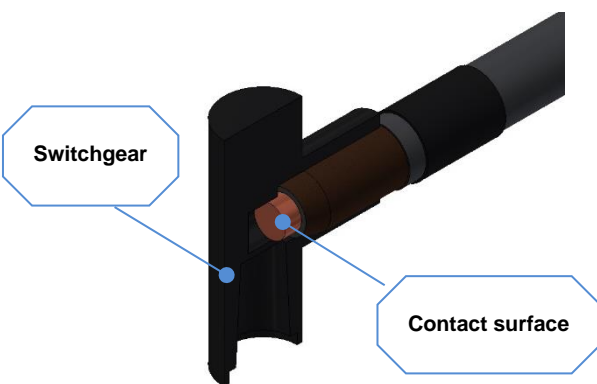
<p>The diagram shows a cross-section of a Siemens SF6 plug. A blue callout box labeled 'groove' points to a circular groove on the outer flange. Another blue callout box labeled 'lamellas' points to the contact surface inside the plug.</p>	<ul style="list-style-type: none"> - Remove carefully the protection cover from the SF6 plug - Clean busbar end and O-Ring groove on the flange with fusselfree rag and some cleaning agent (ethanol) - Put a thin layer of contact grease P1 on the contact lamellas (see list of equipment for grease) - insert O-Ring in the groove and install the busbar straight in the SF6 housing <p>Note: The O-Ring is not in MGC scope of supply, please contact switchgear manufacturer.</p>
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6.1.2 Siemens NX- Plus plug

<p>The diagram shows a cross-section of a Siemens NX- Plus plug installed in a switchgear. Blue callout boxes identify the 'Contact surface' on the busbar, the 'Switchgear' housing, the 'lamellas' on the contact surface, and the 'Contact ring' on the busbar end.</p>	<ul style="list-style-type: none"> - Remove carefully the protection cover from the SF6 plug - Check the position of the busbar contact. The end should be in the correct position before installing the busbar, if not correct it by hand - Clean busbar end with fusselfree rag and some cleaning agent (ethanol) - Put a thin layer of contact grease P1 on the contact surface (see list of equipment for grease) - Use assembling paste (indicated on the drawing) on the busbar end for sliding into the SF6 housing - install the contact ring in the SF6 housing - install the busbar straight in the SF6 housing
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6.1.3 Siemens NX- Plus C plug

	<ul style="list-style-type: none"> - Remove carefully the protection cover from the plug - Clean busbar end with fusselfree rag and some cleaning agend (ethanol) - Put a thin layer of contact grease P1 on the contact surface (see list of equipment for grease) - Use assembling paste (indicate on the drawing) on the busbar end for sliding into the silicone housing - install the busbar straight in the silicone housing <p>Note: The T-Silicone plug is not in MGC scope of supply, please contact switchgear manufacturer</p>
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6.1.4 Schneider SF6 plug

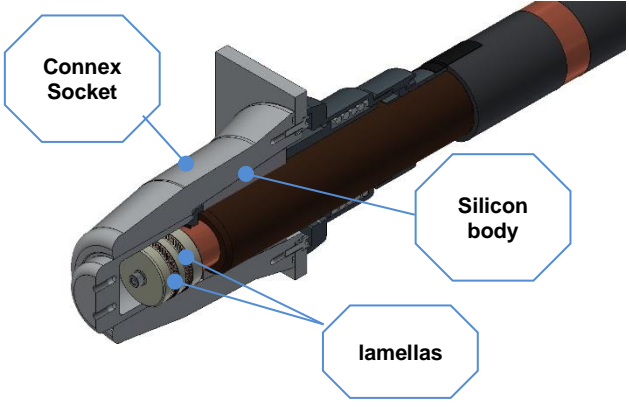
	<ul style="list-style-type: none"> - Remove carefully the protection cover from the SF6 plug - Clean busbar end and O-Ring groove with fusselfree rag and some cleaning agent (ethanol) - Check the surface for contact lamellas. - Put a thin layer of contact grease P1 on the surface for contact lamellas (see list of equipment for grease) - install the busbar straight in the SF6 housing <p>Note: The O-Ring is not in MGC scope of supply, please contact switchgear manufacturer.</p>
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6.1.5 HICO SF6 plug

	<ul style="list-style-type: none"> - Remove carefully the protection cover from the SF6 plug - Clean busbar end and O-Ring groove with clean cloth and some cleaning agent (ethanol) - Put a thin layer of contact grease P1 on the surface for contact area (see list of equipment for grease) - Insert O-ring in the groove and install the busbar straight in the SF6 housing <p>Note: The O-Ring is not in MGC scope of supply, please contact switchgear manufacturer.</p>
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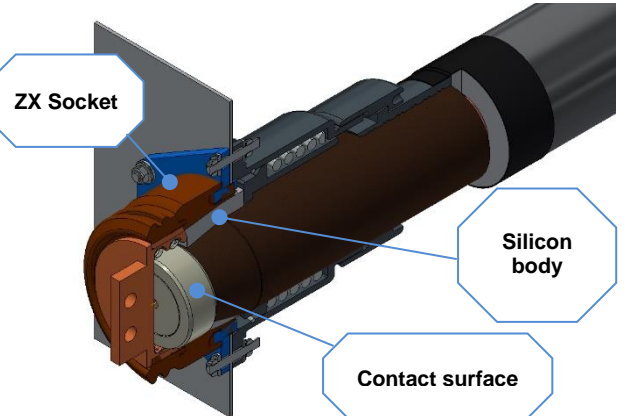
6.1.6 Pfisterer plug (Connex 3 and 4)



- Remove carefully the protection cover from the plug
- Check the contact lamellas.
- Put a thin layer of assembling paste (indicated on the drawing) on the silicon body
- Put a thin layer of contact grease P1 on the contact lamellas (see list of equipment for grease)
- install the busbar straight in the SF6 housing

Note: The connex socket is not in MGC scope of supply, please contact switchgear manufacturer

6.1.7 ABB ZX plug



- Remove carefully the protection cover from the SF6 plug
- Put a thin layer of silicon grease on the silicone body
- Put a thin layer of contact grease P1 on the contact surface (see list of equipment for grease)
- install the busbar straight in the SF6 housing

**Torque for earthing clamp screwing:
M8 = 12,5Nm / 9,2ft.lb or instruction from switchgear supplier**

Note: The ZX socket is not in MGC scope of supply, please contact switchgear manufacturer

General Installation information for every Plug In type Connection

- To ensure that the plug does not jam, support the busbar with the fastening and adjust until it is parallel.
- Slide the SF6 plug carefully into the GIS socket until both flanges touch (except for plugs with silicone bodies where tightening screws is necessary to make the flanges touch). Take care to not damage the sealing. **Do not use a hammer!**
- Fit all the screwing material of the flange according drawing.
- Tighten the fastening without causing lateral forces to the busbar



Follow the instructions of the switchgear manufacturer.

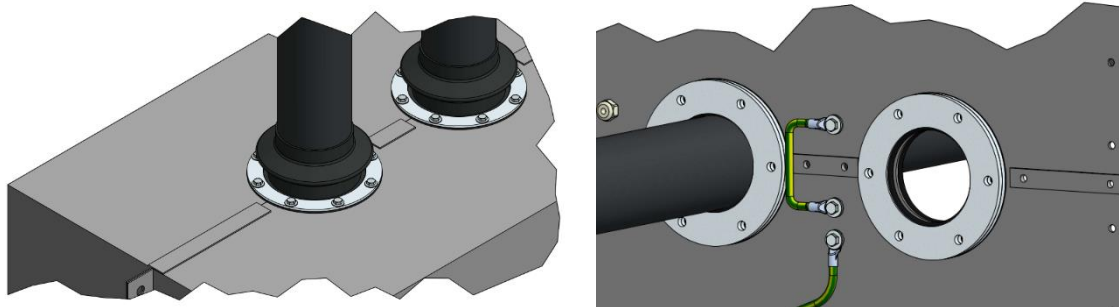
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6.2 Flanges and gaskets



Attention Sealing bellows and other materials made of silicone rubber must not be rubbed with silicone grease, as silicone grease destroys the silicone rubber.

For details see corresponding drawing.



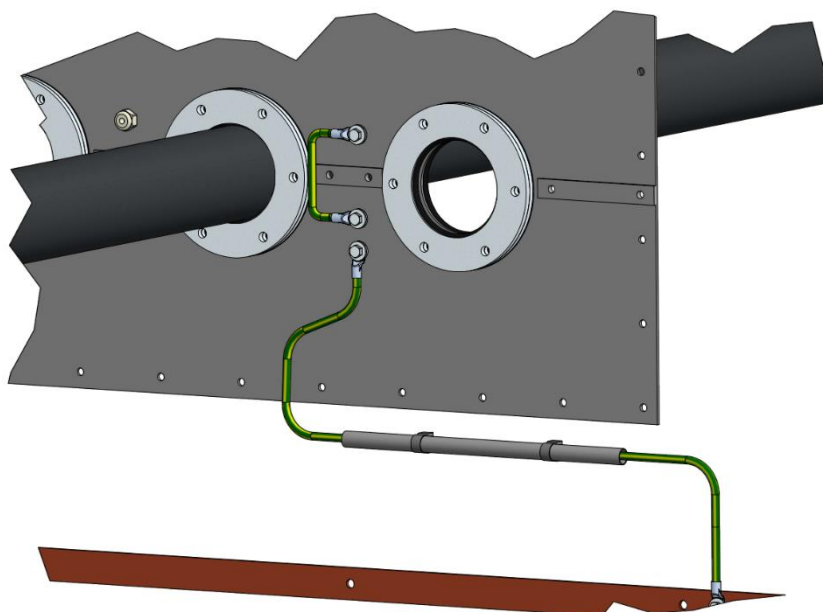
6.3 Earthing of optional components (\neq m)



Caution All optional components such as cover boxes or wall plates must be earthed!

Serial linking of elements is permitted, providing no earth loops occur. The earth cable should be as short as possible.

The earthing has to be made exclusively through earthing cable (standard 50mm²). Metal parts such as aluminum C-profiles must not be used as an earth conductor.



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6.4 Offshore - facilities



The earthing of the fastening is a special case and should be carried out in consultation with the customer.



Because of the corrosive environment all earthing lugs (earth lugs of sleeves, fastening, station earth etc.) including screwing must be sealed.

Corrosion protection for earthing lugs:

1. Wrap cable and cable lug with two layers of Anti-Corrosion Tape BK80050 and then fix it with a heat shrink tube.
2. Connect cable lug to the earth lug.
3. Wrap the whole connection with two layers of Anti-Corrosion Tape BK80050.
4. Secure bandage with PVC tape BK45100.

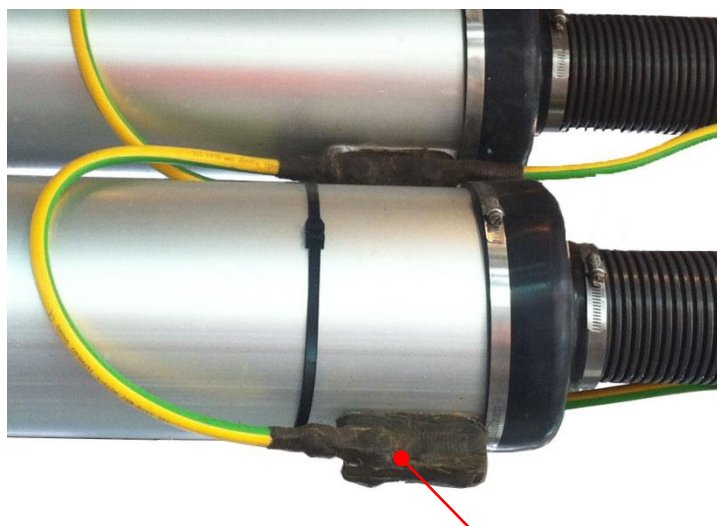


Figure 14: Earthing cable and earthing lug with Anti-Corrosion bandage

6.5 Fire barrier

By default, no fire barrier will be installed. On customer request the following options are available (see instructions):

Fire resistance class	implementation	instructions
S90	firestop wall boards CP673	AA 04 0001-E
S120	firestop mortar CP 636	AA 04 0002-E

Table 2: fire protection

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7. Checklist and information for Duresca® busbars before commissioning

7.1 Checklist for test for Duresca® Busbars before commissioning CL2015-03

See additional document.

7.2 Acceptance test report / Taking over certificate FL2005-1 *(optional)*

Insulation resistance test

Optional test to generate comparative resistance values for long term studies. The resistance is measured with a Megger MIT resistance tester or comparable equipment. The DC voltage (2...10kV) is applied between conductor and earthing. The insulation resistance should be 1000MΩ or more.

High voltage test

Optional test to ensure no major damage occurred during transport and installation. The test is usually performed with DC voltage to minimize the required power supply.

Taking over certificate FL2005-1 *(optional, see additional document)*

Fill out after test on Site.

7.3 Info test on Site 1020FL00001 *(guideline, see additional document)*

See table in the additional formular for Test voltage after installation.

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8. Maintenance

Duresca® busbars are maintenance-free. If however a maintenance inspection is desired by the plant operator (for example as part of a block revision), we do recommend the following:

Earthing

- Check earthing cable visually for damage
- Check earthing cable for discoloration (scorch marks)
- **Optional corrosion protection:** Remove anti-corrosion bandage at earth lugs at random, visually inspect for corrosion, replace if necessary and install new bandage

Busbars

- External visual check for cracks and damage
- Thermovisions pictures to identify earth loops
- In case of heavily soiled busbars clean the grading length with warm soapy water and dry with soft cloth
 - o DURESCA® DE: grading length = white mark to terminal (Figure 15).
 - o DURESCA® DG: grading length = red painted part

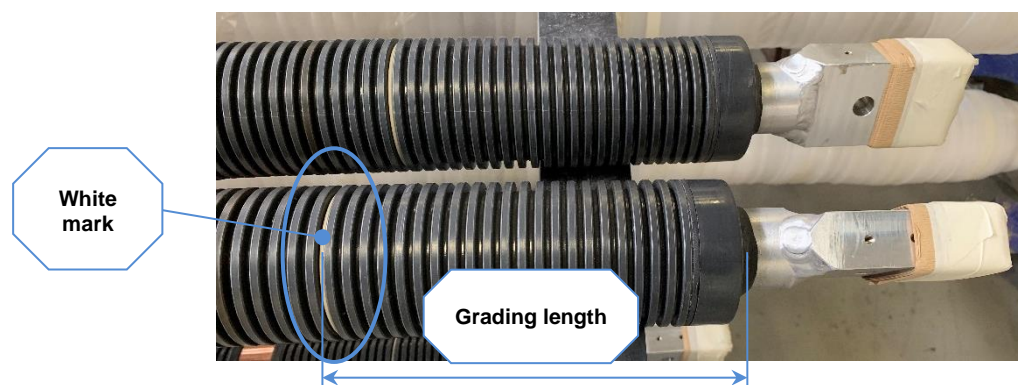


Figure 15: Grading length from white mark until end of isolation (DURESCA® DE Type)

Sleeves

All sleeves:

- Check outside visually for missing, broken or discolored parts

Every sixth sleeve:

- Open sleeve and record the state of desiccant bags
- Check rubber bellows for cracks
- Check inside visually for discoloration or corrosion
- Check inside visually for position of high voltage spring
- Replace desiccant bags and close sleeve immediately

High-current connection at transformers

- Open transformer cover box
- Check high-current screwing visually for corrosion and discoloration (heating) and torque

Fastenings

- Check visually for corrosion and discoloration (heating)
- Check for broken or loose parts

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8.1 Recycling the busbarsystem

The busbars are made with following components:

- Central tube or conductor made of aluminium or copper
- Active part made of epoxy resin impregnated paper with conductive grading layers (aluminium)
- DG protection tube made of stainless steel
- DE protection tube made of Polyamid 12
- Screws, bolts, pins, washer made of stainless steel
- Fastening clamps made of aluminium or plastic
- Flanges made of aluminium

The sleeves are made with following components:

- Protection tube made of aluminium
- Active part made of epoxy resin impregnated paper with conductive grading layers (aluminium)
- Screws, bolts, pins, washer made of stainless steel
- bellows made of rubber

The fastenings are made with following components:

- Bars and connection angles made of Aluminium
- Insulation Discs made of plastic
- Earthing cable made of copper

As most of these parts are fixed together, we preconize to cut the busbar in several parts. None of the busbars contains any liquid.

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Find our installation instructions on our website

www.mgc.ch

or by flashing the QR Code



Revision	Created	Released
-	MGR 06.07.2015	OHA 22.09.2015
A	MGR 30.10.2015	OHA 30.10.2015
B	GBI 17.06.2019	OCA 28.01.2021
C	OCA 21.05.2021	SMU 25.05.2021
D	OCA 25.10.2021	RNE 25.10.2021
E	OCA 14.12.2022	SMU 19.12.2022