



**DURESCA®**



## DTOI(S) Condenser bushings 36 – 362kV

Transformer to Air  
with Dry-Type insulation RIP and RIS  
IEC standard 60137:2017



**MOSER GLASER**

Current and voltage – our passion

# Swiss quality combined with global experience



## Features

### Dry-type RIP Insulation

Moser Glaser researched a way to increase the dielectric characteristics of its High Voltage equipment. As a result Moser Glaser invented the Epoxy Resin Impregnated Paper (RIP) technology in 1958.

With more than 50 years of experience in development of the ERIP technology, Moser Glaser offers transformer bushings DURESCA® DTOI from 36 to 362kV.

The insulation lays directly on the conductor or tube and consists of crepe paper dried under vacuum and impregnated with epoxy resin. Conductive grading layers are embedded during the winding of the insulation for the best field control. This guarantees the highest operational and human safety.

- A strong moisture barrier prevents any contamination or moisture ingress.
- Moser Glaser design does not use any oil; DTOI are completely dry and free of partial discharge.
- DTOI bushings can be applied at any position from 0° to 90° from vertical and allow for safe horizontal transport and storage.



### Silicone housing

- Moser Glaser pioneered the standardization of Silicone Rubber Insulators on Bushings, bringing a high level in safety and reliability to the Electric Utility industry and increasing the performance of the bushing in heavily polluted environments.
- Weight reduced as well as flexible sheds, increase its tolerance to vandalism, or earthquakes. No risk of porcelain break during shipping or handling; no collateral damage.

### Replacement bushings

- In addition to the standard range, our design, combined with our production process, allows a wide flexibility and adaptability to provide tailor-made solutions.

Moser Glaser can interchange a wide variety of bushings designs. This allows the customer to replace existing OIP bushings with the RIP technology. The supply chain is simplified as the silicone molding operation is done in-house, Moser Glaser can offer short lead-times for its standard range of product.



## DTOI bushings are also available with RIS (Resin Impregnated Synthetic) insulation.

The main performance and life expectancy restraint in RIP condenser bushings was found to be the paper itself. Paper is an organic material with inconsistent material parameters, namely the moisture content. Too much moisture will cause high loss values, degrade the insulation system of the bushing, and possibly cause a premature failure. In order to compensate this, modern RIP bushings utilize drying systems during the manufacturing process.

For shipment and storage, plastic bags with a dessicate bag or oil containers are used to protect the bushing. Finding an alternative material to paper was not an easy task, though, due to the fact that paper provides good insulation characteristics and has been used in bushing and transformer manufacturing processes for many years with continual optimization.

Several experimentations were needed to find optimal successor.

Moser Glaser undertook this task by performing tests on many materials in order to find a successor to the paper. After research, Moser Glaser found a special polyester structural material which is an excellent alternative to paper. Moser Glaser performed a sequence of tests to qualify this solution:



Routine and type tests according to IEC 60137:2017 Specifications for the type tests were beyond the requirements of the standard.

In addition several special tests have been developed to challenge this solution.

- Adhesion test of direct moulded silicone on the RIS insulation
- Special humidity test
- Dynamic cantilever load tests
- Temperature cycle test
- Accelerated ageing test under high voltage

The new Resin Impregnated Synthetic RIS is now developed and part of Moser Glaser products portfolio.

An all-inclusive solution!

The result of this development is an ideal association of existing epoxy resin technology and its appreciated characteristics:

- Partial discharge free
- Installation at any angle

enhanced with new features:

- Shorter production cycle
- Easier handling for long transportation and storage
- Reduced power factor and capacitance
- Not affected by humidity

For outdoor application Moser Glaser standardized a direct-moulded silicone insulator to provide an even more safer solution.

Moser Glaser could maintain its strength by providing a high level of customization.

Therefore RIS technology can be applied to the standard range and also can interchange all existing designs. There are no limitation as for the diameter and length.

What you get today with RIP technology can be offered with RIS.

With this important new milestone, Moser Glaser is ready to offer the bushing of the future.



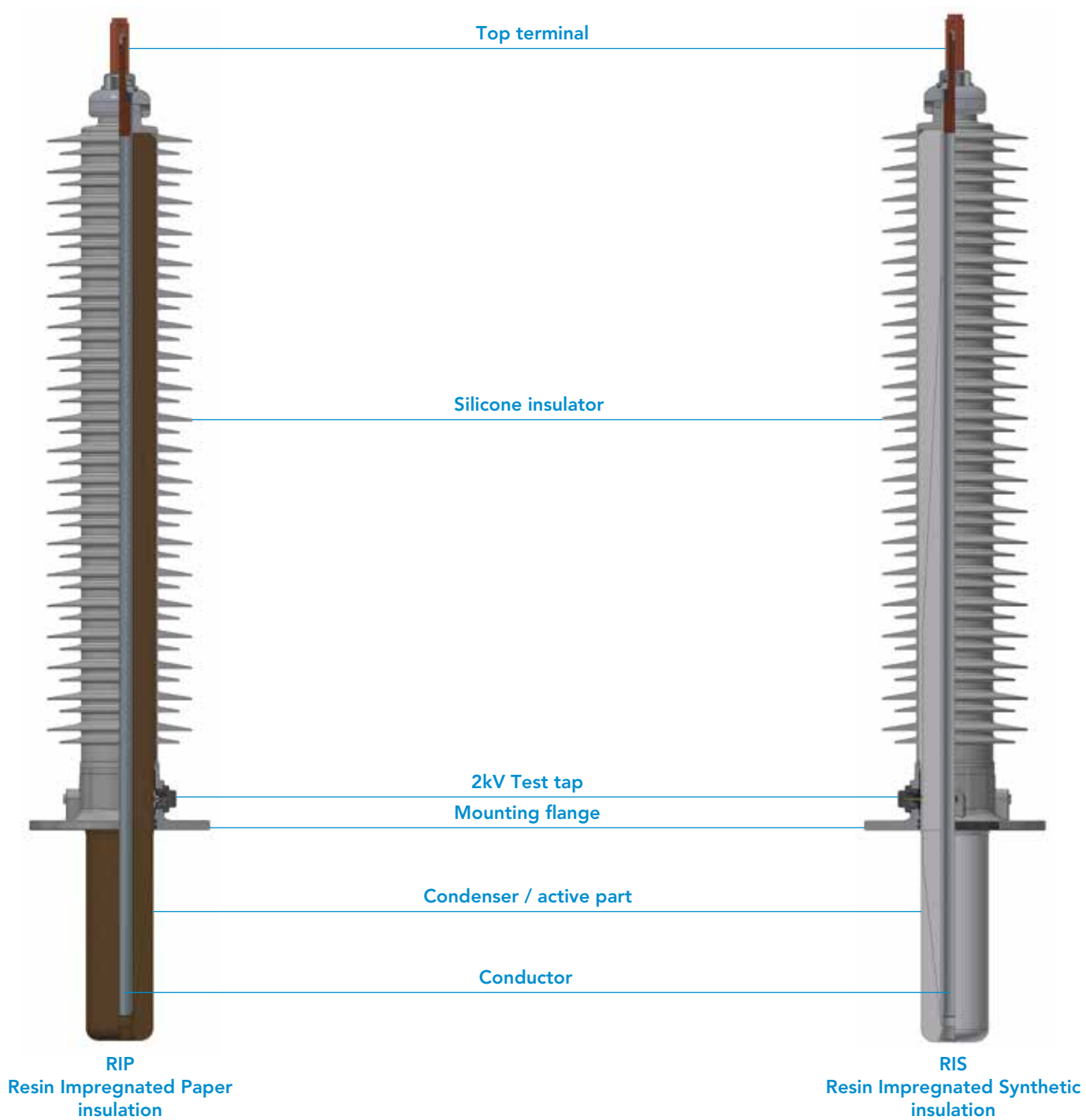
Cut from a RIS active part



Cut from an RIP active part



## Design



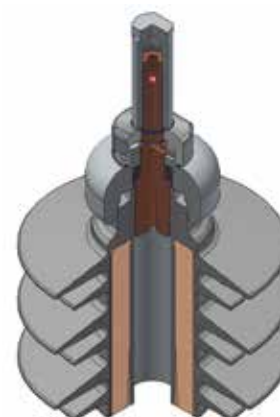
All technical data (electrical and dimensional) from this catalogue are applicable for RIP as well as RIS insulation.

- Bushings with RIP insulation are denominated as DTOI
- Bushings with RIS insulation as DTOIS

## Common characteristics

### Top terminal

- DTOI(S) bushings are delivered with a cylindrical top terminal in copper. It's bolted to the head of the bushing for the draw-lead and split-conductor type, material can be aluminium or copper (blank, sliver or tin-plated) or part of the conductor for the fix-conductor type (not available in aluminium).
- Flat pad top terminal can be offered as an optional accessory.



### Draw-lead

- Connection through brazing

The maximum continuous current rating of the draw-lead cable is determined by the size and type of the cable supplied by the transformer manufacturer. The right selection of the cable size is the responsibility of the transformer manufacturer. The lead must be insulated to isolate it from the bushing centre tube.

Moser Glaser offers various possibilities of draw-lead connectors to ensure a full interchangeability in case of bushing replacement.

The draw-lead connector is equipped with a pilot hole. It has to be drilled according to the lead diameter.

The cable is connected to the draw-lead connector via brazing and draw through the bushing centre tube.

Alternative draw-lead connectors are also offered:

- Connection through brazing on a spade

The apparatus cable is directly brazed on the draw-lead connector spade. Maximum current rating is 400A.

- Connection through crimping

The connector is adapted to draw-lead size. Maximum current rating is 400A.

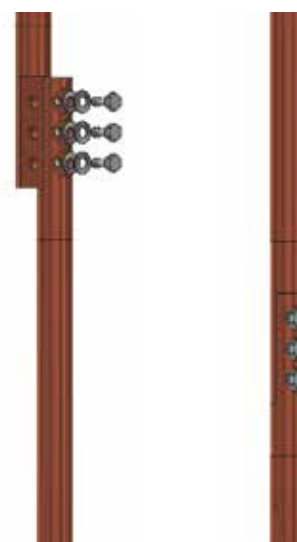
More details on request.



### Split-conductor

Moser Glaser offers extended bushing flexibility and ease-of-use through the use of a split-conductor.

A split copper rod allows easy installation and removal without lowering the oil level, while also providing current ratings beyond draw-lead ratings with the same bushing.



### Mounting flange

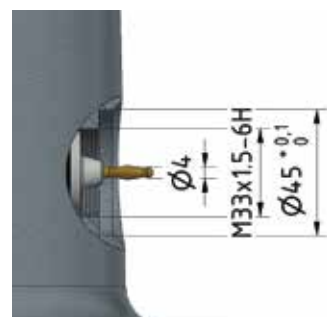
Made of corrosion free aluminium, equipped with:

- Test tap (all ratings), the grounding is done through the cap.
- Test voltage is 2kV / 60sec for 50Hz network or 72sec for 60Hz network.
- Self-earthed test tap available on request.
- Air vent screw at flange.



Standard 2kV test tap

Self-earthed test tap available as accessory



### Air vent screw at the top terminal for draw-lead and split-conductor versions

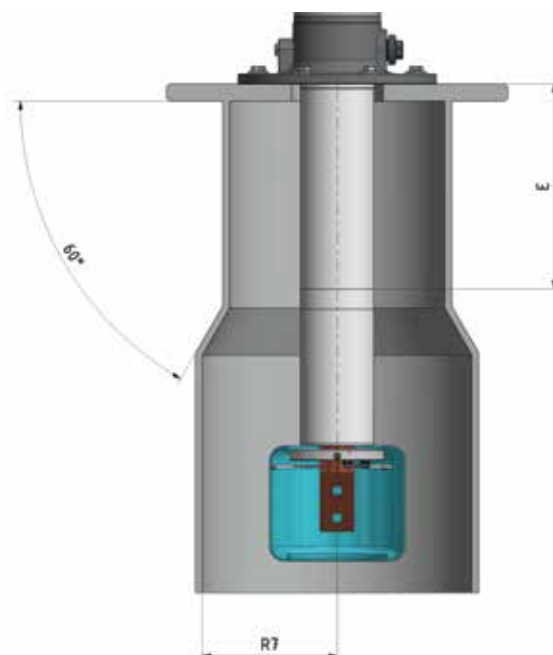
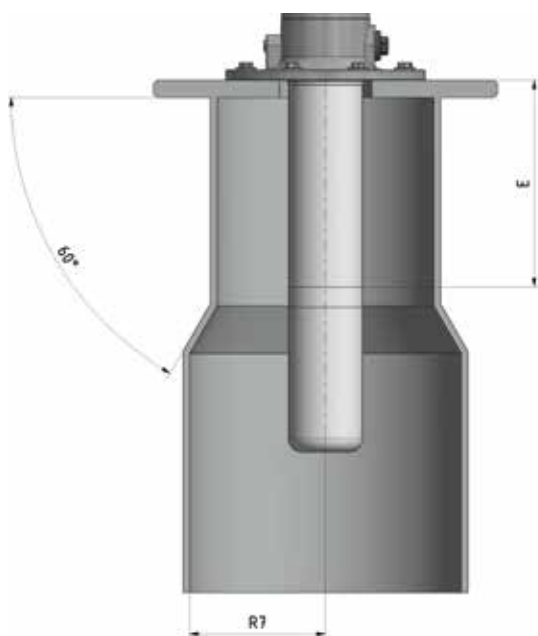
In standard all cable bolt or split-conductor is equipped with an air vent screw.



### Minimum distance to earthed parts

The distance to the earthed parts is depending of voltage, transformer tank design as well as oil condition and quality. This distance is according to the recommendation of the standard CLC / TS 50458, lower distance can be covered after approval from Moser Glaser.

R7 distance is given in the dimensions table.



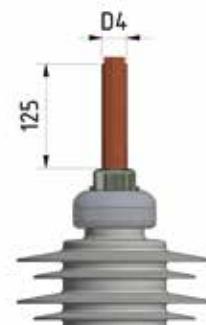
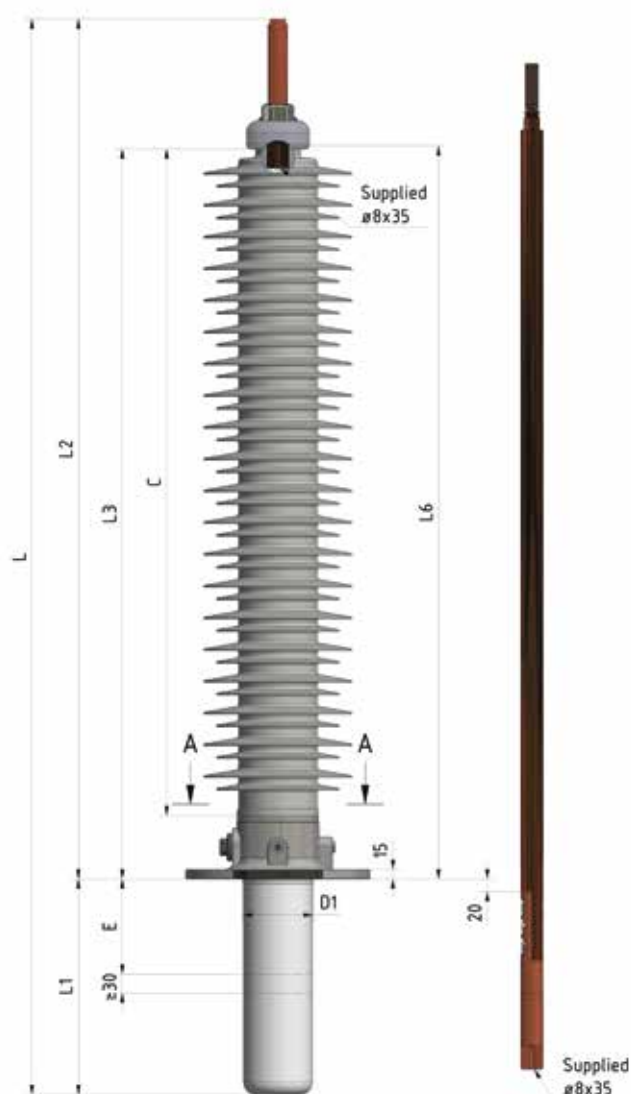


## Dimensions 36 – 170kV

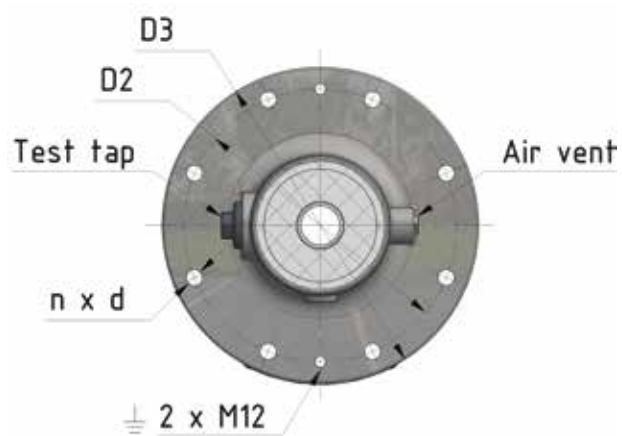
Draw-lead

Split-conductor

Top dimensions



Flange A-A



Draw-lead

Split-conductor

Fix-conductor 2 holes

Fix-conductor 4 holes

Electrode shield for  
Fix-conductor

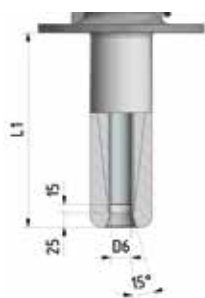


Fig. 1

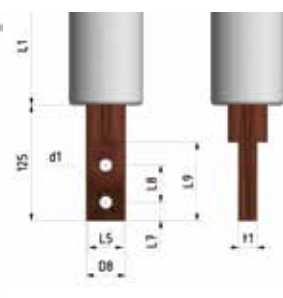
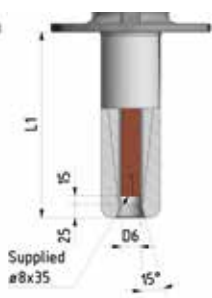


Fig. 2

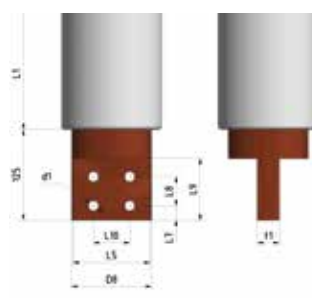


Fig. 3

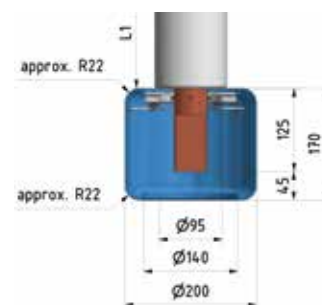


Fig. 4

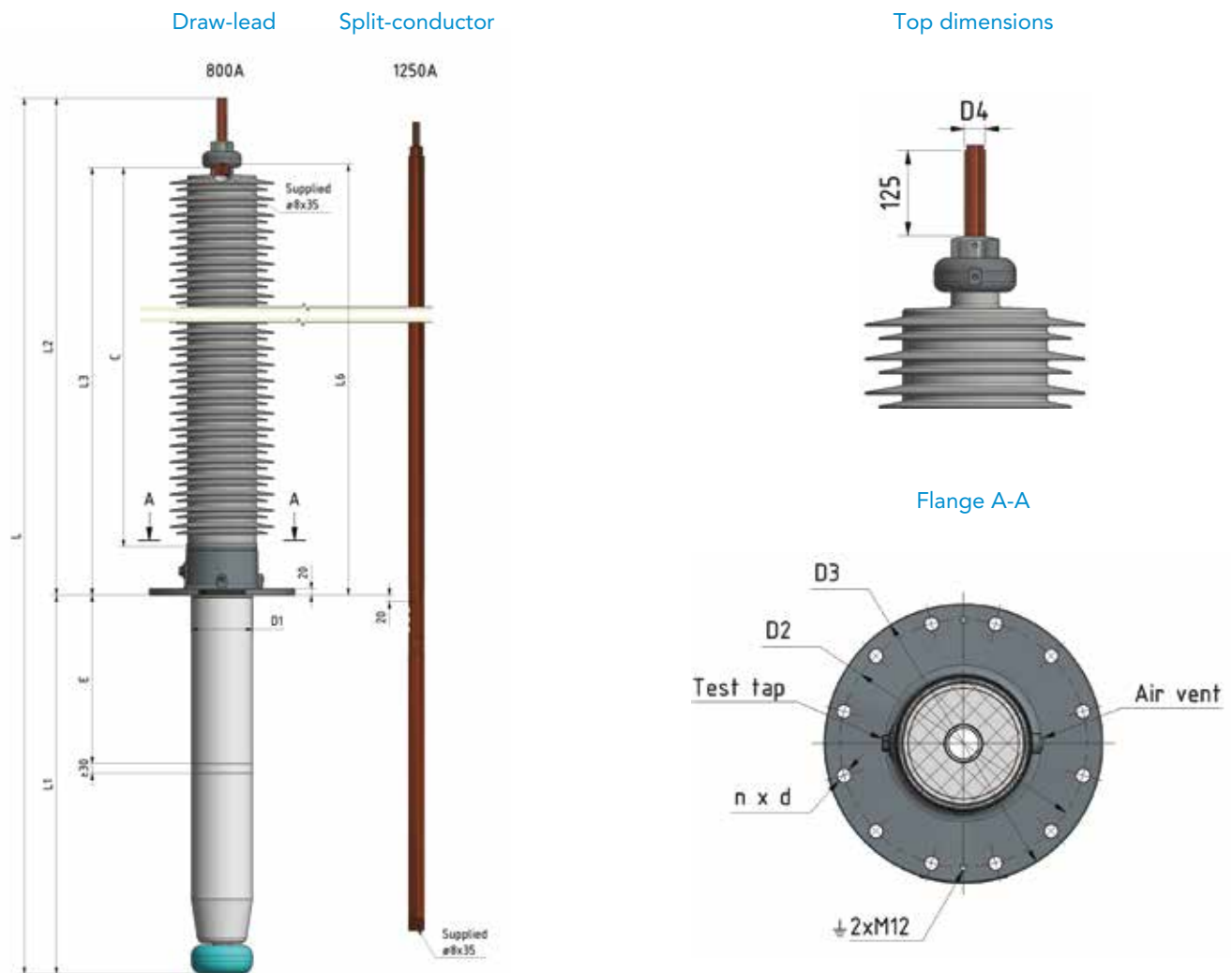
## Dimensions

								Top terminal	Air side dimensions			Flange		
Highest voltage	Dry power frequency withstand voltage	Lightning impulse withstand voltage	Rated current Draw lead	Rated current Split-conductor	Rated current Fix conductor	Unified Specific Creepage Distance 53.7mm/kV	Cantilever test load (min) Class II IEC 60137	Diameter x Length	Length above flange	Arcing distance	Draw lead length	No. of bolts x diameter	Bolt circle diameter	Flange outside diameter
(Um)	(Up)	(UBIL)	(Ir)	(Ir)	(Ir)	(USCD)	(N)	(D4)x(L4)	(L2)	(C)	(L3)	nxd	(D2)	(D3)
kV	kV	kV	A	A	A	mm	N	mm	mm	mm	mm		mm	mm
36	80	200	800	1250		1116	1250	30x125	655	350	460	6x15	185	225
			1250	2000			2000	40x125	665	350	460	8x15	250	290
					1600-2500		2000	50x125	605	350		6x15	185	225
					3150		3150	60x125	605	350		8x15	250	290
					4000		3150	100x125	605	350		8x15	250	290
					5000		3150	Flat Pad	605	350		8x15	250	290
52	105	250	800	1250		1612	1600	30x125	755	450	560	6x15	185	225
			1250	2500			2500	40x125	765	450	560	8x15	250	290
					1600		1600	40x125	705	450		6x15	185	225
					2000		2500	50x125	705	450		8x15	250	290
					2500		2500	50x125	705	450		8x15	250	290
					3150		3150	60x125	705	450		12x15	290	335
72.5	155	350	800	1250		2248	2000	30x125	905	600	710	6x15	185	225
			1250	2000			3150	40x125	915	600	710	8x15	250	290
					1600		2000	40x125	855	600		8x15	250	290
					2000		3150	50x125	855	600		8x15	250	290
					2500		3150	50x125	855	600		8x15	250	290
					3150		4000	60x125	855	600		12x15	290	335
100	205	450	800	1250		3100	2000	30x125	1155	850	960	8x15	250	290
			1250	1600			2000	40x125	1165	850	960	12x15	290	335
					1600		2000	40x125	1105	850		8x15	250	290
					2000		3150	50x125	1105	850		8x15	250	290
					2500		3150	50x125	1105	850		12x15	290	335
					3150		4000	60x125	1105	850		12x20	290	335
123	255	550	800	1250		3813	3150	30x125	1355	1050	1160	8x15	250	290
			1250	1600			3150	40x125	1365	1050	1160	8x15	250	290
					1600		3150	40x125	1305	1050		12x15	290	335
					2000		4000	50x125	1305	1050		12x15	290	335
					2500		4000	50x125	1305	1050		12x15	290	335
					3150		4000	60x125	1305	1050		12x20	290	335
145	305	650	800	1250		4495	3150	30x125	1555	1250	1360	8x15	250	290
			1250	1600			3150	40x125	1565	1250	1360	8x15	250	290
					1600		3150	40x125	1505	1250		8x15	250	290
					2000		4000	50x125	1505	1250		12x15	290	335
					2500		4000	50x125	1505	1250		12x20	290	335
					3150		4000	60x125	1505	1250		12x20	290	335
170	355	750	800	1250		5270	4000	30x125	1755	1450	1560	12x15	290	335
			1250	2000			5000	40x125	1765	1450	1560	12x15	290	335
					1600		4000	40x125	1705	1450		12x15	290	335
					2000-2500		5000	50x125	1705	1450		12x23	400	450
					3150		5000	60x125	1755	1450		12x23	400	450
							4000	30x125	2675	2310	2475	12x23	400	450
245-300	505	1050	800	1250		9300	4000	30x125	2675	2310	2475	12x23	400	450
					1600		4000	40x125	2615	2310		12x23	400	450
					2000		5000	50x125	2615	2310		12x23	400	450
					2500		5000	50x125	2630	2310		12x23	400	450
					3150		5000	60x125	2630	2310		12x23	400	450
							4000	30x125	3625	3210	3425	12x23	400	450
362	560	1175	800	1250		11222	4000	30x125	3625	3210	3425	12x23	400	450
					2000		5000	50x125	3580	3210		12x23	400	450
					2500		5000	50x125	3580	3210		12x23	400	450

<sup>1)</sup> 141mm for CT extension 0mm

Oil side dimensions								Bottom terminal									
Overall length	Oil end length	Overall length	Oil end length	Overall length	Oil end length	Oil side diameter	Inside tube diameter	Type of connection	Diametre	Usable width	Usable length	Thickness	Hole size	Distance between holes	Distance between holes	Distance bottom to the first hole	Distance HV to earth
(L)	(L1)	(L)	(L1)	(L)	(L1)	(D1)	(D6)		(D8)	(L5)	(L9)	(t)	(d1)	(L8)	(L10)	(L7)	(R7)
CT extension 0mm		CT extension 300mm		CT extension 500mm													
mm	mm	mm	mm	mm	mm	mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm
775	120	1075	420	1275	620	80	35.7	1									100
785	120	1085	420	1285	620	111	50	1									100
725	120	1025	420	1225	620	80		2	55	51	85	20	14	40		20	100
725	120	1025	420	1225	620	111		2	80	74.2	85	30	18	40		20	100
725	120	1025	420	1225	620	141		3	110	106	85	30	18	40	50	20	100
725	120	1025	420	1225	620	146		3	120	116.2	85	30	18	40	50	20	100
895	140	1195	440	1395	640	80	35.7	1									100
905	140	1205	440	1405	640	111	50	1									100
845	140	1145	440	1345	640	80		2	42	37	85	20	14	40		20	100
845	140	1145	440	1345	640	111		2	55	51	85	20	18	40		20	100
845	140	1145	440	1345	640	111		2	55	51	85	20	18	40		20	100
845	140	1145	440	1345	640	141		3	90	85	85	20	18	40		20	120
1080	175	1380	475	1580	675	80	35.7	1									130
1090	175	1390	475	1590	675	111	50	1									130
1030	175	1330	475	1530	675	111		2	42	37	85	20	14	40		20	130
1030	175	1330	475	1530	675	111		2	55	51.2	85	20	18	40		20	130
1030	175	1330	475	1530	675	111		2	60	56.6	85	20	18	40		20	130
1030	175	1330	475	1530	675	141		3	90	85	85	20	18	40		20	130
1385	230	1685	530	1885	730	111	35.7	1									145
1395	230	1695	530	1895	730	141	50	1									145
1335	230	1635	530	1835	730	111		2+4	42	37	85	20	14	40		20	145
1335	230	1635	530	1835	730	141		2+4	50	46	85	20	18	40		20	145
1335	230	1635	530	1835	730	141		2+4	60	56.6	85	20	18	40		20	145
1335	230	1635	530	1835	730	190		2+4	60	56.6	85	20	18	40		20	145
1695	340	1995	640	2195	840	111	35.7	1									160
1705	340	2005	640	2205	840	141	50	1									160
1645	340	1945	640	2145	840	111		2+4	42	37	85	20	14	40		20	160
1645	340	1945	640	2145	840	141		2+4	50	46	85	20	18	40		20	160
1645	340	1945	640	2145	840	141		2+4	60	56.6	85	20	18	40		20	160
1645	340	1945	640	2145	840	190		2+4	60	56.6	85	20	18	40		20	160
1915	360	2215	660	2415	860	111 <sup>(1)</sup>	35.7	1									190
1925	360	2225	660	2425	860	141	50	1									190
1865	360	2165	660	2365	860	111 <sup>(1)</sup>		2+4	42	37	85	20	14	40		20	190
1865	360	1805	300	2005	500	141		2+4	50	46	85	20	18	40		20	190
1865	360	1805	300	2005	500	190		2+4	60	56.6	85	20	18	40		20	190
1865	360	1805	300	2005	500	190		3+4	90	85	85	20	18	40		20	190
2205	450	2505	750	2705	950	141	35.7	1									230
		2515	750	2715	950	146	50	1									230
2155	450	2455	750	2655	950	141		2+4	45	40.3	85	20	14	40		20	230
2155	450	2005	300	2205	500	190		2+4	50	46	85	20	18	40		20	230
2205	450	2055	300	2255	500	246		3+4	90	85	85	20	18	40		20	230
3345	670	3645	970	3845	1170	190	50	1a									325
3235	620	3535	920	3735	1120	190		2a	50	45.6	85	20	18	40		20	325
3235	620	3535	920	3735	1120	190		2a	50	45.6	85	20	18	40		20	325
3250	620	3550	920	3750	1120	246		3a	90	85	85	20	18	40	50	20	325
3250	620	3550	920	3750	1120	246		3a	90	85	85	20	18	40	50	20	325
4310	685	4610	985	4810	1185	246	62	1b									370
4265	685	4565	985	4765	1185	246		2a	70	63.2	85	20	18	40		20	370
4265	685	4565	985	4765	1185	246		3a	90	85	85	20	18	50		20	370

## Dimensions 245 – 362kV



### Draw-lead & Split-conductor 245 – 300kV

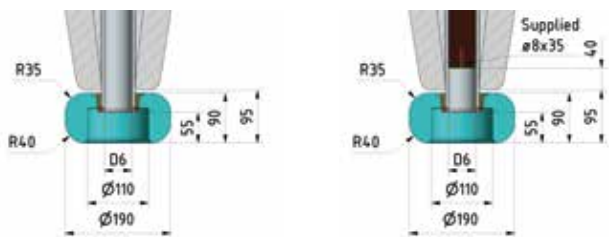


Fig. 1a

### Draw-lead & Split-conductor 362kV

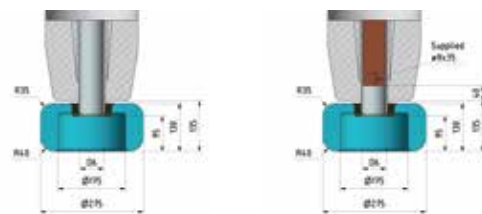


Fig. 1b

### Fix-conductor 2 holes 245 – 300kV



Fig. 2a

### Fix-conductor 4 holes 245 – 300 – 362kV

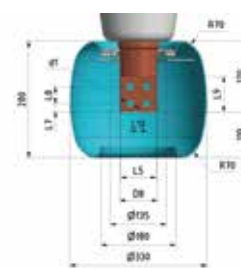


Fig. 3a

## Thermal short-time current level

The bushings withstand a short-time current of 25x rated continuous current for a maximum of 2 seconds.  
For draw-lead the thermal short-time current is defined according to the cable cross section in mm<sup>2</sup>:  $I_{th\ 2sec} (kA) = 0.06 \times S$   
Others values are possible after validation by Moser Glaser.

## Current

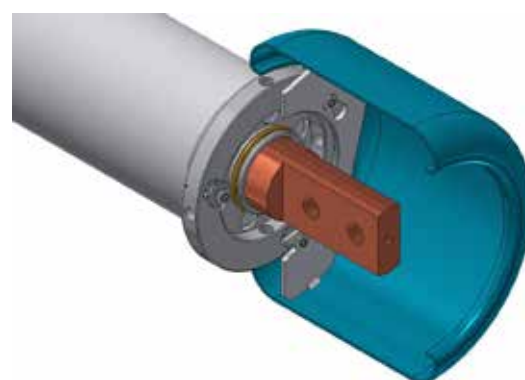
The current rating gives the maximum continuous rating with no effect on the bushing life time.  
Bushing rating as well as cable size has to be chosen at least 20% above transformer rating.

## Corona shield

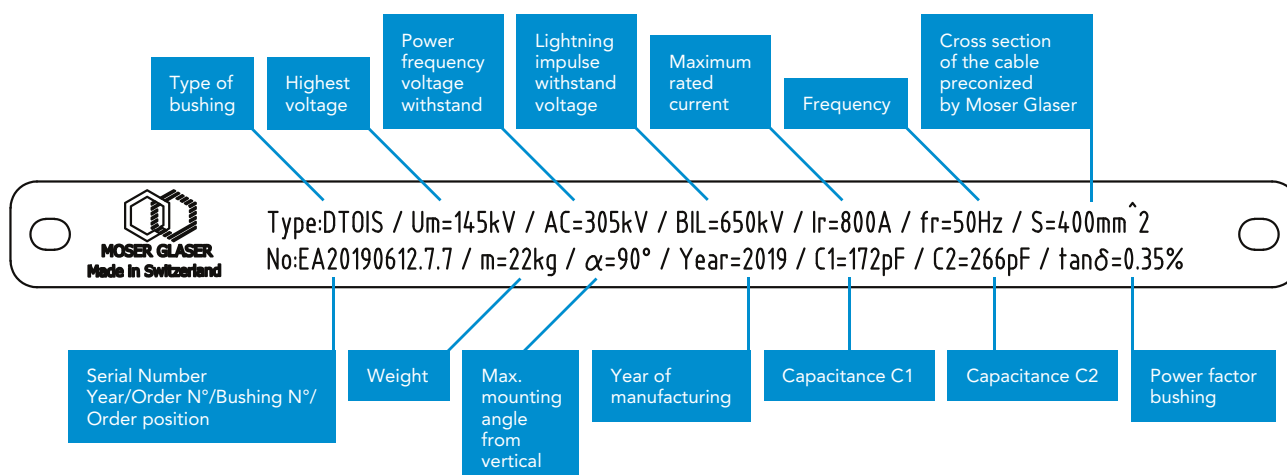
The bushing can be equipped with a removable corona shield as an optional accessory.

Mostly used for bushings with the highest current ratings.

A manhole on the transformer is required to access the connection.



## Example of Nameplate marking

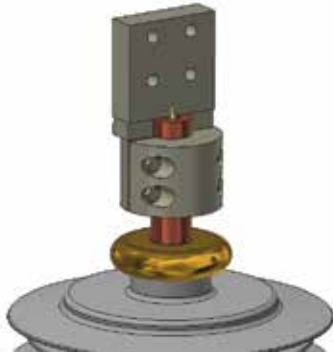


## Accessories

### Flat pad terminal

They are usually cast from aluminium but are also made on customer request from other materials (copper, brass).

More details on request.



### Shock indicator

On request, a shock indicator label can be fixed on the crate to monitor if a mechanical shock happened during transportation or handling.



### Long term storage RIP bushings

Protective tank is used to protect parts of RIP bushing which are used under service in transformer oil against damages or humidity.

They are used for long term storage as well as for protection during long transports.

The protection tank is delivered mounted on the bushing and filled with dry insulating oil.

After the sealing, an air cushion remains in the protection tank which is necessary for compensation purposes due to temperature-sensitive volume variations.



### Offshore application (C5-M)

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.

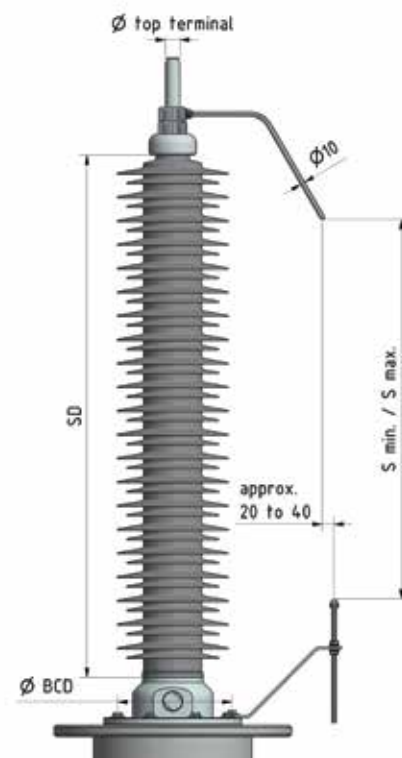
If the bushing is used for offshore application, the flange and the head of the bushing will be anodized and the top terminal will be tin-plated.

Additional mounting advices are given in our online instruction manual [www.mgc.ch](http://www.mgc.ch).



### Arcing horns made of CrNi steel

Um (kV)	Arcing distance (mm)	S min. (mm)	S max. (mm)
36	350	200	250
52	450	300	350
72.5	600	400	450
100	850	500	600
123	1050	650	750
145	1250	800	900
170	1450	900	1000
245/300	2310	1350	1550
362	3610	NA	NA



## Adapted solutions

In addition to the standard products, Moser Glaser can offer various solutions to be interchangeable with existing bushings or when special conditions are required, by example: extra creepage distance, altitude above 1000m or seismic requirement.

- Retrofit solution according to BS Standard.
- With an identical oil and air side length, matching flange footprint and adapted draw-lead.
- Top terminal connector to reuse the existing one.



Interchangeable bushing with existing OIP bushing.  
Transformer design could be kept. Bottom terminal as per NF-C Standard.



## Production facility

### Winding



### Impregnation



### Machining





## Production facility

### Silicone insulator molding



### Routine / type tests



### Packaging



## Range of transformer bushings

### DTOI(S)H / DTOIA(S)H

- Oil to air bushings
- IEC or IEEE standard
- From 52 to 550kV
- With hollow core insulator



### DTOIA(S)

- Oil to air bushings
- IEEE standard
- From 25 to 500kV



### DTO(S)

- Oil to oil bushings
- IEC standard
- From 72.5 to 300kV



### DTOX(S)

- Oil to SF6 bushings
- IEC standard
- From 72.5 to 300kV



### DTOP RIP or RIS Transformer and Switchgear bushings in porcelain housing - up to 252kV

#### ООО МОЗЕР ГЛАЗЕР

In 2018, Moser Glaser decided to firmly consolidate its position on the high-voltage bushings market in Russia, and the CIS countries, by establishing the company ООО Moser Glaser with its head office, assembly site and testing laboratory, in the city of Kaluga.

ООО Moser Glaser is developing dynamically and continues to strengthen its reputation in the energy sector, while competing with international players and local manufacturers.

For more information: [www.mgc-ru.ch](http://www.mgc-ru.ch)

Email: [info@mgc-ru.ch](mailto:info@mgc-ru.ch)



## Range of transformer bushings

### OIP Condenser Bushing

Voltage rating: up to 145kV

Current rating: up to 3150A

Standards: IEC / IEEE

Connection: Draw-lead / Draw Rod / Stem type

Housing: Porcelain / Polymer

- Hermetically sealed and self contained
- Low dielectric loss and partial discharge free
- Exact interchangeability with global reputed makes
- Short lead time
- Excellent lead time
- Excellent mechanical strength
- Good seismic and short circuit withstand
- Easy clean alternate sheds
- Explosion proof lower end insulator

### High Current Bushing

Rated voltage: 24kV – 36kV

Types: Oil filled / Communicating OIP Condenser

Standard: IEC-60137:2017

- Single solid aluminium / copper conductor
- No welding or brazing below mounting flange
- Integral flat bottom terminal, directly milled on solid conductor
- High thermal stability / Short-circuit withstand capability
- High strength Porcelain
- Corrosion resistant metal parts
- Exact interchangeability with global reputed makes
- Shortest lead time

For more information: [www.yashhv.com](http://www.yashhv.com)

Email: [sales@yashhv.com](mailto:sales@yashhv.com)



DURESCA®  
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DURESCA®  
Wall bushings



DURESCA®  
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## MOSER GLASER

Current and voltage – our passion

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### Member of PFIFFNER Group

This document has been drawn up with the utmost care. We can not however, guarantee that it is entirely complete, correct or up-to-date.

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