SPS STANDARD PRODUKTE SCHWANENMÜHLE

Isoflexx®, Ultraflexx®, CoppAl® and much more

All you need for installing switching cabinets

SPS Standard Produkte Schwanenmühle

Drawing on the expertise of the Schwanenmühle Group in the field of high-current technology, SPS offers a wide range of flexible and rigid connection options for switchgear construction.

The longstanding success and broad spectrum of the Isoflexx® product group ensure a perfect solution for any application, while the outstanding technical properties of the Ultraflexx® connectors continue to drive their ever-growing popularity. Many customers see these products as being among the most important innovations in the area of switchgear construction in recent years. The welded connections of the grounding braids ensure durable ground connections with minimum impedance. Together with copper and CoppAl® bars, a full range of support insulators and the many possible combinations of different busbar supports permit the creation of busbar systems for any type of switch cabinet. The copper-clad aluminum CoppAl® bars combine the benefits of copper and aluminum, offering an attractively priced alternative to expensive copper bars. The program is rounded off by a range of tools and useful accessories.

SPS standard products comply with the relevant international standards and are subject to constant quality control. SPS standard products are part and parcel of quality switchgear production - developed in the heart of Germany for the world market.

CONTENTS

OVERVIEW

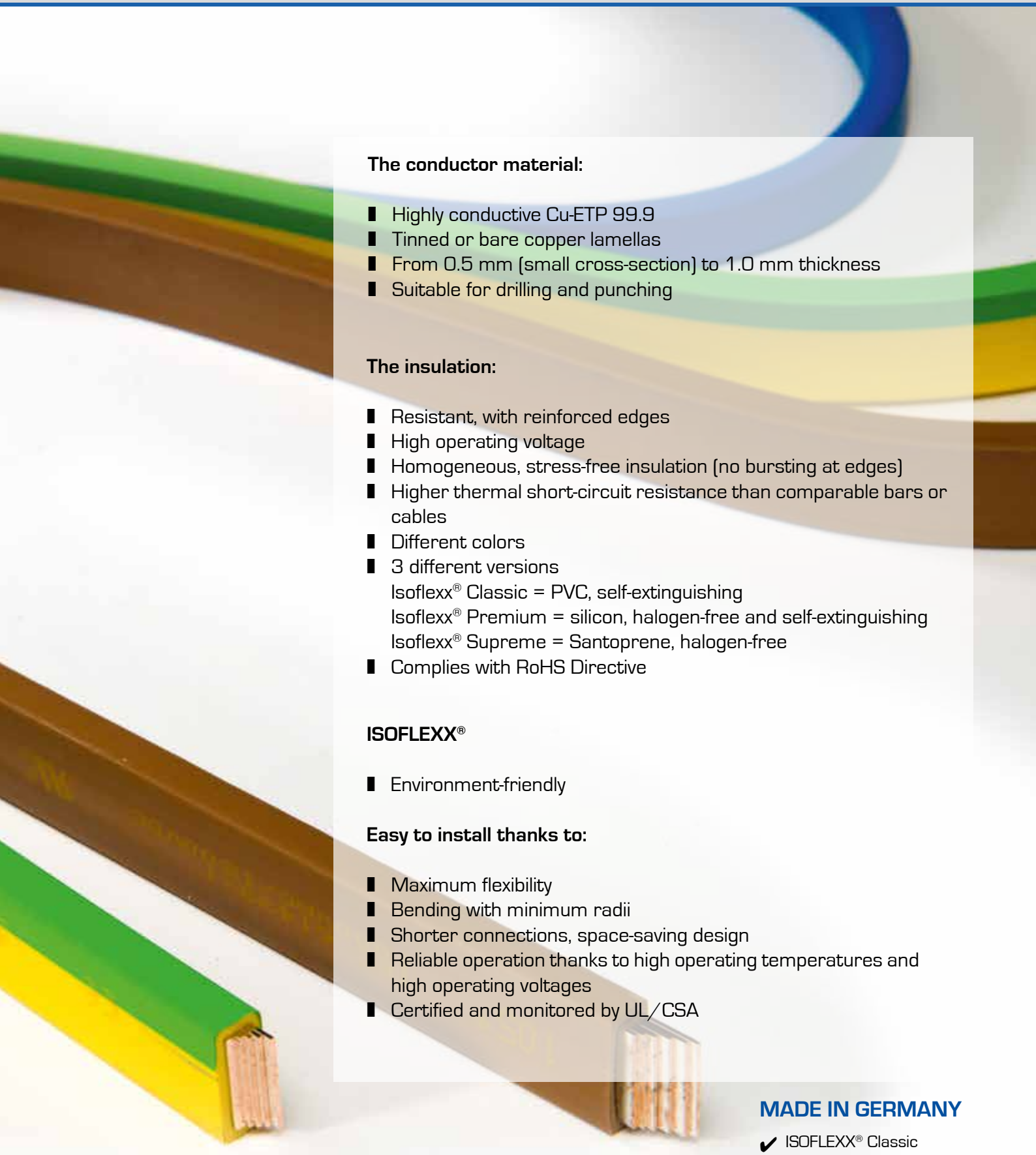
ISOFLEXX® is an insulated laminated busbar of the highest technical standard. ISOFLEXX® sets a new benchmark in the area of flexible busbars with its highly developed and proven technology.

ISOFLEXX® - the busbar that can do MORE! Because flexibility alone is not enough!

ISOFLEXX® is made up of several layered copper lamellas durably protected by special high-grade PVC insulation (ISOFLEXX® Classic) or environment-friendly halogen-free silicon insulation (ISOFLEXX® Premium). The loose arrangement of the lamellas in the insulation allows problem-free bending and twisting, and the fine lamination gives ISOFLEXX® its outstanding flexibility.

ISOFLEXX®, the innovative and cost-effective solution

- ✓ for all electrical connections in switch cabinets and low-voltage switchgear systems
- ✓ as a movable component inside solid busbar systems
- ✓ for connecting generators, transformers, switchgear systems and switching equipment
- ✓ as a connecting lead to machine switches, immersion baths, etc.
- ✓ as a riser in switching systems



The conductor material:

- Highly conductive Cu-ETP 99.9
- Tinned or bare copper lamellas
- From 0.5 mm (small cross-section) to 1.0 mm thickness
- Suitable for drilling and punching

The insulation:

- Resistant, with reinforced edges
- High operating voltage
- Homogeneous, stress-free insulation (no bursting at edges)
- Higher thermal short-circuit resistance than comparable bars or cables
- Different colors
- 3 different versions
  Isoflexx® Classic = PVC, self-extinguishing
  Isoflexx® Premium = silicon, halogen-free and self-extinguishing
  Isoflexx® Supreme = Santoprene, halogen-free
- Complies with RoHS Directive

ISOFLEXX®

- Environment-friendly

Easy to install thanks to:

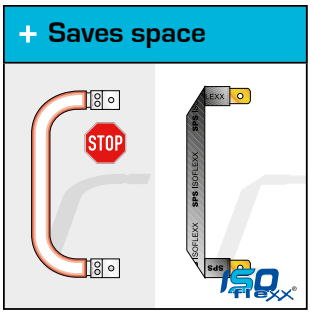
- Maximum flexibility
- Bending with minimum radii
- Shorter connections, space-saving design
- Reliable operation thanks to high operating temperatures and high operating voltages
- Certified and monitored by UL/CSA

MADE IN GERMANY

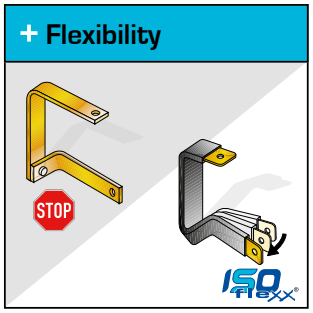
- ✔ ISOFLEXX® Classic
- ✔ ISOFLEXX® Premium
- ✔ ISOFLEXX® Supreme

ISOFLEXX® –

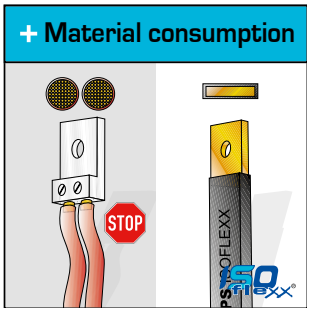
advantages at a glance!



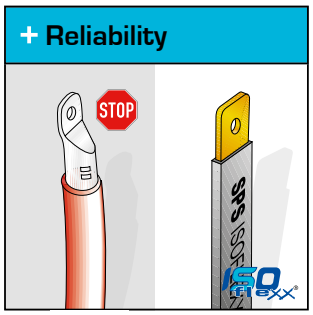
Saves space
ISOFLEXX® possesses unusual flexibility and can even be folded. In addition, the resistance of the conductor cross-section is far lower than that of cable and therefore permits smaller bending radii. This saves time and enables you to work more effectively.



Flexibility
Due to the flexibility of ISOFLEXX®, the number of contact points is far lower than with conventional solid busbar systems. Moreover, the flexible design compensates for construction tolerances during installation, which means it is no longer necessary to perform any additional bending as would be the case with solid busbars.
ISOFLEXX® greatly reduces installation time.

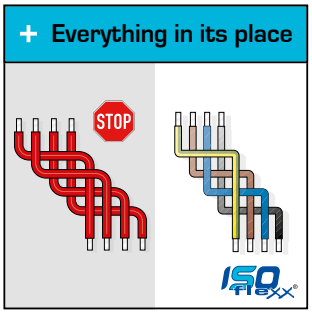


Material consumption
The smaller conductor cross-section of ISOFLEXX® compared to cables with the same ampacity reduces material usage.
The simple and efficient design saves you time and money.



Reliability
ISOFLEXX® enhances the safety of your systems and installations:
- no cable lugs
- reinforced edges
- extreme heat resistance
- certified dielectric strength
- well-balanced insulation

Choose ISOFLEXX® for maximum reliability!



Everything in its place
The special ISOFLEXX® production process allows the use of different colors for the insulation. You can choose from a range of standard colors (green/yellow, blue, brown, black) or specify colors according to your requirements. This means you can color-code different connections, making it easier for you to retain an overview of connections in the switchgear and other systems while making them safer at the same time.
ISOFLEXX® ensures everything is in plain sight.

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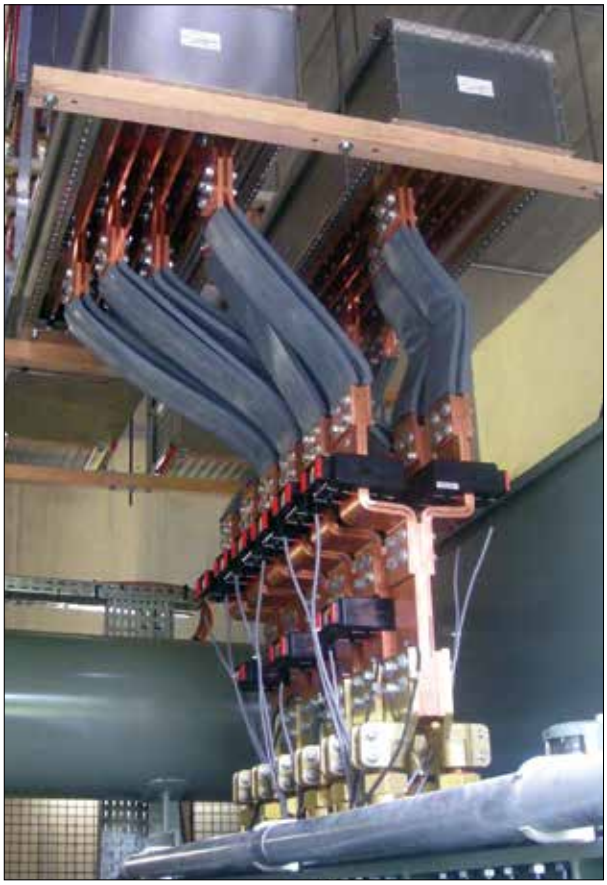
ISOFLEXX® –

is customized to meet your specific needs:

- Cutting to length
- Bending
- Twisting
- Drilling of hole patterns
- Drilling of oblong holes
- Press-welding of connections
- Riveting of connections
- Imprinting of customer names and logos
- Full imprinting to customer specification
- Packaging to customer specification



Classic

Ampacity for ΔT = 50 K	Dimensions[1]	Available in bare Cu (Cu) and tinned Cu (Sn)		Cross-section	Cu - weight per 2 meters (standard length)	Ampacity Values acc. to DIN 43671 for bars in switchgear systems Heating[2] of bar at an ambient temperature of 35°C				Standard color: black - special colors as shown below
						to 65°C ΔT = 30 K	to 85°C ΔT = 50 K	to 105°C ΔT = 70 K	Thermal short-circuit strength at 1 second	
		Cu	Sn	[mm²]	[kg]	[A]	[A]	[A]	[kA]	
> 125 A	3 x 9 x 0,8	x	x	21,6	0,38	98	**130**	152	3	
	6 x 9 x 0,8	x	x	43,2	0,77	147	**196**	228	7	
	9 x 9 x 0,8	x	x	64,8	1,15	179	**238**	277	10	
	3 x 13 x 0,5	x	x	19,5	0,35	108	**144**	167	3	
	6 x 13 x 0,5	x	x	39,0	0,69	162	**215**	251	6	
	2 x 16 x 0,8	x	x	24,8	0,44	110	**148**	195	4	
> 250 A	4 x 16 x 0,8	x	x	49,6	0,88	201	**267**	312	8	
	6 x 16 x 0,8	x	x	74,4	1,32	252	**335**	391	11	
	2 x 20 x 1	x	x	40,0	0,71	188	**250**	291	6	
	3 x 20 x 1	x	x	60,0	1,07	237	**315**	367	9	
	4 x 20 x 1	x	x	80,0	1,42	278	**370**	431	12	
	2 x 24 x 1	x	x	48,0	0,85	201	**267**	312	7	
	3 x 24 x 1	x	x	72,0	1,28	276	**367**	428	11	
	2 x 32 x 1	x	x	64,0	1,14	289	**384**	448	10	
> 400 A	10 x 16 x 0,8	x	x	128	2,28	330	**439**	512	19	
	5 x 20 x 1	x	x	100	1,78	319	**424**	494	15	
	6 x 20 x 1	x	x	120	2,14	355	**472**	550	18	
	4 x 24 x 1	x	x	96	1,71	322	**428**	499	15	
	5 x 24 x 1	x	x	120	2,14	369	**491**	572	18	
	3 x 32 x 1	x	x	96	1,71	359	**477**	556	15	
> 500 A	6 x 24 x 1	x	x	144	2,56	407	**541**	631	22	
	4 x 32 x 1	x	x	128	2,28	418	**556**	648	20	
> 630 A	10 x 20 x 1	x	x	200	3,56	497	**661**	770	31	
	11 x 21 x 1		x	231	4,11	563	**749**	873	36	
	8 x 24 x 1	x	x	192	3,42	483	**642**	749	30	
	10 x 24 x 1	x	x	240	4,27	559	**743**	866	37	
	5 x 32 x 1	x	x	160	2,85	477	**634**	739	25	
	6 x 32 x 1	x	x	192	3,42	526	**700**	815	30	
	5 x 40 x 1	x	x	200	3,56	573	**762**	888	31	
> 800 A	8 x 32 x 1	x	x	256	4,56	623	**829**	966	39	
	10 x 32 x 1	x	x	320	5,70	721	**959**	1118	49	
	8 x 40 x 1	x	x	320	5,70	739	**983**	1145	49	
	5 x 50 x 1	x	x	250	4,45	697	**927**	1080	39	
> 1000 A	10 x 35 x 1		x	350	6,23	757	**1007**	1173	54	
	10 x 40 x 1	x	x	400	7,12	850	**1131**	1318	62	
	8 x 50 x 1	x	x	400	7,12	891	**1185**	1381	62	
	5 x 63 x 1	x		315	5,61	826	**1099**	1280	49	
> 1250 A	10 x 50 x 1	x	x	500	8,90	1020	**1357**	1581	77	
	6 x 63 x 1	x		378	6,73	942	**1253**	1460	58	
	8 x 63 x 1	x		504	8,97	1038	**1361**	1609	78	
	10 x 63 x 1	x		630	11,21	1180	**1569**	1829	97	
	4 x 80 x 1	x	x	320	5,70	954	**1269**	1479	49	
	5 x 80 x 1	x	x	400	7,12	1070	**1423**	1659	62	
	6 x 80 x 1	x	x	480	8,54	1156	**1537**	1792	74	
> 1600 A	8 x 80 x 1	x	x	640	11,39	1328	**1766**	2058	99	
	10 x 80 x 1	x	x	800	14,24	1500	**1995**	2325	123	
	5 x 100 x 1	x	x	500	8,90	1300	**1729**	2015	77	
> 2000 A	8 x 100 x 1	x	x	800	14,24	1606	**2136**	2489	123	
	10 x 100 x 1	x	x	1000	17,80	1810	**2407**	2806	154	
> 2500 A	12 x 100 x 1	x	x	1200	21,36	1974	**2625**	3059	185	

Standard length 2000 mm, available in lengths from 250 to 3000 mm on request / [1] Other dimensions on request / [2] Heating of busbar depends on: current strength, ambient temperature, heat dissipation, laying method, installation, application / Multiplication factor of 1.72 if 2 bars are used, multiplication factor of 2.25 if 3 bars are used in parallel arrangement based on DIN 43 671 / Available in the color gray (standard) / The SPS product ranges are continuously extended - you can find more information on our website at: www.sps-standard.com

You can find accessories for ISOFLEXX® on page 32 / 33 | You can the technical data for ISOFLEXX® Classic on page 35 / 36

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Premium

Ampacity for ΔT = 50 K	Dimensions[1]	Available in bare Cu (Cu) and tinned Cu (Sn)		Cross-section	Cu - weight per 2 meters (standard length)	Ampacity Values acc. to DIN 43671 for bars in switchgear systems Heating[2] of bar at an ambient temperature of 35°C to 65°C ΔT = 30 K	to 85°C ΔT = 50 K	to 105°C ΔT = 70 K	Thermal short-circuit strength at 1 second
		Cu	Sn	[mm²]	[kg]	[A]	[A]	[A]	[kA]
> 400 A	5 x 20 x 1	x	x	100	1,78	319	**424**	565	26
	5 x 24 x 1	x	x	120	2,14	369	**491**	653	31
> 630 A	10 x 20 x 1	x	x	200	3,56	497	**661**	880	52
	10 x 24 x 1	x	x	240	4,27	559	**743**	989	62
	5 x 32 x 1	x	x	160	2,85	477	**634**	844	41
	5 x 40 x 1	x	x	200	3,56	573	**762**	1014	52
> 800 A	10 x 32 x 1	x	x	320	5,70	721	**959**	1276	83
	8 x 40 x 1	x	x	320	5,70	739	**983**	1308	83
	5 x 50 x 1	x	x	250	4,45	697	**927**	1234	65
> 1000 A	10 x 40 x 1	x	x	400	7,12	850	**1131**	1505	100
	8 x 50 x 1	x	x	400	7,12	891	**1185**	1577	100
	5 x 63 x 1	x		315	5,61	826	**1099**	1462	82
> 1250 A	10 x 50 x 1	x	x	500	8,90	1020	**1357**	1805	130
	8 x 63 x 1	x		504	8,97	1038	**1361**	1837	130
	10 x 63 x 1	x		630	11,21	1180	**1569**	2089	160
	5 x 80 x 1	x	x	400	7,12	1070	**1423**	1894	100
> 1600 A	8 x 80 x 1	x	x	640	11,39	1328	**1766**	2351	166
	10 x 80 x 1	x	x	800	14,24	1500	**1995**	2655	208
	5 x 100 x 1	x	x	500	8,90	1300	**1729**	2301	130
> 2000 A	8 x 100 x 1	x	x	800	14,24	1606	**2136**	2843	208
	10 x 100 x 1	x	x	1000	17,80	1810	**2407**	3204	260
	8 x 120 x 1	x	x	960	17,09	1794	**2386**	3175	250
> 2500 A	12 x 100 x 1	x	x	1200	21,36	1974	**2625**	3494	310
	10 x 120 x 1	x	x	1200	21,36	2110	**2806**	3735	310

Supreme

Ampacity for ΔT = 50 K	Dimensions[1]	Available in bare Cu (Cu) and tinned Cu (Sn)		Cross-section	Cu - weight per 2 meters (standard length)	Ampacity Values acc. to DIN 43671 for bars in switchgear systems Heating[2] of bar at an ambient temperature of 35°C to 65°C ΔT = 30 K	to 85°C ΔT = 50 K	to 105°C ΔT = 70 K	Thermal short-circuit strength at 1 second
		Cu	Sn	[mm²]	[kg]	[A]	[A]	[A]	[kA]
> 125 A	3 x 9 x 0,8	x	x	21,6	0,38	98	130	173	5
	6 x 9 x 0,8	x	x	43,2	0,77	147	196	260	11
	9 x 9 x 0,8	x	x	64,8	1,15	179	238	317	16
	3 x 13 x 0,5	x	x	19,5	0,35	108	144	191	5
	6 x 13 x 0,5	x	x	39,0	0,69	162	215	287	10
> 250 A	4 x 16 x 0,8	x	x	49,6	0,88	201	267	356	12
	6 x 16 x 0,8	x	x	74,4	1,32	252	335	446	19
	2 x 20 x 1	x	x	40,0	0,71	188	250	333	10
	3 x 20 x 1	x	x	60,0	1,07	237	315	419	15
> 400 A	10 x 16 x 0,8	x	x	124	2,21	330	439	584	32
	5 x 20 x 1	x	x	100	1,78	319	424	565	26
	5 x 24 x 1	x	x	120	2,14	369	491	653	31
	3 x 32 x 1	x	x	96	1,71	359	477	635	25
> 630A	11 x 21 x 1		x	231	4,11	563	749	997	60
	10 x 24 x 1	x	x	240	4,27	559	743	989	62
	5 x 32 x 1	x	x	160	2,85	477	634	844	41
	6 x 32 x 1	x	x	192	3,42	526	700	931	50
	5 x 40 x 1	x	x	200	3,56	573	762	1014	52
> 800 A	8 x 32 x 1	x	x	256	4,56	623	829	1103	66
	10 x 32 x 1	x	x	320	5,70	721	959	1276	83
	8 x 40 x 1	x	x	320	5,70	739	983	1308	83
	5 x 50 x 1	x	x	250	4,45	697	927	1234	65
> 1000 A	10 x 35 x 1		x	350	6,23	757	1007	1340	91
	10 x 40 x 1	x	x	400	7,12	850	1131	1505	100
> 1250 A	10 x 50 x 1	x	x	500	8,90	1020	1357	1805	130

We can naturally also produce ISOFLEXX® in different lengths and cross-sections to meet your specifications.

Standard length 2000 mm, available in lengths from 250 to 3000 mm on request / [1] Other dimensions on request / [2] Heating of busbar depends on: current strength, ambient temperature, heat dissipation, laying method, installation, application / Multiplication factor of 1.72 if 2 bars are used, multiplication factor of 2.25 if 3 bars are used in parallel arrangement based on DIN 43 671 / Available in the color gray (standard) / The SPS product ranges are continuously extended - you can find more information on our website at: www.sps-standard.com

Ultraflexx® flexible connectors are highly flexible connectors made from flat copper braid and absorb oscillations and switching vibrations in all directions.

Unlike generally available press-welded components, our press-welded connectors are press-welded across their full connection cross-section and can be machined like one solid end piece.

Our full-surface welded connections have the following advantages:

- No additional transition resistances, hence lower power loss and reduced voltage loss
- No corrosion and therefore no deterioration of connection resistances over time

Ultraflexx® braided connectors are highly flexible connectors that are quickly and easily mounted ready for use.

Technical information:

- Current range up to 700 A
- Outstanding electrical contact transition
- Superb long-term mechanical characteristics

Insulation:

- Halogen-free insulation
- Wall thickness: 0.8 ±0.3 mm (other wall thicknesses on request)
- Insulation: black (other colors on request)
- Operating temperatures; -55° C to +125° C
- Flame retardant to UL224-VW1
- Operating voltage: max. 1000 VAC - 1500 VDC
- Dielectric strength: 20kV/mm

Braided material:

- High-grade electrolytic copper with outstanding conductivity
- Individual wire diameter of 0.15mm for maximum flexibility
- Vibration-proof due to press-welded connection leads
- Minimum transition resistance due to press-welded connection leads

The best alternative to customized cables

We supply a wide range of different lengths and cross-sections to meet customer specifications and designed for specific applications. Our manufacturing processes uses only the very best electrolytic copper to ensure optimum conductivity. Outstanding product quality - easy to use and made in Germany.

Ultraflexx® – optimized and highly flexible use of space

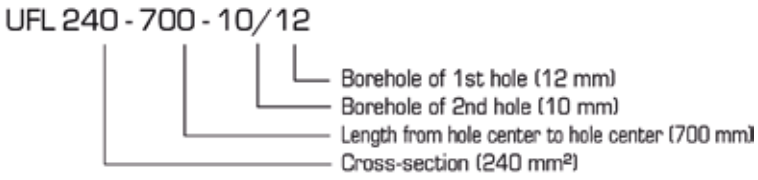
Extremely wide range of cross-sections, can be adapted to different isolator sizes with fuse links – and installed as connectors between many different types of switch cabinet modules and units.

Ultraflexx® is available in the following cross-sections:

			Ampacity Values acc. to DIN 43671 for bars in switchgear systems Heating[2] of bar at an ambient temperature of 35°C		
Cross-section	Length[1]	Weight	to 65°C ΔT = 30 K	to 85°C ΔT = 50 K	to 105°C ΔT = 30 K
[mm²]	[mm]	[kg/m]	[A]	[A]	[A]
25	150-1000	0,25	120	160	185
50	150-1000	0,51	200	270	315
100	150-1000	1,02	320	425	500
120	150-1000	1,22	355	470	555
240	150-1000	2,44	560	745	870

[1]Lengths from 150mm to 1000mm in 50mm increments - other lengths on request; the length is defined as the hole center spacing.
[2]Heating of busbar depends on: current strength, ambient temperature, heat dissipation, laying method, installation, application
Multiplication factor of 1.72 when using 2 Ultraflexx®, multiplication factor of 2.25 when using 3 Ultraflexx® in parallel arrangement.

Ultraflexx® nomenclature:



You can find the technical data for Ultraflexx® on page 37

The following photos show the universal applications of Ultraflexx®

Ultraflexx® for the flexible bridging of bar and power switch

Application photos top and bottom: Kautz company, Trier - 4000A switch connection to busbar system

Ultraflexx® prepared for connection of a safety load-break switch

GROUNDING BRAIDS

The MBS grounding braids from SPS are a one-of-a-kind in the market, as the connections of the braids are press-welded in a special process. The braids are made of highly flexible flat material (Cu-ETP bare or tinned).

SPS grounding braids have the following advantages:

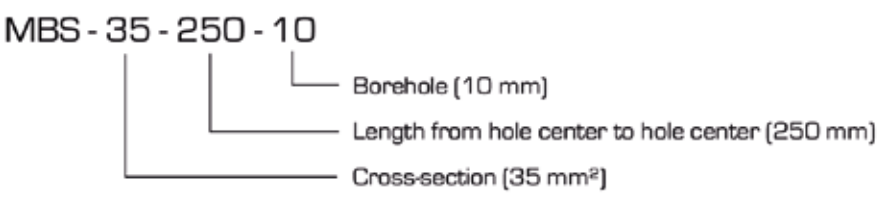
- Low heating in the event of a short circuit: welding of the connections ensures minimum transition resistance and means there is no need for contact sleeves with increased resistance.
- Long-term stability: the welded design guarantees consistent resistance, and there is no aging due to corrosion as is the case with contact sleeves.
- High operating reliability: the welded connections can withstand extremely high short-circuit currents with high limit temperatures. No softening of the connections can occur as is the case with soldered connections. .

MBS grounding braids, bare and tinned copper

Cross-section [mm²]	Length[1] [mm]	Weight [kg/m]	max. current load [A]
6	100 - 500	0,06	50
10	100 - 500	0,10	80
16	100 - 500	0,16	120
25	100 - 500	0,26	150
30	100 - 500	0,31	180
35	100 - 500	0,37	195
50	100 - 500	0,53	250

[1]Lengths from 100mm to 500mm in 50mm increments - other lengths on request; length is defined as hole center distance.

Ultraflexx® nomenclature:



INFOBOX

In modern switchgear systems with devices like programmable logic controllers or field bus connections, high-frequency grounding is of paramount importance. It is not only ohmic DC resistance that plays a role but also the impedance, which increases with increasing frequency.

The key factor here is the conductor shape, the overall length and the connection technology. The flat braided materials also used to make grounding braids have an impedance that is many times lower than that of comparable round grounding cables and are for this reason alone far more suitable for high-frequency grounding. They also possess an ideally low transition resistance, something that can only be achieved by welding. The SPS grounding braids are also highly suitable for ensuring the electromagnetic compatibility of different system components and equipment. Electromagnetic interference is generally of high frequency, and the low inductance of the grounding connection is of particular importance when working with higher frequencies. As a rule, this means these connections shoud be as short as possible. However, the shape of the ground connector (flat and thin) plays a more important role in determining inductance in the higher frequency range. The SPS grounding braids perfectly meet this requirement.

Bare and tinned flat copper braids

SPS also produces flat braids in any desired length for special applications.

These braids are cut to length according to customer specifications. Tinned copper sleeves are available to ensure good connections. These sleeves are pushed onto the braids and pressed in place.

SPS supplies tinned and bare flat braids in different cross-sections up to 95 mm².

Type	Cross-section [mm²]	Braid width [mm]	Braid thickness [mm]	Max. ampacity [A]	Copper weight per meter [kg]
FGKB 10	10	13	1,0	80	0,10
FGKB 16	16	15	1,5	120	0,16
FGKB 25	25	23	1,5	150	0,25
FGKB 30	30	23	2,0	180	0,30
FGKB 35	35	23	2,5	195	0,35
FGKB 50	50	28	3,0	250	0,50
FGKB 70	70	30	3,5	290	0,70
FGKB 95	95	40	4,0	340	0,95
FGKV 10	10	13	1,0	80	0,10
FGKV 16	16	15	1,5	120	0,16
FGKV 25	25	23	1,5	150	0,25
FGKV 30	30	23	2,0	180	0,30
FGKV 35	35	23	2,5	195	0,35
FGKV 50	50	28	3,0	250	0,50
FGKV 70	70	30	3,5	290	0,70
FGKV 95	95	40	4,0	340	0,95

FGKB = bare copper FGKV = tinned copper
The key parameter is the cross-section; width and thickness may vary

Sleeves for flat braids

Type	Material	Width A [mm]	Length B [mm]	Wall thickness [mm]
HFG 16	copper tinned	16	15	1
HFG 25	copper tinned	22	25	1
HFG 50	copper tinned	30	30	1

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– the composite busbars with aluminum core and copper cladding

– the alternative to copper bars

Busbars made of CoppAl® have a number of advantages compared to conventional copper bars as the benefits of copper and aluminum are combined in one bar.

Advantages:

- Improved heat dissipation due to larger surface area
- Contact surfaces of the electrical conductor are made of copper (low contact resistance)
- Thermal short-circuit strength is similar to that of copper, as the current flows via the outer skin of the conductor during transient processes (skin effect)
- Cost reduction due to lower material costs
- Lower price fluctuations due to lower copper content
- Lower weight
- Easy handling
- Lower transport workload and costs

CoppAl® is a bi-metal composite material for use as an electrical connection in switch cabinets, switchgear systems and distributors. The copper cladding encases and is inseparably joined with the aluminum core. This permits the optimum combination of the positive properties of highly conductive copper and the low weight of aluminum. Processing (drilling, bending, punching, cutting ...) is comparable with that of copper bars.

Simply use CoppAl® in place of conventional copper bars and see the advantages for yourself!

CoppAl® is available in similar dimensions to copper bars.

CoppAl® bars are the cost-effective alternative to copper bars, as they are cheaper for the same ampacity values.

FAQ on CoppAl®

What are the main advantages of CoppAl® compared to solid copper bars?

- CoppAl® bars with the same ampacity are cheaper and lighter. This makes itself particularly noticeable with large cross-sections.

How can I machine CoppAl® bars (drilling, bending, punching etc. ...)?

- You can machine CoppAl® bars in the same way as conventional copper bars. Bending of more than 90° is also no problem. A bending mandrel does not damage either the copper cladding or the aluminum core.

Must I expect increased corrosion with CoppAl® under normal conditions (e.g. in switchgear systems) or do I need to apply additional corrosion protection?

- No, there is no increased corrosion under normal conditions of the kind prevailing in electrical operating rooms.

Can CoppAl® be used in environments with increased corrosion risk?

- Outside electrical operating rooms, in environments with increased humidity and in the presence of electrolytes (e.g. sea air), you must expect increased corrosion on the cutting edges and in the area of the boreholes. We therefore recommend additional corrosion protection (e.g. pain coat, grease, acid-free vaseline) in case of doubt.

Is CoppAl® compatible with galvanized screws or stainless steel screws?

- Yes, galvanized or stainless steel screws can be used without any problem under normal conditions.

What support spacing should I choose for short-circuit resistant installation of CoppAl®?

- In most cases, you can use the same support spacing as with copper bars.

Are there special supports for CoppAl® bars?

- You can use most commercially available supports. If you decide in favor of CoppAl®, you should, however, bear in mind that you need an approx. 20% larger cross-section compared to copper bars for the same nominal current.

How could the thermal and dynamic short-circuit characteristics of CoppAl® be described?

- The thermal characteristics are similar to those of copper bars. The dynamic properties are between those of copper and aluminum bars.

In which DIN standard can I find more details on CoppAl® bars?

- DIN 43 670, Part 2 (aluminum busbars, copper cladding) applies to CoppAl® busbars.

CoppAl® - as light as aluminum, as conductive as copper

			Ampacity Values acc. to DIN 43670P2 for bars in switchgear systems Heating[2] of bar at an ambient temperature of 35°C			
Dimensions[1] [mm]	Cross-section [mm²]	Weight [kg/m]	to 65°C ΔT = 30 K [A]	to 85°C ΔT = 50 K [A]	to 105°C ΔT = 70 K [A]	Thermal short circuit strength at 1 second [kA]
20 x 5	100	0,363	237	315	370	11
20 x 10	200	0,726	367	488	573	22
30 x 5	150	0,545	327	435	510	17
30 x 10	300	1,089	494	657	771	33
40 x 5	200	0,726	416	553	649	22
40 x 10	400	1,452	617	821	963	44
40 x 12	480	1,742	690	918	1076	53
50 x 5	250	0,908	504	670	786	28
50 x 10	500	1,815	737	980	1150	55
50 x 12	600	2,178	825	1097	1287	66
60 x 5	300	1,170	592	787	924	33
60 x 10	600	2,178	854	1136	1332	66
60 x 12	720	2,614	955	1270	1490	79
80 x 5	400	1,452	763	1015	1190	44
80 x 10	800	2,904	1081	1438	1686	88
100 x 10	1000	3,630	1304	1734	2034	110
100 x 12	1200	4,356	1460	1942	2278	132
120 x 10	1200	4,356	1523	2026	2376	132
120 x 12	1440	5,227	1705	2268	2660	158
140 x 10	1400	5,516	1738	2312	2711	154
140 x 12	1680	6,619	1945	2587	3034	185
160 x 10	1600	6,304	1947	2590	3037	176
160 x 12	1920	7,565	2180	2899	3401	211
200 x 10	2000	7,880	2361	3140	3683	220
200 x 12	2400	9,456	2645	3518	4126	264

[1]Other dimensions on request
Bar length: 4m

You can find the technical data for CoppAl® on page 39-41

COPPER BARS

SPS offers a range of standard solid copper bars in the standard length of 4 m.

The bars are also holed, bent or cut to length on request, and you can also find a range of different insulators and busbar supports from page 20 onwards.

Hole size, number and arrangement in accordance with your specifications.

- Copper bars, flat and solid
- Standard length: 4000 mm (tolerance: –0, +200mm)
- Material: Cu-ETP F25 bare[1] - Cu-ETP F20 and F30 on request
- Structural strength: approx. 250 N/mm²
- Electrical conductivity: 57 S x m/mm² acc. to DIN EN 13601 (DIN 46433; DIN 40500)

	Bar dimensions			
Type	Width [mm]	Thickness [mm]	Cross-section [mm²]	Weight / 4m bar [kg]
SCCU 20x5x4000	20	5	100	3,56
SCCU 30x5x4000	30	5	150	5,34
SCCU 40x5x4000	40	5	200	7,12
SCCU 50x5x4000	50	5	250	8,90
SCCU 60x5x4000	60	5	300	10,68
SCCU 80x5x4000	80	5	400	14,24
SCCU 100x5x4000	100	5	500	17,80
SCCU 20x10x4000	20	10	200	7,12
SCCU 30x10x4000	30	10	300	10,68
SCCU 40x10x4000	40	10	400	14,24
SCCU 50x10x4000	50	10	500	17,80
SCCU 60x10x4000	60	10	600	21,36
SCCU 80x10x4000	80	10	800	28,48
SCCU 100x10x4000	100	10	1000	35,60

[1] Other versions and surfaces on request

INFOBOX

The DIN standards DIN 43670 and DIN 43671 outline the ampacity for conductors made of aluminum and copper under various conditions in tabular form. Correction factors take account of deviating conditions. These factors are listed for:

- Conductivity-dependent load changes
- Different temperatures
- Different bar orientation and routing
- Geometry-based change for AC applications
- Height changes

DIN 43670 lists the values for aluminum busbars, and Part 2 of this standard specifies the continuous ampacity values for copper-clad busbars made of aluminum. DIN 43671 lists the corresponding values for copper busbars.

Expansion connectors are standardized in DIN 46276. This standard describes expansion connectors made of both copper and aluminum.

EXPANSION AND BRAIDED CONNECTORS

SPS has chosen the most commonly used types from the wide variety of customized expansion and braided connectors. These standard expansion flexibles are manufactured in line with DIN 43670 and DIN 43671 and are available in copper and aluminum.

Copper expansion connectors are made of copper lamellas which are 0.2 mm thick and press-welded at the ends.

Aluminum connectors are made of lamellas which are 0.3mm thick and MIG-welded with solid connections.

Cu expansion connectors:

Type	Width [mm]	Nominal current (65° C bar temperature / 35°C ambient temperature) [A]	Weight / unit [kg]
DBCU 38/5/60/220/S	38	490	0,67
DBCU 48/5/60/220/S	48	590	0,83
DBCU 38/10/60/250/S	38	720	1,25
DBCU 48/10/60/250/S	48	860	1,50
DBCU 58/10/80/310/S	58	990	2,17
DBCU 78/10/80/310/S	78	1240	2,83
DBCU 98/10/60/350/S	98	1490	3,75
DBCU 118/10/100/350/S	118	1710	4,67

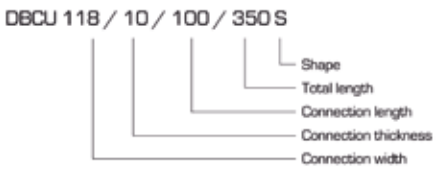
Al expansion connectors:

Type	Width [mm]	Nominal current (65° C bar temperature / 35°C ambient temperature) [A]	Weight / unit [kg]
DBAL 40/5/60/250/S	40	380	0,33
DBAL 40/5/80/310/S	40	380	0,42
DBAL 40/10/80/310/S	40	560	0,58
DBAL 50/10/80/310/S	50	670	0,67
DBAL 60/10/80/310/S	60	770	0,83
DBAL 80/10/100/350/S	80	980	1,08
DBAL 100/10/100/350/S	100	1190	1,33

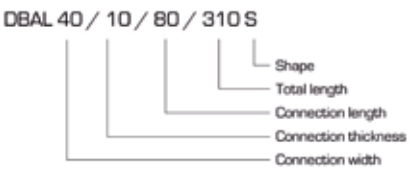
Cu braided connectors:

Type	Width [mm]	Nominal current (65° C bar temperature / 35°C ambient temperature) [A]	Weight / unit [kg]
LICU 120/40/60/220	40	370	0,42
LICU 240/40/60/220	40	580	0,67
LICU 360/50/60/250	50	700	1,08
LICU 480/50/60/250	50	850	1,40
LICU 600/60/80/310	60	990	2,08
LICU 720/80/80/310	80	1180	2,50
LICU 960/100/100/350	100	1490	3,67

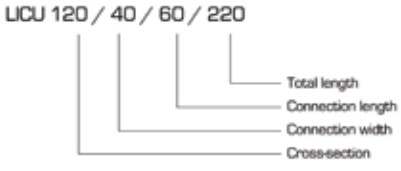
Nomencl. for Cu expansion connectors:



Nomencl. for Al expansion connectors:



Nomencl. for braided connectors:



INSULATORS

SPS keeps a stock of selected insulators for different applications and requirements. All insulators are silicon-free, halogen-free and self-extinguishing in line with UL 94 V0. Different colors (red, black and white) have been chosen to make it easier to distinguish between the specific properties.

The **red supporting insulators** are made of glass fiber-reinforced polyester of high mechanical stability and with an operating temperature of max. 130°C. The threaded inserts on both sides are made of zinc plated steel. A hex for fixing with a standard OE spanner is integrated in the center of the insulator. The operating voltage is highly dependent on the insulator height and it is only with large heights this voltage reaches high values that correspond to the phase voltage of 400 VAC. Otherwise, supporting structures can be realized between bars in a phase, bars with ground potential or for control switching systems easily and at low cost.

The **black insulators** are made of glass fiber-reinforced polyamide 6.6 with an operating voltage of 1000 V and an operating temperature of max. 130°C. Up to a diameter of 25mm, the black insulators consist of a round body with a cast-on hex on one side. The round body is replaced by a six-point star via this hex. The threaded inserts are made of brass, while threaded bolts are made of galvanized and passivated steel. The various types are listed in the table below.

Insulator type	Diameter [mm]	Threaded insert	Threaded rod
1	25 (round)	2x (brass)	-
2	35 (star)	2x (brass)	-
3	25 (round	1x (brass)	1x (steel*)
4	35 (star)	1x (brass)	1x (steel*)

* galvanized

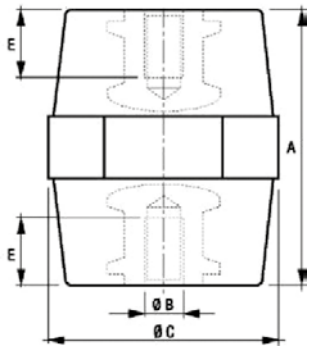
The **white spacer insulators** serve to support cover plates and protective devices and are therefore only available in the thread sizes M4 and M5.

The body consists of a continuous hex with a wrench width of 12 mm. These insulators are designed for low smoke emissions and are flame retardant, the glass fiber-reinforced polyamide is designed for 140°C. The spacer insulators are available in two types (2 x threaded insert / 1 x bolt, 1 x threaded insert) in heights from 20 – 60 mm.

INSULATORS

Designation	Flexural-strength [kN]	Tensile strength [kN]	Test voltage DC [V=]	Test voltage AC [V~]	Torque [Nm]	A x C x B [mm]	E [mm]
ISO 20M4	2	3	900	750	3	20 x 19 x 4	6
ISO 20M6	2	4	900	750	6	20 x 19 x 6	6
ISO 25M5	2	6	1200	1000	6	25 x 22 x 5	6
ISO 25M6	2	6	1200	1000	6	25 x 22 x 6	6
ISO 30M6	3	6	1500	1200	10	30 x 30 x 6	9
ISO 30M8	3	6	1500	1200	25	30 x 30 x 8	9
ISO 35M6	5	9	1600	1400	10	35 x 32 x 6	10
ISO 35M8	5	9	1600	1400	25	35 x 32 x 8	10
ISO 35M10	5	9	1600	1400	50	35 x 32 x 10	10
ISO 40M6	9	11	1900	1600	10	40 x 41 x 6	10
ISO 40M8	9	11	1900	1600	25	40 x 41 x 8	10
ISO 40M10	9	11	1900	1600	50	40 x 41 x 10	10
ISO 45M8	10	15	2100	1800	25	45 x 46 x 8	13
ISO 45M10	10	15	2100	1800	50	45 x 46 x 10	13
ISO 50M6	6	10	2400	2000	10	50 x 36 x 6	13
ISO 50M8	6	10	2400	2000	25	50 x 36 x 8	15
ISO 50M8	11	18	2400	2000	25	50 x 50 x 8	13
ISO 50M10	11	18	2400	2000	50	50 x 36 x 10	13
ISO 50M10	11	18	2400	2000	50	50 x 50 x 10	13
ISO 50M12	11	18	2400	2000	85	50 x 50 x 12	13
ISO 60M8	11	22	2800	2400	25	60 x 55 x 8	15
ISO 60M10	11	22	2800	2400	50	60 x 55 x 10	18
ISO 60M12	11	22	2800	2400	85	60 x 55 x 12	18
ISO 70M12	12	25	3600	3000	85	70 x 60 x 12	18
ISO 70M16	12	25	3600	3000	200	70 x 60 x 16	24
ISO 80M12	16	31	4200	3500	85	80 x 65 x 12	18
ISO 80M16	16	31	4200	3500	200	80 x 65 x 16	24
ISO 100M12	15	36	6000	5000	85	100 x 65 x 12	18
ISO 100M16	15	36	6000	5000	200	100 x 65 x 16	24

- Operating temperature: -40° C to +130° C
- Self-extinguishing in line with UL 94 V0
- Halogen-free
- Silicon-free
- UL - E111031
- QMF22 Component - Plastics
- Color: red (RAL 3002)



INSULATORS

Designation	Height (H) [mm]	Width (W) [mm]	Thread (M)	Thread depth (D) [mm]	Type
B1 25M6	25	25	M6	7	1
B1 30M6	30	25	M6	7	1
B1 30M8	30	25	M8	9	1
B1 35M6	35	25	M6	7	1
B1 35M8	35	25	M8	10	1
B2 35M6	35	35	M6	7	2
B2 35M8	35	35	M8	9	2
B2 35M10	35	35	M10	10	2
B2 40M6	40	35	M6	7	2
B2 40M8	40	35	M8	9	2
B2 40M10	40	35	M10	10	2
B2 45M6	45	35	M6	7	2
B2 45M8	45	35	M8	9	2
B2 45M10	45	35	M10	10	2
B2 50M6	50	35	M6	7	2
B2 50M8	50	35	M8	9	2
B2 50M10	50	35	M10	10	2

Type 1

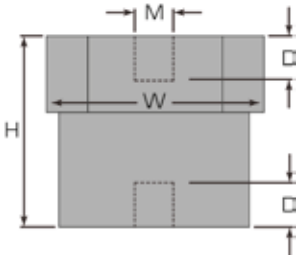
Type 2

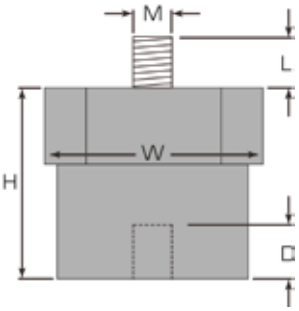
Designation	Height (H) [mm]	Width (W) [mm]	Thread (M)	Thread depth (D) [mm]	Length (L) [mm]	Type
B3 25M6	25	25	M6	7	20	3
B3 25M8	25	25	M8	9	20	3
B3 30M6	30	25	M6	7	20	3
B3 30M8	30	25	M8	9	20	3
B3 35M6	35	25	M6	7	20	3
B3 35M8	35	25	M8	9	20	3
B4 35M6	35	35	M6	7	20	4
B4 35M8	35	35	M8	9	20	4
B4 35M10	35	35	M10	10	34	4
B4 40M6	40	35	M6	7	20	4
B4 40M8	40	35	M8	9	20	4
B4 40M10	40	35	M10	10	34	4
B4 45M6	45	35	M6	7	20	4
B4 45M8	45	35	M8	9	20	4
B4 45M10	45	35	M10	10	34	4
B4 50M6	50	35	M6	7	20	4
B4 50M8	50	35	M8	9	20	4
B4 50M10	50	35	M10	10	34	4

Type 3

Type 4

- Marerial: polyamide 6.6, glass fiber-reinforced
- Temperature: 130°C continuous load
- Halogen-free
- Self-extinguishing in line with UL 94 V0
- Color: black
- Female thread: brass
- Male thread: steel, galvanized





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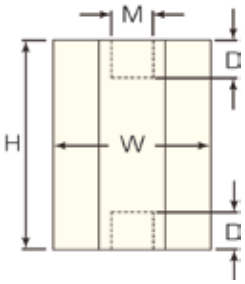
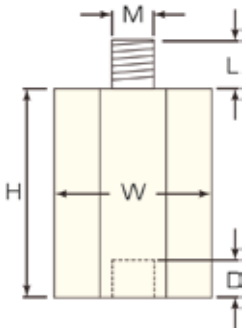
Designation	Height (H) [mm]	Width (W) [mm]	Thread (M)	Thread depth (D) [mm]	Length (L) [mm]	Type
W2 20M4	20	12	M4	5	-	1
W2 20M5	20	12	M5	5	-	1
W2 25M4	25	12	M4	5	-	1
W2 25M5	25	12	M5	5	-	1
W2 30M4	30	12	M4	5	-	1
W2 30M5	30	12	M5	5	-	1
W2 40M5	40	12	M5	5	-	1
W2 50M5	50	12	M5	5	-	1
W2 60M5	60	12	M5	5	-	1
W1 20M4	20	12	M4	5	16	2
W1 20M5	20	12	M5	5	14	2
W1 25M4	25	12	M4	5	16	2
W1 25M5	25	12	M5	5	14	2
W1 30M4	30	12	M4	5	16	2
W1 30M5	30	12	M5	5	14	2
W1 40M5	40	12	M5	5	14	2
W1 50M5	50	12	M5	5	14	2
W1 60M5	60	12	M5	5	14	2

Type 1

Type 2

- Material: polyamide 6, glass fiber-reinforced
- Temperature: 140°C continuous load
- Halogen-free
- Self-extinguishing in line with UL 94 V0
- Color: white
- Female thread: brass
- Male thread: steel, tinned





GENIFLEX® BUSBAR SUPPORTS

The universal suitability of the busbar supports for different bar formats greatly reduces stocking needs.

The 3-fold support SH3 has a phase center spacing of 60 mm and can therefore be used for all operating equipment, such as NH isolators or power switches with 60 mm phase spacing.

Type	SH1	SH3
No. of poles	1-pole	3-pole
Phase center distance	-	60 mm

SH 1

SH 3

Technical Data

Bar sizes and arrangement options					
Horizontal	12 x 5	20 x 5	30 x 5		
	12 x 10	20 x 10	30 x 10		
	12 x 10	20 x 10	30 x 10		
Vertical		20 x 5	30 x 5*		
		2 x 20 x 5	2 x 30 x 5*		
		20 x 10	30 x 10*	40 x 10*	50 x 10*

* Bar arrangement with adapter and spacer sleeves

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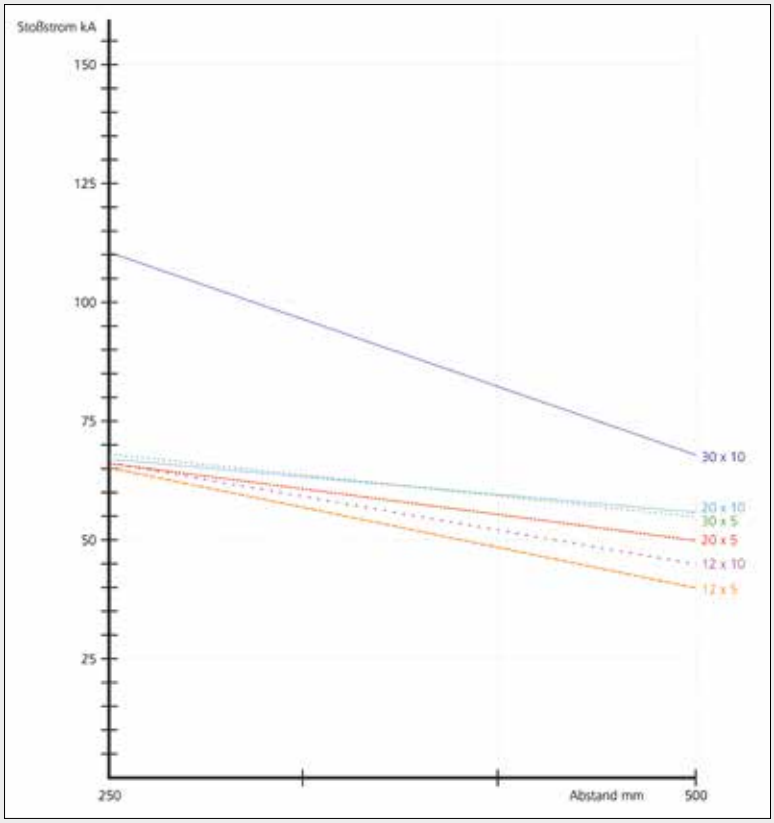
INFOBOX

Short-Circuit current

When it comes to short-circuit current, a distinction is made between surge current and continuous short-circuit current. It is the continuous short-circuit current that is responsible for heating the conductor. It is proportional to the current square I^2 and the duration of the short circuit t.

The surge current generates the maximum force that is exercised on the current-carrying conductors and therefore on the supports. The spacing between two neighboring supports can be changed to absorb the forces of the maximum expected surge current. This dependence for supports SH1 and SH3 is shown in the diagram. With a given current, this permits calculation of the maximum admissible spacing between the busbar supports for different bar formats. The maximum spacing differs between busbar supports.

Surge current



For more information please use the QR-Code or visit www.sps-standard.com

Example:

With a Cu bar measuring 30x10 mm and a support spacing of 250 mm, the maximum short-circuit current is 110 kA

SHS BUSBAR SUPPORTS

For upright busbar mounting, 3-pole and 4-pole for 10 mm bars.

The busbar supports are used to create a 3 or 4-pole busbar system with conductor heights from 30 – 100 mm. The bar can have both individual conductors and double conductors per phase. Different phase center spacings permit adaptation of the busbar system to different room dimensions or concepts with different short-circuit strengths. The nominal operating voltage according to IEC 61439 is 1000VAC or 1500VDC.

The data on short-circuit current is listed under the link in the info box on page 25.

The busbar supports are made of glass fiber-reinforced polyamide 6.6 and are self-extinguishing in line with UL 94 V0. The material permits a maximum bar temperature of 120°C and is halogen-free. The top and bottom sections of a support are identical, thereby ruling out the problem of interchanging. The two support sections are connected to each other via threaded rods or threaded bolts. The spacing of the support sections is defined by so-called spacers to suit the bar height.

5 supports are required for laying within a switch cabinet. This is why the busbar supports are available in packs of 10, equivalent to 5 supports.

The length of the required threaded rods depends on the bar height plus the length for securing of the support on the base structure.

Designation	No. of poles	Conductor width [mm]	Phase center spacing [mm]	No. of bars [Type]
SHS 3-10-82-2	3	10	82	2
SHS 3-10-110-1	3	10	110	1
SHS 3-10-110-2	3	10	110	2
SHS 4-10-60-1	4	10	60	1
SHS 4-10-65-1	4	10	65	1
SHS 4-10-65-2	4	10	65	2
SHS 4-10-82-1	4	10	82	1
SHS 4-10-82-2	4	10	82	2

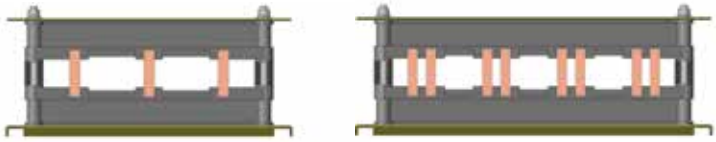
Spacer

Designation	Spacer height
SH-SP5	5 mm
SH-SP25	25 mm
SH-SP50	50 mm

Conductor height (mm)	Min. length of threaded rod (mm)	Spacers per threaded rod
30	120	1 x SH-SP5
40	130	3 x SH-SP5
50	140	1 x SH-SP25
60	150	1 x SH-SP25 + 2 x SH-SP5
80	170	1 x SH-SP5 + 1 x SH-SP50
100	190	1 x SH-SP25 + 1 x SH-SP50

Please note that spacers, threaded rods, nuts and washers all need to be additionally ordered!

Mounting example with spacer:



SHL BUSBAR SUPPORTS

For horizontal bar arrangement, 3-pole and 4-pole for 10 mm bars.

The busbar supports are used to create a 3 or 4-pole busbar system with the conductor dimensions 20/25/30 x 10mm and 20/25 x 5 mm. The nominal operating voltage according to IEC 61439 is 1000VAC or 1500VDC.

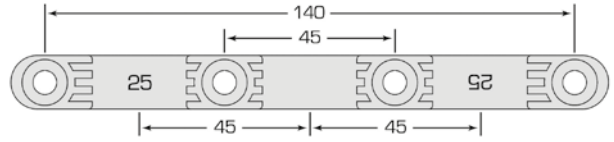
The data on short-circuit current is listed under the link in the info box on page 25.

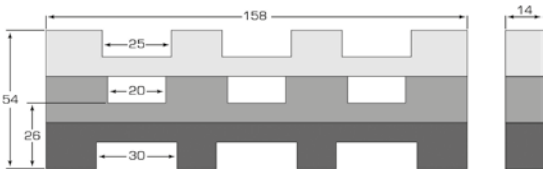
The busbar supports are made of glass fiber-reinforced polyamide 6.6 and are self-extinguishing in line with UL 94 V0. The material permits a maximum bar temperature of 120°C and is halogen-free. Each support consists of 3 molded parts that can be used to create various conductor widths and thicknesses. The support sections are joined using screws.

Designation	No. of poles	Conductor width [mm]	Spacing phase center/phase c. [mm]
SHL3	3	20, 25, 30	45
SHL4	4	20, 25, 30	45

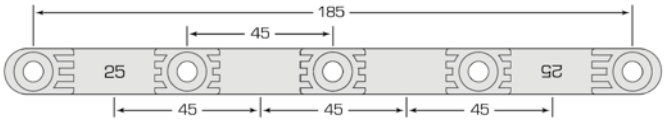
3 and 4-pole busbar supports are suitable for the following bar sizes:

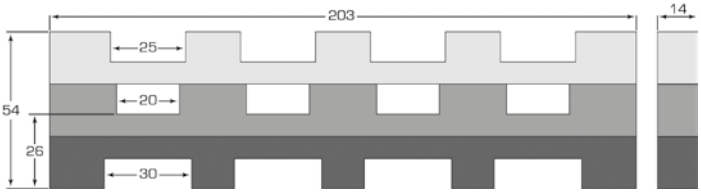
30 x 10, 25 x 10, 20 x 10, 25 x 5 and 20 x 5





SHL 3

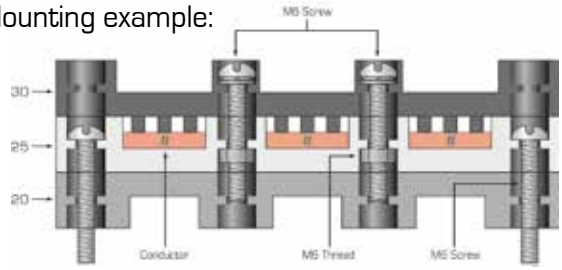




SHL 4

Type	Dimensions			
	Length [L]	Width [B]	Total height [H]	Width of groove [B1]
SHL3	158	14	54	20,25,30
SHL4	203	14	54	20,25,30

Mounting example:



For mounting use M6 Screws.

SHK FLAT BUSBAR SUPPORTS

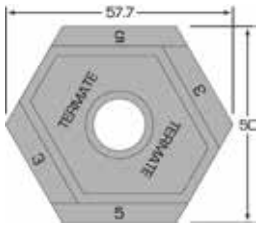
Flat horizontal bar arrangement for bar widths of 3, 5, 6, 8 and 10 mm.

The innovative design allows the use of 5 different bar thicknesses with one bar support. Combination of individual supports permits the creation of 3, 4 and 5-pole systems. The bar width can be varied between 25 and 80 mm without the need to use additional adapter pieces. The nominal operating voltage according to IEC 61439 is 1000VAC or 1500VDC. The all-round character of the supports paves the way for an easy-to-install, lightweight and cost-effective solution for the creation of a bar system.

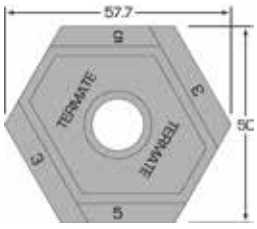
The busbar supports are made of glass fiber-reinforced polyamide 6.6 and are self-extinguishing in line with UL 94 V0. The material permits a maximum bar temperature of 120°C and is halogen-free. A support consists of an upper and lower section. The two support sections are connected by a threaded bolt which simultaneously secures them on the base structure. The spacings of the support sections can be chosen in line with the short-circuit strength. The data on short-circuit current is listed under the link in the info box on page 25.

The desired conductor thickness can be achieved by coordinating the positions of the top and bottom sections relative to one another. The diagram shows you how to do this:

Dimensions:



top section SHK-O



bottom section SHK-U

Conductor thickness:	3 mm	5 mm	6 mm	8 mm	10 mm
Position of top section	0 mm	5 mm	3 mm	5 mm	5 mm
Pos. of bottom section	3 mm	0 mm	3 mm	3 mm	5 mm

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VMS BUSBAR SUPPORTS

For upright bar arrangement, for 10 mm bars with 2 or 3 conductors per phase.

The busbar supports are used to create a 2, 3, 4 or 5-pole busbar system with conductor heights from 30 – 120 mm and bar thickness of 10 mm. The bar system can have double or triple conductors per phase or just one conductor per phase. Different phase center spacings permit adaptation of the busbar system to different room dimensions or concepts with different short-circuit strengths. The nominal operating voltage according to IEC 61439 is 1000VAC or 1500VDC.

The busbar supports are made of glass fiber-reinforced polyamide 6.6 and are self-extinguishing in line with UL 94 V0. The material permits a maximum bar temperature of 120°C and is halogen-free. The top and bottom sections of a support are identical, thereby ruling out the problem of interchanging. The two support sections are connected to each other via threaded rods. The spacing of the holder sections adapts automatically to the bar height.

The phase center spacings can be extended using spacers from 110 mm to 130 mm to ensure clear spacing between neighboring phases. In addition, the larger structure of the individual supports permits any desired phase spacing dimension above 130 mm. This means that correspondingly high short-circuit currents can be absorbed. The data on short-circuit current is listed under the link in the info box on page 25.

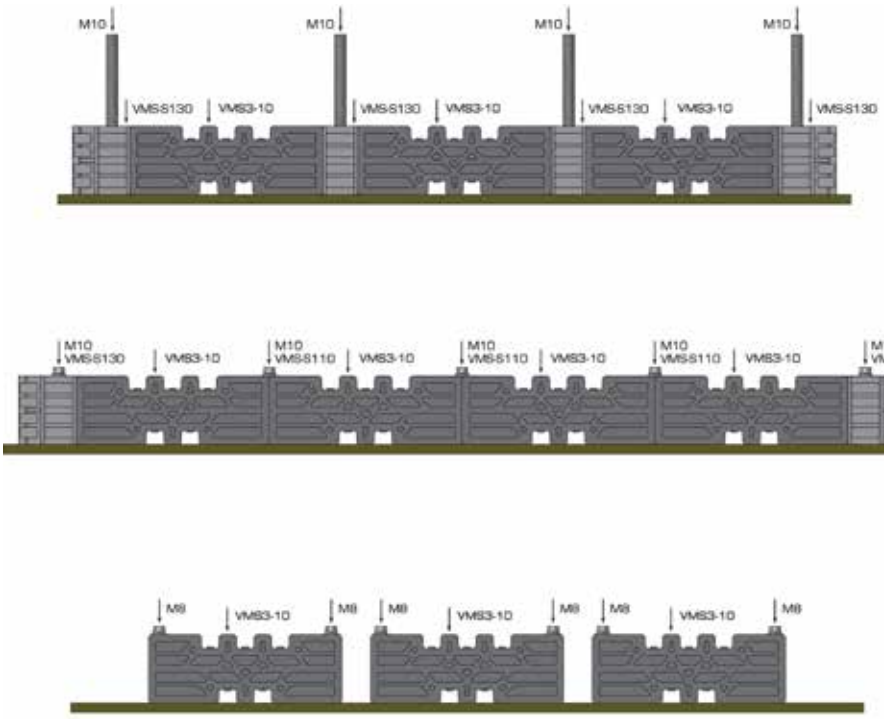
The length of the required threaded rods depends on the bar height plus the length for securing of the support on the base structure.

VMS3-10

Spacer for 110 mm phase centers
VMS-S110

Spacer for 130 mm phase centers
VMS-S130

Mounting example:



NS250 and NS400

The NS250 and NS400 busbars plugs are designed to serve as screwless, removable connectors for the contacting of 5mm and 10mm copper and CoppAl® bars.

The spring contacts are made from a high-strength and highly conductive silver-plated copper alloy. The surrounding casing is made from glass fiber-reinforced polyamide 6.6 with its known outstanding properties.

For the purpose of conductor contacting, the plug connector can be used with a max. temperature of 105°C and complies with IEC 61439.

Type	Current [1] [A]	Conductor size [mm]	Certified current peak [kA]	Breakdown voltage [kV]
NS250-5	250	5	30	8
NS250-10	250	10	30	8
NS400-5	400	5	40	8
NS400-10	400	10	40	8

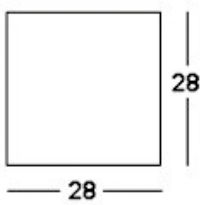
[1] The aforementioned current was tested with an increase of 30 k above the ambient temperature of 35° C in accordance with IEC 61439.

Both connectors have the same outer dimensions and are suitable for the same mounting parameters:

- Total length: 112mm
- Connector insert length after mounting: 80mm
- Connector width: 48mm
- Thickness of mounting plate: 1.5 - 3 mm

We recommend the use of contact grease for plug connections.

N.B. Plug connectors may only be connected and disconnected in no-load state!



Recommended cutout for the plug connectors

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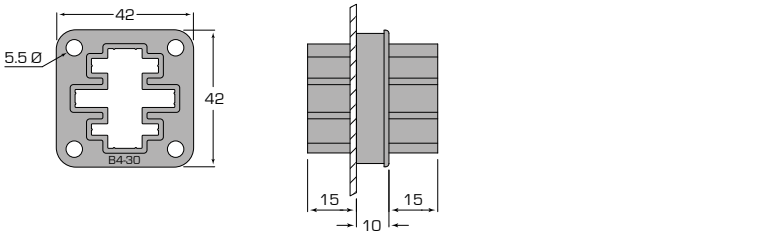
BUSHING INSULATOR

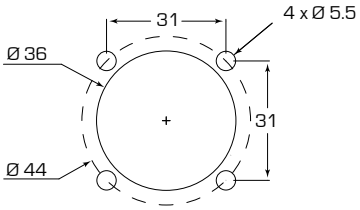
Each B4 bushing insulator is used to route bars in 4 formats through casing walls, switchgear sections and mounting plates.

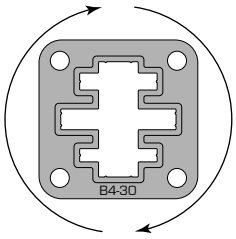
B4-30 can be used for bars up to 30x10mm and B4-50 for bars of sizes up to 50x10mm. The B4-30 and B4-50 bushings can route bars both upright and horizontally, and can also be twisted into any angle position. This is what sets the B4-30 and B4-50 apart from similar bushing insulators.

- Material: polyamide 6.6, glass fiber-reinforced
- Temperature: 145° C
- Halogen-free
- Self-extinguishing in line with UL 94 V0
- Color: black

B4-30 for bars measuring 20 x 3, 20 x 4, 30 x 5 and 30 x 10

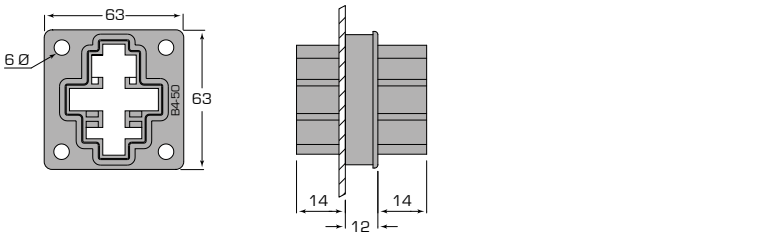


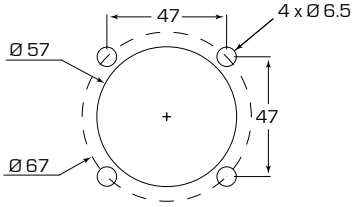


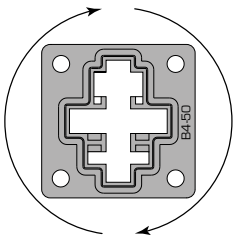


- rotate as required to suit application - either horizontal or vertical

B4-50 for bars measuring 25 x 5, 20 x 10, 40 x 10 and 50 x 10







- rotate as required to suit application - either horizontal or vertical

Flat connector clamps

for the connection of ISOFLEXX® to flat bars lengthwise or at an angle of 90° without drilling

Article nr.	Type	Conn. widths [mm x mm]	Outer dim. [mm x mm]	Clamp width [mm]	No. in pack
90010200	FAK 16 x 16	16 x 16	35 x 35	20	9
90010310	FAK 16 x 32	16 x 32	35 x 52	20	9
90010210	FAK 20 x 20	20 x 20	40 x 40	20	9
90010320	FAK 20 x 40	20 x 40	40 x 60	20	6
90010220	FAK 25 x 25	25 x 25	45 x 45	20	9
90010330	FAK 25 x 50	25 x 50	45 x 70	20	6
90010230	FAK 32 x 32	32 x 32	52 x 50	20	6
90010340	FAK 32 x 63	32 x 63	52 x 82	20	6
90010240	FAK 40 x 40	40 x 40	60 x 60	20	3
90010350	FAK 40 x 63	40 x 63	60 x 82	32	3
90010360	FAK 40 x 80	40 x 80	70 x 110	35	3
90010250	FAK 50 x 50	50 x 50	70 x 70	20	3
90010370	FAK 50 x 80	50 x 80	80 x 110	35	3
90010380	FAK 50 x 100	50 x 100	80 x 130	35	3
90010260	FAK 60 x 63	60 x 63	80 x 82	32	3
90010280	FAK 80 x 80	80 x 80	120 x 120	35	3
90010300	FAK 100 x 100	100 x 100	140 x 140	35	3

Pressure plates

for the connection of ISOFLEXX® to flat bars, including fastening material; plates made of 5 mm thick steel with DIN hole

Article nr.	Type	Dimensions [mm]	No. of boreholes	With screws	No. in pack
90080300	DP 32/1	32 x 30	1	M 8 x 40	3
90080310	DP 40/1	40 x 40	1	M 10 x 40	3
90080330	DP 50/1	50 x 50	1	M 10 x 40	3
90080320	DP 40/2	40 x 80	2	M 12 x 40	3
90080340	DP 40/2	50 x 80	2	M 12 x 40	3

Plastic support

Plastic support for the mounting of ISOFLEXX® on DIN 35 mm profile bars; made of halogen-free, self-extinguishing, glass fiber-reinforced polyamide; alternatively suitable for fixing with cable ties

Article nr.	Type	Description	No. in pack
90080400	KSH 50	complete	4
90080410	KSH 51	bottom section for cable ties only	12

High-current clamps

for clamp connections of ISOFLEXX® to flat bars lengthwise without drilling; clamp width 40 mm; made of stainless steel, with high bending strength, perfect for constant contact pressure across the entire surface

Article nr.	Type	Description	No. in pack
90010600	HSSK 80	80	1 clamp connection
90010610	HSSK 100	100	1 clamp connection
90010620	HSSK 120	120	1 clamp connection

Conductor connection clamps

for the mounting of round connectors or ISOFLEXX® on flat bars with a thickness of 5 mm without drilling

Article nr.	Type	Connection [mm²]	Can be used up to max. [A]	Clamping space [mm]	No. in pack
90010410	LASK 16/5	1,5 - 16	180	7,5 x 7,5	20
90010440	LASK 35/5	4 - 35	270	10,5 x 11	10
90010470	LASK 70/5	16 - 70	400	14 x 14	5

Drilling templates

for problem-free drilling of ISOFLEXX®, matched to the relevant bar width, with different drill bits

Article nr.	Type	Bar width [mm]	Bohehole [mm]	No. in pack
90080100	BL 16	16 mm	6 / 8	1
90080110	BL 20	20 mm	8 / 10 / 12	1
90080120	BL 24	24 mm	8 / 10 / 12	1
90080130	BL 32	32 mm	10 / 12	1

Bending tool

for manual bending of ISOFLEXX® and flat Cu bars; angle stop steplessly adjustable from 0 - 120°; maximum bending performance: solid Cu bars, 100 x 12 mm; made of breakproof spherical cast metal

Article nr.	Type	Packaging dimensions [mm]	Weight [kg]	No. in pack
90090100	BV - 100	780 x 280 x 290	ca. 24	1

Twisting tool

for manual twisting of ISOFLEXX® using the bending tool BV-100 or another suitable holding device

Article nr.	Type	Packaging dimensions [mm]	Weight [kg]	No. in pack
90090110	VD	480 x 80 x 40	ca. 1,6	1

Our accessories are naturally also available with different dimensions on request.

CERTIFICATES

All SPS products represent the latest state of the technical art. They are optimized in line with technical advances and the ongoing definition of standards.

All SPS products comply with the legal stipulations and technical guidelines within the European Union and are CE labeled in line with the valid regulations. This process is monitored and implemented on a continuous basis by our CE Officer. We will be happy to send you the underlying declarations of conformity on request.

SPS is certified in accordance with ISO 9001:2008 and is subject to quality monitoring and auditing by BVQI (Bureau Veritas). In addition, parts of our production process are audited by UL (Underwriters Laboratories).

Norms and standards

- DIN ISO 9001:2008
- DIN VEN 50525
- Underwriters Laboratories (UL)
- Canadian Standards Association (CSA)
- Rohs
- CE

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TECHNICAL DATA ISOFLEXX®

Product group	ISOFLEXX® Classic	ISOFLEXX® Premium	ISOFLEXX® Supreme
Conductor			
Material	E-Cu bare E-Cu tinned	E-Cu bare E-Cu tinned	E-Cu bare E-Cu tinned
Lamella thickness	0.5 mm with width 13 mm 0,8 mm with width 9 mm/16 mm 1 mm from width 20 mm	1 mm	0.5 mm with width 13 mm 0,8 mm with width 9 mm/16 mm 1 mm from width 20 mm
Structural strength	180-220 MPa (F20)	180-220 MPa (F20)	180-220 MPa (F20)
Electr. Conductivity	57 S x m/mm²	57 S x m/mm²	57 S x m/mm²
Insulation			
Material	High-grade special PVC blend Plasticizer, non-migrating. Compatible with construction materials like polycarbonate, polymethylmethacrylate etc.	High-grade silicon, halogen-free Homogeneous, extruded profile	High-grade Santoprene, halogen-free Homogeneous, extruded profile
Flammability	UL 94 V0	UL 94 V0	UL 94 HB
Color	Black, brown, blue, yellow/green Other colors on request	Gray, brown Other colors on request	Black Other colors on request
Thickness	≥ 1 mm	≥ 2 mm	≥ 1 mm
Dielectric strength	20 kV/mm	16 kV/mm	30 kV/mm
Expansion	370%	180%	540%
Operating temperature	-30°C / +105°C	-40°C / +190°C	-40°C / +135°C
Operating voltage	1000 VAC/1500 VDC (UL 600 VAC/750 VDC)	1000 VAC/1500 VDC (UL 600 VAC/750 VDC)	1000 VAC/1500 VDC
Dimensions			
Length	2000 mm (Standard) other lengths on request	2000 mm (Standard) other lengths on request	2000 mm (Standard) other lengths on request
Width	9-120 mm other widths on request	20-120 mm other widths on request	9-50 mm other widths on request
Norms and standards			
	DIN EN ISO 9001:2008 DIN EN 50525 Underwriters Laboratories (UL) Canadian Standards Association (CSA) Rohs CE	DIN EN ISO 9001:2008 DIN EN 50525 Rohs CE	DIN EN ISO 9001:2008 DIN EN 50525 Rohs CE

ISOFLEXX® bar screw connections

The following standards should be observed:
- DIN 43671 and 43670: Busbars with rectangular cross-section
- DIN 43673: Busbars - drilling and crew connection

Creating busbar connections:

It is generally advisable to tighten non-rusting screws with a torque wrench.

In addition, sprung elements should be used that can maintain the required contact pressure. The tension discs maintain the tension force within a defined range and are therefore also recommended for the fixing of screws.

Sufficient tension force prevents the screws from loosening by themselves. This facilitates maintenance of busbar connections. In fact, no maintenance may be necessary at all.

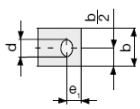
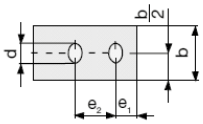
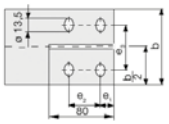
In the case of vibrations etc., micro-encapsulated screws or other screw fixing devices should be used.

With DC and AC current up to 6300 A, connecting material (bolts, nuts) of strength class 8.8 or higher (DIN 267T3) can be used in indoor areas.

Treatment of contact surfaces:

The surfaces should be even but not polished. The contact resistance is lower if the contact surfaces have medium coarseness (RA 1.6-3.2) as this makes it easier to pass through the oxides. However, the contact surfaces should be free of oxidation and grease. If this is not the case, you must clean the contact surfaces.

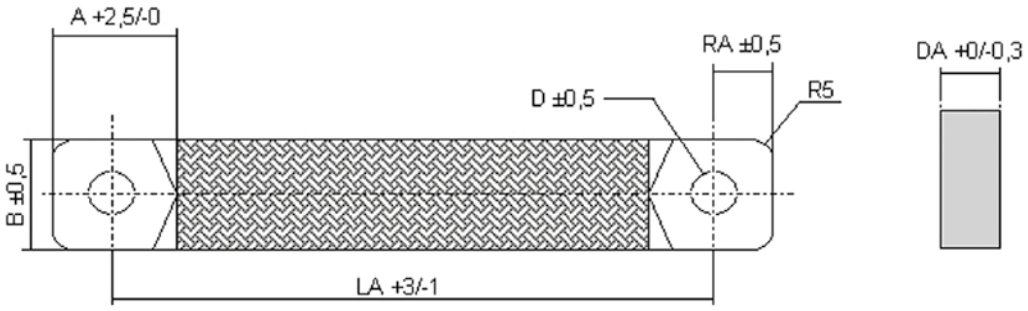
Boreholes DIN 43673

Bar widths	12 to 50	25 to 60	80 to 120
Drilling of bar ends (drilling profile)			

Drilling measurements

Nom.width b	d	e_1	d	e_1	e_2	e_1	e_2	e_3
12	5,5	6						
15	6,6	7,5						
20	9	10						
25	11	12,5	11	12,5	30			
30	11	15	11	15	30			
40	13,5	20	13,5	20	40			
50	13,5	25	13,5	20	40			
60			13,5	20	40			
80			3			20	40	40
100						20	40	60
120						20	40	60

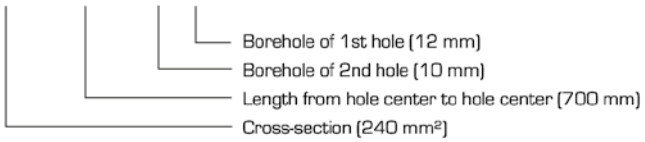
All dimensions in mm



Type	Cross-section	Connection Width	Connection Thick-ness	Length	Borehole	Spacing	Length hole/ hole	Weight per meter	Nominal current[2] Indiv.	Nominal current[2] two parallel
	[mm²]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/m]	[A]	[A]
		B	**DA**	**A**	**D**	**RA**	**LA**			
UFL 25 - LA - D - RA[1]	25	20	1,5	35	8,5 / 10,5	9	150 - 1000	0,25	160	270
UFL 50 - LA - D - RA[1]	50	20	4	35	8,5 / 10,5	9	150 - 1000	0,51	270	460
UFL 100 - LA - D - RA[1]	100	20	6	35	8,5 / 10,5	9	150 - 1000	1,02	425	730
UFL 120 - LA - D - RA[1]	120	32	4,5	35	10,5 / 12,5	12	150 - 1000	1,22	470	810
UFL 240 - LA - D - RA[1]	240	32	9	35	10,5 / 12,5	12	150 - 1000	2,44	745	1280

[1]Specify Length (LA), Borehole (D) and Spacing (RA)
[2] Nominal current at 35°C ambient temperature and 85°C conductor temperature
The conductor temperature caries accordingly with higher or lower ambient temperature;
max. operating temperature: 105°C
Deviating current loads can be converted using the factors listed in DIN 43671.

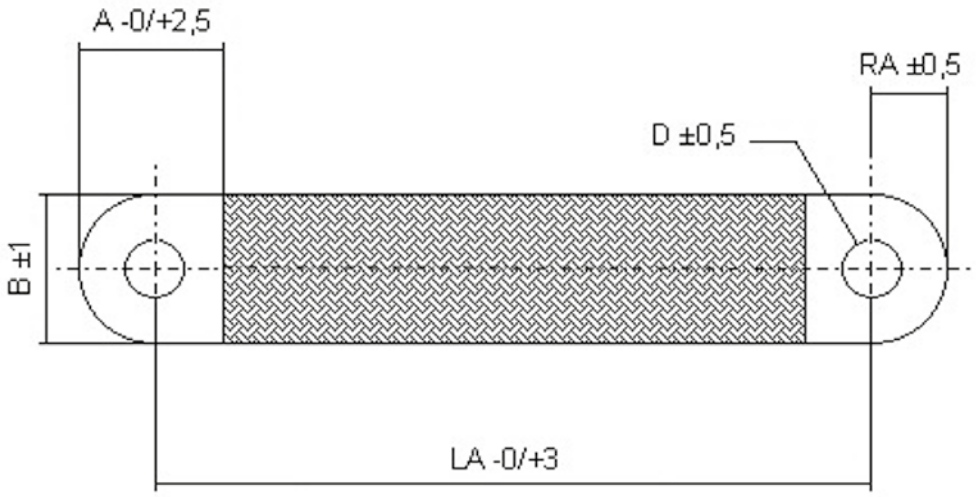
Ultraflexx® nomenclature: UFL 240 - 700 - 10/12



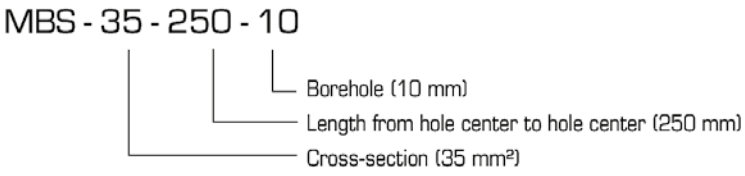
TECHNICAL DATA GROUNDING BRAIDS

Type CU bare/tinned	Cross-section [mm²]	Width B ± 1mm [mm]	Length A hole/ hole [mm]	Spacing RA	Mass [kg/m]	Borehole [mm]
MBS 6-XXX-6	6	12	16	7,5	0,062	6,5
MBS 10-XXX-6	10	12	16	7,5	0,104	6,5
MBS 16-XXX-6	16	15	16	11,5	0,164	6,5
MBS 16-XXX-8	16	15	16	11,5	0,164	8,5
MBS 25-XXX-10	25	tinned 23 / bare 21	21	11,5	0,262	10,5
MBS 30-XXX-10	30	23	21	11,5	0,314	10,5
MBS 35-XXX-10	35	23[1]	22	11,5	0,366	10,5
MBS 50-XXX-10	50	28	24	11,5	0,528	10,5
MBS 50-XXX-12	50	28	24	11,5	0,528	12,5

[1] For 35 mm² the tolerance is ± 2 mm.



Grounding braid nomenclature:



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Continuous ampacity

Dimensions	Cross-section	Resistance	Continuous ampacity [A] (Bar temperature 65°C, ambient temperature 35°C)		Continuous ampacity [A] (Bar temperature 85°C, ambient temperature 35°C)	
		(DC, 20°C)	AC	DC	AC	DC
[mm]	[mm²]	(µΩ/m)	(50 Hz / 60 Hz)	(and 16 2/3 Hz)	(50 Hz / 60 Hz)	(and 16 2/3 Hz)
20 x 5	100	265	235	235	311	311
30 x 5	150	177	328	329	435	436
20 x 10	200	138	363	365	481	484
40 x 5	200	133	418	420	554	557
30 x 10	300	88	493	497	653	659
50 x 5	250	105	508	511	673	677
60 x 5	300	88	594	599	787	794
40 x 10	400	66	617	625	818	828
40 x 12	480	56	681	727	902	963
50 x 10	500	53	736	751	975	995
80 x 5	400	66	762	773	1010	1024
50 x 12	600	45	809	831	1072	1101
60 x 10	600	44	853	875	1130	1159
60 x 12	720	37	934	967	1238	1281
80 x 10	800	33	1074	1119	1423	1483
100 x 10	1000	27	1287	1358	1705	1799
100 x 12	1200	22	1399	1496	1854	1982
120 x 10	1200	22	1488	1589	1972	2105
120 x 12	1440	19	1617	1755	2143	2325

Continuous ampacity using more than one parallel bar

Dimensions	Continuous ampacity [A] (Bar temperature 65°C, ambient temperature 35°C)					
[mm]	n = 2		n = 3		n = 4	
	AC	DC	AC	DC	AC	DC
20 x 5	441	443	646	650	848	858
30 x 5	603	607	872	885	1134	1162
20 x 10	699	709	1027	1052	1340	1396
40 x 5	756	766	1084	1110	1395	1453
30 x 10	923	949	1331	1401	1703	1853
50 x 5	905	1285	1334	1285	1637	1743
60 x 5	1047	1077	1471	1550	1856	2022
40 x 10	1126	1176	1586	1725	1996	2273
40 x 12	1243	1316	1737	1938	2176	2559
50 x 10	1314	1396	1810	2038	2252	2680
80 x 5	1320	1376	1809	1971	2248	2565
50 x 12	1440	1559	1966	2284	2440	3009
60 x 10	1492	1612	2012	2344	2488	3075
60 x 12	1625	1796	2173	2621	2690	3445
80 x 10	1825	2033	2378	2939	2930	3843
100 x 10	2141	2443	2718	3518	3338	4589
100 x 12	2301	2709	2913	3912	3581	5111

Values for vertical orientation of the bar package with clear bar spacings equal to the bar thickness; clear main conductor spacing > 0.8 x main conductor center spacing.

Comparison table for copper - CoppAl® - aluminum busbars

Dimensions	Width	Cross-section	Continuous ampacity (A) for busbars in indoor installations at 35°C air temperature and 65°C bar temperature based on DIN 43670 and DIN 43671		
mm	mm	mm²	Copper Cu-ETP	CoppAl®	Aluminum Al-EL
12 x 5	12	60	180	–	144
15 x 5	15	75	215	–	170
20 x 5	20	100	274	237	214
25 x 5	25	125	327	–	255
30 x 5	30	150	379	327	295
40 x 5	40	200	482	416	376
50 x 5	50	250	583	504	455
60 x 5	60	300	688	592	533
80 x 5	80	400	885	763	688
100 x 5	100	500	1080	935	846
12 x 10	12	120	294	249	222
20 x 10	20	200	427	367	331
30 x 10	30	300	573	494	445
40 x 10	40	400	715	617	557
50 x 10	50	500	852	737	667
60 x 10	60	600	985	854	774
80 x 10	80	800	1240	1081	983
100 x 10	100	1000	1490	1304	1190
120 x 10	120	1200	1740	1523	1390
140 x 10	140	1400	1980	1738	1590
160 x 10	160	1600	2220	1947	1780
200 x 10	200	2000	2690	2361	2160
40 x 12	40	480	800	690	625
50 x 12	50	600	955	825	745
60 x 12	60	720	1105	955	865
100 x 12	100	1200	1670	1460	1335
120 x 12	120	1440	1950	1705	1555
140 x 12	140	1680	2220	1945	1780
160 x 12	160	1920	2485	2180	1995
200 x 12	200	2400	3015	2645	2420

Data on bending

Bending				
Thickness [mm]	Height [mm]	≤ 90°	90° - 120°	> 120°
5	20 - 60	1d	2d	4d
10	20 - 120	2d	3d	4d
12	40 - 120	2d	3d	4d

CoppAl® bars should not be bent over a sharp edge.

Continuous ampacity DIN 43670 und DIN 43671

To calculate the continuous ampacity under changed conditions, multiply the relevant value in the table by the factors k2, k3, k4 or k6 listed below.

Factor k_2 (change in ambient and bar temperature)

	Ambient temperature		
Bar temperature	**25°C**	**35°C**	**45°C**
55°C	1,04	0,80	0,54
65°C	1,19	1,00	0,77
75°C	1,34	1,17	0,98
85°C	1,47	1,33	1,16
95°C	1,60	1,45	1,30
105°C	1,71	1,57	1,43

See DIN 43670 for other temperature values.

Factor k_3 (horizional orientation of the bar width)

No. of bars	**Bar width [mm]**	**Factor k_3**
1	-	1,00
2	bis 80	0,85
3	bis 80	0,80
3	über 80	0,75
4	über 80	0,70

Factor k_4 (change in geographic location)

Hight above sea level [m]	**Factor k_4**
1000	0,71
2000	0,58
3000	0,41
4000	0,29

Values for bar internal mounting.

Factor k_6 (for frequencies greater than 60 Hz)

Frequency [Hz]	**Factor k_6**
100	0,71
150	0,58
300	0,41
600	0,29
1.200	0,20

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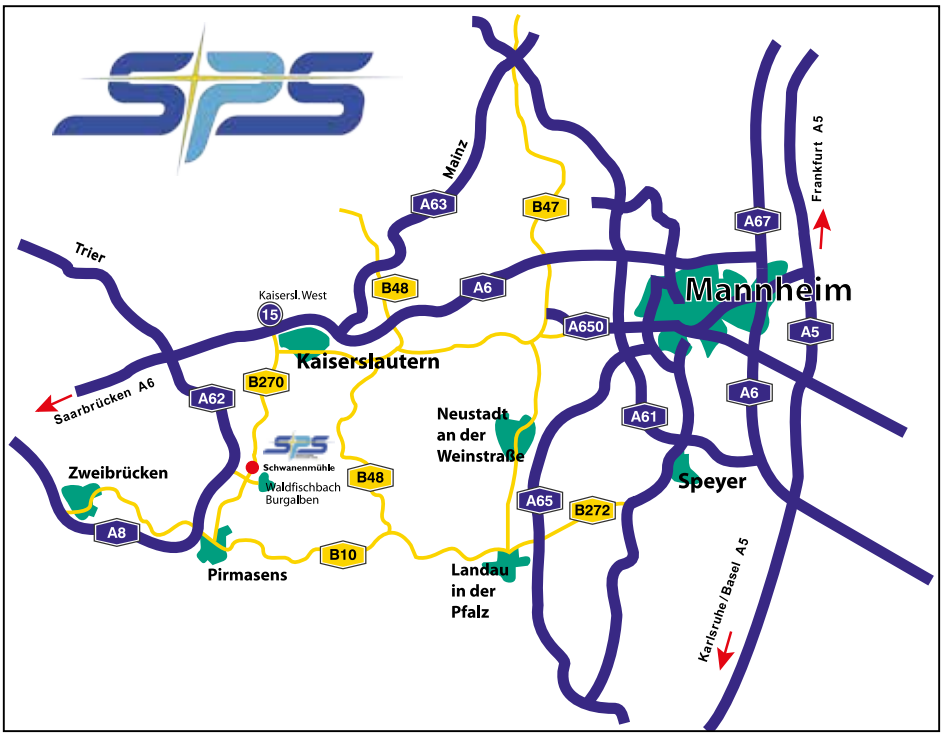
LOCATION



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