

## SURGE PROTECTION

### Spark gap: EXFS L

Document No.: 14-101-R1

Sheet: 1 of 1

German Cathodic Protection



Ex isolating spark gaps EXFS L are used for conductive system parts which cannot be interconnected directly in hazardous zones. This includes, for example, pipe sections supplied with a cathodic corrosion protection system.

ATEX certified EXFS L spark gaps provide approved and tested safety according to harmonised European standards.

The arc-resistant tungsten-copper electrodes ensure a long service life of the Ex spark gaps.

The approved type EXFS L with flexible conductor connection adjusts itself quickly to any application environment. The prewired spark gaps include connecting cables of different lengths with cable lugs, M10 screws and nuts. Flat or angled connection brackets (IF), which are available as accessories, allow for easy connection of the spark gap at pipeline flanges.



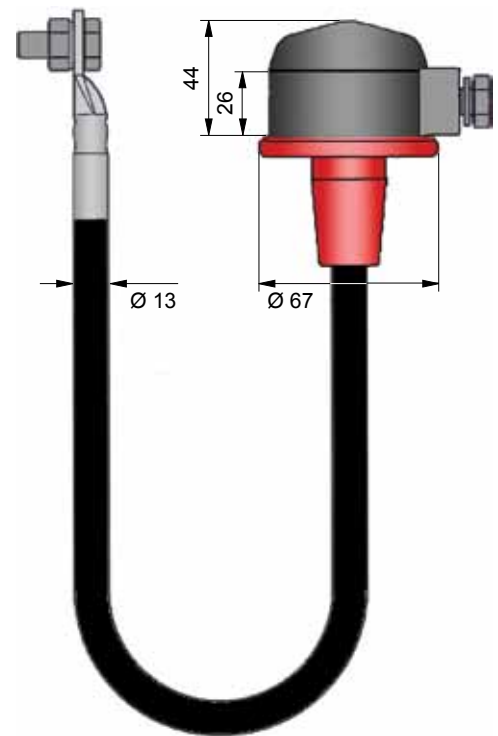
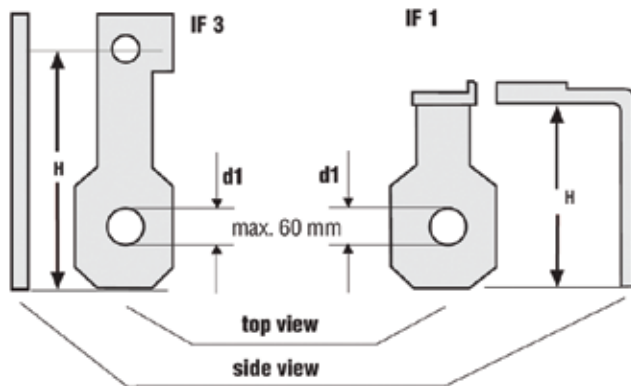
### Application

An isolating spark gap makes an indirect connection between functionally separate parts of an installation, e.g. isolated earth-termination systems. It can be used to bridge insulating pieces, insulating couplings and insulating flanges on installations with cathodic corrosion protection parts of an installation, such as pipelines or tanks, or as a measure of lightning equipotential bonding according to DIN VDE 0185.

### Connection bracket

Terminal height H

Size	IF 1	IF 3
1	H = 0.08 m	H = 0.10 m
2	H = 0.10 m	H = 0.12 m
3	H = 0.14 m	---



EXFS L ...: Ex isolating spark gap for above ground installation	EXFS L100	EXFS L200	EXFS L300
Lightning impulse current	50 kA	50 kA	50 kA
Classification of lightning current carrying capability acc. to EN 50164-3	N	N	N
Nominal discharge current (8/20 µs)	100 kA	100 kA	100 kA
100% lightning impulse sparkover voltage	≤ 2.5 kV	≤ 2.5 kV	≤ 2.5 kV
Power frequency sparkover voltage (50 Hz)	≤ 1.2 kV	≤ 1.2 kV	≤ 1.2 kV
Type of protection according to EN 50014, EN 50021	II 3 G EEx nC II T4	II 3 G EEx nC II T4	II 3 G EEx nC II T4
Operating temperature range [TU]	-20°C...+80°C	-20°C...+80°C	-20°C...+80°C
Degree of protection	IP 54	IP 54	IP 54
Approvals, Certifications	ZELM 03 ATEX 3192X	ZELM 03 ATEX 3192X	ZELM 03 ATEX 3192X
Length of enclosure	90 mm	90 mm	90 mm
Diameter of enclosure	63 mm	63 mm	63 mm
Enclosure material	zinc die casting, plastic	zinc die casting, plastic	zinc die casting, plastic
Connecting cable	H01N2-D 25 mm <sup>2</sup> with cable lug and M10 screw / nut	H01N2-D 25 mm <sup>2</sup> with cable lug and M10 screw / nut	H01N2-D 25 mm <sup>2</sup> with cable lug and M10 screw / nut
Cable length	100 mm	200 mm	300 mm
Suitable for flange size	20 - 130 mm	120 - 230 mm	220 - 320 mm

## SURGE PROTECTION

### Spark gap: EXFS KU

Document No.: 14-102-R1

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German Cathodic Protection



Ex isolating spark gaps EXFS KU are used for conductive system parts which cannot be interconnected directly in hazardous zones. This includes, for example, pipe sections supplied with a cathodic corrosion protection system.

ATEX certified EXFS L spark gaps provide approved and tested safety according to harmonised European standards.

Ex isolating spark gap EXFS KU with connecting cables for aboveground and underground installation. For lightning equipotential bonding according to IEC 62305-4.

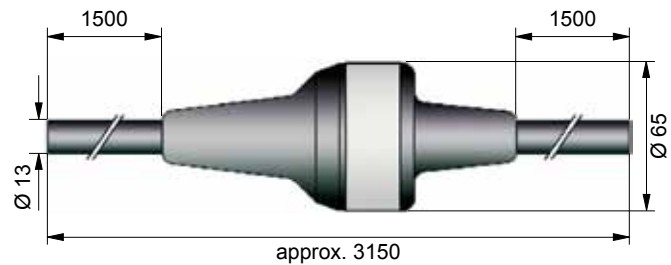


### Application

Spark gaps are used in installations with cathodic corrosion protection systems. They can be used to bridge insulating flanges and insulating couplings, or for the indirect connection of the earthing system parts on installations with cathodic protection, such as pipelines or tanks.

The spark gap is to be installed in the immediate vicinity, e.g. on the pipe. Ensure that any loop formed on installation is as small as possible.

The connection to the pipe can be screwed or welded. All screwed connections should be secured with spring washers to prevent them working loose.



### Maintenance and operation

The spark gap is maintenancefree.

An overload usually causes welding/short circuiting of the electrodes. Overloads detected by the potential indicator of the cathodic protection system. A defective spark gap can also be detected by a simple resistance measurement (measured value <math>< 10 \text{ k}\Omega</math>).

EXFS KU: EX isolating spark gap for installation above or below ground	EXFS KU
Lightning impulse current	50 kA
Classification of lightning current carrying capability acc. to prEN 50164-3	N
Nominal discharge current (8/20 $\mu$ s)	100 kA
100% lightning impulse sparkover voltage	$\leq 2.5 \text{ kV}$
Power frequency sparkover voltage (50 Hz)	$\leq 1.2 \text{ kV}$
Type of protection according to EN 50014, EN 50021	II 3 G EEx nC II T4
Operating temperature range [TU]	-20°C...+80°C
Degree of protection	IP 67
Approvals, Certifications	ZELM 03 ATEX 3192X
Length of enclosure	90 mm
Diameter of enclosure	63 mm
Enclosure material	zinc die casting, plastic covered
Connecting cable	NY-Y-J 1 x 25 mm <sup>2</sup>
Cable length	2 x approx. 1500 mm

## SURGE PROTECTION

### Spark gap: EXFS 100 / EXFS 100 KU

Document No.: 14-103-R1

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German Cathodic Protection



#### EXFS 100

Isolating spark gap for use in hazardous zones with plastic coating and threaded M10 sockets.

- For indirect connection/earthing of functionally separate parts of installations when being affected by lightning
- Device for lightning equipotential bonding according to IEC 62305 in hazardous areas
- For bridging insulating pieces, insulating flanges, etc. in cathodic protected pipeline sections
- For safe application in explosion protection zone 1 (gases) or 2 (dust)
- Considerably low sparkover voltage
- Considerably high AC current withstand capability

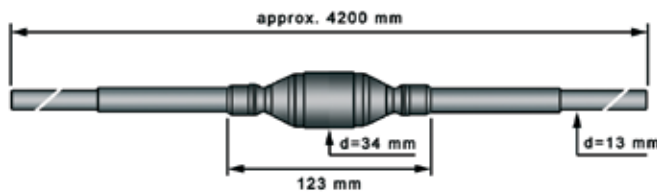
#### Connection cable Cu 25 mm<sup>2</sup> for EXFS 100

Connection cable for EXFS 100 with cable lug for M10 bolt, M10 screw, StSt nut (V2A) and spring washer.  
Available cable length: 100, 200 or 300 mm



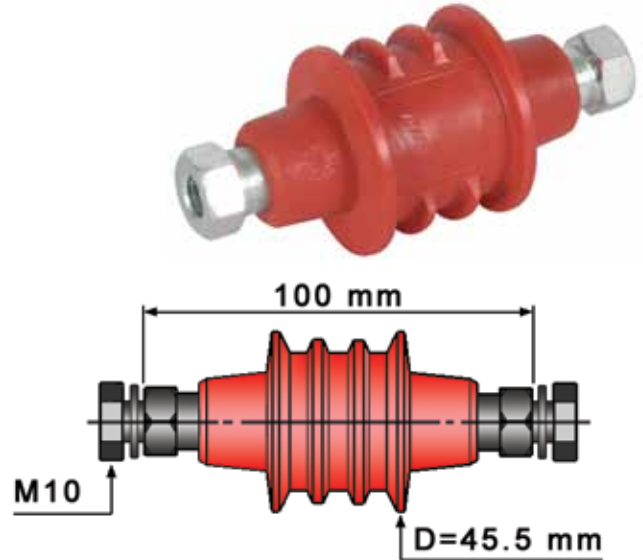
#### EXFS 100 KU

Spark gap for hazardous zones with 2 m connecting cables for underground installation



#### EXFS 100

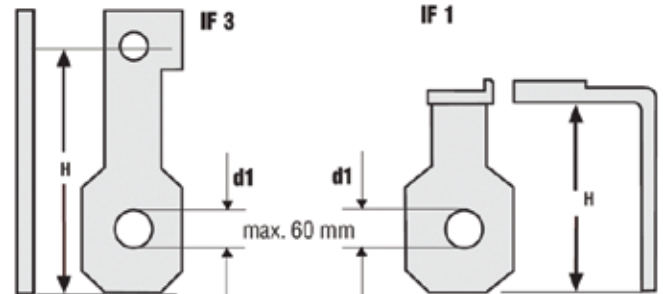
Isolating spark gap for hazardous zones with M10 bolt and nut



#### Connection bracket for EXFS 100

Terminal height H

Size	IF 1	IF 3
1	H = 0.08 m	H = 0.10 m
2	H = 0.10 m	H = 0.12 m
3	H = 0.14 m	---



EX isolating spark gap for installation above or below ground	EXFS 100	EXFS 100 KU
Lightning impulse current (10/350 μs)	100 kA	100 kA
Class of lightning impuls current strength acc. to EN 50164-3	H	H
Nominal discharge current (8/20 μs)	100 kA	100 kA
Rated power frequency withstand voltage (50 Hz)	250 V	250 V
100% lightning impulse sparkover voltage	≤ 1.25 kV	≤ 1.25 kV
Power frequency sparkover voltage (50 Hz)	≤ 0.5 kV	≤ 0.5 kV
Rated discharge current (50 Hz)	500 A/0.5 sec. (Tu: ≤ 45°C)	500 A/0.5 sec. (Tu: ≤ 45°C)
(Ex) Marking acc. to EN 60079 (gas atmospheres)	II 2G Ex d II T6	II 2G Ex d IIC T6
(Ex) Marking acc. to EN 61241 (combustible dust)	II 2D Ex tD A21 IP67 T 80°C	II 2D Ex tD A21 IP67 T 80°C
Operating temperature range [TU]	-20°C...+60°C	-20°C...+60°C
Degree of protection	IP 67	IP 67
Approvals Certifications	BVS 06 ATEX E 099	BVS 06 ATEX E 099
Enclosure material	plastic coating	plastic coating; water-proof coating
Connection of enclosure	hexagon screw M10 x 16, M10 nut	./.
Connecting cable / Cable length	./.	NYY-J 1 x 25 mm <sup>2</sup> / approx. 2 m

## SURGE PROTECTION

Spark gaps: TC100A and TC500A

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German Cathodic Protection

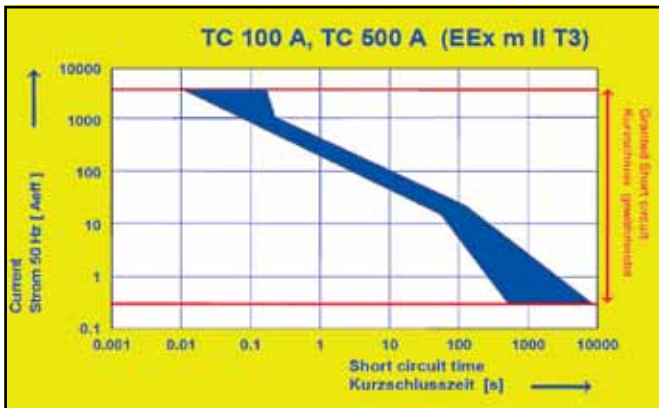


## ATEX approved protection class Ex II 2G EEx m II T3 Lightning protection equipotential bonding in Ex-zone



- high quality industrial ceramics
- filled with inert gas, hermetically sealed
- no radioactivity!
- Extremely low spark-over voltage
- high impulse current resistance 100 kA
- robust highly reliable and robust
- stable functioning, long service life
- Fail-safe characteristics

### Fail-safe characteristics



### Description

ATEX approved Ex-protected Isolating Spark Gaps type TC100A, TC500A are hermetically sealed, heavy duty metal/ceramic spark gaps filled with inert gas, Ex-proof encapsulated with stainless steel/Araldite. Fail-safe execution.

### Application

For use in Ex-zones, where a special high protection against dangerous lightning and surge voltage influences is required. Especially used for equipotential bonding in cathodic corrosion systems on gas and oil pipelines, in the petrochemical industry etc. To protect against dangerous spark-over on isolation flanges and isolation parts in pipeline systems; for equipotential bonding of separate grounded systems in case of lightning strikes. TC 500 A used where high voltages are induced.

### Accessories

Cable connection kit:

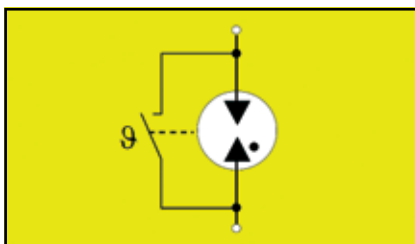
K1/300 (300 mm), Total length with K1 = 445 mm

K1/600 (600 mm), Total length with K2 = 745 mm

Other cable length on request



### Symbol



**SURGE PROTECTION****Spark gaps: TC100A and TC500A**

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**German Cathodic Protection****Technical data**

Protection class / approvals	Zündschutzart Ex II 2G EEx m II T3 EN 50014, EN 50028, ASEV 93.1 2325 U European patent EP 0 603 428 B1	ZELM 02 ATEX 0095X (28.06.2002) 1. Ergänzung (30.03.2004) PTB Teilbescheinigung Ex-96.D.2004 U (29.01.1996) ASEV Zulassung/approval No. 94.10 11 36 U SEV 00.0084, Prüfbericht SEV 94.1 01136.01 SK certificate P/01463/101/1/97		
Terms in accordance with: CENELEC / BTTF 62-2 / DIN 48810 / DIN 0845		TC 100 A	TC 500 A	
Nominal DC spark-over voltage at 100V/s	$V_{sdc}$	[V DC]	100V + 20%	500V + 15%
Nominal DC spark-over voltage at 50Hz	$V_{sac}$	[V AC]	70V + 20%	350V + 15%
Impulse spark-over voltage, typical value	$V_{si}$	1kV/ $\mu$ s [V DC]	650	950
Impulse spark-over voltage, max. value	$V_{si}$	1kV/ $\mu$ s [V DC]	950	1300
3 x impulse discharge surge current (10/350 $\mu$ s) + long term current (acc. to CENELEC / BTTF 62-2)	$I_{imp+}$ ( $i_{sb}$ )	[kA]/[As]/[MJ/ $\Omega$ ] + [A]/[s]/[As]	75 kA / 38 As / 1,45 MJ/ $\Omega$ plus 150 A / 0,5 s / 75 As	
20 x impulse discharge surge current (10/45 $\mu$ s) + mains half wave (acc. to DIN 48810)	$I_{imp+}$ ( $i_{sb}$ )	[kA]/[As]/[MJ/ $\Omega$ ]	60 kA / 10 As / 0.1 MJ/ $\Omega$	
10 x nominal impulse discharge surge current (8/20 $\mu$ s)	$I_n$ ( $i_{diN}$ )	[kA]	100	
5 x nominal alternating discharge current, 1s / 3min break	( $i_{daN}$ )	[A <sub>rms</sub> ]/[s]	100 / 1	
1 x nominal alternating discharge current (max.)	( $i_{daN}$ )	[A <sub>rms</sub> ]/[s]	200 / 0.5	
1 x alternating discharge current max. load 50 Hz	( $i_{damax}$ )	[A <sub>rms</sub> ]/[s]	4000 / 0.25	
Spark gap extinguishing conditions	( $V_{ex}$ / $i_{ext}$ )	[A <sub>rms</sub> ]/[s]	<70 V / <20 A	<230 V / <100 A
Insulation resistance at 10 V or 100 V	$R_{is}$	[G $\Omega$ ]	<1	
Capacitance at 1 kHz	C	[pF]	20	20
Climatic category, relative humidity/ambient protection	DIN IEC 60068 - 1		40/90/21, 10%....95% rh IP 67	
Operating / storage temperature range	[°C]		- 40 °C.....+70 °C	
Connections			M10 bolt/nut ...stainless steel	
Net weight / pc	[g]		approx. 700	
Protection category			IP 67	
Measurements ( $\varnothing$ x L)	[mm]		approx. 50 x 127 (160)	
<b>Remark:</b> After a long period of storage in darkness, GDT-spark gaps may show a first measured value of DC or AC spark-over voltage that exceeds tolerance levels. However, this is not important when assessing isolating spark gaps.				

**Ordering information**

Connection kit*: K1/300 (300 cm)	Art. no.:	49 51 08
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Type name	TC 100 A	TC 500 A
Art. no.:	48 78 30	48 78 50
	complete with connection Kit K1/300:	
Art. no.:	49 51 07	49 51 05

# PIPELINE INSULATING JOINTS

## Flange insulating kits

Document No.: 14-201-R1

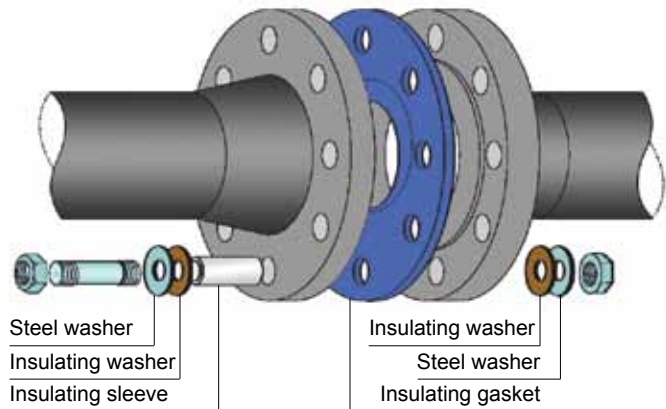
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German Cathodic Protection



Flange Insulating Kits are used for electrically isolating cathodic protected pipeline sections from unprotected pipelines or other metallic structures.

Gasket-seals are sealings which are effective immediately after installation when the pipes are assembled the first time. The gaskets have an almost unlimited durability and can be removed and reinstalled several times. Gask-O-Seal gaskets are available to fit all international standards, sizes and pressure ratings.



Material	Gaskets			Sleeve Spiral Wound Mylar	Washer High Strength Phenolic
	A	B	C		
Dielectric strength ( V/ mm )	20 000	20 000	94 000	4 000	2 000
Compressive strength ( N/cm <sup>2</sup> )	16 900	16 900	14 000		
Flexural strength ( N/cm <sup>2</sup> )	15 820	15 820	highly flexible		
Tensile strength ( N/cm <sup>2</sup> )	17 580	17 580	2 670		
Water absorption ( % )	1.6	1.6	5	0.8	1.0
Recommended max. temperature for continuous use ( °C )	80	107	316	150	107

### General Information

Gasket-seals are based on the advantageous principle of O-ring seals, but without their characteristic disadvantages. Unlike O-rings, there is no need to provide grooves in the flanges with close tolerances or to align the flanges exactly during assembly.

Gasket seals are made of first-class insulating materials. Later on, they may be converted into insulating flanges by adding insulating sleeves and washers.

Deformation of the sealing element under pressure is predetermined by the construction of the ring. The synthetic rubber of the element reverts to its original form if the flange is able to breathe under the pressure in the pipes, that is, the crown of the sealing ring remains in uniform contact with the inner flange surfaces, thus ensuring perfect sealing, even during pressure fluctuations.

The materials for the retainer and the sealing are carefully selected to allow their use in a wide range of liquids and gases under various operating conditions. Standard type gaskets can be used up to a maximum operating temperature of 107° C. High temperature gaskets even tolerate temperatures up to 180° C. Pressure capabilities considerably exceed the test pressure of ANSI 2500 flanges. They can also be used under low vacuum conditions.

**Material :** **A** Neoprene faced phenolic

**B** GASKET-SEAL retainer phenolic laminate with integral nitrile or viton seals

**C** Red Devil® Style 940 non-asbestos

High temperature materials: max. operating temperature 180° C

Retainer: high temperature phenolic

Seal element: fluorocarbon

If required, retainers and seals made of other materials can be supplied for special applications (for corrosive liquids, gases, vacuum).

### Insulating Kits

Flange Insulating Kits consist of the following :

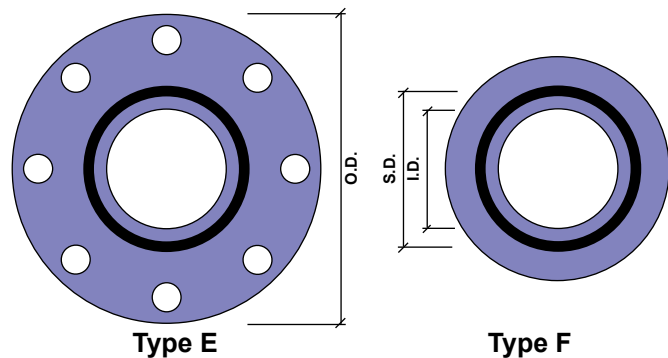
1 Gasket

Insulating sleeves (qty. according to flange type)

Insulating washers (qty. according to flange type)

Bright steel washers (qty. according to flange type)

Bolts and nuts are not included as standard but can be delivered on request.



Gasket-Seal **Type E** are used to avoid electrical contact points.

When using **Type F** gasket seals, the outside of the flange has to be taped.

No shutdown will be necessary when converting a normal gasket seal into an insulating flange. The bolts are removed one after another, fitted with insulating sleeves and washers, and then reinstalled. The flange coupling remains unaffected.



**Flange Insulating Kits (Gasket Dimensions)**

Nom. Pipe Size	Gasket I.D.		Gasket O.D.		Seal Ring centre line dia.	Seal Ring width	Number and size of bolts							
	from	to	Type E	Type F			ANSI 150	ANSI 300	ANSI 400	ANSI 600	ANSI 900	ANSI 1500	ANSI 2500	
1	1 1/16	1	Same as O.D. of flange	Bolt circle less bolt diameter	1.524"	.156	4- 1/2	4- 5/8	4- 5/8	4- 5/8	4- 7/8	4- 7/8	4- 7/8	
1 1/4	1 3/8	1 1/4			1.940"	.156	4- 1/2	4- 5/8	4- 5/8	4- 5/8	4- 7/8	4- 7/8	4- 1	4- 1
1 1/2	1 5/8	1 1/2			2.210"	.156	4- 1/2	4- 3/4	4- 3/4	4- 3/4	4- 1	4- 1	4- 1 1/8	4- 1 1/8
2	2 1/16	1 15/16			2.760"	.156	4- 5/8	8- 5/8	8- 5/8	8- 5/8	8- 7/8	8- 7/8	8- 1	8- 1
2 1/2	2 1/2	2 5/16			3.020"	.156	4- 5/8	8- 3/4	8- 3/4	8- 3/4	8- 1	8- 1	8- 1 1/8	8- 1 1/8
3	3 1/16	2 15/16			3.600"	.156	4- 5/8	8- 3/4	8- 3/4	8- 3/4	8- 7/8	8- 1 1/8	8- 1 1/8	8- 1 1/4
3 1/2	3 9/16	3 7/16			4.170"	.172	8- 5/8	8- 3/4	8- 7/8	8- 7/8				
4	4 1/16	3 13/16			4.750"	.172	8- 5/8	8- 3/4	8- 7/8	8- 7/8	8- 1 1/8	8- 1 1/4	8- 1 1/2	8- 1 1/2
5	5 1/16	4 13/16			5.650"	.172	8- 3/4	8- 3/4	8- 7/8	8- 1	8- 1 1/4	8- 1 1/2	8- 1 3/4	8- 1 3/4
6	6 1/16	5 3/4			6.720"	.172	8- 3/4	12- 3/4	12- 7/8	12- 1	12- 1 1/8	12- 1 3/8	12- 1 3/8	8- 2
8	8	7 5/8			8.720"	.172	8- 3/4	12- 7/8	12- 1	12- 1 1/8	12- 1 3/8	12- 1 3/8	12- 2	12- 2
10	10 1/16	9 3/4			11.000"	.172	12- 7/8	16- 1	16- 1 1/8	16- 1 1/4	16- 1 3/8	12- 1 7/8	12- 2 1/2	12- 2 1/2
12	12 1/16	11 3/4			13.500"	.172	12- 7/8	16- 1 1/8	16- 1 1/4	20- 1 1/4	20- 1 3/8	16- 2	12- 2 3/4	12- 2 3/4
14	13 1/4	13			14.700"	.172	12- 1	20- 1 1/8	20- 1 1/4	20- 1 3/8	20- 1 1/2	16- 2 1/4		
16	15 1/4	15			16.750"	.188	16- 1	20- 1 1/4	20- 1 3/8	20- 1 1/2	20- 1 5/8	16- 2 1/2		
18	17 1/4	17			19.000"	.188	16- 1 1/8	24- 1 1/4	24- 1 3/8	20- 1 5/8	20- 1 7/8	16- 2 3/4		
20	19 1/4	19			21.000"	.188	20- 1 1/8	24- 1 1/4	24- 1 1/2	24- 1 5/8	20- 2	16- 3		
22	21 1/4	21			23.250"	.188	20- 1 1/4	24- 1 1/2	24- 1 5/8	24- 1 3/4				
24	23 1/4	23			25.000"	.188	20- 1 1/4	24- 1 1/2	24- 1 3/4	24- 1 7/8	20- 2 1/2	16- 3 1/2		
26	25 1/4	25			26.500"	.188	24- 1 1/4	28- 1 3/8	28- 1 3/4	28- 1 7/8	20- 2 3/4			
28	27 1/4	27			28.500"	.188	28- 1 1/4	28- 1 3/8	28- 1 7/8	28- 2	20- 3			
30	29 1/4	29			30.500"	.188	28- 1 1/4	28- 1 3/4	28- 2	28- 2	20- 3			
32	31 1/4	31			32.500"	.188	28- 1 1/2	28- 1 7/8	28- 2	28- 2 1/4	20- 3 1/4			
34	33 1/4	33			34.500"	.188	32- 1 1/2	28- 1 7/8	28- 2	28- 2 1/4	20- 3 1/2			
36	35 1/4	35			36.500"	.250	32- 1 1/2	32- 2	32- 2	28- 2 1/2	20- 3 1/2			
40	39 1/4	39			40.500"	.250	36- 1 1/2	36- 2	32- 2 1/2	28- 2 3/4				
42	41 1/4	41			42.500"	.250	36- 1 1/2	36- 2	32- 2 1/2	28- 2 3/4				

Pipe Size DN	Type E	Type F	Number and size of bolts according to DIN, ISO and BS 4504										
			nominal pressure										
			10	16	25	40	64	100	160	250			
10	Same as O.D. of flange	Bolt circle less bolt diameter	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M16	
15			4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M12	4-M16	
20			4-M12	4-M12	4-M12	4-M12	4-M12						
25			4-M12	4-M12	4-M12	4-M12	4-M16	4-M16	4-M16	4-M16	4-M20		
32			4-M16	4-M16	4-M16	4-M16							
40			4-M16	4-M16	4-M16	4-M16	4-M20	4-M20	4-M20	4-M20	4-M24		
50			4-M16	4-M16	4-M16	4-M16	4-M20	4-M24	4-M24	4-M24	8-M24		
65			4-M16	4-M16	4-M16	4-M16	8-M16	8-M20	8-M24	8-M24	8-M24	8-M24	
80			8-M16	8-M16	8-M16	8-M16	8-M20	8-M24	8-M24	8-M24	8-M27	8-M27	8-M30
100			8-M16	8-M16	8-M16	8-M20	8-M24	8-M27	8-M30	8-M30	8-M30	12-M30	
125			8-M16	8-M16	8-M20	8-M24	8-M24	8-M30	12-M30	12-M30	12-M30	12-M33	
150			8-M20	8-M20	8-M24	8-M24	8-M30	12-M30	12-M30	12-M30	12-M30	12-M33	
175				8-M20	8-M24	12-M27	12-M30	12-M30	12-M30	12-M30	12-M33	12-M33	
200			8-M20	12-M20	12-M27	12-M27	12-M33	12-M33	12-M33	12-M33	12-M33	12-M39	
250			12-M20	12-M24	12-M27	12-M30	12-M33	12-M36	12-M39	16-M39	16-M39	16-M45	
300			12-M20	12-M24	12-M27	16-M30	16-M33	16-M39	16-M39	16-M39	16-M39		
350			16-M20	16-M24	16-M27	16-M33	16-M36	16-M45	16-M45	16-M45	16-M45		
400			16-M24	16-M27	16-M30	16-M36	16-M39	16-M45					
450			20-M24	20-M27	16-M33								
500			20-M24	20-M30	20-M33	20-M39	20-M45	20-M52	20-M52	20-M56	20-M56		
600	20-M27	20-M33	20-M33	20-M45	20-M52	20-M56	20-M56	20-M56	20-M56				
700	24-M27	24-M33	20-M36	24-M45	24-M52	24-M56	24-M56	24-M64	24-M64				
800	24-M30	24-M36	24-M39	24-M52	24-M56	24-M56	24-M56						
900	28-M30	28-M36	24-M45	28-M52	28-M56	28-M56	28-M56						
1000	28-M33	28-M39	28-M45	28-M52	28-M56	28-M64	28-M64						
1200	32-M36	32-M45	28-M52	32-M56	32-M56	32-M72	32-M72						
1400	36-M39	36-M45		36-M56	36-M56								

**PIPELINE INSULATING JOINTS**  
**Monobloc insulating joints**

Document No.: 14-202-R1

Sheet: 1 of 1

German Cathodic Protection

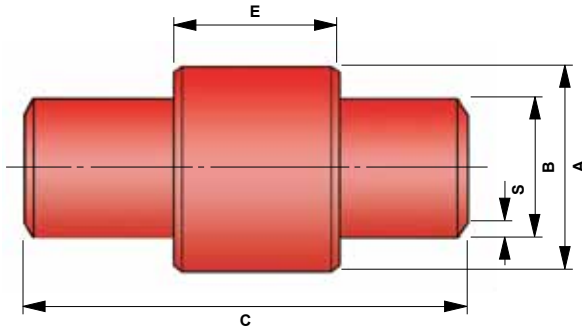


Our Monobloc Insulating Joints are always manufactured according to the highest technical standards.

Full technical details of the planned application should be supplied so that we can select the joint that is suited to the requirements.

The **PN** always refer to the maximum pressure for each application but all joints offer the following characteristics:

- Resistance in air: greater than 5 MΩ
- Testing voltage: 3 000 V - 50 Hz
- Hydraulic test pressure: 1.5 x PN
- Temperature: up to 70° C



**Joint Material:**

**FE 45-1 UNI 7088-72**  
**API 5L-5LX**

On request, we can also supply joints with different materials, joints with operating pressures in excess of ANSI 600, joints for temperatures over 70° C and joints for voltages over 3 kV.

DN	B	PN 25 ANSI 150				PN 64 ANSI 300 - 400				PN 100 ANSI 600			
		S	A	C	E	S	A	C	E	S	A	C	E
1/2"	21.3	3.25	49	230	34	3.25	60	250	60	3.25	60	250	60
3/4"	26.7	3.91	51	230	35	3.91	65	250	60	3.91	65	250	60
1"	33.4	3.91	58	230	37	3.91	75	250	60	3.91	75	250	60
1 1/4"	42.4	3.91	70	250	40	3.91	82	300	70	3.91	82	300	70
1 1/2"	48.3	3.91	75	250	42	3.91	95	300	80	3.91	95	300	80
2"	60.3	3.91	88	290	57	3.91	108	350	92	3.91	108	350	92
2 1/2"	76.1	4.78	113	360	63	5.49	114	500	94	5.49	118	500	96
3"	88.9	4.78	127	390	65	5.49	135	500	96	5.49	136	500	105
4"	114.3	4.78	151	440	72	6.02	159	500	108	6.02	166	500	120
5"	141.3	4.78	192	460	89	6.55	194	600	124	6.55	197	600	135
6"	168.3	5.56	217	490	94	7.11	240	600	136	7.11	240	600	149
8"	219.1	6.35	272	540	102	8.18	273	600	158	8.18	293	600	176
10"	273.0	6.35	322	620	115	9.27	350	800	186	9.27	350	800	205
12"	328.8	6.35	380	830	153	9.52	400	1000	206	9.52	406	1000	228
14"	355.6	7.14	430	880	168	10.31	440	1000	228	12.70	450	1000	249
16"	406.4	7.14	483	930	175	12.70	490	1000	244	12.70	505	1000	273
18"	457.4	7.14	525	960	195	12.70	546	1000	267	14.27	558	1000	300
20"	508.0	7.14	600	1000	205	12.70	604	1200	290	15.88	621	1200	322
22"	558.8	7.92	645	1000	220	14.27	655	1200	311	17.48	682	1200	348
24"	609.6	7.92	700	1000	240	15.88	706	1200	335	19.05	739	1200	371
26"	660.4	7.92	750	1000	250	15.88	760	1200	354	19.05	800	1200	391
28"	711.2	8.14	810	1200	260	17.48	813	1300	376	19.05	857	1300	419
30"	762.0	8.74	850	1400	270	19.05	864	1300	398	19.05	912	1300	434

Dimensions in mm

DIAMETER OVER 30" ALSO AVAILABLE ON REQUEST



**Plastic Insulators**

Polypropylene insulators are universally used in the installation of pipelines when the carrier pipe runs inside a casing.

Plastic insulators provide various advantages:

- Easy installation of the carrier pipe since the plastic material reduces the friction coefficient to a minimum.
- Minimised friction prevents damage to the protective coating and insulation of the pipes.
- A wide range of skid heights ensures concentricity of the carrier pipe in the casing (if required).
- Excellent insulating properties of the plastic material ensures that all requirement for cathodic protection are met.

Plastic insulators are suitable for all pipe diameters from 25 mm upwards and many skid heights are available to suit specific requirements.



Type: PA	
carrier pipe	dia. 25 - 336 mm
skid height	11.5 - 90 mm
body	half rings or segments depending on pipe O.D.
fixing system	steel bolts DIN 912 and nuts DIN 562 or plastic bolts and nuts



Type: RGV	
carrier pipe	dia. 504 - 2000 mm
skid height	50 - 125 mm
body, 1 ring	1 ring = (x) segments depending on pipe O.D.
fixing system	steel bolts and nuts required for assembly are included



Type: AZ	
carrier pipe	dia. 98 - 385 mm
skid height	16 - 125 mm
body, 1 ring	1 ring = (x) segments depending on pipe O.D.
fixing system	steel bolts and nuts required for assembly are included

The insulator segments are specially designed for the requirements of cathodic protection with regard to insulation between the casing and carrier pipes which requires an insulator ring without metallic parts. Insulators are supplied with all required steel bolts and nuts or with a bolt less wedge system.

For ordering, the following information is required:

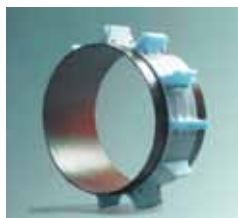
- Outside diameter of carrier pipeline
- Inside diameter of casing pipe



Type: GKO	
carrier pipe	dia. 150 - 450 mm
skid height	16 - 125 mm
body, 1 ring	1 ring = (x) segments depending on pipe O.D.
fixing system	bolt less wedge system for assembly is included

**Special types for high temperatures**

Special carrier pipe insulator types for high temperatures are also available. The segments, reinforced and resistant to 140° C, are particularly suitable for hot water pipelines, steam pipelines or direct heating pipelines.



Type: MA	
carrier pipe	dia. 400 - 1200 mm
skid height	25 - 75 mm
body, 1 ring	1 ring = (x) segments depending on pipe O.D.
fixing system	steel bolts and nuts required for assembly are included

## PIPELINE ACCESSORIES

### AC Voltage limiter

Document No.: 14-401-R1

Sheet: 1 of 1

German Cathodic Protection



Pipelines running parallel to high voltage overhead lines are subjected to interference from OHL operating and short circuit currents.

Inductive coupling results in the generation of AC voltages between the pipeline and surrounding soil. Maximum permissible voltage exposure for personnel and equipment under different operating conditions are defined by various International Standards and Safety Codes.

Instances of high induced voltages may call for earthing measures to ensure that the magnitude of AC voltages remains within safe limits.

#### Effect on protection range and the measurement of OFF Potential of an impressed current system

The average current density [ $J_{sM}$ ] for a PE insulated pipeline with a directly connected earthing system results in a large reduction of the protection range of an impressed current system.

At direct connection of the earthing system with the pipeline emerges when switching off the impressed current system a potential difference ( $U_{RE}$ ) between the pipeline and the zinc earthing system of about 80...230 mV. The real OFF Potential (IR free potential) is not measurable because of the appearing transient currents.

In addition, it is not possible to locate pipeline insulation holidays in the potential gradient area of a directly connected earthing system.



#### AC Voltage limiter VL-14-401

AC Voltage limiter VL-14-401 is designed to protect operating personnel and pipeline equipment against electrical shocks and damages caused by AC fault currents.

Limiter VL-14-401 effectively blocks the protective DC-current required for cathodic protection while providing a low ohmic connection for induced AC currents caused by operating or short circuit currents of high voltage overhead line systems.

Limiter VL-14-401 is available in standard models with the following technical data:

$V_{RSM}$	500 V - 2300 V	$V_{RRM}$	400 V - 2200 V
$I_{FRMS}$	10 A	$i^2t$	100 A <sup>2</sup> s

( $V_{RSM}$ ) non-repetitive peak reverse voltage

( $V_{RRM}$ ) max. allowable peak value of repetitive transient off-state and reverse voltage

( $I_{FRMS}$ ) max. current for continuous operation

( $i^2t$ ) rating which should not be exceeded due to short circuits

Dimensions:

Length: 270 mm, Diameter: 65 mm, Weight: 1.2 kg



The dimensions of VL-14-401 allows installation inside test stations

## PIPELINE ACCESSORIES

### Kirk® Polarisation cells

Document No.: 14-501-R1

Sheet: 1 of 1

German Cathodic Protection



#### Protection Against Dangerous Voltage

Induced alternating current, lightning strikes, and grounding fault currents on buried pipelines not only pose serious safety threats to pipeline operators and contractors, they can also cause major damage to buried pipelines.

Kirk grounding cells control these hazardous voltages while permitting lower level cathodic protection voltage to flow. The cells do not possess an internal voltage. Instead, they act as an electrochemical switch to shunt dangerous voltage to ground. They consist of multiple pairs of stainless steel plates which are immersed in a 30 percent potassium hydroxide solution. An oil seal is also added to prevent evaporation and limit foaming of the electrolyte solution under high current flow.

When low levels of DC current flow through the grounding cell, a film of hydrogen gas forms on the negative plates of the Kirk cell. At the same time a film of oxygen gas forms on the positive plates. This polarisation allows the low level DC voltage associated with cathodic protection to develop. As the applied voltage across the cell increases from either AC or higher DC current, the polarisation film on the plates breaks down and the Kirk cell conducts current.

Kirk grounding cells can be installed above or below ground. For exterior installations, a series of galvanised steel enclosures are offered which are in conformity with the EN Standards or NEMA and 3R. The cells are shipped with a dry package of potassium hydroxide and can be stored indefinitely in clean, dry locations.

#### Typical Applications

Kirk grounding cells control the flow of potentially dangerous AC and DC current on buried metallic structures. They are often used on buried oil, gas, and water pipelines that share the same right-of-way as high voltage power lines. Because the cells produce various gases that can be explosive, they should be installed with proper venting.

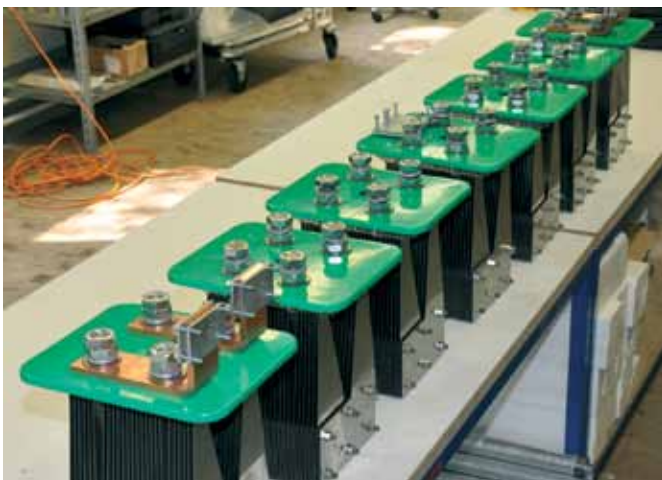
They should also be routinely inspected to ensure adequate electrolyte levels are present.

The cells can be operated in temperatures ranging from -40°F to 140°F (-40°C to 60°C).



**K-50 KIRK CELL PERFORMANCE TABLE**

Delta E Across Cell Terminals	Resultant Current Flow	Apparent Internal Impedance (Ω)
DIRECT CURRENT DATA		
0.15 V	100 μA	1500
0.42 V	2 mA	210
0.46 V	4 mA	115
0.50 V	6 mA	83
0.53 V	8 mA	66
0.59 V	10 mA	59
0.86 V	20 mA	43
1.00 V	30 mA	33
1.20 V	50 mA	24
1.30 V	100 mA	13
1.72 V	500 mA	3.4
1.76 V	1 A	1.8
1.82 V	5 A	0.36
1.85 V	10 A	0.19
2.15 V	100 A	0.022
2.65 V	500 A	0.053
3.15 V	1 kA	0.0032
ALTERNATING CURRENT DATA		
0.01 V	500 mA	0.02
0.02 V	1 A	0.02
0.04 V	5 A	0.01
0.20 V	10 A	0.02
0.58 V	50 A	0.012
0.62 V	100 A	0.0062
1.30 V	500 A	0.0026
10.6 V	14 kA	0.00076
12.5 V	38.5 kA	0.00032
14.0 V	44.0 kA	0.00032
15.0 V	52.5 kA	0.00029
17.0 V	58.0 kA	0.00029
19.9 V	64.0 kA	0.00031



Further Kirk cells available: Type K-5A and K-25

To order the right cell for your application, please indicate your requirements and technical specifications. We can supply special enclosures or other items on request.

