



DEHN protects Pipelines

Protection solutions for cathodic corrosion protection systems





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DEHN protects Pipelines

from damage caused by interference voltages

Pipelines: Secure transport – non-stop supply

Safe for people and the environment. Pipelines are the most secure means of transport for flammable liquids and gases. They represent a seamless, reliable supply of oil and gas. In Germany alone, around 40,000 kilometres of pipelines are laid in the ground.

To ensure permanent safety, protection against corrosion constitutes the greatest challenge. Various techniques are deployed to this end: a passive approach, with enclosures or coatings on the one hand, and an active approach on the other, with cathodic corrosion protection systems and decoupling devices.

The problem: Interference voltages

Pipelines are very well insulated. They can therefore pick up interference voltages. This mainly happens when they share routes with railway lines or high-voltage transmission lines. Another cause of interference voltages is lightning strikes. Surges triggered this way spread out quickly throughout the pipeline network.

The damage resulting from this is enormous:

- **Environmental damage**
Interference voltages lead to corrosion, resulting in leaks.
- **Breakdowns**
Damaged gas pressure control and measurement system, slide gate valve and compressor stations disrupt transport.
- **Threat to human life**
Touch voltages on freely accessible system parts during maintenance work could lead to an electric shock.

Provide permanent safety

Safety for pipelines and people is the top protection goal of operators. To this end, interference voltages must be discharged to earth at the correct points.

Suitable measures for this are, for example, robust decoupling devices or spark gaps, as well as special surge protection solutions for cathodic protection rectifiers or field instruments.

Operators frequently use remote monitoring systems for particularly sensitive pipeline sections. Protection solutions are demanded here that are not only robust but above all smart.

For the operator, the integration of decoupling devices into the cathodic corrosion protection and management systems means being notified of the status of the pipeline at all times – making everyday work considerably easier.



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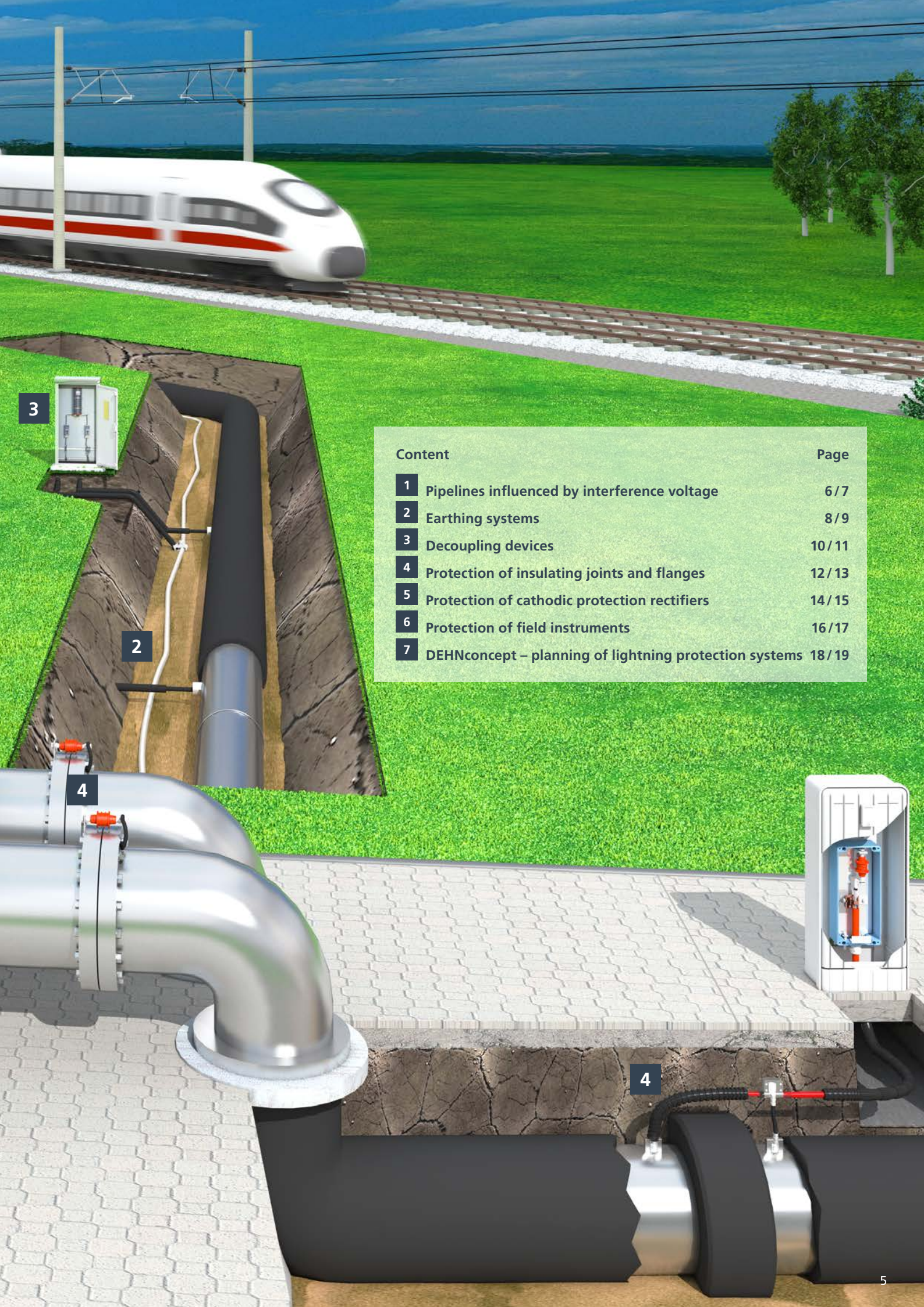
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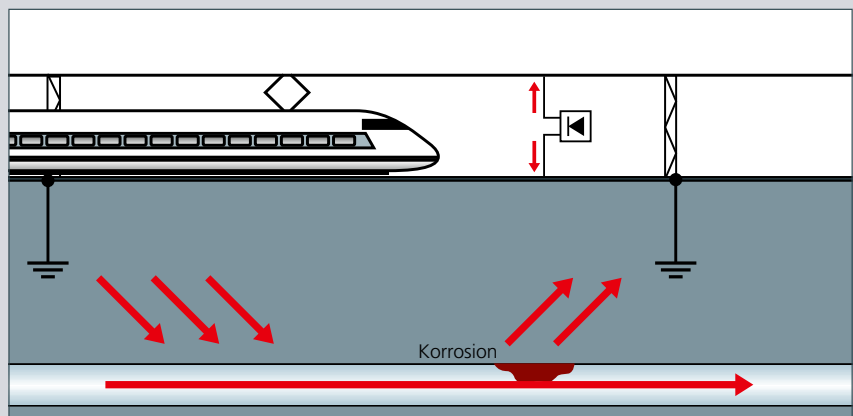
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Sources of interference cause stray currents and electromagnetic fields.

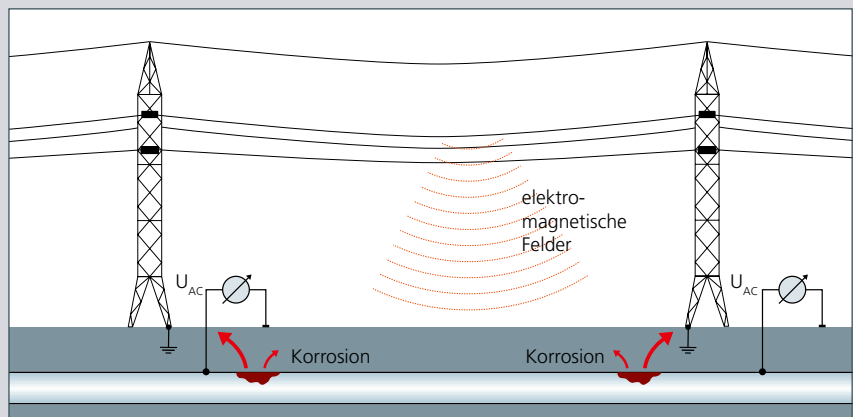
Electric railways

Electric railways produce galvanically injected stray currents which enter the pipeline via the ground through defects, thus changing the potential of the pipeline by means of interference voltages.



High-voltage transmission lines

High-voltage transmission lines generate electromagnetic fields which are injected into parallel pipelines and usually occur in the form of permanent interference voltage.



Interference voltages threaten people and materials

Interference voltages are non-system voltages that are triggered by sources of interference, such as electrified railway lines, high-voltage transmission lines, earth faults and lightning strikes. Overvoltages are referred to as being transient, temporary or long-duration depending on the duration of the interference voltages.

Stray currents that are injected through the earth and electromagnetic fields change the potential of the pipeline. This results in material erosion due to stray current or alternating current corrosion (AC corrosion), which regularly leads to material damage to the pipeline, economic damage and environmental damage due to leaks.

Yet interference voltages can also threaten humans, because of the high touch voltages involved. With freely accessible system parts or during maintenance work, these dangerous overvoltages constitute an enormous risk to people.

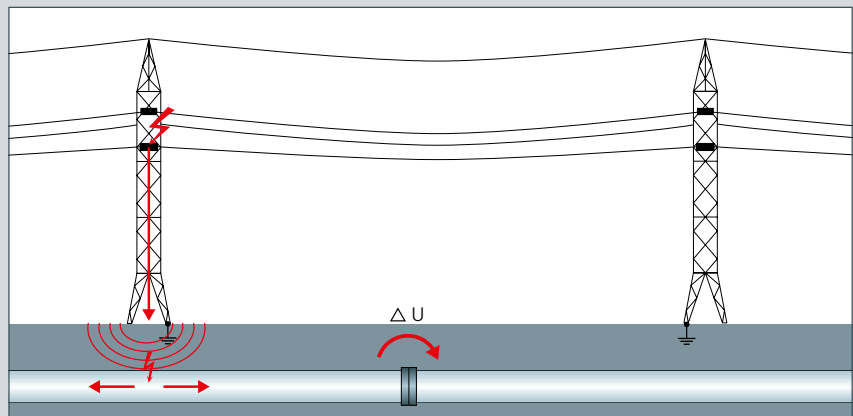
Integrated protection concepts, consisting of earth electrodes, decoupling devices and surge protection measures (e.g. spark gaps) can limit interference voltages to levels below the specified limit values. Consequently, pipelines and the people working on them are protected in equal measure.



More information at:
de.hn/2RToQ

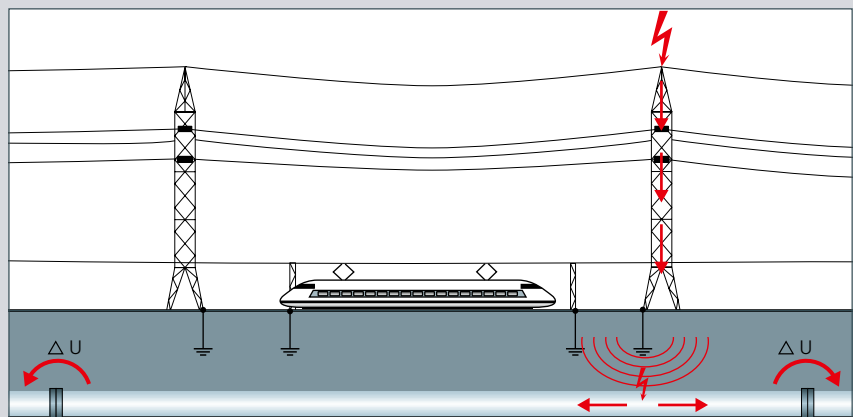
Earth faults

An earth fault causes a potential gradient area in the surrounding soil whose potential affects pipelines located in this area. This potential gradient area thus spreads over to the relevant pipeline network in the form of interference voltage.

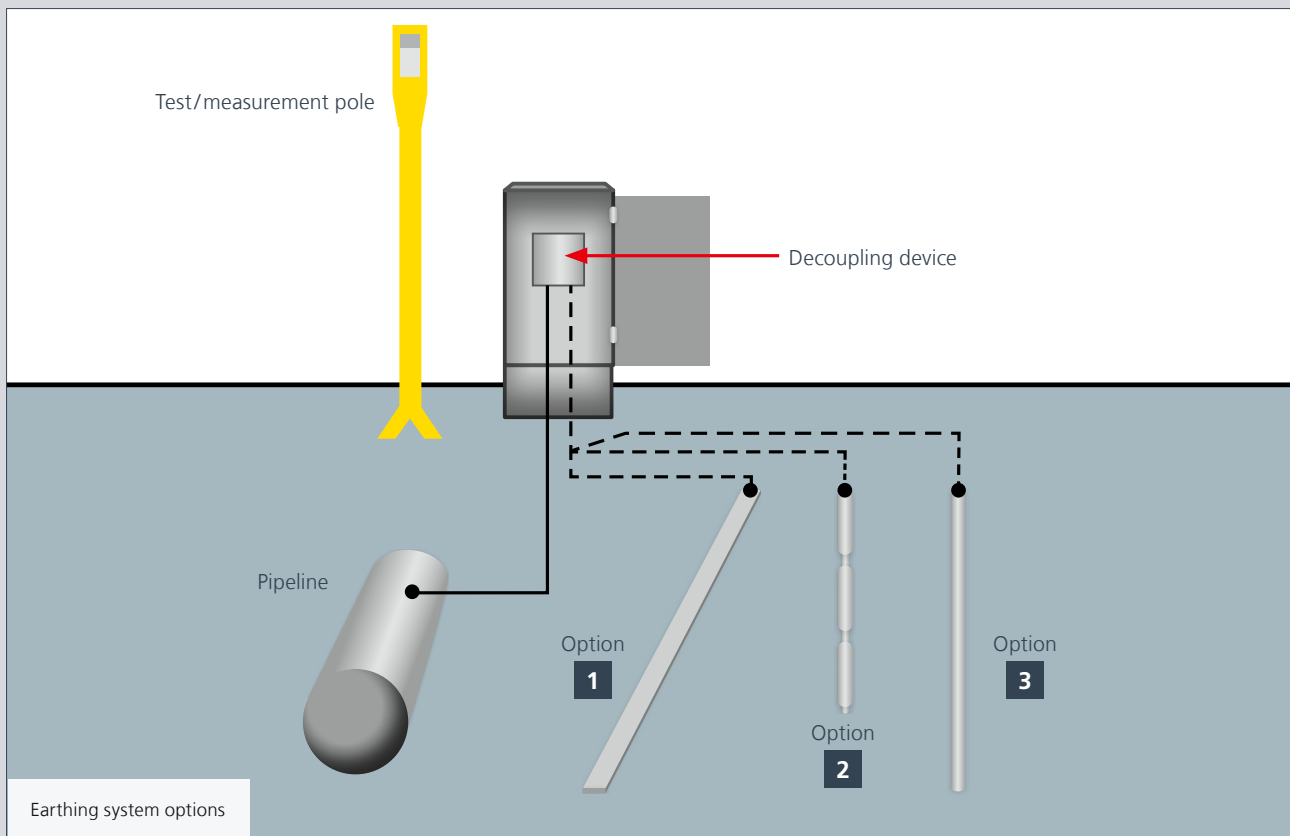


Lightning strike

Lightning-induced surges generate transient interference voltages towards unaffected systems. Injected via a potential gradient area, they spread over the entire pipeline network.



All these interference voltages can cause injury, material damage and AC corrosion



Earthing systems – discharge surges safely

The earthing system is the basis for the safe discharge of interference voltages.

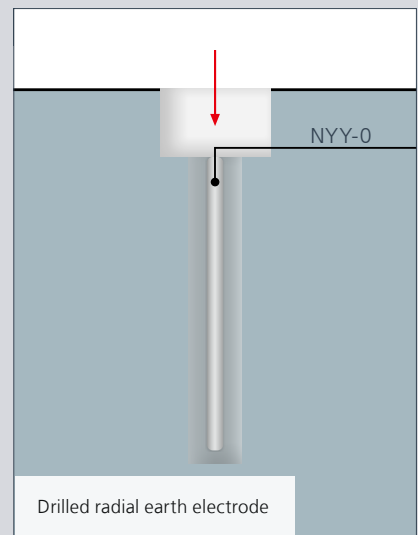
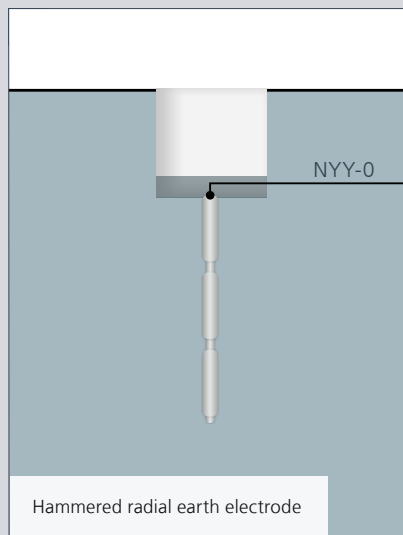
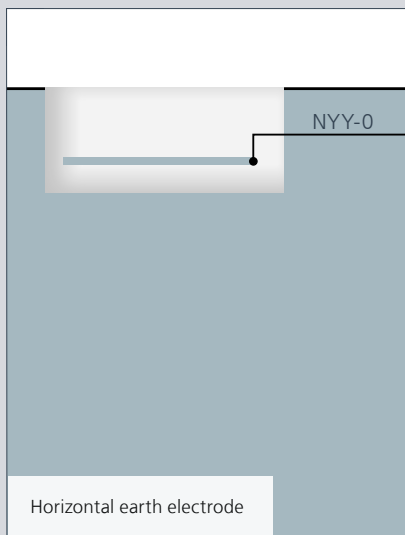
To dimension the system, how intensive the interference from interference voltages is must first be determined. This is usually performed by service providers.











Protective measures are deduced from measurements and calculations. This will determine how many earth electrodes are required and where they are placed.

In the area surrounding pipelines, it must be ensured that the materials used for the earthing system meet the particular requirements. This means they must have sufficient current-carrying capability and be corrosion-resistant.

Earthing – good to know:

- An earthing system is a locally interconnected system.
- It consists of earth electrodes, decoupling devices and cable connections, as well as the associated contact elements.
- Depending on local conditions, different types of earth electrode are set up individually or in combination.



Earthing system options		Type	Part no.
1 Horizontal earth electrode (strip, round wire or cable earth electrodes)			
	Steel strip With zinc coating (St/tZn) for use in lightning protection and earthing systems.	BA 30X3.5 STTZN R50M	810 335
	Round steel wire With zinc coating (St/tZn) for use in lightning protection and earthing systems.	RD 10 STTZN R81M	800 010
	Cross unit, stainless steel (V4A) For the aboveground and underground connection of two flat conductors.	KS FL30 V4A	318 233
	Cross unit, stainless steel (V4A) For the aboveground and underground connection of round and flat conductors.	KS 8.10 FL30 V4A	318 209
2 Hammered radial earth electrode (Earth rod – interference fit connection by driving in with a vibration hammer)			
	Earth rod (St/tZn) For setting up earthing systems. With self-closing coupling and triple knurled pin	TE 20 1500 Z STTZN	620 151
	Earth rod connection clamp, stainless steel (V4A) For cross and parallel connection of round conductors, flat strips or cables to earth rods.	AK TE 20 7.10 FL40 V4A	610 020
	Earth rod connection clamp, stainless steel (V4A) For the connection of flat conductors to the earth rod.	AS TE 20 ASSM 10 STTZN	620 021
3 Drilled radial earth electrode (Earth wire – pressing with backfill material required)			
	Copper cable (Cu/galSn) For lightning protection and earth-termination systems or equipotential bonding.	CABLE 10.5 70Q CUGALSN R100M	832 292
	Earth rod connection clamp, stainless steel (V4A) For cross and parallel connection of round conductors, flat strips or cables to earth rods.	AK TE 20 7.10 FL40 V4A	610 020
Earth improver / backfill material			
	DEHNIT Special clay for improving and stabilising the earth-electrode resistance.	DEHNIT	573 000

More protection solutions are available on request. Please contact info@dehn.de



Decoupling units – safety for pipelines and people

For technical reasons, the earth electrode must not be connected directly to the pipeline.

Why? To prevent corrosion, pipelines are charged with a protective current – a direct link with the earth electrode would lead to the cathodic corrosion protection measure losing its effectiveness.

That is why the decoupling device is installed between the pipeline and earth electrode, where it acts like a filter. It receives the protective DC current and discharges all the harmful alternating current and impulse currents via the earth electrode.



More information at:
de.hn/cfVWt

Safe and smart: VCSD decoupling device

Voltage-Controlled Smart Decoupling Device

The intelligent decoupling device protects pipelines and people from damage caused by surges. To do this, the voltage-controlled short-circuiting device limits transient and temporary overvoltages, as well as long-duration AC voltages, to a preset value.

With its filtering function, it ensures that the desired DC potential is reliably maintained as protective current.

VCSD is a smart decoupling device. It can be integrated into cathodic corrosion protection monitoring systems and permanently supplies current measured values, such as discharge current, pipeline voltage and device temperature.

VCSD is primarily used in

- Cathodic-corrosion-protected systems such as pipelines or storage tanks

- Especially critical pipeline sections
- Isolated earthing systems (e.g. system earth and signal earth).


Save time during checks

VCSD is remotely controllable from the control room. For checks, this means that the cathodic corrosion protection measurement is conveniently performed digitally.

On site maintenance is also simplified. Just the push of a button on the device activates the self-test routine, immediately providing information on functionality.

Important to know

The VCSD does not require an external voltage supply for the 'discharge' function. The decoupling device sources the energy required for the status LEDs from the pipeline voltage.

Voltage-controlled decoupling device VCSD		Type	Part no.
	Protection against transient, temporary and long-duration overvoltages Adjustable response threshold (3 to 50 V AC) Integrated USB interface for outputting measured values (e.g. discharge current, pipeline voltage, device temperature) Remotely controllable from the control room Simple checking with the self-test routine Can be used outdoors (degree of protection IP 65) Technical data – discharge current: Transient 100 kA@10/350 / Temporary 1.1 kA / Long-duration 45 A	VCSD 40 IP65	923 401



Robust and powerful: DASD decoupling device

DEHN Advanced Solid-State Decoupler

This decoupling device is independent of an external power supply. It protects against damage to pipelines and harm to people by limiting transient and temporary overvoltages, as well as long-duration AC voltages, to levels that are harmless to people. With its filtering function, it ensures that the desired DC potential is reliably maintained as protective current.

DASD is a robust decoupling device. Compact in a dust-proof and waterproof IP 68 housing, it can be installed underground and aboveground. It therefore shows off its strengths primarily in tough, inhospitable environments.

The DASD is the optimum solution for installation in

- Limited spatial conditions (e.g. flush-mounted systems)
- Exposed installation locations (e.g. in wet conditions outdoors)
- Decoupling of electrical equipment in cathodic protection systems

Protect employees

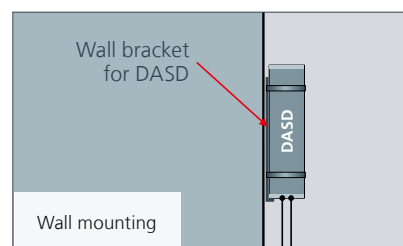
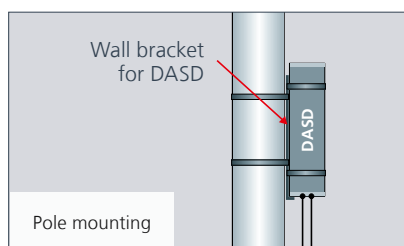
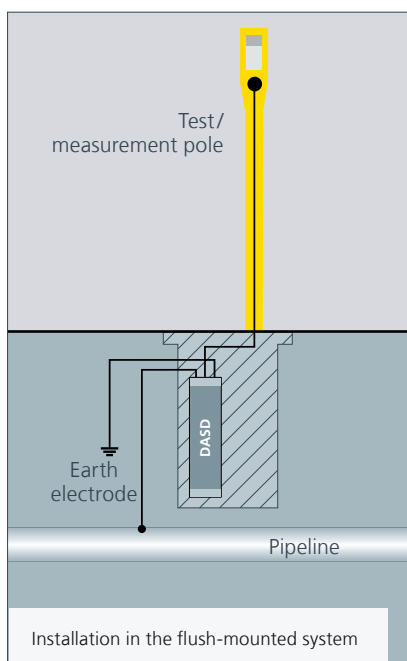
In the event of a failure due to overload, the DASD goes into a secure state. This fail-safe failure mode thus protects the people working on the pipeline from touch voltages.


Save time during maintenance

The function test is performed quickly and easily by means of the integrated test socket.



More information at:
de.hn/4DJYL



Capacitive decoupling device DASD	Type	Part no.
 <ul style="list-style-type: none"> Protection against transient, temporary and long-duration overvoltages High discharge capacity Fail-safe failure mode Integrated diagnostics socket Can be used outdoors (degree of protection IP 68) Technical data – discharge current: Transient 75 kA@10/350 Temporary 3.7 kA Long-duration 45 A 	DASD 45 LP 100 T	923 402



Protect insulating joints and insulating flanges

Insulating joints and insulating flanges are used if pipelines affected by high voltages are split into individual pipeline sections.

They establish the electric (galvanic) isolation of cathodic-corrosion-protected pipeline systems to system earth. Cathodic protection systems are electrically isolated until the dielectric strength of the insulation of the insulating joint is reached. Exceeding this value leads to open sparking, leakages or the destruction of the insulating joint.

Reasons for exceedance might be overvoltages due to a lightning strike on exposed parts of the pipeline system or the effect of short circuit currents from high-voltage transmission lines routed in parallel.

Ex isolating spark gaps protect the insulation clearance against transient and temporary overvoltages, by discharging the energy in a non-sparking manner. This is an important factor in potentially explosive environments.

Incorrect installation of an ex isolating spark gap can damage or destroy the insulation. This quickly leads to very high costs, particularly in case of underground insulating joints.

This is because the protecting spark gap is also usually installed underground. The reason for this is the stipulation that the connecting cable must be kept as short as possible.

A situation like this involves a lot of work for maintenance and inspections, since digging up frequently has to be performed before work can begin on the technical installations.

Good to know:

The ex isolating spark gap coaxial connection box can be installed outside of hazardous areas.

The advantages:

- The spark gap is installed aboveground, so that longer cables can be used.
- Maintenance and inspection are much easier since no digging up is required.

This considerably facilitates the testing of spark gaps. The inspection can be performed without the inspection approval from the operator. No special protective clothing or test equipment is required. If the coaxial connection box is installed outside the hazardous area, the test is performed quickly and easily directly on the box.

Protected all-round with DEHN

- Protection of the insulation in case of temporary and transient overvoltage
- Explosion protection through a tested, non-sparking connection system (ATEX and IECEx-approved)



Spark gaps must be tested regularly – the test is performed within the inspection intervals designated for the system: Every 2 years as per DIN EN 62305-3 or every 3 years as per DIN EN 60079-17 (0165 Part 10-1).

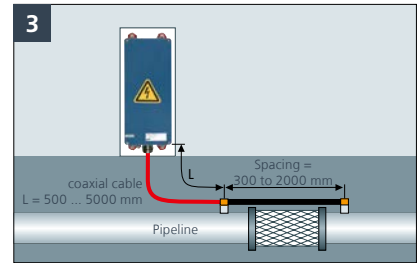
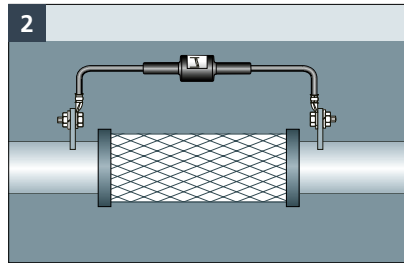
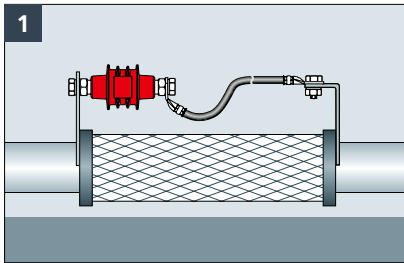
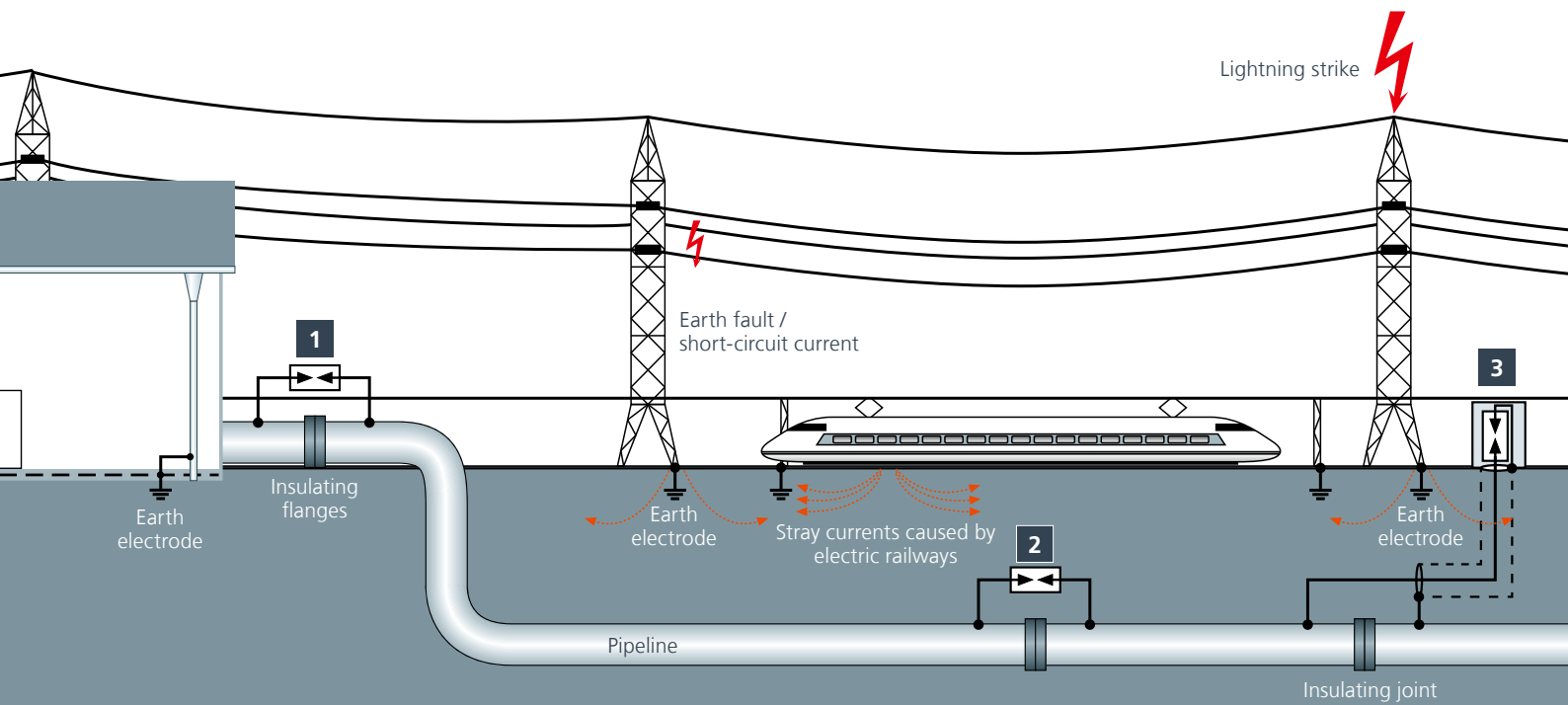
Good to know:

For the quick and simple documentation of the test results, use the report for checking ex isolating spark gaps



More information at:
de.hn/9gzvA



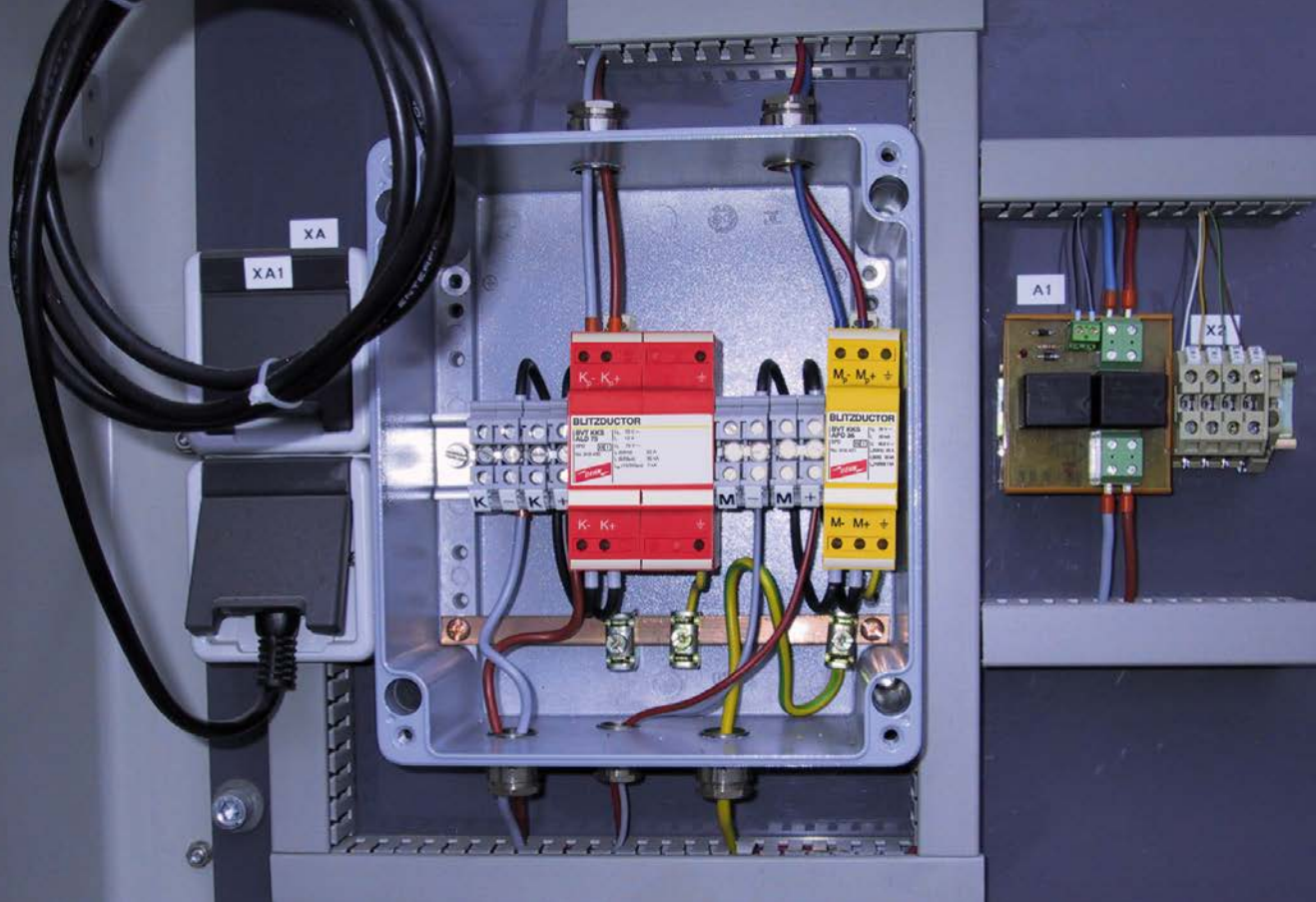


EXFS 100 / EXFS 100 KU Isolating spark gap

- EXFS 100 spark gap certified according to ATEX (94/9/EC) and IECEx
- Safe use in Ex zone 1/21 and 2/22
- Suited for non-sparking connection to pipelines, insulating flanges or insulating joints in hazardous areas
- High AC discharge capacity, low sparkover voltage
- Suitable for protecting insulating joints or flanges tested to class 2 / 2.5 kV_{rms}
- Transient: 100 kA (10/350 μs) and 100 kA (8/20 μs)
- Temporary: 500 A_{rms} / 0.2 s

Isolating spark gap		Type	Part no.
1	Aboveground isolating spark gap for protecting aboveground insulating joints. Simple maintenance / inspection through aboveground installation outside the hazardous area	EXFS 100	923 100
2	Isolating spark gap installed underground for buried insulating joints High maintenance effort	EXFS 100 KU	923 101
EXFS Coaxial connection box		Type	Part no.
3	Connection box for coaxial (low-impedance) connection of EXFS 100 isolating spark gaps Aboveground installation for protecting buried insulating joints Simple maintenance / inspection through aboveground installation outside the hazardous area	NAK SN4631	999 990
Accessories		Type	Part no.
	Coaxial cable	N2XSY cable	506 771

More protection solutions are available on request. Please contact info@dehn.de



Protection of cathodic protection rectifiers

In case of impressed current cathodic protection, the required protective current is produced by a mains-powered rectifier and fed into the protected object, for example the pipeline, via impressed current anodes which are buried in the ground. Modern rectifiers additionally feature a control device which detects the protection potential of the pipeline against a reference electrode (e.g. Cu/ CuSO₄ electrode) and automatically sets the optimal cathodic protective current.

A cathodic corrosion protection system mainly consists of:

- Cathodic protection rectifiers for the protective current
- Control devices with a reference electrode
- Impressed current anode

The direct galvanic connection of the cathodic protection rectifier to the pipeline, anodes, system earth and reference electrode can lead to overvoltages, which disrupt or destroy the devices. Furthermore, there is an elevated risk of fire.

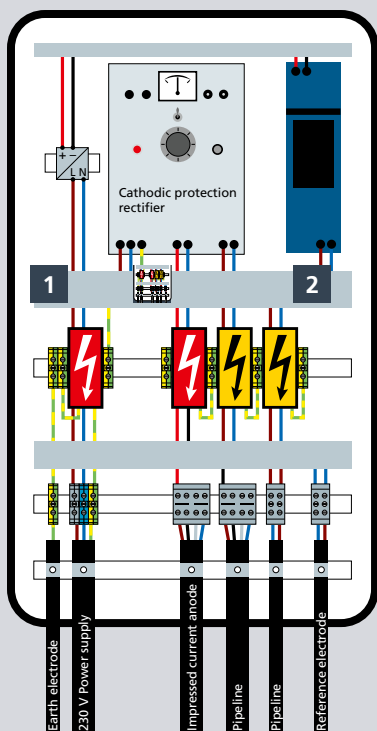
Through the use of protection concepts that have been explicitly developed for the protection of cathodic protection rectifiers, the following forms of overvoltage can be managed:

- Transient overvoltage (direct and indirect lightning effects and switching operations)
- Temporary overvoltage (short-circuits resulting from traction current and high-voltage systems)

Failures or faults with cathodic protection rectifiers due to surges can be prevented in this way.

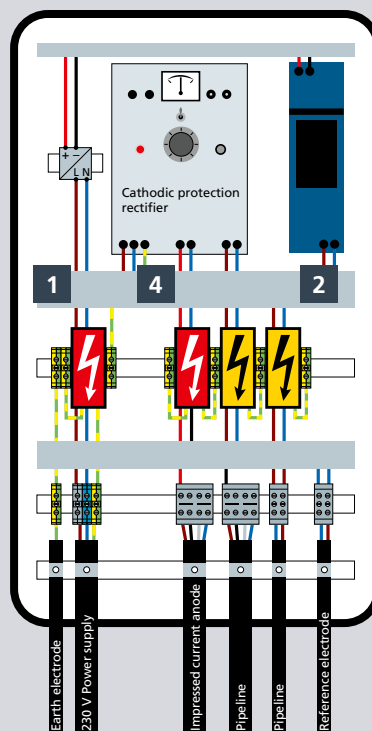
So that systems run safely and reliably.

Protection solution for protective currents up to 12 A







Installation option 1: With BLITZDUCTOR VT

Protection solution for protective currents > 12 A



Installation option 2: With DEHNsecure

Protection of cathodic protection rectifiers			Type	Part no.
1		DEHNventil M2 Multipole, modular combined arrester type 1 + 2 + 3, spark-gap-based for single-phase TT and TNS systems. Compact design: Width 2 DIN modules For protecting against surges in low-voltage consumer installations, and even direct lightning strikes.	DV M2 TT 2P 255 FM	954 115
2		BLITZDUCTOR VT Energy-coordinated combined arrester for protecting the voltage measuring circuit in cathodic corrosion protection systems.	BVT KKS APD 36	918 421
3		Installation option 1: With BLITZDUCTOR VT Energy-coordinated combined arrester for protecting the rectifier in the protective circuit. For protective currents up to 12 A	BVT KKS ALD 75	918 420
4		Installation option 2: With DEHNsecure Two-pole, coordinated lightning current arrester type 1 for protecting the rectifier in the protective circuit. For protective currents > 12 A	DSE M 2P 60 FM	971 226








Protection of field instruments

Whether it's a pipeline valve station or a gas compressor station: for safe, reliable operation, the constant availability of sensor and measuring signals is a key pre-requisite.

The immunity of field devices such as pressure or temperature transmitters meets the usual requirements as laid out in EMC standards. In the case of overvoltages that are caused

by lightning strikes, this immunity frequently does not suffice. Such instances risk the destruction of the transmitters and open sparkovers, which can lead to explosions.

This is where protective devices are used that discharge overvoltages in a non-sparking manner and protect the electronics of the transmitter and other electronic devices.

Surge protection for telecommunications		Type	Part no.
	DEHNpipe – protection of field instruments Surge arrester for screwing into field devices with 2-wire measuring equipment in an EX(i) design for protecting intrinsically safe systems and balanced interfaces according to the NAMUR (User Association of Automation Technology in Process Industries) standard. Nominal voltage 24 V DC With thread M20 x 1.5 or ½-14 NPT MD Ex(i): serial wiring CD Ex(i): parallel wiring	DPI MD EX 24 M 2 DPI CD EXI 24 M	929 960 929 961
		BLITZDUCTORconnect – protection of the measuring and control equipment Space-saving, modular combined arrester with a width of 6 mm and push-in connection technology with status indication for the protection of 1 pair BCO ML2 BD 24: for unearthed balanced interfaces BCO ML2 BD EX 24: for intrinsically safe measuring circuits and bus systems, meets FISCO requirements. With signal disconnection for maintenance purposes	BCO ML2 BD 24 BCO ML2 BD EX 24
	Space-saving, compact combined arrester with a width of 12 mm and push-in connection technology with status indication for protecting unearthed 4-conductor measuring circuits.	BCO CL4 BC 24	927 954
	DEHNrecord – Condition-monitoring unit Two-part monitoring unit in a compact enclosure for the condition monitoring of arresters of the BLITZDUCTORconnect product family. Visual arrester status indication via LED group display in combination with remote signalling contact (break contact).	DRC IRCM	910 710
Surge protection for power supply systems		Type	Part no.
	DEHNventil M2 Modular combined arrester type 1 + 2 + 3, spark-gap-based in compact design: Width 4 DIN modules For protecting against transient overvoltages in low-voltage switchgear assemblies, and even direct lightning strikes.	DV M2 TT 2P 255 FM	954 315





System safety and explosion protection

Surge protection increases system availability and protects the lives and health of those working on the system.

BLITZDUCTORconnect, the universal combined arrester from the Yellow/Line product series, protects the sensitive measuring and control equipment from damage caused by lightning and surges.

With a lightning current discharge capacity of 3 kA (total) and low voltage protection levels, this arrester is optimally suited for protecting terminal devices.



Easy maintenance

The BLITZDUCTORconnect product series offers a compact and modular arrester, made up of a base part and protection module. All the protection components are integrated into a housing just 6 mm in width. When servicing the modular arresters, only the module is replaced. The protective function for the system is therefore quickly re-established without rewiring.



Convenient measuring

The arrester itself boasts a disconnection function. Plugging the arrester module in the other way round interrupts the signal circuit – a clear time advantage when it comes to performing measurements. And all of this without any tools or the installation of disconnecting clamps.



Always in the know

The mechanical status indication always provides a full overview. Failures of individual arresters in the case of an overload can be recognised at a glance from the red inspection window. With the right remote signalling unit, there is also the option of having the status reported directly to a higher-level control system.

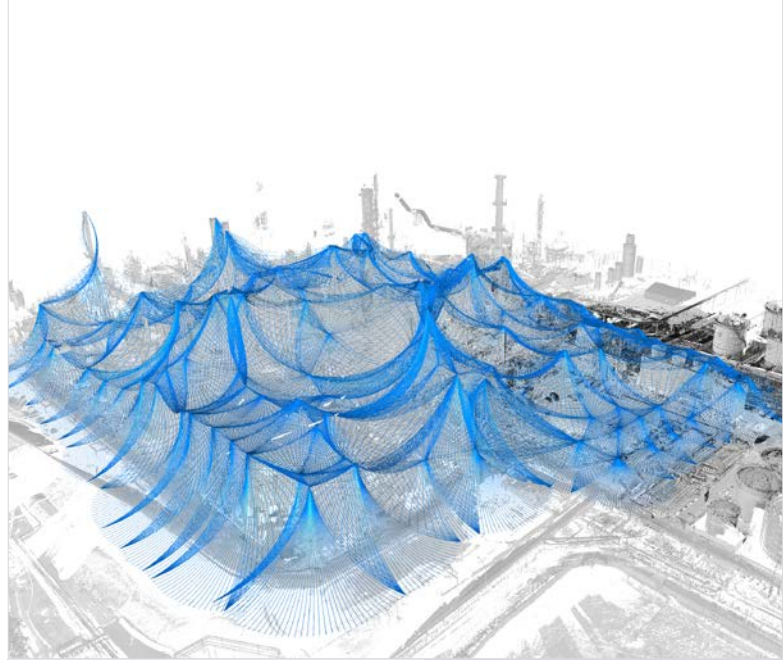


Safe in hazardous areas

All arresters of the BLITZDUCTORconnect series are approved for use in Ex zone 2. They therefore correspond to ignition protection type 'ec'. Especially for the protection of intrinsically safe signal circuits, there is an ex-approved device version. This corresponds to ignition protection type 'ia' and is approved for use in the Ex zones 1 + 2 (fields of application involving gas and dust).



1 Digitisation of a plant with a 3D laser scan



1 Completed 3D model of a laser point cloud including rolling sphere model

Plan lightning protection systems for gas compressor stations professionally

All from a single source with DEHNconcept

From a risk analysis, to 3D planning, to implementation: DEHNconcept helps with planning holistically – for new parts of plants and existing plants.

Always run safely and be available – that is what is required of gas compressor stations to prevent bottlenecks in the gas supply. The protective systems must therefore always be reliable and be continuously adapted in the event of expansions to existing buildings or the addition of new plant facilities.

Considering all parts of a plant or building holistically is critical to an effective lightning protection concept. The basis for this is a risk analysis according to DIN EN 62305-2. With a 3D plan from DEHNconcept, lightning protection concepts are then integrated into the complex plant architecture. Special attention and consideration is given to areas with a high risk class (hazardous areas).

The entire plant is recorded digitally. This is performed either based on as-built 3D drawings, or alternatively the digitisa-

tion of the system can also be performed by means of a 3D laser scanning process. All protected volumes are presented clearly and spatially in this way. This is the basis for finding the optimum position for air-termination systems.

Benefits of 3D planning

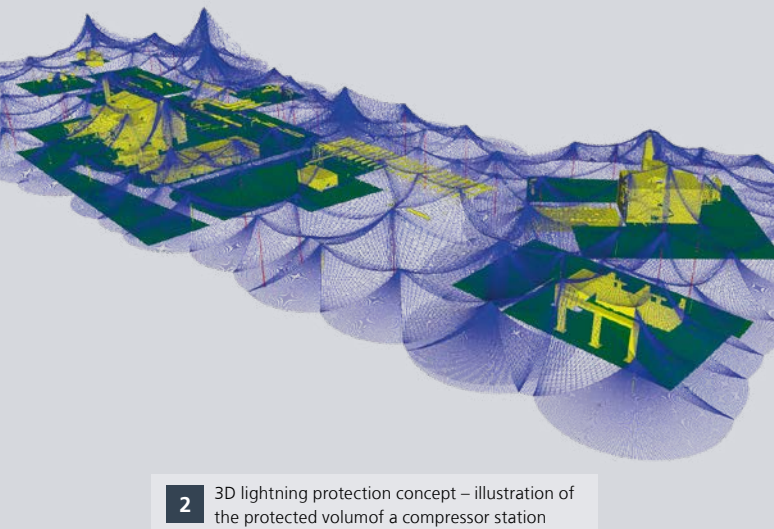
- The precise positioning of the air-termination systems optimises material expenses and installation work. Another aspect which reduces the material expenses is that the 3D visualisation makes it quickly noticeable where existing parts of the building (e.g. lamp posts) might serve as elements of the protection concept.
- Bills of materials with detailed drawings simplify purchasing.
- Once the system has been digitised, all future expansions, modifications and annexes can be added to the 3D model at any time.



We look forward to hearing from you.
The DEHNconcept team
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Email: dehnconcept@dehn.de



More information at:
de.hn/9JUEE



2 3D lightning protection concept – illustration of the protected volumof a compressor station



3 Lightning protection system with lightning-protected telecommunications poles on a compressor station

Planning with DEHNconcept – step by step

Step 1 Recording

The plant data is recorded based on as-built drawings or 3D laser scans from DEHN.

Step 2 Creating the concept

Planning with DEHNconcept includes the entire protection concept. This involves: As-built drawings, detailed drawings, written descriptions with images and design documentation, as well as bills of materials.

Step 3 Implementation and approval

Lightning protection contractors execute the lightning protection concept based on the 3D planning. After the installation, approval is granted by a certified lightning protection contractor for hazardous areas. The acceptance report 'Inspection of a Lightning Protection System in Areas at Risk of Explosion as per DIN EN 62305-3 Including Supplements' forms part of the explosion protection document.

DEHNconcept, the professional planning service for comprehensive lightning protection systems. An immense simplification to the complex planning involved in the process industry in particular.

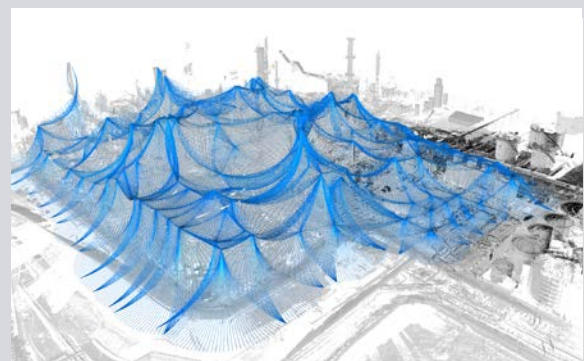
Good to know: Precise planning with laser scanning

With this special technology, your plant will be recorded and digitised in detail – the result is a quick and precise quantity survey of complex buildings and installations in the form of a 3D model. This can then be incorporated directly into a 3D lightning protection plan from DEHNconcept.

Benefits of 3D laser scanning

- With this method, no plans of the plant need to be provided by the customer. Laborious reconstructions using as-built drawings are done away with entirely with this method.
- Digitisation takes place while the system is in operation. Even hazardous areas can be scanned without any problems.

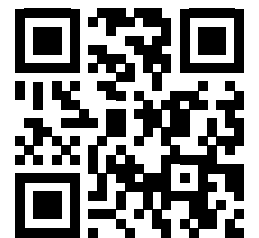
3D laser scanning – the ideal basis for precise 3D lightning protection planning!



Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

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de.hn/2x9qo

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