



**DEHN**

DEHN protects  
Wind Turbines



Ensure smooth operation, protect investments:  
With lightning and surge protection by DEHN

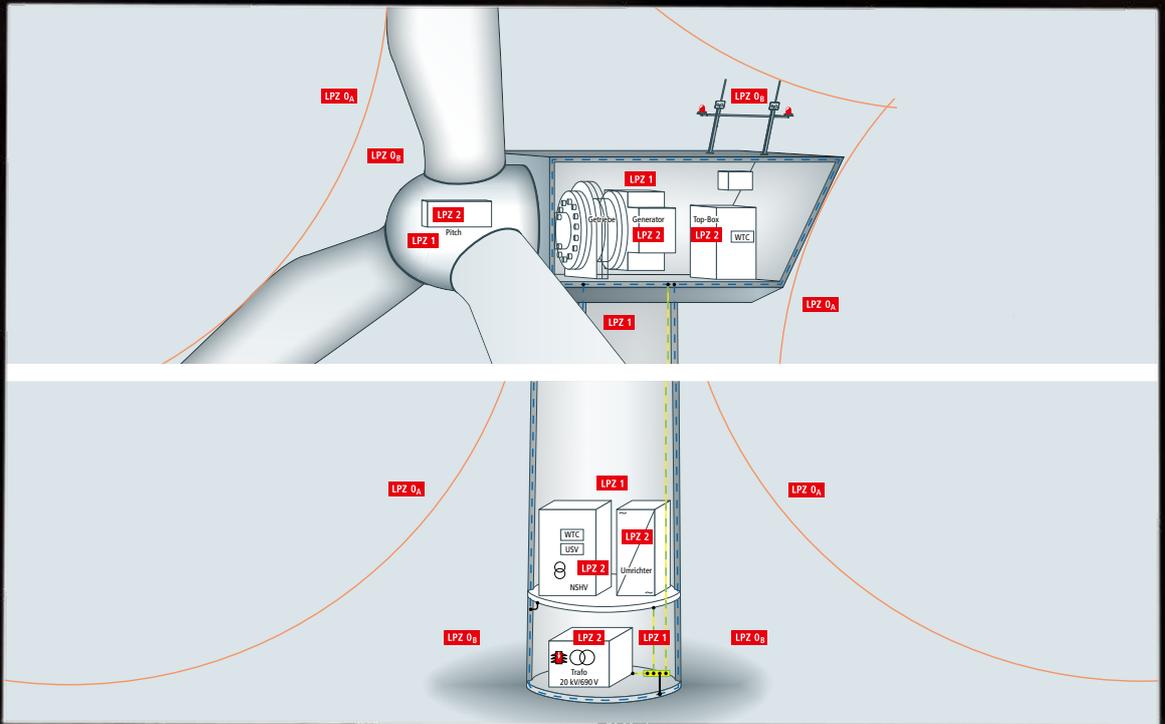


## Secure profit on your investment

The feed-in remuneration for renewables is sinking worldwide and putting the wind branch under increasing pressure. To ensure that investments in new wind turbines pay off in future, too, the top priority is to optimise the availability of the turbines. This prevents loss of revenue due to downtime and high service and repair costs.

Their height makes wind turbines particularly susceptible to destructive lightning events. If insufficient protective measures are taken, the risk of damage and downtime due to lightning is correspondingly high. An integrated lightning protection system is therefore a must. It consists of external and internal lightning protection, earthing and equipotential bonding.

Take the safe option and entrust the globally recognised specialist DEHN with your lightning and surge protection. Our high-quality and durable products protect turbines on all continents, from the foundations to the rotor blades. Take advantage of our services and make quicker and verifiable progress. We can assist you by, for example, conducting risk analyses, creating bespoke protection concepts and product solutions, or conducting system tests in our accredited test centre.



## Developing lightning protection zone concepts with expertise

To secure the availability of wind turbines, the lightning protection zone concept aims to prevent lightning damage to mechanical and electric components. This is achieved by discharging lightning current and controlling surges.

The lightning protection zone concept for wind turbines described in IEC 61400-24 deals with the topic of lightning protection for wind turbines including detailed information on the selection of lightning and surge protection measures <sup>1)</sup>.

As the basis for creating a protection concept, a wind turbine is subdivided into lightning protection zones. One distinguishes here between external zones (LPZ 0<sub>A</sub> und 0<sub>B</sub>) and internal zones (LPZ 1, LPZ 2...n) <sup>2)</sup>. The external zones of a wind turbine – except the rotor blade – are determined by way of the rolling sphere method. The subdivision of the internal zones very much depends on the construction of the individual wind turbine and should be conducted accordingly.

Having laid down the relevant lightning protection zones, one can then define the necessary protective measures. It is advisable to create a lightning protection concept at the initial planning stage of a wind turbine to avoid later cost-intensive repairs and retrofitting. Long experience in the field of lightning and surge protection and the numerous system tests conducted for the wind industry have given DEHN the know-how to develop effective lightning protection systems for wind turbines. We will assist you in developing a lightning protection concept for your turbine consisting of external lightning protection, internal lightning protection, equipotential bonding and earthing.

<sup>1)</sup> IEC 61400-24 Lightning Protection of Wind Turbines

<sup>2)</sup> LPZ: Lightning Protection Zone



## Always reliably informed with DEHNdetect

### Lightning current measuring system prevents subsequent damage

Damage resulting from a lightning strike does not necessarily lead to the immediate failure of the turbine. This means that lightning events often remain undetected, especially in the case of upward flashes where the initial long stroke current flowing is only a few 100 A and can be the main cause of damage, e.g., to the rotor blades. Continued operation of the turbine can lead to serious subsequent damage. Lightning current measuring systems are often employed to detect lightning events and prevent subsequent damage. However, dangerous upward flashes are not always fully detected due to the low current flow of the measuring system. As well as impulse currents, DEHNdetect also reliably registers these dangerous long stroke currents, thus preventing expensive maintenance work and long downtimes.

#### DEHNdetect identifies the following parameters:

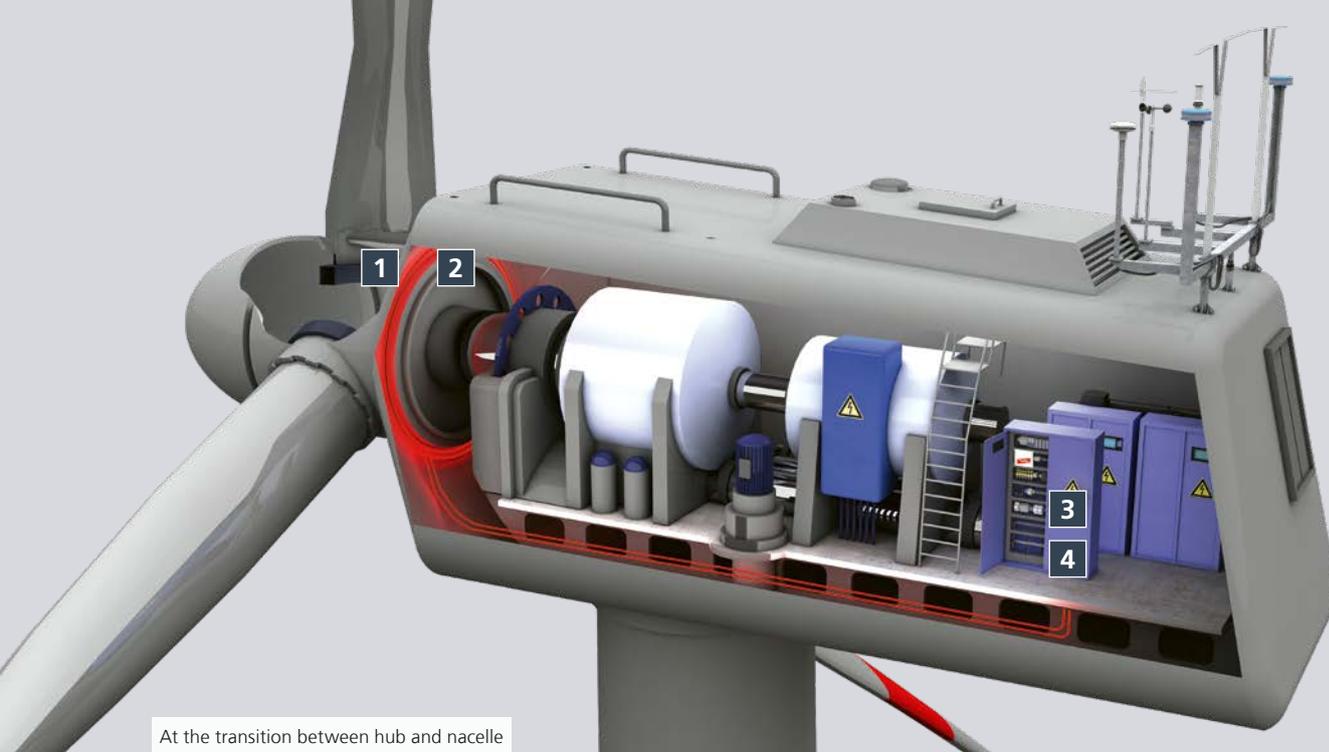
- Impulse current [kA]
- Long stroke current [A]
- Load [C]
- Specific energy [MJ/Ω]
- Rise time [kA/μs]

#### Your benefits:

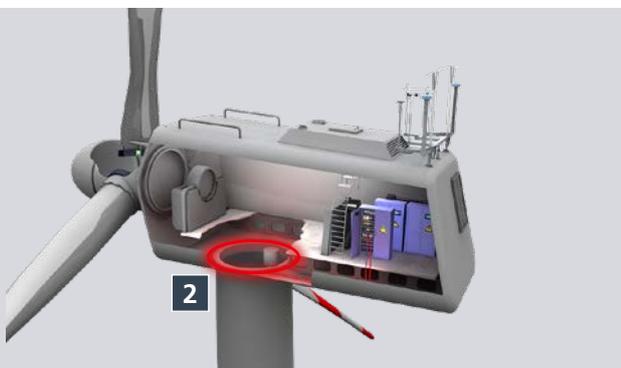
- Prevention of subsequent damage
- Reduction of maintenance / repair costs
- Reduction of downtime

The system can be integrated in the IT infrastructure of the wind turbine via existing interfaces. The data can then simply be read out and managed using the available SCADA systems. If direct integration is not possible, the data can be transmitted to a cloud and evaluated via a web application. This makes it possible to monitor several turbines or even entire wind parks.

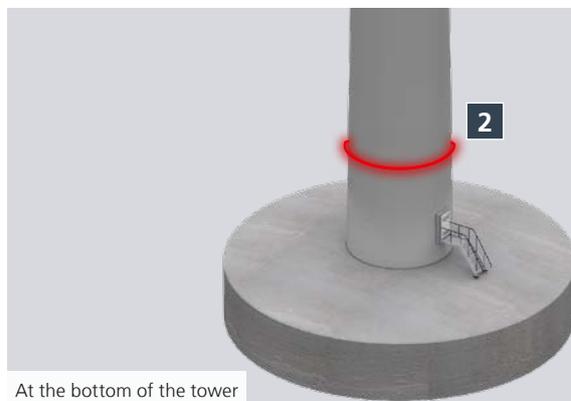
**Invest in availability to secure the power supply of your turbine, today and tomorrow.**



At the transition between hub and nacelle



At the transition between nacelle and tower (e.g. around the yaw system)



At the bottom of the tower

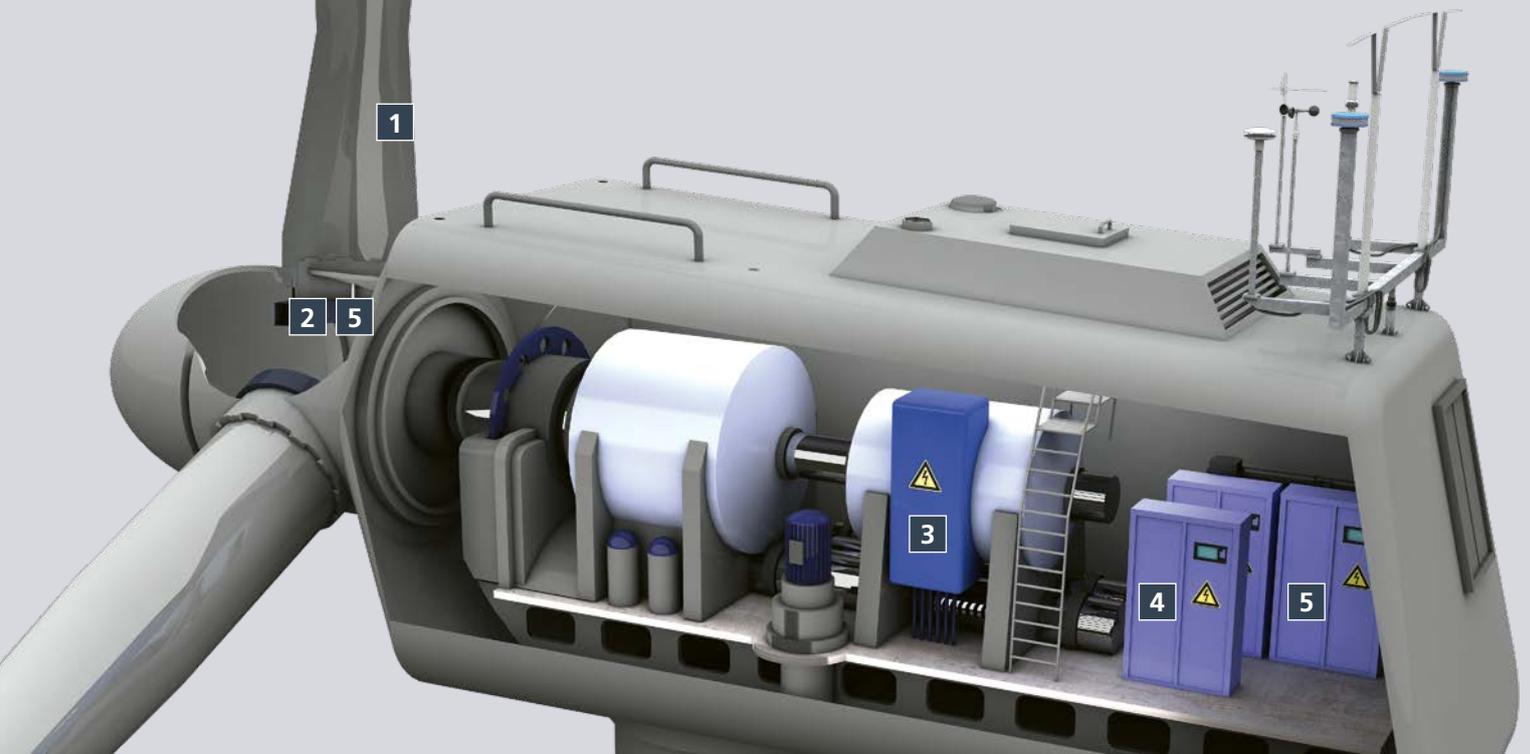
### DEHNdetect components

1		<p><b>DEHNdetect BDU</b> Detector for the wireless detection of lightning current in the rotor.</p>
2		<p><b>DEHNdetect ICC IMP</b> Measuring coil long stroke current and impulse current. Measuring range 60 A to 250 kA.</p>
3		<p><b>DEHNdetect DL</b> Data logger with different interfaces for integration in IT systems.</p>
4		<p><b>DEHNdetect integrator</b> Processing of the measuring signals and transmission to the data logger.</p>

DEHNdetect is configured individually for your application.

More info. at: [de.hn/3jjWe](https://de.hn/3jjWe)





## Lightning and surge protection in the nacelle

All lightning and surge protective devices by DEHN for application in wind turbines are vibration- and shock-tested in compliance with IEC 60068-2.

### Power supply systems

By implementing coordinated surge protection measures for power supply systems, the risk of system downtime due to

lightning currents and surges can be avoided. This increases the availability of the wind turbine in the long term.

### Information technology systems

A consistent protection concept prevents damage to information and data systems. Condition monitoring is indispensable for operational safety and plant availability.

The monitoring unit for the condition-oriented monitoring of up to 50 BLITZDUCTORconnect arresters fulfils this task. Remote monitoring is also possible.

Application	Type	Part No.	
Power supply systems			
1	 <b>DEHNSolid</b>	<b>Rotor blade heating</b> Coordinated type 1 SPD, with 200 kA discharge capacity and low voltage protection level ( $U_p \leq 2.5$ kV).	<b>900 230</b>
2	 <b>DEHNgard M TN CI</b>	<b>Pitch system, aircraft warning light</b> Type 2 SPD, especially space- and cost-saving due to integrated backup fuse.	<b>952 178</b>
3	 <b>DEHNgard SE H 1000 VA FM + earthing clip</b>	<b>Generator</b> Type 2 SPD, further development of the "Neptune circuit" – Advantages: small dimensions save space and costs, improved protection level.	<b>952 940</b> 3x <b>900 418</b>
4	 <b>DEHNgard M TNC</b>	<b>Voltage supply</b> Type 2 SPD	<b>952 305</b>
Information technology systems			
5	 <b>BLITZDUCTORconnect ML2 BE 24 ML2 BE HF 5</b>	<b>Protects signal, bus or control lines</b> Combined lightning current and surge arrester with status indication and push-in connection terminals. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.	<b>927 224</b> <b>927 271</b>
	 <b>DEHNpatch Class EA</b>	Universal arrester for Industrial Ethernet, Power over Ethernet (compliant to 4PPoE) with status indication. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.	<b>929 161</b>
	 <b>BLITZDUCTORconnect CL2 BD HC10A 24</b>	<b>Weather station</b> Combined lightning current and surge arrester with status indication and push-in connection terminals. Protection of DC power supply up to 10 A. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.	<b>927 408</b>
	 <b>DEHNrecord IRCM</b>	Unit for monitoring the condition of BLITZDUCTORconnect arresters and DEHNpatch with LifeCheck. With LED status indication and floating remote signalling contact.	<b>910 710</b>



## Lightning and surge protection in the tower base

A comprehensive lightning protection concept comprises the protection of the nacelle and surge protection in the tower base. In the tower base, both the medium- and low-voltage power side and the data side require protection.

Depending on the concept of the wind turbine manufacturer, technologies with different end of life behaviour can be applied to the protective devices for inverters. If permanent availability is paramount, arresters with a defined disconnection of the protective element from the current circuit in case of overload are preferable. These devices from the DEHNguard family are also available with an optional integrated backup fuse and remote signalling contact. The protective modules can simply be replaced when necessary. However, if the main aim of the concept is to make sure that the system is safe after the protective device has overloaded, DEHN V SCP arresters can be used. Overloading the arrester causes a defined short-circuit in the protective device. This

triggers the upstream protective element and disconnects the system being protected..

**Whatever your concept, we are here to offer you advice!**

Application	Type	Part No.
Power supply systems		
1	 <p><b>DEHNGuard M WE</b> <b>DEHNGuard SE CI WE</b> with integrated backup fuse</p>	<p>Inverter and main supply Type 2 SPD, higher rated varistor voltage, especially for applications with higher voltage peaks.</p> <p><b>952 307</b> <b>952 923</b></p>
2	 <p><b>DEHNGuard M TNC</b></p>	<p>Voltage supply Type 2 SPD</p> <p><b>952 305</b></p>
3	 <p><b>DEHNBloc Maxi</b></p>	<p>Transformer low-voltage side Coordinated type 1 SPD (440 V AC) (760 V AC)</p> <p><b>961 145</b> <b>961 175</b></p>
	 <p><b>DEHNBloc Maxi CI</b></p>	<p>Coordinated type 1 SPD, especially space- and cost-saving due to integrated backup fuse. (440 V AC) (760 V AC)</p> <p><b>961 146</b> <b>961 176</b></p>
4	 <p><b>DEHNmid</b></p>	<p>Transformer medium-voltage side Surge arrester for medium voltage systems.</p> <p><b>990 010</b></p>
Information technology systems		
5	 <p><b>BLITZDUCTORconnect</b> <b>ML2 BE 24</b> <b>ML2 BE HF 5</b></p>	<p>Protects signal, bus or control lines Combined lightning current and surge arrester with status indication and push-in connection terminals. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.</p> <p><b>927 224</b> <b>927 271</b></p>
	 <p><b>DEHNpatch Class Ea</b></p>	<p>Universal arrester for Industrial Ethernet, Power over Ethernet (compliant to 4PPoE) with status indication. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.</p> <p><b>929 161</b></p>
	 <p><b>BLITZDUCTORconnect</b> <b>CL2 BD HC10A 24</b></p>	<p>Weather station Combined lightning current and surge arrester with status indication and push-in connection terminals. Protection of DC power supply up to 10 A. With optional monitoring of arresters via the DRC IRCM condition monitoring unit.</p> <p><b>927 408</b></p>
	 <p><b>DEHNrecord IRCM</b></p>	<p>Unit for monitoring the condition of BLITZDUCTORconnect arresters and DEHNpatch with LifeCheck. With LED status indication and floating remote signalling contact.</p> <p><b>910 710</b></p>



## Safely discharging lightning current

### External lightning protection

Safe interception and discharge of direct lightning strikes is paramount for the availability of a wind turbine. DEHN ensures that this is the case by testing components like the HVI power Conductor with a lightning current of 200 kA

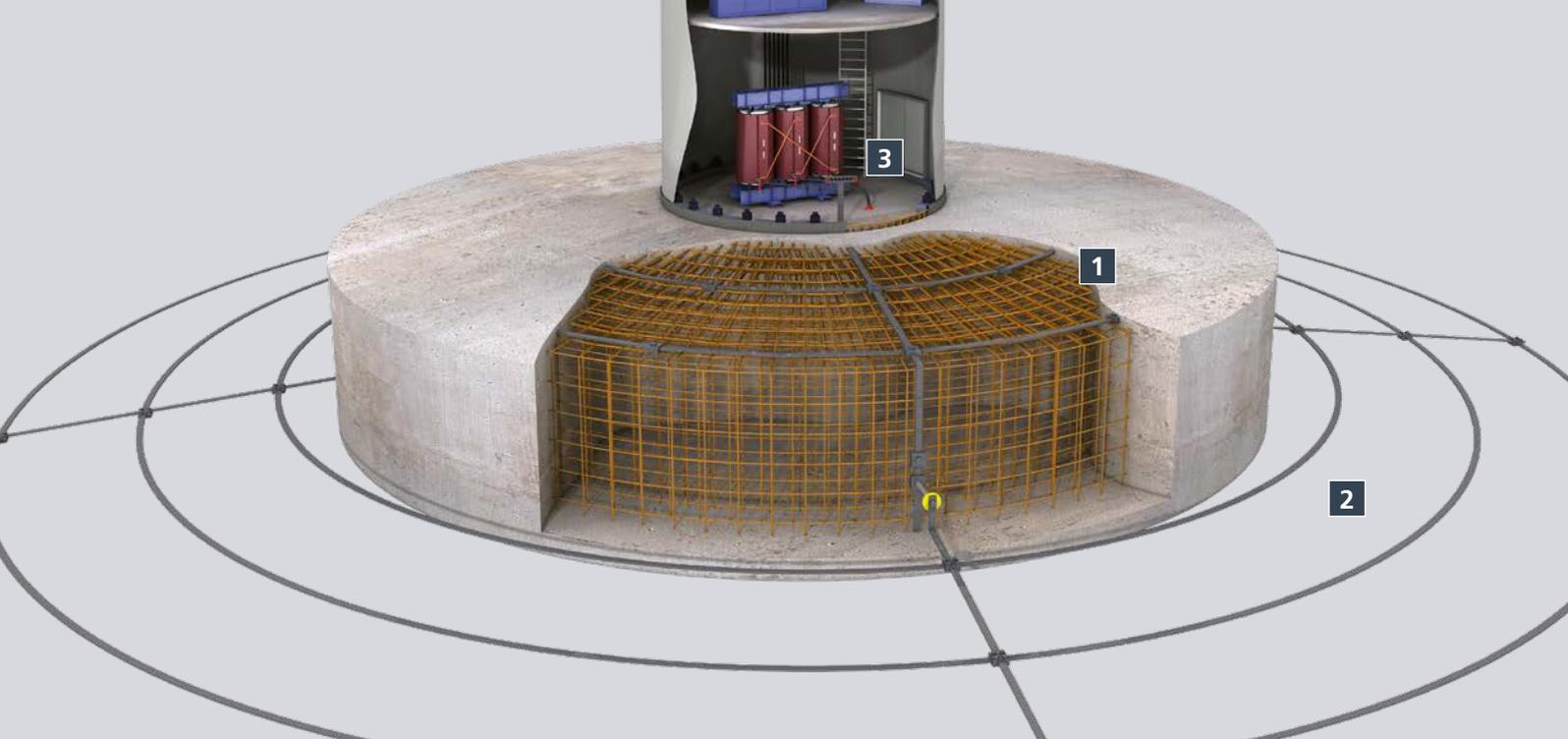
(10/350  $\mu$ s) as stipulated in IEC 62561. The stainless steel design of the air-termination rods and connection elements fulfils stringent corrosion resistance requirements.

### Earthing and equipotential bonding

Safe operation of electrical equipment and systems and a well-functioning lightning protection system require an earth-termination system designed according to IEC 61400-24 <sup>1)</sup>. Connection elements which are capable of carrying short-circuit current ensure the safe contact of the

earth-termination system with metal parts of the foundations and the main earthing busbar. A high level of product quality safeguards long-term mechanical strength and corrosion resistance.

Application	Type	Part No.	
External lightning protection			
<b>1</b> 	<b>HVI power Conductor</b> (in supporting tube with air-termination rod))	Class of LPS 1 – 200 kA (10/350 $\mu$ s) – High-voltage-resistant, insulated down conductor for maintaining the separation distance.	<b>819 430</b>
	<b>HVI power long Conductor</b> (cut to length)	Individual lengths, on request we can assemble your conductors with the appropriate connection elements.	<b>819 163</b>
	<b>UNI disconnection clamp 200 kA</b>	200 kA lightning current carrying capability according to IEC 62561-1 <sup>2)</sup> , stainless steel V2A.	<b>459 200</b>
	<b>KS connector 200 kA</b>	200 kA lightning current carrying capability according to IEC 62561-1 <sup>2)</sup> , stainless steel V2A.	<b>301 209</b>
	<b>MV clamp 200 kA</b>	200 kA lightning current carrying capability according to IEC 62561-1 <sup>2)</sup> , stainless steel V2A. Lightning current carrying connection of the air-termination system and down conductor.	<b>392 209</b>
	<b>Tubular air-termination rod</b>	Safe interception of the flash charge in permanently corrosion-resistant, stainless steel design.	<b>103 419</b>
	<b>Air-termination rod StSt</b>	Safe interception of the flash charge in permanently corrosion-resistant, stainless steel design.	<b>101 009</b>



Application	Type	Part No.
<b>Foundation earthing</b>		
<b>1</b>	 <p><b>Connecting clamps</b></p> <p>Clamps for connecting round and flat conductors in concrete foundations and reinforcements with round and flat conductors with tested short circuit current carrying capacity (50 Hz).</p>	<b>308 031</b>
	 <p><b>Round wire 10 mm St/tZn</b></p> <p>Round wire tested to IEC 62561-2 for use in lightning protection and earth-termination systems <sup>3)</sup>.</p>	<b>800 010</b>
	 <p><b>Strip 30 x 3.5 St/tZn</b></p> <p>Strip tested to IEC 62561-2 for use in lightning protection and earth-termination systems <sup>3)</sup>.</p>	<b>810 335</b>
	 <p><b>Fixed earthing terminal type M V4A</b></p> <p>Corrosion-resistant connection of the ring earthing with the foundation earthing at the base of the tower.</p>	<b>478 011</b>
<b>Ring earth electrode</b>		
<b>2</b>	 <p><b>Connection clamp with threaded bolt StSt (V4A)</b></p> <p>For connection of round and flat V4A conductors to fixed earthing terminal</p>	<b>478 149</b>
	 <p><b>Cross unit StSt V4A</b></p> <p>Corrosion-resistant connection of the individual ring conductors in V4A.</p>	<b>319 209</b>
	 <p><b>Stainless steel strip V4A</b></p> <p>Corrosion-resistant ring conductor in V4A.</p>	<b>860 335</b>
<b>Equipotential bonding</b>		
<b>3</b>	 <p><b>Equipotential bonding in the tower base/equipotential busbar StSt</b></p> <p>Suitable for equipotential bonding and protective/functional equipotential bonding.</p>	<b>472 209</b>

<sup>1)</sup> IEC 61400-24 Wind turbines – Part 24: Lightning protection

<sup>2)</sup> IEC 62561-1 Lightning protection system components (LPSC) – Part 1: Requirements for connection components

<sup>3)</sup> IEC 62561-2 Lightning protection system components (LPSC) – Part 2: Requirements for conductors and earth electrodes



# Safe service and maintenance work

## DEHN safety equipment

### Safe right down the line!

Work on electrical systems is becoming more and more demanding. Make sure you use safe and reliable equipment.

DEHN offers tested products and reliable services which protect your employees from injury caused by arc faults and secure the availability of your systems. This gives you, as the employer, legal certainty.

### Safe at work withh

- Personal protective equipment
- Voltage detectors
- EaS devices
- Fixed ball points
- Arc fault protection systems

Application		
Personal protective equipment		
	<p><b>Safe when it matters most</b></p> <p>Reliable protection against arc faults in electrical installations: DEHNcare personal protective equipment keeps you safe from the thermal effects of an arc fault. DEHNcare equipment is also comfortable to wear thanks to the unique material combination of leather and neoprene.</p> <p>The protective equipment is tested to international standards and consists of a hood, safety helmet for electricians, face shield, protective gloves, jacket and trousers or coat.</p>	 <p>More info at: <a href="https://de.hn/62nNg">de.hn/62nNg</a></p>
Voltage detectors		
	<p><b>Safe right down the line</b></p> <p>Make sure that no voltage is present with a capacitive voltage detector from 1 to 420 kV. Choose from a wide range of voltage detectors – you are bound to find your voltage and frequency!</p>	 <p>More info at: <a href="https://de.hn/814iL">de.hn/814iL</a></p>
EaS devices and fixed ball points		
	<p><b>Safe earthing and short-circuiting (EaS)</b></p> <p>Configuring your individual EaS device for your system is simple and flexible at <a href="http://www.dehn.de/en/euk">www.dehn.de/en/euk</a>.</p> <p><b>Fixed ball points</b></p> <p>You can achieve maximum short-circuit strength by connecting the ball head cap and the connection clamps of the earthing and short-circuiting device.</p>	 <p>More info at: <a href="https://de.hn/42yft">de.hn/42yft</a></p>  <p>More info at: <a href="https://de.hn/2z45H">de.hn/2z45H</a></p>
Arc fault protection system		
	<p><b>Safe – fast – flexible</b></p> <p>DEHNshort quenches arc faults in your low-voltage switchgear installations in milliseconds. Your employees are safe when carrying out maintenance and repairs. Profit from optimised system availability: your system runs and runs, downtime due to an arc fault is significantly reduced.</p>	 <p>More info at: <a href="https://de.hn/5TSMS">de.hn/5TSMS</a></p>



## DEHN Services

More than just a product

### Quick answers to technical questions

You have questions about the technology or applications? Get in touch with our technical support:

Phone: +49 9181 906-1750

E-Mail: [technik.support@dehn.de](mailto:technik.support@dehn.de)



### Intelligent planning

Simple and safe planning with the help of the DEHNSupport Toolbox software. With DEHNconcept, the planning service for integrated protection solutions in the wind energy sector, you can save even more time.



### Personal consultation

You have special questions on the topic? One of our field staff will be happy to pay you a visit.



### Easily acquire knowledge

Get hold of practical information on all topics relating to lightning and surge protection and safety equipment at our DEHNacademy seminars and other training events.



### All from a single source

At DEHN, you will find specific protection solutions, wide-ranging services and high-quality products for:

- lightning protection/earthing
- equipotential bonding
- surge protection
- safety equipment





Accredited according  
to IEC 17025 <sup>1)</sup>

## DEHN Test Centre

### Testing components for wind turbines

#### Play it safe!

Our test centre – with a floor space of 800 m<sup>2</sup> – is equipped with the latest devices and technologies for engineering and testing services according to IEC 61400-24 <sup>2)</sup>. With 400 kA (10/350  $\mu$ s), the testing facility in the lightning current laboratory, part of our test centre, is one of the most powerful of its kind in the world.

- Lightning current tests on bearings and gearboxes of the mechanical drive train
- High current tests on the receptors and down conductors of rotor blades
- System-level immunity tests of important control systems such as the blade pitch control or aircraft warning light
- Tests on customer-specific prewired connection units to protect the electrical installation

Take advantage of our know-how when it comes to the latest standards and fundamental technical principles; know-how we are pleased to make available to you through our engineering and testing services. This makes your protection concepts practicable. In the long-term, you profit from the operational reliability and high availability of your wind turbines.

If you have questions about engineering and testing services for wind energy, please contact our:

#### Team Test Centre:

Phone: +49 9181 906-1812

E-Mail: [labor@dehn.de](mailto:labor@dehn.de)

<sup>1)</sup> IEC 17025 General requirements for the competence of testing and calibration laboratories

<sup>2)</sup> IEC 61400-24: Wind turbines – Part 24: Lightning Protection



# Bespoke solutions

We develop and produce bespoke solutions for our customers based on our sophisticated technologies and more than 20 years' experience in the effective protection of wind

turbines. In a cooperative partnership with you we offer the highest level of reliability and quality, fulfilling your requirements in all respects.

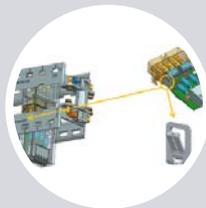
## Your benefits in a nutshell:

- Joint creation of solutions
- Design in line with the standards
- Testing and verification of the solution

Integration of a surge protective device in a client device.

### Advantages:

- Platzersparnis
- höchste Flexibilität
- optimal abgestimmter Schutz



Two in one – integration of customised electronics in a surge protective device.

### Advantages:

- Space-saving
- Optimally adjusted protection



Solution with high-voltage-resistant insulated HVI power Conductor for conducting lightning currents safely past sensitive components.

### Advantages:

- Reduces the load on electrical and mechanical systems
- Increases availability and lowers service costs



Offshore connection distributors for mediumvoltage cables.

### Advantages:

- High corrosion resistance
- Flexible connection possibilities
- Further information and purchase from DESITEK A/S, [www.desitek.dk/da/kontakt](http://www.desitek.dk/da/kontakt)



If you have commercial or specific technical questions, please contact our commercial customer services or our experts for lightning protection, earthing, surge protection, safety equipment and arc fault protection:

### Contact:

#### Key Account Manager – Wind & Energy

Allan Gade Nielsen  
Phone +45 6389 3210  
[agn@desitek.dk](mailto:agn@desitek.dk)

#### Commercial Customer Service

Phone +49 9181 906-1462  
Fax +49 9181 906-1444  
[sales@dehn.de](mailto:sales@dehn.de)

#### Technical Support

Phone +49 9181 906-1774  
Fax +49 9181 906-1444  
[itss@dehn.de](mailto:itss@dehn.de)

Surge Protection  
Lightning Protection  
Safety Equipment  
DEHN protects.

DEHN SE  
Hans-Dehn-Str. 1  
92318 Neumarkt  
Germany

Phone +49 9181 906-0  
Fax +49 9181 906-1100  
sales@dehn.de  
www.dehn-international.com



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