Reliable System Solutions for Isolated Air-Termination Systems.
DEHNiso Combi – modular, versatile and robust.

For the entire DEHNiso Combi programme and additional technical information, please refer to our Lightning Protection main catalogue and to installation instructions 1475.

DEHNiso Combi is a practice-oriented, modular and flexible component programme which meets the mechanical and constructive requirements on site. The components of the DEHNiso Combi system allow for an isolated air-termination system to be complex constructions of the volume to be protected against lightning strikes and coupling of parts of the lightning current into the building is prevented. The separation distance can be calculated based on EN 62305-3. The DEHNiso Combi programme allows for installation of the following components:

- Air-termination rods with conical protection zone.
- Four and more air-termination rods with a large protection zone.
- Isolated air-termination systems with tripod.
- Isolated air-termination systems with tripod.

For electrical and metal installations protruding above the roof, protection against lightning strokes and coupling of parts of the lightning current into the building is prevented. If the separation distance is considered, uncontrolled flashover (sparks) can be prevented and partial lightning currents cannot enter the building installations. The separation distance can be calculated based on EN 62305-3. The DEHNiso Combi programme allows for installation of the following components:

- Air-termination rods with conical protection zone.
- Four and more air-termination rods with a large protection zone.
- Isolated air-termination systems with tripod.

Pipes or profile systems, wall or corners: the fixing system of the DEHNiso Combi component programme offers solutions for every application. An insulating piece in the supporting tube and a glass fibre reinforced plastic (GFRP) insulating piece allow for maintaining the separation distance. With adjustable lengths and are mounted firmly or can be inserted into a fixing socket. Materials factors are used for determining the separation distance.

Tripods with fixed terminals (concrete base) can be used for enduring insulated air-termination rods which have to withstand the wind load. The DEHNiso Combi system allows for easy installation of isolated air-termination systems.
DEHNiso Combi
DEHNiso spacer – versatile, durable and elegant.

The DEHNiso spacer system is a comprehensive, versatile and convenient component programme. This system offers easy and cost-effective solutions for almost every application. The spacer system can be used as a static support for isolated air-termination rods (diameter 16 mm) or as a base for the composition of a SEI (static electrical isolation) system. The combination of the rod holder and the spacer ensures that the separation distance s (material factor km = 0.7) is observed. Thus, an air-termination rod (diameter 16 mm) can be directly attached to the structure via spacers if the separation distance is up to 1 m with pre-mounted fixing elements and pre-mounted conductor holders and/or rod holders are available. If special lengths are required, spacers can be assembled in 3 m lengths and the relevant individual components. Even though projects may require versatile installation options, the system offers very cost-effective solutions. Therefore, DEHN + SÖHNE does not only offer set solutions but also a modular DEHNiso system.

DEHNiso spacer – versatile, durable and elegant.
DEHNiso spacer
Isolated air-termination rods – easy to install, stable and weight-optimised.

Isolated air-termination rods allow integration of large superstructures into protection zone 0, without mechanically connecting or drilling installations with roof superstructures, air conditioning systems or fans. Air-termination rods can be inserted into tripods which are positioned on the roof area or on the ground. Stability has to be ensured considering the wind load zones and wind velocities stipulated by the relevant standard. The map shows that approximately 89% of the surface of Germany is covered by wind zones I and II. For this reason, air-termination rods are generally designed for wind zone II. Depending on the occurring loads, it has to be verified separately if isolated air-termination rods can be used in wind zones III and IV.
DEHN telescopic lightning protection masts – easy to transport, practical and cost-effective.

It is useful to apply the protection angle method to plan buildings. The values of the protection angle depend on the class of LPs and the height of the LP. The protection distances between the LPs and the structure to be protected have to be observed in accordance with DIN 4131.

The masts are installed in a bucket foundation (finished part) or in a concrete foundation (to be ordered separately). For more detailed information on the plug-in systems, foundation and installation, please refer to our lightning protection catalogue. The masts are dimensioned for wind speeds up to 187 km/h (point load zone 8 in accordance with DIN 4131).

DEHN telescopic lightning protection mast in a bucket or concrete foundation

The masts are installed on site in a bucket foundation (finished part) or in a concrete foundation with a bucket basket (to be ordered separately).

For more detailed information on the plug-in systems, foundation and installation, please refer to our lightning protection catalogue. For further details, please see also installation instructions No. 1581.

DEHN telescopic lightning protection mast with concrete foundation

The masts are installed with a screw-in foundation. No digging or foundation work is necessary. Without special preparation the concrete foundation is just screwed into the ground and fixed additionally with wall nuts. The masts are dimensioned for wind velocities up to 187 km/h (point load zone 8 according to DIN 4131).

Height above ground from 6 m to 11 m.
Part No. 103 121 - 103 126
For further details, please see also installation instructions No. 1581.

Foundation baskets for concrete foundation on site

To be encased in concrete, with threaded bolts, compatible with the flange plate of the telescopic lightning protection masts.
Part No. 100 950 and 100 961

For more technical information, please refer to our Lightning Protection main catalogue.
DEHN telescopic lightning protection masts
High impulse voltages can occur at the surface of insulating materials if no additional protection measures are taken. This effect is known as creeping flashover. If the creeping discharge inception voltage is exceeded, a surface discharge occurs which may range over a distance of several metres without any problems. In order to avoid creeping discharges, the HVI® conductor is equipped with a special external coating which allows for diverting high lightning impulse voltages to a reference potential. If the reference potential is connected to an equipotential bonding connection, the lightning potential flows via an equipotential bonding connection element, e.g. at earthed metal roof superstructures in the protection zone of the lightning protection system, at earthed parts of the building construction which are free of lightning currents or at the protective conductor of the low-voltage system. Under certain conditions, the special external coating can be connected to parts of the lightning protection system such as air-termination system and down conductors. For this purpose, it has to be ensured that the calculated separation distance does not exceed 35 cm in air at the contact point. In this case, the special external coating has to be directly connected to the part through which lightning potential flows via an equipotential bonding connection element. The black coated HVI® conductor with an outer diameter of 20 mm and the grey coated HVI® conductor with an outer diameter of 23 mm consist of a 19 mm copper wire, a thick-walled, high-voltage-resistant insulation and a weatherproof special external coating. In order to prevent low-energy flashovers due to capacitive displacement currents, the HVI® conductor can be additionally connected to the equipotential bonding structure during conductor installation. These connections do not have to be capable of carrying lightning currents as the capacitive displacement currents have low energy and do not cause dangerous sparking. Extensive measurements show that the HVI® conductor with its high electric strength has an equivalent separation distance of s = 0.75 m (air).
DEHNconductor system HVI® conductor
Isolated air-termination systems for antennas and emitting characteristics / omnidirectional antennas.

Antennas with 360° emitting characteristics (omnidirectional antennas) are used for different radio applications. When installing isolated air-termination systems for omnidirectional antennas, it has to be considered that an isolated air-termination rod with a sufficient protective angle covers the antenna to be protected. Furthermore it has to be ensured that a sufficient separation distance is maintained.

From a functional point of view, a distance has to be kept between the antenna and the air-termination system, which corresponds to a quarter of the wave length of the radio frequency used. Installation instructions No. 1521 have to be observed.

<table>
<thead>
<tr>
<th>Units:</th>
<th>mHz</th>
<th>m</th>
<th>Hz</th>
<th>m</th>
</tr>
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<td>3000</td>
<td>1 000 000</td>
<td>300</td>
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<td>10 000 000</td>
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<tr>
<td>10 x 10⁶</td>
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<td>160 x 10⁶</td>
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<td>900 x 10⁶</td>
<td>0.33</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1800 x 10⁶</td>
<td>0.17</td>
<td></td>
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</table>

Covered by DEHN® spacers for omnidirectional antennas.
Special measures have to be taken to protect all industrial sectors against explosion in which the processing or transport of combustible substances causes gases, vapours, mist or dusts creating a potentially explosive atmosphere with air. Depending on the probability and duration of the occurrence of potentially explosive atmospheres, the areas of the potentially explosive system are divided into zones which are referred to as hazardous areas. Annex D of EN 62305-3 provides detailed information on lightning protection systems for potentially explosive systems taking into consideration threats posed by direct and indirect lightning strokes, causes of damage, structures to be protected and protection measures to be taken.

Due to the ever increasing complexity of systems, effective protection in case of lightning strokes and surges becomes more and more important. Legislation e.g. the Landesbauordnungen (German building regulations) and Betriebssicherheitsverordnung (German Health and Safety at Work Regulations) calls for lightning protection measures for structures housing potentially explosive facilities such as paint facilities, chemical facilities, large warehouses with combustible liquids and large gas tanks with a high fire risk. The DEHN conductor system allows for the installation of an external lightning protection system in hazardous areas 1 or 2 and 21 or 22. Installation instructions No. 1501 have to be observed.
No proximities with DEHNcon-H.

Metal and electric superstructures protruding above the roof are particularly exposed lightning striking points. If the external lightning protection system is installed correctly, that is with an isolated air-termination system for these roof superstructures, partial lightning currents do not enter the building. The new lightning protection standard EN 62305-3 (VDE 0185-305-3), the safety standard for antenna installations EN 60728-11 (VDE 0855-11) as well as supplement 1 of DIN VDE 0845 for surge protection of IT systems call for an isolated lightning protection system or an isolated air-termination system for antenna installations or other installations protruding above the roof.

DEHNcon-H

The variable component system consists of the following components:
- **HVI® conductor light**, a refined insulated down conductor, which is installed in a supporting tube with air-termination tip
- Fixing elements, conductor holders and other accessories

The equivalent separation distance of the HVI® conductor light is \( s \leq 0.45 \text{ m} \) (in air) or \( s \leq 0.90 \text{ m} \) (solid material).

DEHNcon-H comes with a practice-oriented design since the dimensions of the supporting tubes were reduced. Another benefit of DEHNcon-H is the reduced weight of the total structure. This allows for already existing antenna masts to be retrofitted with DEHNcon-H.

Possible applications are protection against direct lightning strokes into:
- Antennas (satellite antennas, terrestrial antennas, DVBT receiver installations)
- Photovoltaic and solar thermal systems
- Object surveillance systems

For a complete component overview, please refer to our Lightning Protection main catalogue. For more detailed information on DEHNcon-H, please refer to installation instructions No. 1632.
Nowadays roof areas of industrial and office buildings are often the last installation level. Regardless of the risk of possible lightning strikes, pipes e.g. for ventilation systems, electrical and IT systems are installed on the roof area. All these systems have electrical links into the building which allow for inducing partial lightning currents. Isolated air-termination systems prevent partial lightning currents from being induced into buildings where they may interfere with or even damage sensitive electrical/electronic equipment. If bare, non-insulated wires of the air-termination system are directly installed on the roof, the separation distance to electric and metal systems situated underneath the roof area has to be observed according to the state of the art and the current EN 62305-3 lightning protection standard. The separation distance has also to be observed in standard residential buildings with steep roofs. Various conductors, pipes and large metal-coated thermal insulation systems underneath the roofing are located close to the air-termination system and down conductor so that the problem of proximity arises.

Isolated air-termination systems with high-voltage-resistant down conductors, HVI® conductors, provide the solution to this problem. The air-termination system is installed e.g. conventionally by means of air-termination rods which are mounted on a GRP pipe for insulation/electrical isolation from the roof.

The length of air-termination rods or an arrangement of several air-termination rods is selected in such a way that the protection zone is sufficiently large. If an individual air-termination rod is used, the protection zone is the area formed by the protective angle. If two air-termination rods are used, a tent-shaped protection zone is formed beside the air-termination rods and between these two air-termination rods. If several air-termination rods are arranged, an entire large protection zone is formed underneath the air-termination rod according to the rolling sphere method.

The newly developed HVI® conductor light, an extension of the tried and tested DEHNconductor system, offers various design options for external lightning protection systems. There are also connection types of the HVI® conductors light which require no sealing end for connection to the equipotential bonding element in the connection area. The coupling point at the tripod has to be effected in a defined way so that a functional earth conductor is not required. This allows for easy installation and consequently saves a lot of time.

For a complete component overview, please refer to our Lightning Protection main catalogue. For more detailed information on the HVI® conductor light, please refer to installation instructions No. 1637.
Isolated air-termination systems for protecting roof superstructures considering the separation distances according to standard requirements

According to the state of the art of lightning protection systems, large roof superstructures should be protected against direct lightning strokes by isolated air-termination systems. Electrical isolation of the lightning protection system from conductive parts of the building construction (metal construction parts, reinforcement, etc.) and isolation with regard to electrical conductors in the building prevent lightning currents from flowing through control and supply lines as well as interference / destruction of sensitive electrical and electronic installations.

In accordance with the current EN 62305-3 standard, air-termination rods and/or elevated air-termination systems (ring conductors or spanned cables) should be installed taking into account the separation distances according to standard requirements. Three methods can be used for determining the arrangement and position of air-termination systems:

- Rolling sphere method
- Protective angle method
- Mesh method.

The mesh size, the radius of the rolling sphere and the protective angle depend on the class of LPS. The rolling sphere method as universal design method should be used particularly for geometrically complicated applications. A risk analysis in accordance with EN 62305-2 has to be carried out to determine the class of LPS. When using the protective angle method, the protective angle of an air-termination system depends on the selected class of LPS of the lightning protection system and the height of the air-termination system above the area to be protected.

We recommend to use the DEHN Distance Tool software for the calculation of the separation distance.

### Design procedure

**POSSIBILITY 1: Manual calculation of the separation distance**

1. **Determine the length of the air-termination rod via the protective angle method or rolling sphere method.**
2. **Calculate the separation distance to determine the position of the air-termination rod.**
   1. **Calculation of** $s_1$ **(roof top edge):**
      $$ s_1 = \frac{k_c}{k_a} \left( \frac{h}{2} + \frac{0.1 + 0.2 \cdot \sqrt{\frac{h}{2}}}{1} \right) $$
   2. **Calculation of** $s_2$ **between the base point of the air-termination rod and the roof superstructure** ($k_a = 0.04$):
      $$ s_2 = \frac{1}{2} \left( (1 + 5 \cdot 0.5 + 6 \cdot 0.5 + 0.25 \cdot 22) \right) $$
      $$ s_2 = 0.84 \cdot \frac{1}{2} = 1.08 \text{ m} $$
   3. **Calculation of** $s_3$ **between the air-termination rod and the top edge of the roof superstructure** ($k_a = 0.04$):
      $$ s_3 = \frac{1}{2} \left( (1 + 7.5 \cdot 0.5 + 6 \cdot 0.5 + 0.25 \cdot 22) \right) $$
      $$ s_3 = 0.94 \cdot \frac{1}{2} = 0.64 \text{ m} $$

   Note: $L_{1*}$, $L_{2*}$ = 5 m length of the connecting line from the base to the next node

4. **Comparison of** $s_2$ **(solid material)** vs **$s_2$ (air):**
   - $s_2$ (solid material) = 1.26 m
   - $s_2$ (air) = 0.68 m

   **Note:** Use the DEHN Support Toolbox software available on www.dehn.de

**POSSIBILITY 2: Calculation of the separation distance by means of DEHN Distance Tool**

1. **Calculation of** $s_1$ **top edge of the roof (lightning strike into the middle of the metal capping):**
   - $s_1_{\text{max}}$ = 0.89 m

2. **Calculation of** $s_2$ **between the base point of the air-termination rod and the roof superstructure:**
   - $s_2$ (solid material) = 1.26 m
   - $s_2$ (air) = 0.68 m

3. **Calculation of** $s_3$ **between the air-termination rod and the top edge of the roof superstructure:**
   - $s_3$ (solid material) = 1.36 m
   - $s_3$ (air) = 0.68 m

   **Note:** Use the DEHN Support Toolbox software available on www.dehn.de
<table>
<thead>
<tr>
<th>Distance between the air-termination rods in m</th>
<th>Class of LPS I</th>
<th>Class of LPS II</th>
<th>Class of LPS III</th>
<th>Class of LPS IV</th>
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<tbody>
<tr>
<td>Class of LPS I radius 20</td>
<td>sag in m</td>
<td>sag in m</td>
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<tr>
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<td>Class of LPS IV Angle α</td>
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</tbody>
</table>

Table 3: Sag of the rolling sphere depends on the distance between two air-termination rods and the class of LPS.

Table 2: Assignment of the height of the air-termination rod \( h \) to the protective angle \( \alpha \) and distance \( a \) depending on the class of LPS.