OBO Typicals

Detailed mounting drawings

of lightning protection, earthing and
equipotential bonding systems

O-line

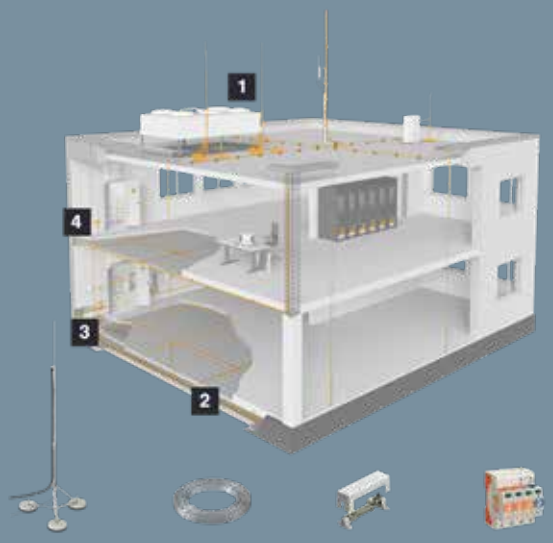
Basic knowledge

Basic principles of standardised planning

Your planning aid for the practical implementation of current standards and regulations.

With innovative OBO technology against:

- Risk from lightning current and induced voltages
- Damage from fire, explosions, stepped voltage, contact voltage, etc.
- Damage to people, buildings and building contents



1 Air-termination and down-conductor systems
2 Earthing systems
3 Equipotential bonding systems
4 Surge protection systems

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Protected 4

The “Protected to the power of four” principle: Only matched protection is real protection. Discover in the video what our different systems do.

OBO ACADEMY

Connect to knowledge

From the basics through to concrete applications – in local training offers, we can provide knowledge about:

- Basic standardisation principles
- Risk analyses, lightning protection classes, lightning protection systems
- Earther requirements for earth rods, ring earthers and foundation earth electrodes
- Risks of lightning discharges and surge voltages
- Lightning protection zones and arrester technologies
- Protective equipotential bonding and functional equipotential bonding
- Application examples, installation information, planning aids, practical questions

Earthing systems

The foundation for lightning and surge protection

Earther requirements according to IEC/EN 62305-3

Type A
- Horizontal earther
- Vertical earther (earth rod)

Type B
- Ring earther (surface earther)
- Foundation earth electrode

Earther arrangement, type A (Horizontal and earth rods)

At least two earthers are required for the type A arrangement.
A minimum dimension for type A earthers is, for example, a length of 2.5 m for vertical installation and 5 m for horizontal installation for lightning protection class III.

Horizontal earther

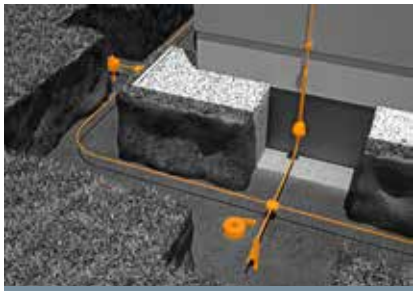
In the form of radiation, ring and grid earthers. Round or strip material is used, which is generally inserted up to a depth of 0.5 m to 1.0 m (depending on the local frost depth).

Earth rod

Made of round or profile steel, which is generally inserted vertically into greater depths
However, depending on the earth, they are subject to more or less strong corrosion. Therefore, you should check whether it is a part of the foundation earthing (V4A) or a purely lightning protection earthing (V4A not necessarily required).

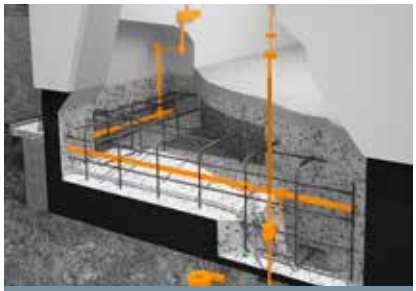
Earther arrangement, type B (Foundation earth electrode, ring earther)

To ensure the foundation earth electrode is protected against corrosion, it must be surrounded on all sides by at least 5 cm of concrete. This gives it an almost unlimited lifespan. Steel should be used as the material for the foundation earth electrode. The steel may both be galvanised or ungalvanised.
If the earther cannot be integrated in the building foundation or is run out of the foundation, then round or strip material, made of corrosion-resistant stainless steel (V4A), must be used.
Round steels must have a diameter of at least 10 mm. In the case of strip steel, the dimensions must be at least 30 x 3 mm.



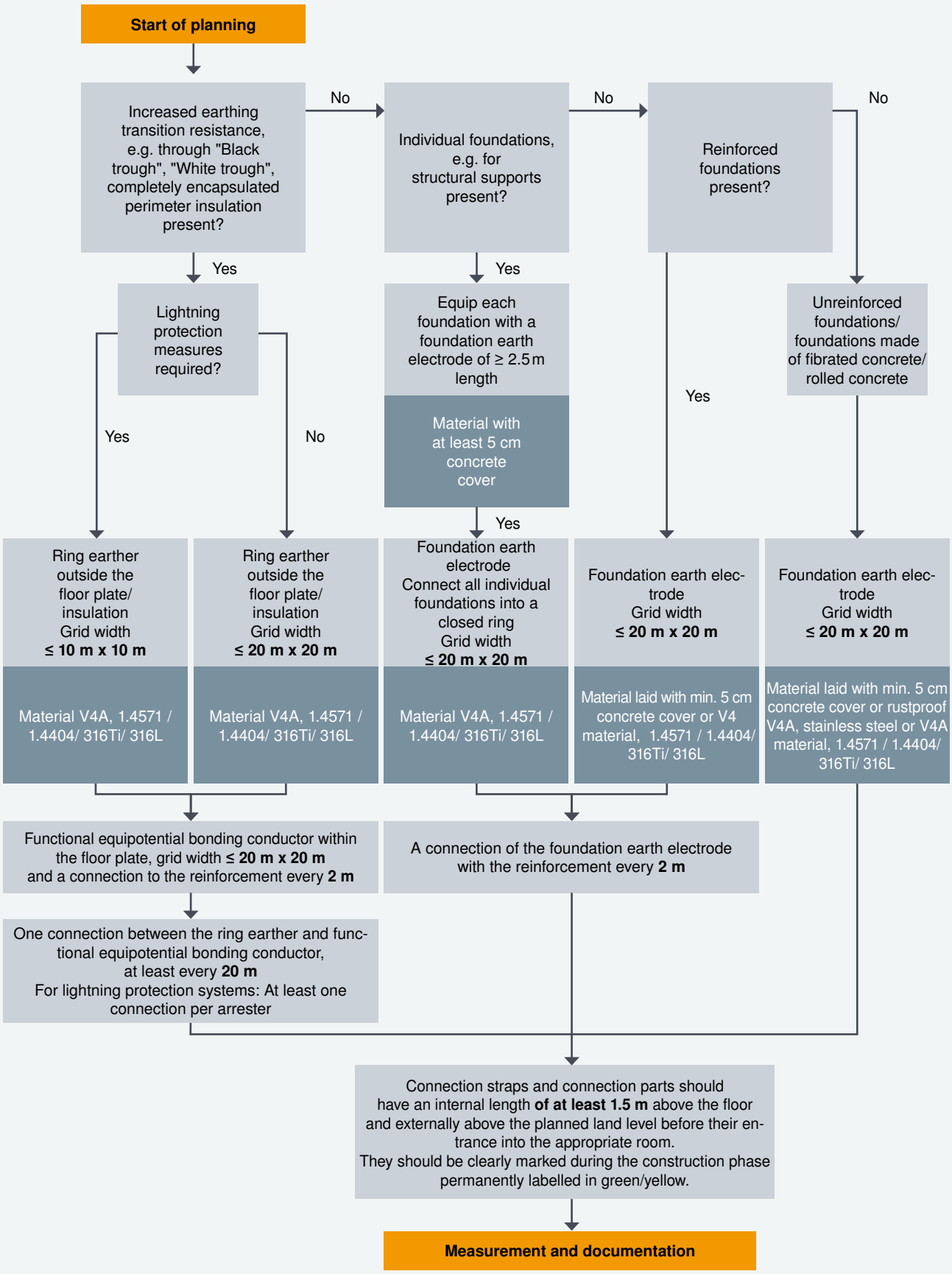
Type A – earth rod with equipotential bonding

Type B – ring earther



Type B – foundation earth electrode

Planning aid for creating a foundation earth electrode

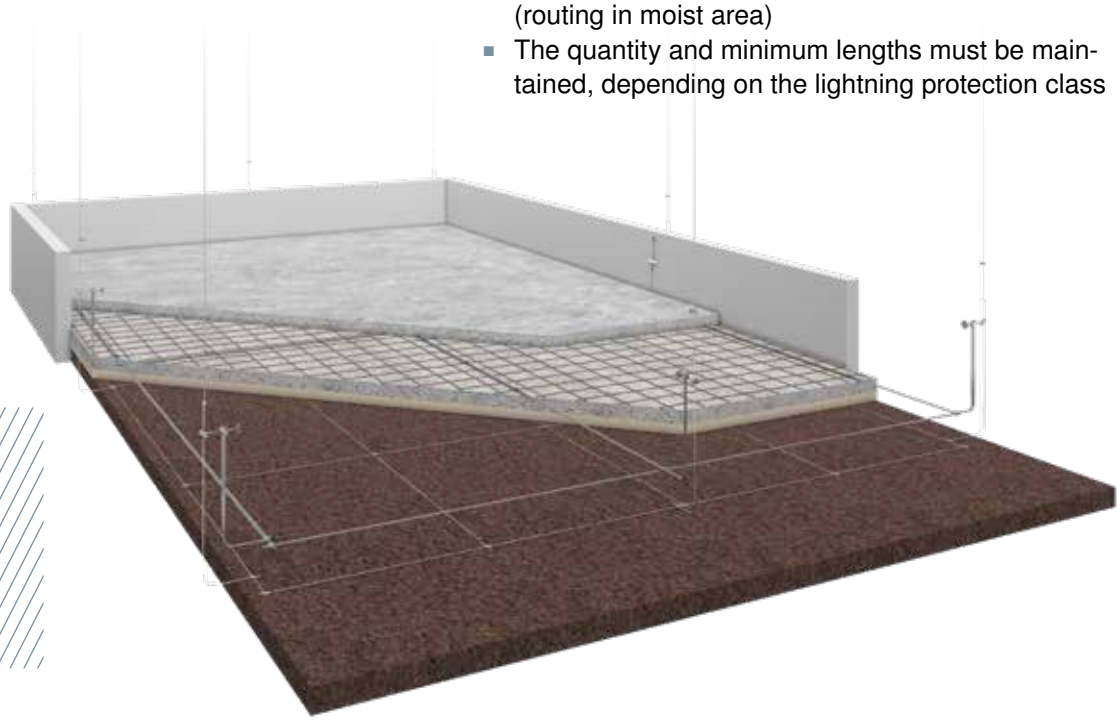


Earthing material for use in concrete:

- Surrounded with at least 5 cm of concrete on all sides
- Connect ≤ 2 m with reinforcement
- Grid width max. 20 x 20 m

Earthing material for use in the earth:

- V4A material
- Clamps in earth with corrosion protection strip
- Routing depth 0.5–1.0 m (depending on local frost depth)
- Routing outside the drainage layer (routing in moist area)
- The quantity and minimum lengths must be maintained, depending on the lightning protection class

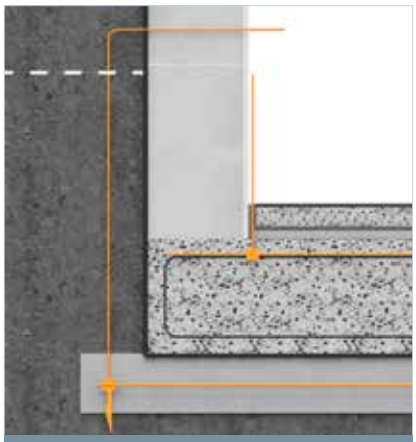


	Type	PU	Item no.	Description
	RD 10 FT	80 m	5021 10 3	Round conductor ∅ 10 mm FT, 50 kg/ring (0.63 kg/m)
	5052 DIN 30X3.5	60 m	5019 34 7	Flat conductor 30x3.5 FT, 50 kg/ring (0.84 kg/m)
	5052 DIN 40X4	40 m	5019 35 5	Flat conductor 40x4 FT, 50 kg/ring (1.28 kg/m)
	1811	25 pieces	5014 01 8	Spacer FT length 250 mm
	1814 FT	25 pieces	5014 46 8	Connection terminal on reinforcement ∅ 8–14 mm
	1814 FT D37	25 pieces	5014 46 9	Connection terminal on reinforcement ∅ 16–37 mm
	205 DG L180 A4	10 pieces	5420 02 2	Fixed earthing terminal M10/M12 V4A
	205 DG L180 FT	10 pieces	5420 02 4	Fixed earthing terminal M10/M12 FT
	DW RD10	10 pieces	2360 04 1	Sealing sleeve for round conductors, 10 mm
	252 8-10 FT	25 pieces	5312 31 0	Cross-connector with intermediate plate
	RD 10-V4A	50 m	5021 64 2	Round conductor ∅ 10 mm V4A, 32 kg/ring (0.63 kg/m)
	5052 V4A 30X3.5	25 m	5018 73 0	Flat conductor 30x3.5 V4A, 21 kg/ring (0.83 kg/m)
	250 V4A	10 pieces	5312 92 5	Cross-connector for flat conductors and round conductors V4A
	252 8-10 V4A	10 pieces	5312 31 8	Cross-connector with intermediate plate V4A
	249 8-10 V4A	10 pieces	5311 40 4	Vario quick connector round/round, V4A
	219 20 BP V4A	5 pieces	5000 86 6	BP earth rod, ∅ 20 mm, length: 1.5 m, V4A
	1819 20BP	5 pieces	3041 21 2	Earth point for earth rod ST and BP
	2760 20 V4A	5 pieces	5001 63 3	Connection clip for earth rod, universal, V4A
	356 50	1 piece	2360 05 5	Corrosion protection strip, width: 50 mm
	ProtectionBall	25 pieces	5018 01 4	Protective cap for connection straps

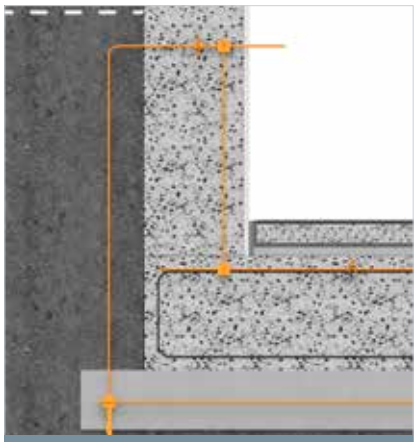
Special requirements for foundations with trough seals and perimeter insulation
With trough seals, the earth contact of the earther is not guaranteed. For this reason, a ring earther is to be installed outside the trough seal. Long-lasting corrosion protection is to be ensured. Rustproof stainless steels (V4A) must be used.

Black trough
These are building seals which can withstand the water pressure and are made of multi-layer plastic or bitumen strips (black material).

White trough
The white trough is created from water-impervious concrete (WI concrete). The concrete can take up water but, even with the long-term effect of the water on the concrete, is not fully permeated, i.e. no moisture occurs on the inner side of the wall.



Black trough,
ring earther entry above the highest groundwater level



White trough, pressurised water-tight ring earth entry in the groundwater

Insulated floor plate with perimeter insulation (here: shown in blue)

Equipotential bonding

Protection against dangerous potential differences

Protective equipotential bonding is to be created by connecting the following conductors to the main earthing rail, if appropriate:

- Earthing conductor to system earther;
- Protective conductor of the main cable (PE or PEN conductor);
- Protective equipotential bonding conductors of antenna systems;
- Functional and surge voltage earthing conductors in IT;
- Protective equipotential bonding conductors of the lightning protection system (LPS);
- Equipotential bonding conductor of conductive water consumption lines;
- Protective equipotential bonding conductor of conductive internal gas lines;

- Protective equipotential bonding conductor of other metallic pipe systems run into the building from another building,
  e.g. central heating and air-conditioning systems, exhaust gas traps;
- Protective equipotential bonding conductor from other outside conductive parts, if they can be touched in the normal state of use;
- Protective equipotential bonding conductor of conductive reinforcements of concrete structures, where they can be touched and are reliably interconnected

Products for equipotential bonding

	Type	PU	Item no.	Description
	1801 VDE	1 piece	5015650	Equipotential busbar for inside installation with clamping rail – also suitable for industry and Ex areas. 7 x 2.5-25 mm²; 2 x 25-95 mm²; 1 x FL 30 x 3.5 mm
	1809	1 piece	5015073	Equipotential busbar for inside installation for private applications. 7 x up to 25 mm²; 1 x Rd 8-10; 1 x FL 30 or Rd 8-10
	1809 BG	1 piece	5015502	Equipotential busbar for small systems 3 x up to 6 mm²; 2 x up to 16 mm²
	1809 A	1 piece	5015111	Equipotential busbar for outside installation, UV-resistant, VA screws and crossbar. 7 x up to 25 mm²; 1 x Rd 8-10; 1 x FL 30 or Rd 8-10
	1802 10 VA	1 piece	5015866	BigBar equipotential busbar for the industrial sector (also suitable for Ex area) made of V2A stainless steel, with insulation feet, 10 connections with M10 carriage bolts
	927 1	10 pieces	5057 51 5	Stainless steel earthing pipe clamp

Lightning protection systems

Lightning protection is preventive fire protection

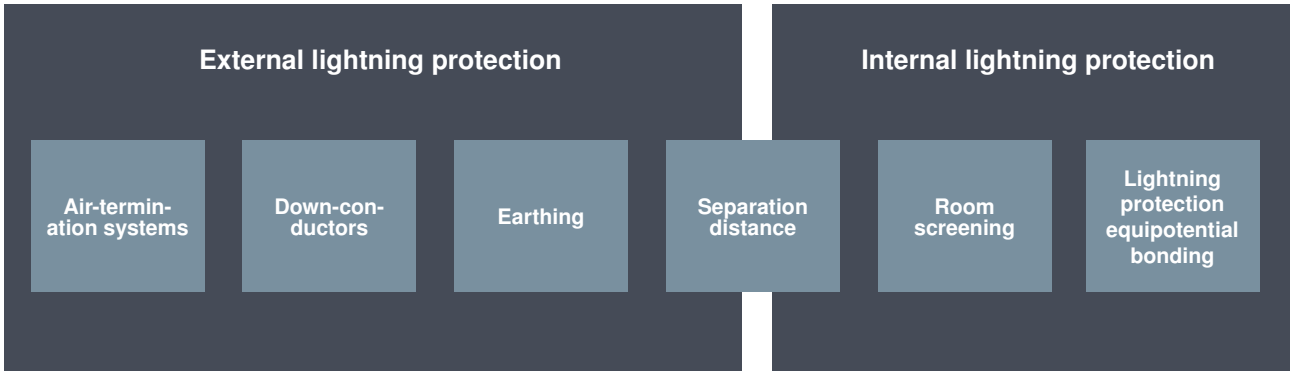
Currently valid standard:
IEC/EN 62305 Part 1–4

Part 1: General principles
Part 2: Risk management
Part 3: Physical damage to structures and life hazard
Part 4: Electrical and electronic systems with structures

One of the key evaluation factors in each lightning protection risk analysis is the local density of lightning strikes. These are expressed in lightning strikes per km²/year and should be determined by measurements in a lightning location method. The result of this risk analysis is the existing risk level I–IV. The planner must implement the appropriate lightning protection class I–IV.

External and internal lightning protection systems

Comprehensive lightning protection can only be achieved through a coordinated approach.

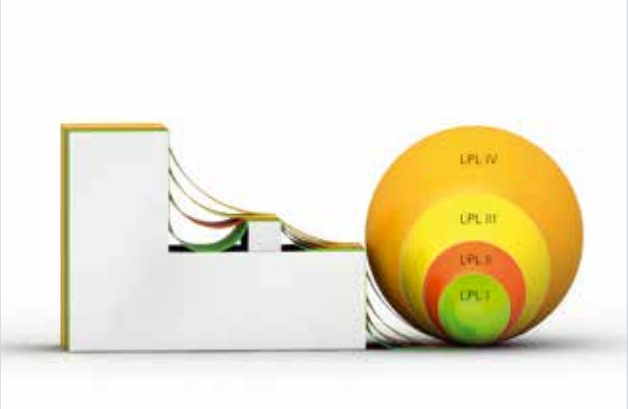


Protection class of the lightning protection system
The characteristics of a lightning protection system (LPS) are specified by the characteristic values of the structure system to be protected and according to the lightning protection class.

Each protection class of an LPS is characterised by:

a) Characteristic data, according to the protection class of the LPS:
- Characteristic lightning values
- Rolling sphere radius, grid width and protective angle
- Typical distances between down-conductors and ring conductors
- Separation distance to avoid dangerous spark formation
- Minimum length of the earthers

b) Characteristic data, irrespective of the protection class of the LPS:
- Lightning protection equipotential bonding
- Minimum thickness of metal plates or pipes in air-termination systems
- Material, shape and minimum dimensions of air-termination systems, down-conductors and earthers



Standard	German supplement	Contents
VDE 0185-305-1 (IEC 62305-1)		Protection against lightning – Part 1: General principles
VDE 0185-305-2 (IEC 62305-2)		Protection against lightning – Part 2: Risk management
	1	Lightning risk in Germany
	2	Calculation aids for estimating the risk of damage for buildings
	3	Additional information on use of EN 62305-2
VDE 0185-305-3 (IEC 62305-3)		Protection against lightning – Part 3: Physical damage to structures and life hazard
	1	Additional information on use of EN 62305-3
	2	Additional information for building structures
	3	Additional information for the testing and servicing of lightning protection systems
	4	Use of metal roofs in lightning protection systems
	5	Lightning and surge protection for PV power supply systems
VDE 0185-305-4 (IEC 62305-4)		Protection against lightning – Part 4: Electrical and electronic systems within structures
	1	Distribution of the lightning current
VDE 0675-6-11 (IEC 0675-6-11)		Low-voltage surge protection devices – Part 11: Surge protection devices connected to low-voltage power systems
VDE 0100-534 (IEC 60364-5-53)		Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control – Clause 534: Devices for protection against surge voltages (ÜSE)
VDE 0100-443 (IEC 60364-4-44)		Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic. disturbances – Clause 443: Protection against surge voltages of atmospheric origin or due to switching
VDE 0100-712 (IEC 60364-7-712)		Requirements for operational premises, special rooms and systems – photovoltaic (PV) power supply systems
VDE 0855-1 (IEC 60728-11)		Cable networks for television signals, sound signals and interactive services
VDE 0127-24 (IEC 61400-24)		Wind power plants – Part 24: Lightning protection

Key lightning protection standards and specifications

Product standards	Contents
VDE 0185-305-1 (IEC 62305-1)	Lightning protection system components – Requirements for connection components
VDE 0185-561-2 (IEC 62561-2)	Lightning protection system components – Requirements for conductors and earthers
VDE 0185-561-3 (IEC 62561-3)	Lightning protection system components – Requirements for isolating spark gaps
VDE 0185-561-4 (IEC 62561-4)	Lightning protection system components – Requirements for holders
VDE 0185-561-5 (IEC 62561-5)	Lightning protection system components – Requirements for inspection housings and earth electrode penetrations
VDE 0185-561-6 (IEC 62561-6)	Lightning protection system components – Requirements for lightning strike counters
VDE 0185-561-7 (IEC 62561-7)	Lightning protection system components – Requirements for earthing enhancing compounds
VDE V 0185-561-8 (IEC TS 62561-8)	Lightning protection components – Requirements for components for an insulated lightning protection system
VDE 0675-6-11 (IEC 61643-11)	Surge protection devices for use in low-voltage power systems – Requirements and test methods
VDE 0845-3-1 (IEC 61643-21)	Surge protective devices connected to telecommunications and signalling networks

Product standards for lightning and surge protection components

Air-termination systems

Planning with the protective angle, rolling sphere and grid method

The probability that a lightning current enters a construction system to be protected is reduced considerably by a correctly planned air-termination system.

The air-termination system can be comprised of any combination of the following components:

- Air-termination rods (including freestanding masts)
- Tensioned cables
- Meshed conductors

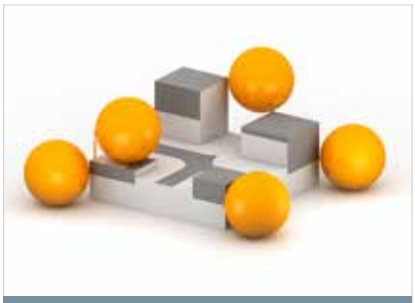
The individual air-termination rods should be interconnected at roof height, in order to guarantee current distribution.

On a structure, air-termination systems must be attached to corners, exposed areas and edges (particularly to the top part of facades).

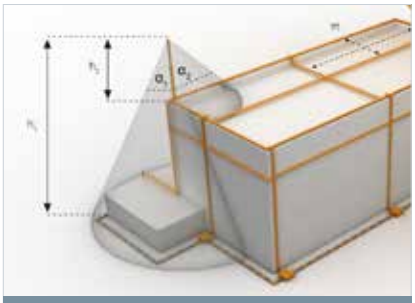
Following a practical assessment of the building, one or a combination of the following planning methods is selected.

- Rolling sphere method
- Protective angle method
- Grid method

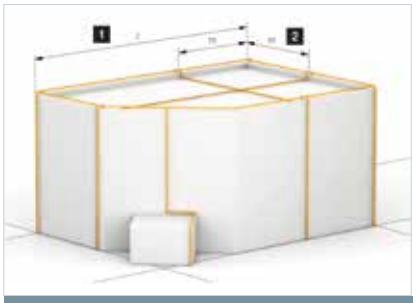
Planning methods for air-termination systems



The rolling sphere method is suitable in every case, but is particularly suitable for complex systems.



The protective angle method is suitable for buildings with simple shapes.



The grid method is suitable for buildings with simple shapes, e.g. with flat roofs.

With the different protection methods, the bases for the calculation of the air-termination system are the rolling sphere radius, the grid width or the protective angle α. The basis data for the appropriate lightning protection class can be found in the tables and the aid diagram and are intended as orientation for the following protection methods.

Protection method			
Lightning protection class	**Radius of this rolling sphere r**	**Grid width W**	**Protective angle α°**
I	20 m	5 x 5 m	See graphic below
II	30 m	10 x 10 m	
III	45 m	15 x 15 m	
IV	60 m	20 x 20 m	

Maximum values of the rolling sphere radius, the grid width and the protective angle according to the appropriate lightning protection class of the LPS according to IEC/EN 62305-3

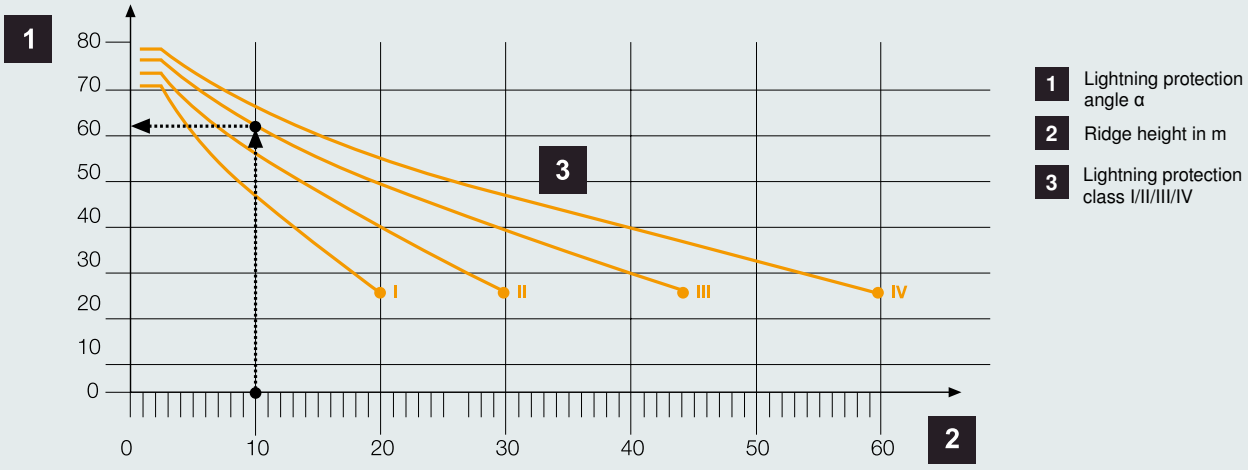


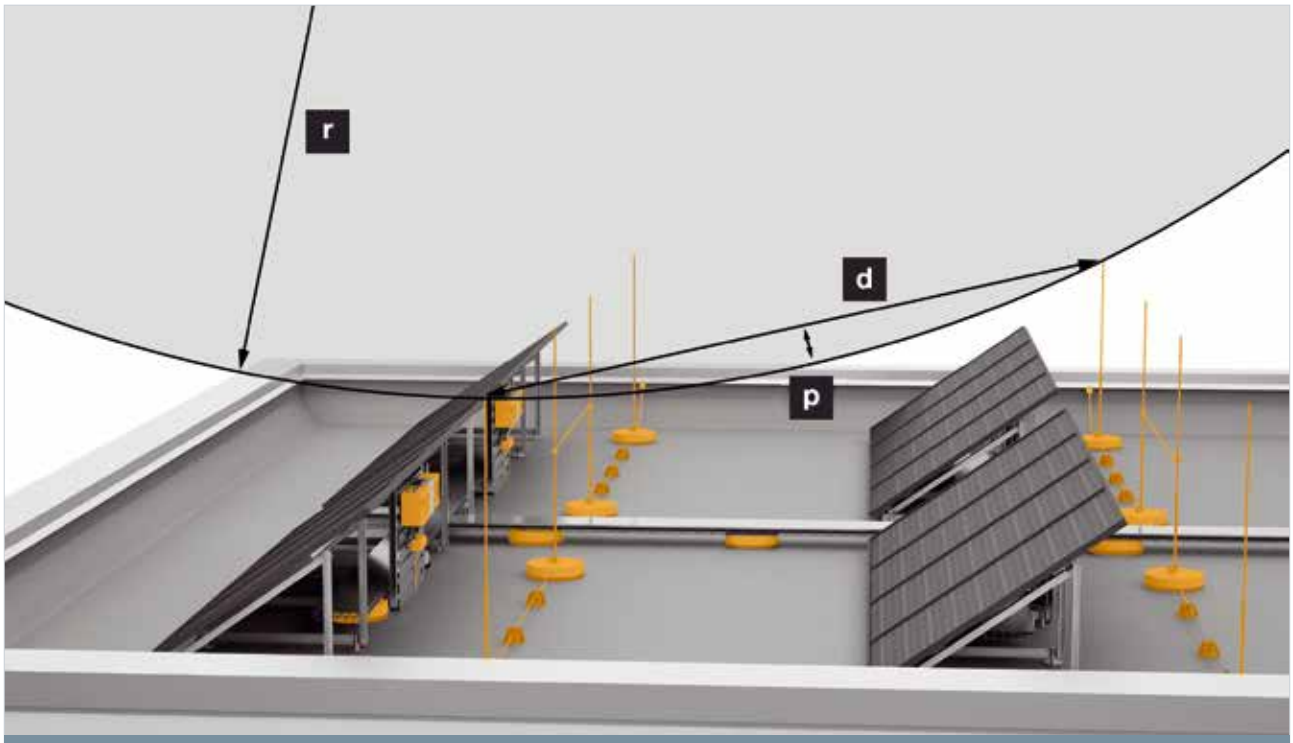
Diagram for determining the protective angle in accordance with IEC 62305

Lightning protection class	Protection angle α for air-termination rods of up to 2 m length
I	70 °
II	72 °
III	76 °
IV	79 °

Protective angle based on lightning protection class according to IEC 62305-3 for air-termination rods up to 2 m

Rolling sphere method

Calculation of the penetration depth



p Penetration depth r Radius of the lightning sphere d Distance of the air-termination system

$$p = R - \sqrt{R^2 - \left(\frac{d}{2}\right)^2}$$

Formula for calculating the penetration depth (p)

Roof structures with multiple air-termination rods

If you use several air-termination rods to protect an object, you must take into consideration the penetration depth between them. Use the formula alongside for a precise calculation. The table below gives you a quick overview.

Penetration depth according to the lightning protection class

Distance of the air-termination system (d) in m	Penetration depth in m Lightning protection class I Rolling sphere: R = 20 m	Penetration depth in m Lightning protection class II Rolling sphere: R = 30 m	Penetration depth in m Lightning protection class III Rolling sphere: R = 45 m	Penetration depth in m Lightning protection class IV Rolling sphere: R = 60 m
2	0.03	0.02	0.01	0.01
3	0.06	0.04	0.03	0.02
4	0.10	0.07	0.04	0.04
5	0.16	0.10	0.07	0.05
10	0.64	0.42	0.28	0.21
15	1.46	0.96	0.63	0.47
20	2.68	1.72	1.13	0.84

Protective angle method

Installation principle, building with pitched roof

1st step: Determining the building height

Determine the ridge height of the building. This height is the starting point for planning the entire lightning protection system. The ridge conductor is arranged on the ridge and thus forms the “backbone” for the air-termination system.

2nd step: Determination of the protective angle α

Transfer the height of the building to the diagram to read off the protective angle. Transfer the protective angle to the building.

3rd step: Building sections outside the protective angle

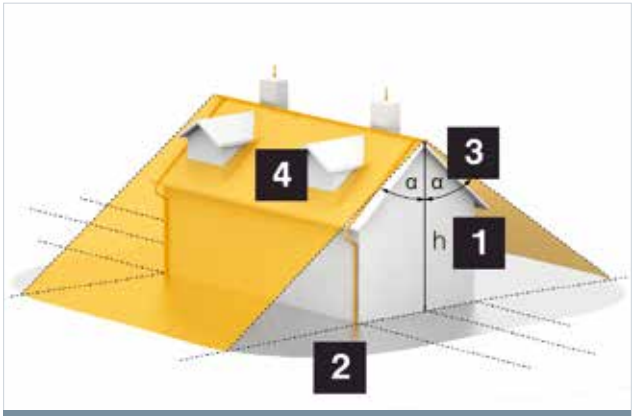
Building parts outside of the protected area require additional protection. The chimney in our example has a diameter of 70 cm and therefore requires a 1.5 m long air-termination rod. Dormer windows are given their own ridge conductor.

4th step: Completing the air-termination system

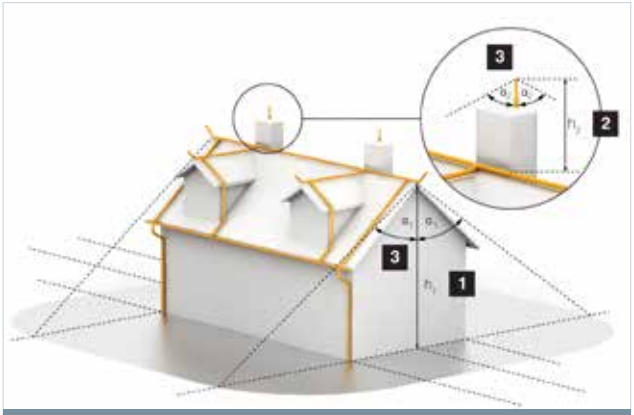
Connect the air-termination system with the down-conductors. The ends of the ridge conductor should protrude and curve upwards by 0.15 m. This also protects any projecting canopies.

The following roof structures must be protected with air-termination systems against direct lightning strikes:

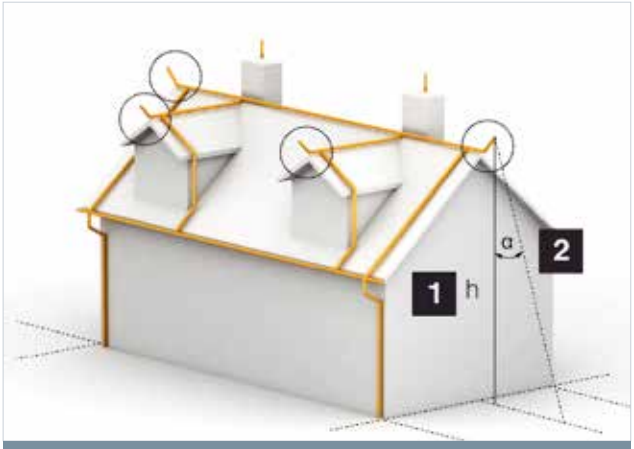
- Metallic materials higher than 0.3 m
- Non-conductive materials (e.g. PVC pipes) with a height greater than 0.5 m



1 Building height h 2 Protected area
3 Protective angle α 4 Dormer windows not protected by the ridge cable



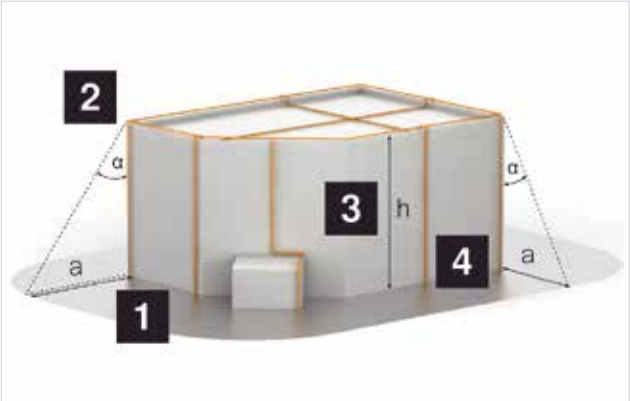
1 Building height (h1)
2 Air-termination rod height (h2) 3 Protective angle α



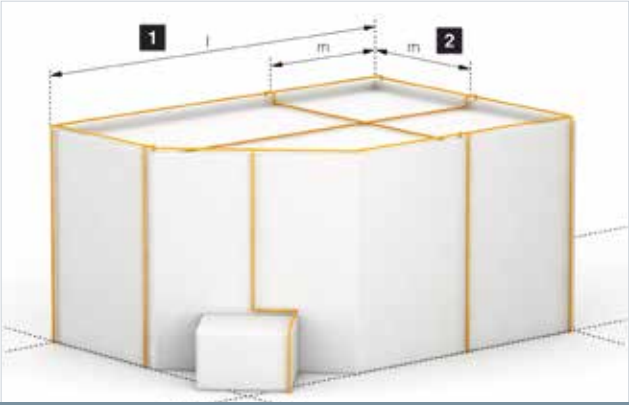
1 Building height (h) 2 Protective angle α

Grid method

Installation principle, building with flat roof



1 Protected area 2 Protective angle
3 Height of the building 4 Distance to the furthest point of the protected area



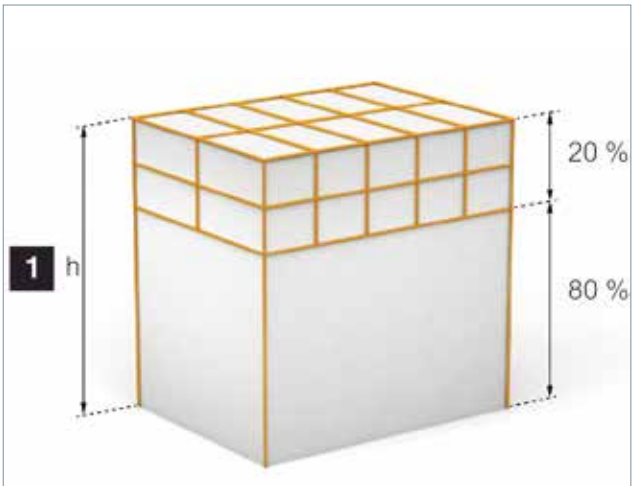
1 Building length 2 Grid width

1st step: Installing the air-termination system

First, a round conductor is installed at all primary impact points such as ridges, crests or edges. Determine the protected area by transferring the height of the building to the diagram, reading off the protective angle and transferring this to the building.

2nd step: Installing the grids

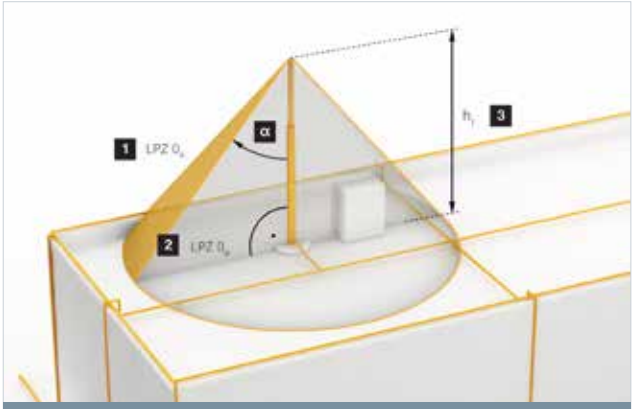
A number of different loop sizes are suitable for the particular lightning protection class of the building. If, as in our example, the overall length l is greater than 20 m, an expansion piece must also be integrated for temperature-controlled length changes.



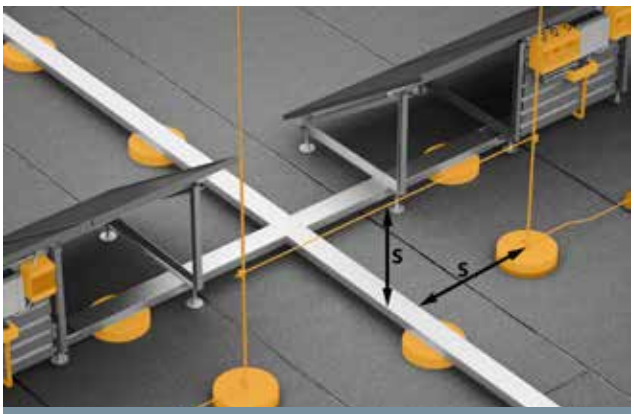
1 Building height > 60 m

3rd step: Protection against lateral impact

From a building height of 60 m and the risk of serious damage (e.g. with electrical or electronic devices) it is advisable to install a ring circuit to protect against lateral impact.



1 Risk through direct lightning strikes 2 Protected against direct lightning strikes but at risk
3 Height of the air-termination rod α Protective angle



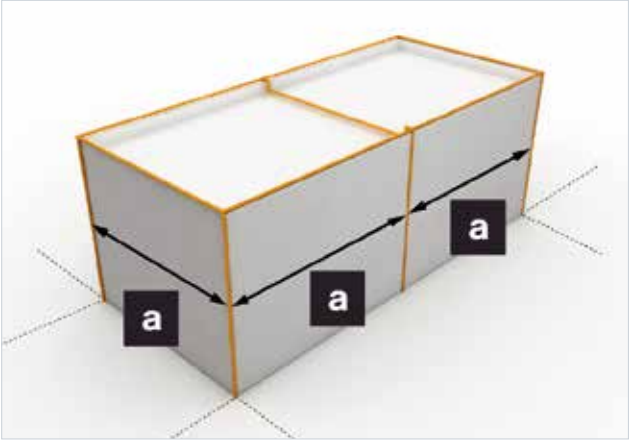
s = separation distance

4th step: Protection of roof structures

You must now protect all roof structures with air-termination rods. This involves observing the separation distance (s).
The air-termination rods must be erected at a certain distance (s) from the building to be protected. This distance safely prevents arcing of the lightning current and dangerous spark creation.

Down-conductor systems

Connection of the air-termination system with the earthing system



Lightning protection class	Typical distance a
I	10 m
II	10 m
III	15 m
IV	20 m

Number of down-conductors

The number of down-conductors is derived from the scope of the building to be protected although at least two down-conductors are required in every case. Care must be taken to ensure that the current paths are short and installed without loops.

Number of down-conductors of a separated LPS

If the air-termination system consists of air-termination rods on separate masts (or one mast), which is/are not made from metal or connected reinforced steel, then at least one down-conductor is required for each mast. Metal masts or masts made from connected reinforced steel do not require additional down-conductors.

Arrangement of the down-conductors

The down-conductors should preferably be installed near the corners of the building. In order to achieve optimum splitting of the lightning current, the down-conductors must be evenly distributed around the outer walls of the building.
Down-conductors must be routed so that they are straight and vertical and represent the shortest possible direct connection to the earth. Loop formation must be avoided.
Down-conductors may not be routed in drain pipes or down pipes, even if they are jacketed with insulation.

Calculation of the separation distance according to IEC/EN 62305-3

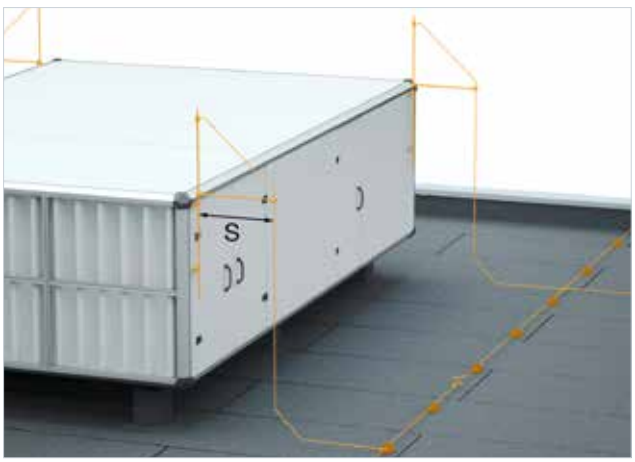
Steps	
Calculate the value of the coefficient k_i	k_i is dependent on the selected protection class of the lightning protection system: ▪ Protection class I: $k_i = 0.08$ ▪ Protection class II: $k_i = 0.06$ ▪ Protection class III: $k_i = 0.04$
Calculate the value of the coefficient k_C (simplified system)	k_c is dependent on the (partial) lightning current that flows into the down-conductors: ▪ 1 down-conductor (only in the case of an isolated lightning protection system): $k_c = 1$ ▪ 2 down-conductors: $k_c = 0.66$ ▪ 3 down-conductors and more: $k_c = 0.44$ The values apply to all type B earthers and to those type A earthers in which the earther resistance of the neighbouring earther electrodes does not differ by more than a factor of 2. If the earther resistance of individual electrodes deviates by more than a factor of 2, $k_c = 1$ should be assumed.
Calculate the value of the coefficient k_m	k_m is dependent on the material of the electrical insulation: ▪ Material air: $k_m = 1$ ▪ Material concrete, brickwork: $k_m = 0.5$ ▪ GFK insulating rods: $k_m = 0.7$ If several insulating materials are used, in practice the lowest value for k_m is used.
Calculate the value L	L is the cable length in metres, measured from the point at which the separation distance (s) is to be calculated up to the closest point of the equipotential bonding.

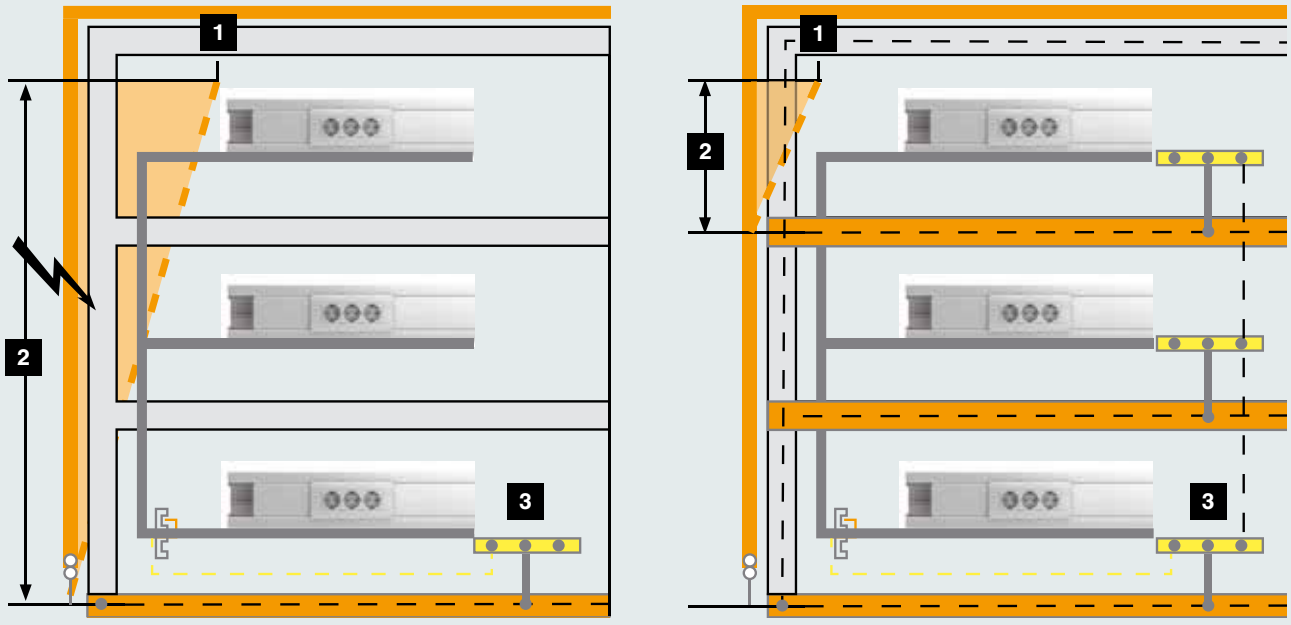
The high-voltage-resistant, insulated **isCon®** down-conductor is the modern solution for maintaining the necessary separation distances safely.

isCon®
MADE BY OBO

$$s = k_i \frac{k_c}{k_m} L(m)$$

s = separation distance





1 Separation distance (s)

3 HES

2 Length L

Equipotential areas as the reference layer for calculating the separation distance in high buildings

In high buildings, conventional separation distance calculations can create separation distances which can no longer be implemented, as the length to the next reference level (e.g. earthing system or closest point of the equipotential bonding) is very long in the calculation due to the building dimensions.

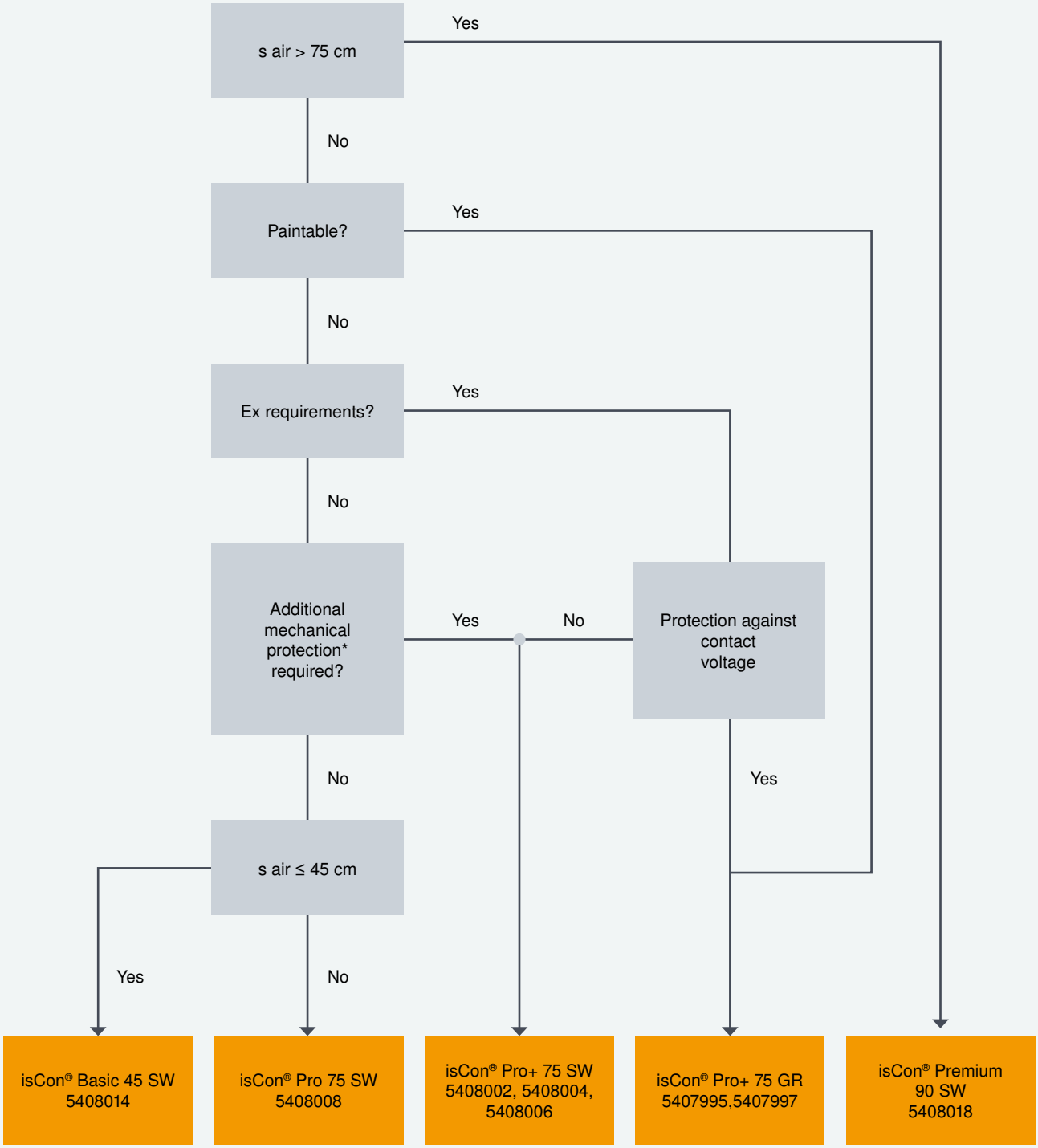
To still be able to plan and install a lightning protection system according to VDE 0185- 305-3 (IEC/EN 62305-3), the creation of equipotential layers should be taken into account early in the project planning.

Creation of equipotential areas, e.g. on every 2nd or 3rd floor using:

- Lightning protection equipotential bonding through suitable lightning arresters and surge protection devices for power and communication units
- Meshed earthing system according to DIN 1804
- Meshed ceiling reinforcement (multiple times in the building) 5 x 5 m according to DIN EN 62305-4 (VDE 0185-304-4)
- Connection to reinforcement every 2 m
- Lightning protection equipotential bonding of all metallic or electrical cables running into the equipotential levels (e.g. external cameras, luminaires, supply lines, PV systems, etc.)

isCon® down-conductors

Selection aid



**Additional mechanical protection: Surface damage of the external protective jacket does not influence the high-voltage-resistant, insulating function of the black isCon® Pro+ down-conductor! For this, the jacketing must remain for a minimum of 0.2 mm over the entire scope of the down-conductor.*

Materials and corrosion protection

Requirements for long-lasting protection

The following materials are preferred for use in external lightning protection systems: Hot galvanised steel, rustproof steel (VA), copper and aluminium.

Corrosion

Especially when different materials are connected with one another, there is a risk of corrosion. For this reason, no copper parts may be installed above galvanised surfaces or above aluminium parts as copper particles worn away by rain or other environmental influences can penetrate the galvanised surface. In addition, a galvanic element is created, which accelerates corrosion of the contact surface.

Material combinations without increased risk of corrosion

	Steel, galvanised	Aluminium	Copper	Stainless steel	Titanium	Tin
Steel, galvanised	Yes	Yes	No	Yes	Yes	Yes
Aluminium	Yes	Yes	No	Yes	Yes	Yes
Copper	No	No	Yes	Yes	No	Yes
Stainless steel	Yes	Yes	Yes	Yes	Yes	Yes
Titanium	Yes	Yes	No	Yes	Yes	Yes
Tin	Yes	Yes	Yes	Yes	Yes	Yes

Material	Shape	Minimum dimensions
Copper **Tin-plated copper**	Strip, solid Round, solid (b) Cable (b) Round, solid	20 x 2.5 mm ø 8 mm 50 mm² ø 15 mm
Aluminium	Round, solid Cable	ø 8 mm 50 mm²
Copper-coated aluminium alloy	Round, solid (c)	ø 8 mm
Aluminium alloy	Strip, solid Round, solid Cable (b) Round, solid	20 x 2.5 mm ø 8 mm 50 mm² ø 15 mm
Hot galvanised steel	Strip, solid Round, solid Cable (b) Round, solid	20 x 2.5 mm ø 8 mm 50 mm² ø 15 mm
Copper-coated steel (c)	Round, solid Strip, solid	ø 8 mm 20 x 2.5 mm
Rustproof steel (a)	Strip, solid Round, solid Cable (b) Round, solid (d)	20 x 2.5 mm ø 8 mm 50 mm² ø 15 mm

Material, form and minimum dimensions of air-termination conductors, air-termination rods, earth entry rods and down-conductors

(a) Chromium ≥ 16%; nickel ≥ 8%; carbon ≤ 0.08%
(b) In certain applications, 8 mm diameter can be reduced to 28 mm² (6 mm diameter) if echanical resistance is not a primary criterion.
(c) At least 70 µm copper plating with 99.9% copper content
(d) Can be used for air-termination rods and base

Material	Shape	Minimum dimensions		
		Earth rod	Earthing cable	Earth plate
Copper **Tin-plated copper**	Cable			
	Round, solid			
	Strip, solid		50 mm²	
	Round, solid	ø 15 mm	ø 8 mm	
	Grid plate	ø 20 mm	20 x 2.5 mm	
	Pipe			500 x 500 mm
	Plate, solid			600 x 600 mm
Hot galvanised steel	Round, solid			
	Round, solid	ø 14 mm		
	Pipe	ø 25 mm	ø 10 mm	
	Strip, solid			
	Plate, solid			
	Grid plate		30 x 3 mm	500 x 500 mm
	Profile (a)	290 mm²		600 x 600 mm
Bright steel (b)	Cable		70 mm²	
	Round, solid	ø 8 mm	ø 10 mm	
	Strip, solid		25 x 3 mm	
Copper-coated steel (c)	Round, solid		ø 8 mm	
	Round, solid	ø 14 mm	ø 10 mm	
	Strip, solid		30 x 3 mm	
Rustproof steel (d)	Round, solid		ø 10 mm	
	Round, solid			
	Strip, solid	ø 15 mm	30 x 3.5 mm	

Materials, form and cross-section of earthers according to VDE 0185-561-2 (IEC 62561-2)

(a) Various profiles with a cross-section of 290 mm² and a minimum thickness of 3 mm are approved, e.g. cross profiles.
(b) Must be embedded in concrete to a depth of at least 50 mm.
(c) At least 250 µm copper plating with 99.99% copper content.
(d) Chromium ≥ 16%; nickel ≥ 5%; molybdenum ≥ 2%; carbon ≤ 0.08%.

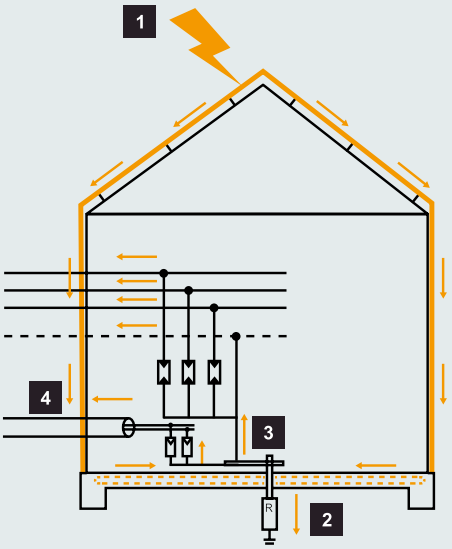
Lightning and surge protection systems

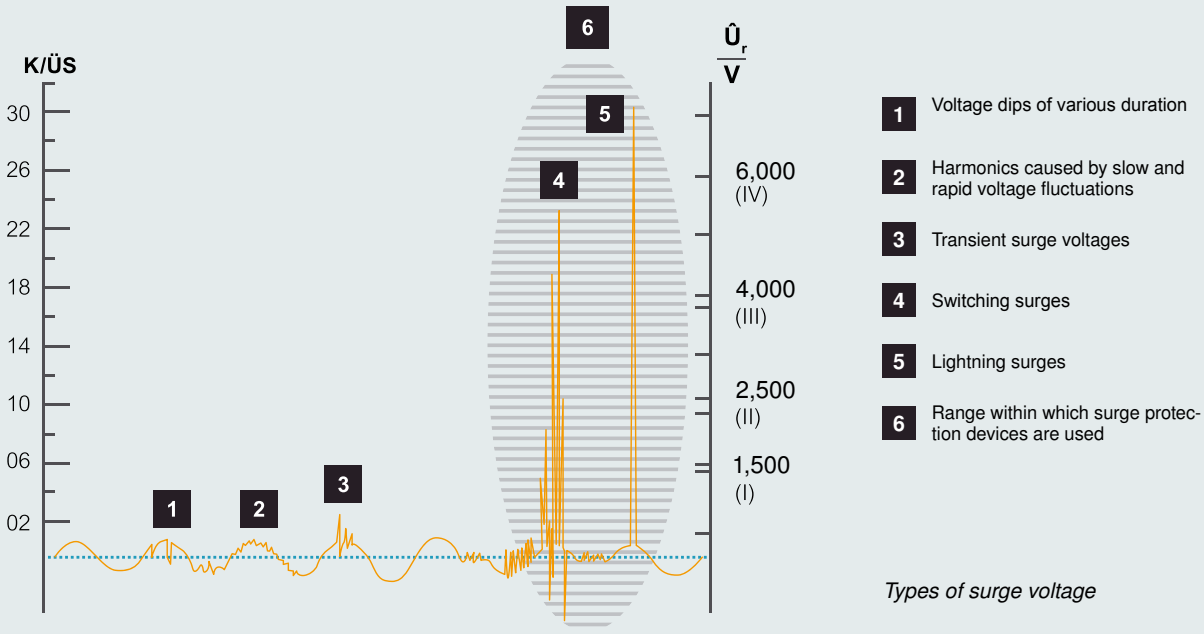
During a lightning strike, only 50% of the lightning energy is arrested into the ground via the earthing system. The other half flows into the electrical installation of the structure. Other reasons for surge voltages are remote lightning strikes or switching operations. OBO lightning current and surge arresters offer secure protection of the sensitive electrical devices in the system against damage from surge voltages.

The highest surges are caused by lightning strikes. According to IEC/EN 62305, lightning strikes are simulated with lightning surge currents of up to 200 kA (10/350 µs).

1	Lightning strike	100%	limp = max. 200 kA (IEC/EN 62305)
2	Earthing system	~ 50%	I = 100 kA
3	Electrical installation	~ 50%	I = 100 kA
4	Data cable	~ 5%	I = 5 kA

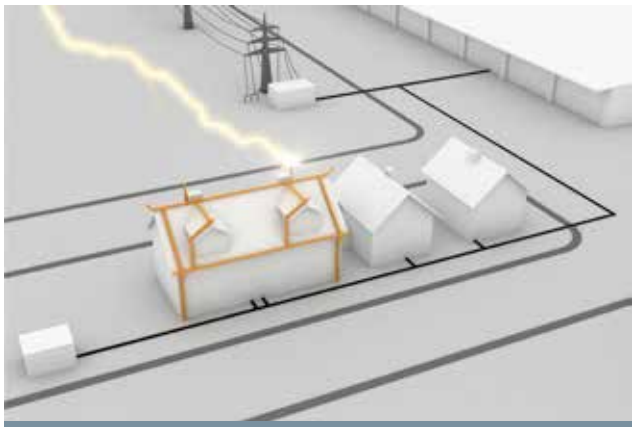
Typical distribution of lightning current





Types of surge voltage

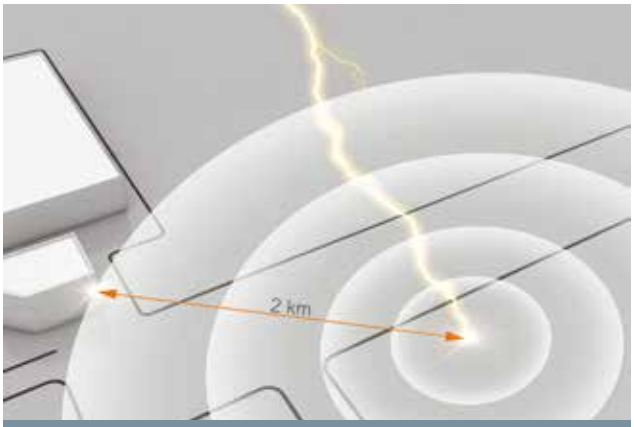
Causes of damage
Equipment and systems can be protected against all the shown causes of damage using OBO surge arresters.



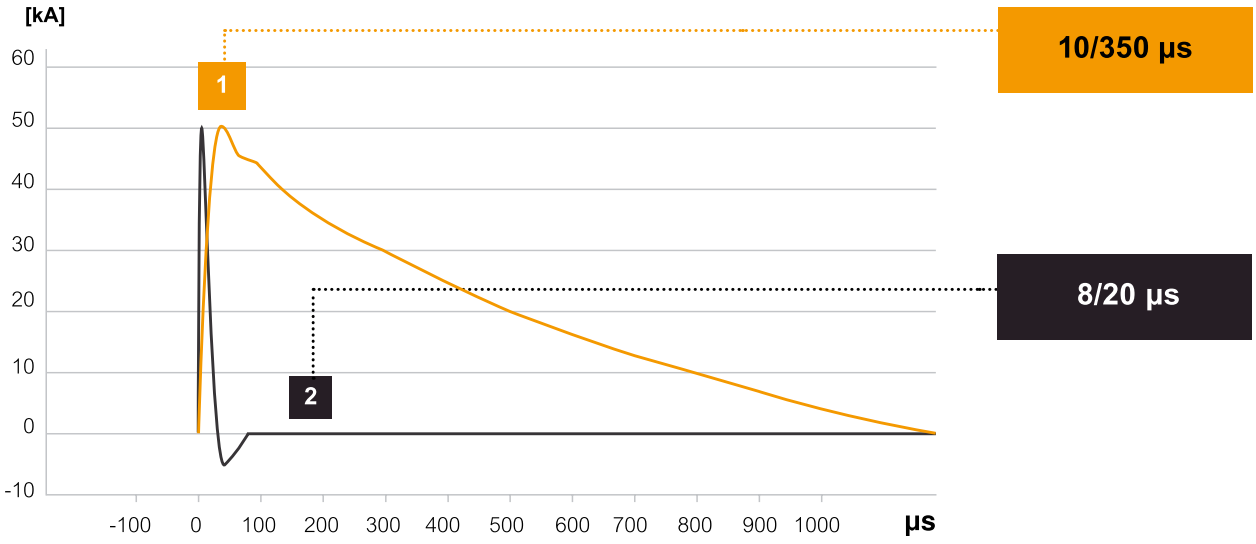
Direct lightning strikes

Lightning strikes in the supply line

Lightning strikes next to the supply line and switching operations



Lightning strikes nearby



Types of pulse and their characteristics:

1 Pulse shape 1, direct lightning strike, 10/350 µs simulated lightning pulse

2 Pulse shape 2, remote lightning strike or switching operation, 8/20 µs simulated lightning pulse (surge voltage)

Surge protection systems for energy technology

Surge protection devices ensure that power lines under voltage are properly equipotentially bonded. They respond before the insulation in electrical and electronic devices can be irreparably damaged by surges.

Lightning current arrester, type 1/class I Combination arrester, type 1+2/class I+II

TN-C system: type 1/class I lightning current arresters and type 1+2/class I+II combination arresters are used in the 3-pin circuit (e.g.: 3 x MCD 50-B).

TN-S and TT system: Lightning current and combination arresters are used in the 3+1 circuit (e.g. 3 x MC 50-B and 1 x MC 125-B NPE). With the 3+1 circuit, the external lines (L1, L2, L3) are connected to the neutral cable (N) via arresters. The neutral conductor (N) is connected to the protective earth via a collective spark gap. Following consultation with the local energy provider, use before the main meter device is also possible.

Surge arrester type 2/class II

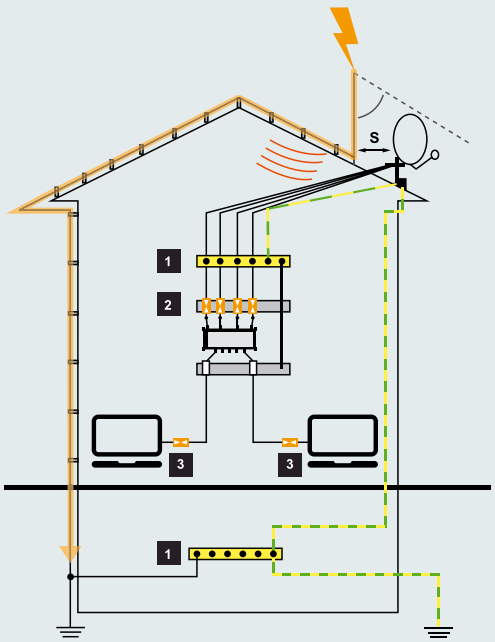
Type 2/class II surge arresters are used in the 3+1 circuit (e.g. V20 3+NPE). With the 3+1 circuit, the external lines (L1, L2, L3) are connected to the neutral cable (N) via arresters. The neutral conductor (N) is connected to the protective earth via a collective spark gap. The arresters must be used before a residual current protective device (RCD), as it would otherwise interpret the surge current as a residual current and interrupt the power circuit.

Lightning and surge protection for satellite systems according to IEC/EN 60728-11

Satellite systems and antennas are often in exposed locations on roofs, next to the air-termination rods. For this reason, air-termination rods must be used to protect these systems against direct lightning strikes, to prevent them from serving as lightning air-termination systems themselves. Ideally, in the finished lightning protection system, the satellite antenna should be located within the protective angle of the air-termination rod. In this case, the risk of a direct lightning strike in the SAT cables is almost zero.

However, if the air-termination rod is struck, surge voltages will be coupled.

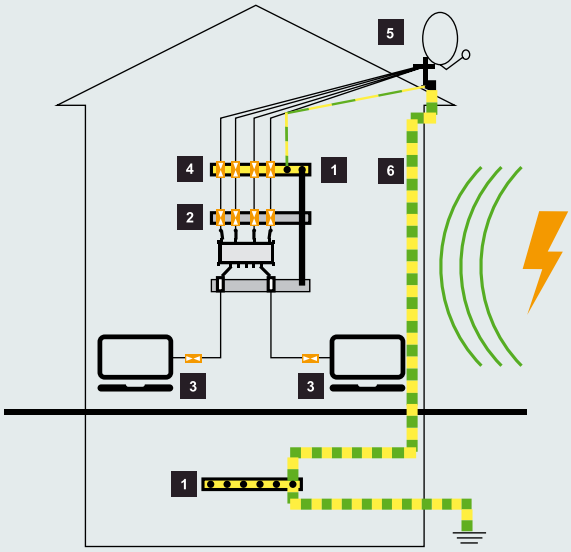
Using a surge protection device like the OBO TV 4+1 (for protecting for example multiswitches) or FC-SAT-D (for protecting a TV set), these surge voltages can be limited to a level that is safe for the device in question. Here, it is vital that the required separation distance (s) is maintained between the air-termination rod and the antenna system. The following figures show the lightning and surge protection for a satellite TV system:



Current path in case of a direct strike close to a satellite dish

	Product	Item no.
1	Equipotential busbar, e.g. 1801 VDE	5015650
2	Coaxial surge protection, e.g. TV 4+1	5083400
3	Fine protection device for SAT and 230 V supply line, e.g. OBO FC-SAT-D	5092816

With appropriate coordination of the lightning and surge protection components, lightning currents and surges can be safely arrested. If there is no external lightning protection on the building, the exposed installation of the satellite system poses the risk of attracting a direct strike, like an air-termination rod. For this reason, class D1 lightning arresters are needed in addition to the surge protection. As well as the standard antenna earthing using 4 mm² Cu, the antenna system must additionally be connected with the main earthing rail using a copper earthing conductor of minimum 16 mm².



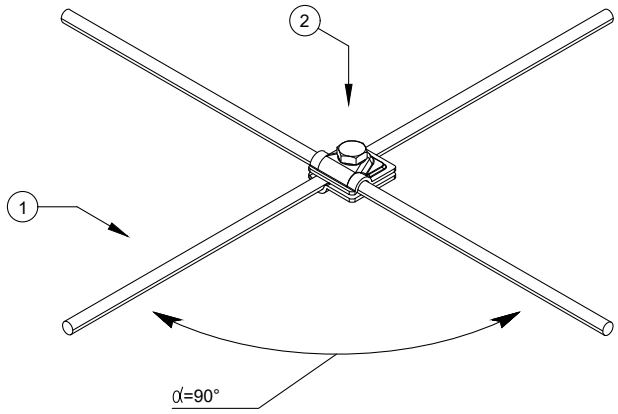
Induction of surge voltage into a satellite system

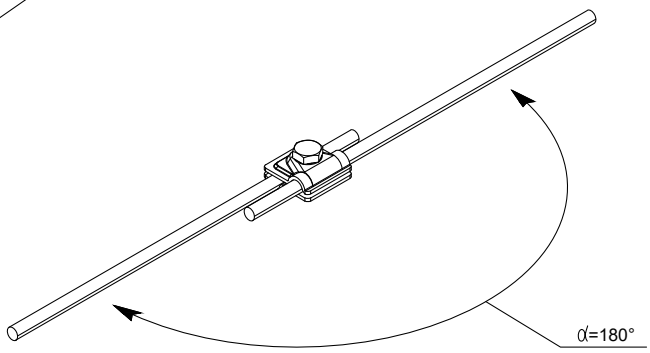
Should a risk analysis according to VDE 0185-305-2 (IEC/EN 62305-2) not be possible or not be required by the authorities, then static atmospheric surge voltages (e.g. lightning) can cause arcing from the 16 mm² earthing conductor to the electrical installation or the antenna system of the building. For this reason, we recommend making the earthing conductor insulating and resistant to high voltages and floating discharges through suitable measures.

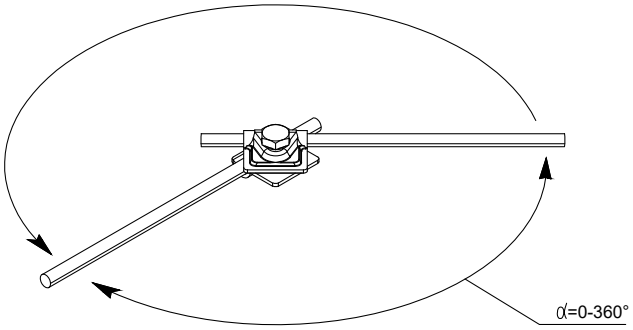
	Product	Item no.
1	Equipotential busbar, e.g. 1801 VDE	5015650
2	Coaxial surge protection, e.g. TV 4+1	5083400
3	Fine protection device for SAT and 230 V supply line, e.g. OBO FC-SAT-D	5092816
4	OBO DS-F lightning arrester	5093275/5093272
5	Antenna earthing with 4 mm² Cu	-
6	Min. 16 mm² Cu earthing conductor	-

Notes

OBO Typicals – detailed mounting drawings of lightning protection, earthing and equipotential bonding systems







	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.01	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Methods of longitudinal and transverse connection of round conductors			
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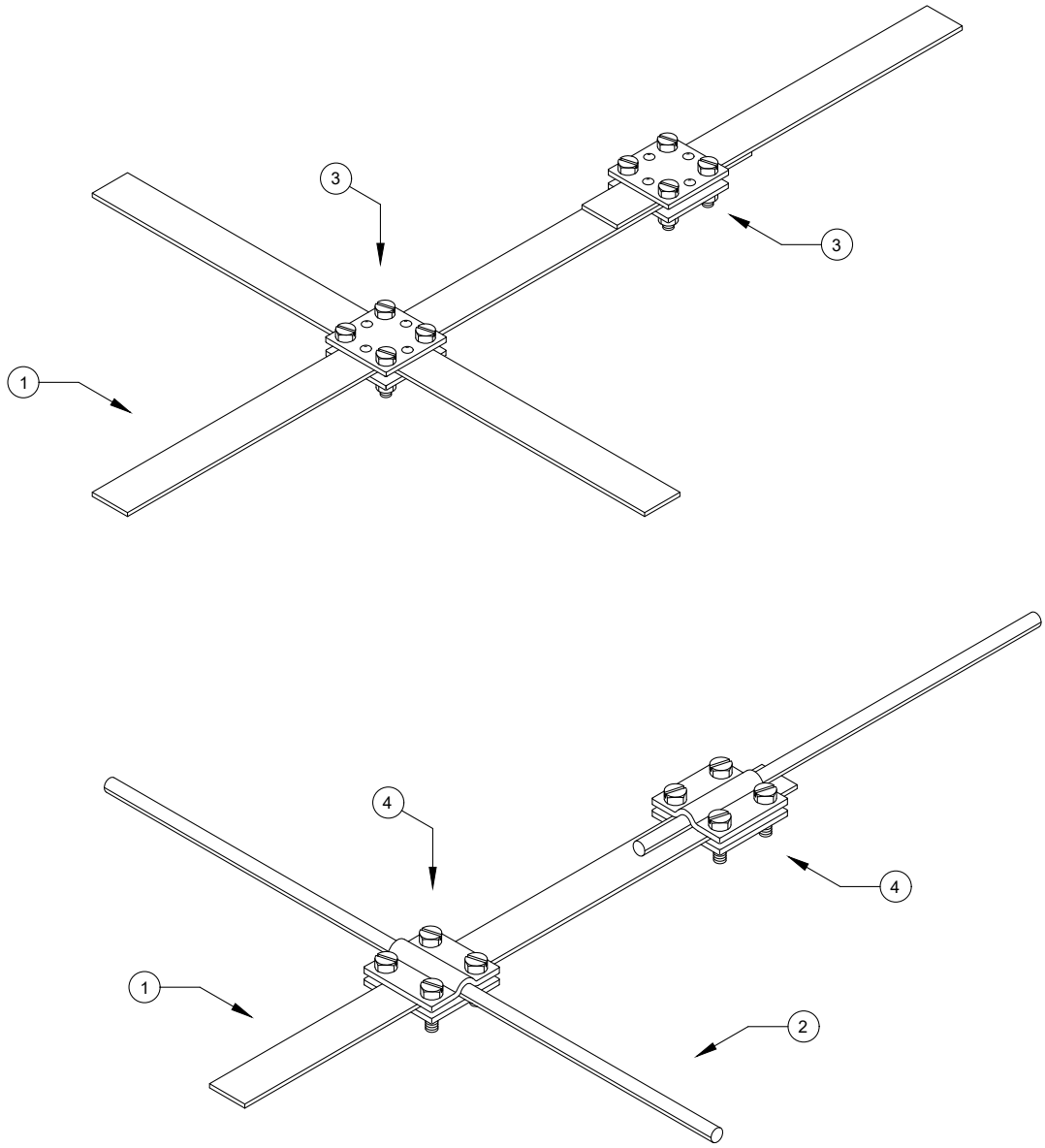
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Galvanised steel, flat conductor	
2	5021081	RD 8-FT	Galvanised steel, round conductor	
3	5314658	256 A-DIN 30 FT	Cross-connector for flatconductor	
4	5312655	252 8-10 x FL30 FT	Cross-connector for round and flat conductors	

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Editor:						
Status:			Comment: Methods of longitudinal and transverse connection of flat and round conductors			
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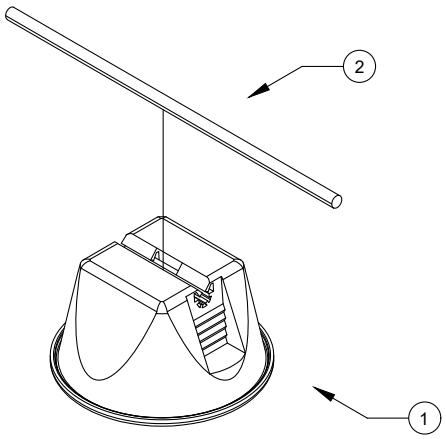
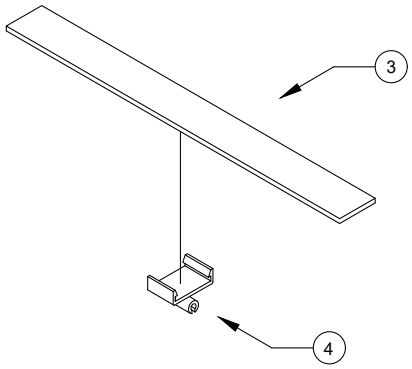
Ind.	Amendment typical	Date:	Name:			

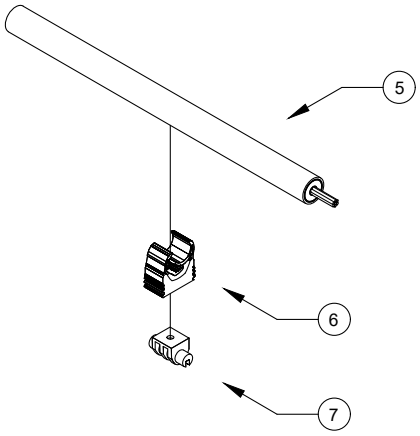
1 Fixing the round conductor



2 Fixing the flat conductor



3 Fixing the isCon conductor



	Item No.	Designation	Description	Q-ty
1	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
2	5021294	RD 8-ALU T	Round conductor, aluminium	
3	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
4	5218885	165 MBG HFL	Flat conductor adapter for roof conductor holder	
5	5408008	isCon Pro 75 SW	isCon conductor, Pro	
6	2153114	M-Quick 18-22 LGR	Multi-Quick clip	
7	5218882	165 MBG UH	Universal flat conductor adapter for roof conductor holder	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.03	Project No.:
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Creator:						
Editor:						
Status:			Comment: Methods of mounting various conductors on a flat roof surface			

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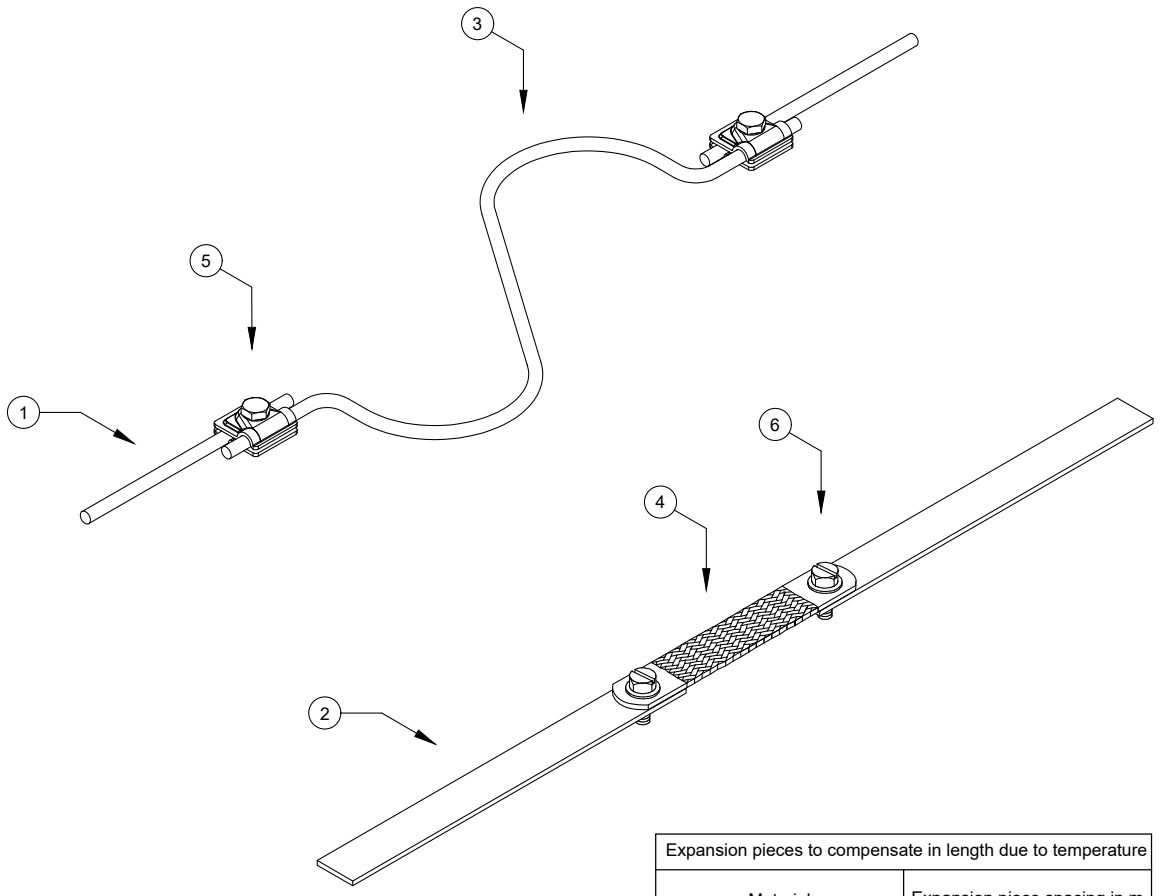
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



Expansion pieces to compensate in length due to temperature	
Material	Expansion piece spacing in m
Steel	15
Stainless steel	10
Copper	10
Aluminium	10

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
3	5218926	172 AR	Expansion piece	
4	5331501	856	Connection and expansion strip	
5	5311519	249 8-10 ALU	Vario quick connector	
6	3160734	SKS 10x25 F	Hexagonal bolt with nut and washer M10	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.04	Project No.:
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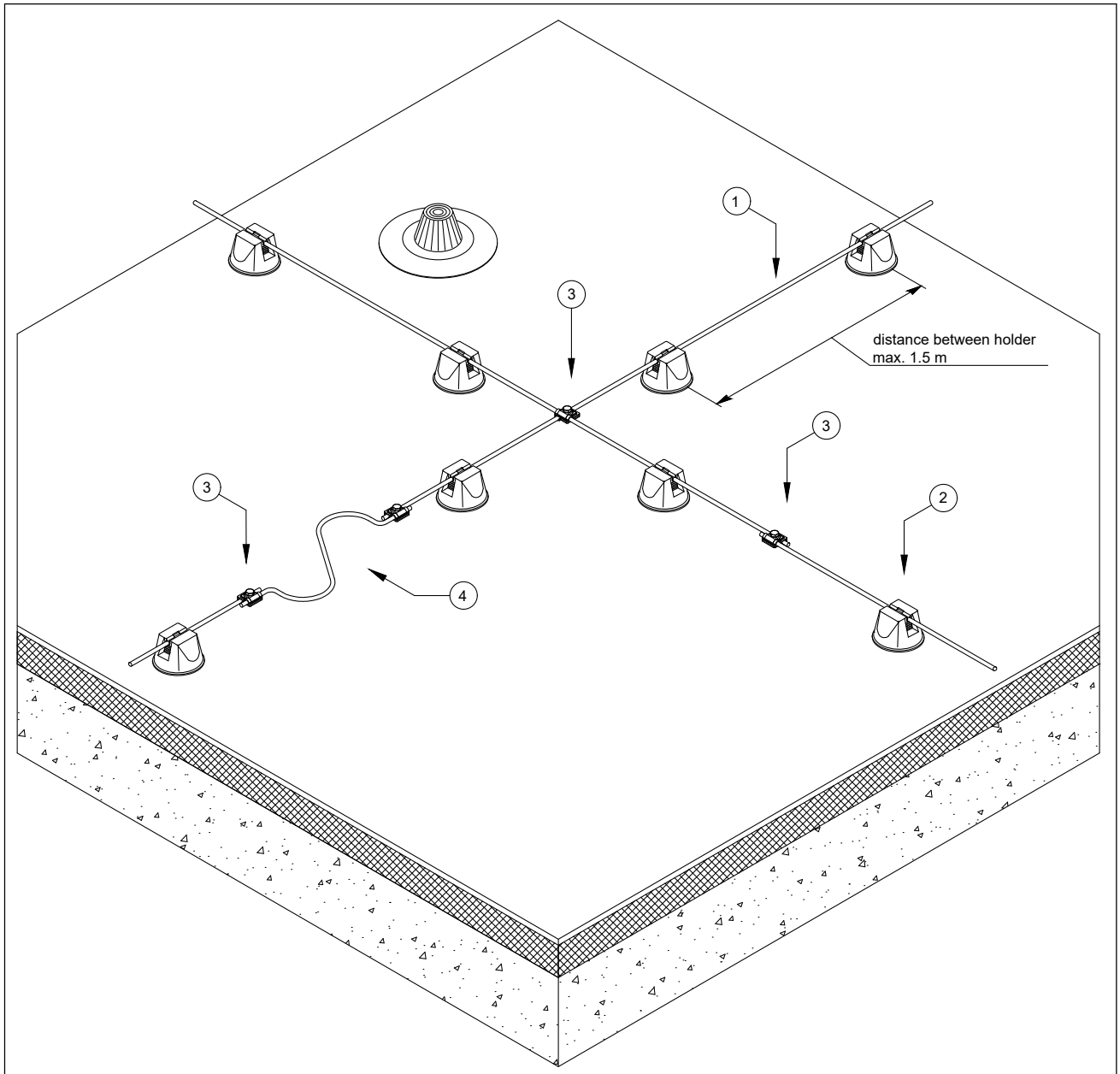
1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5218926	172 AR	Expansion piece	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.05	Project No.:	
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Editor:						
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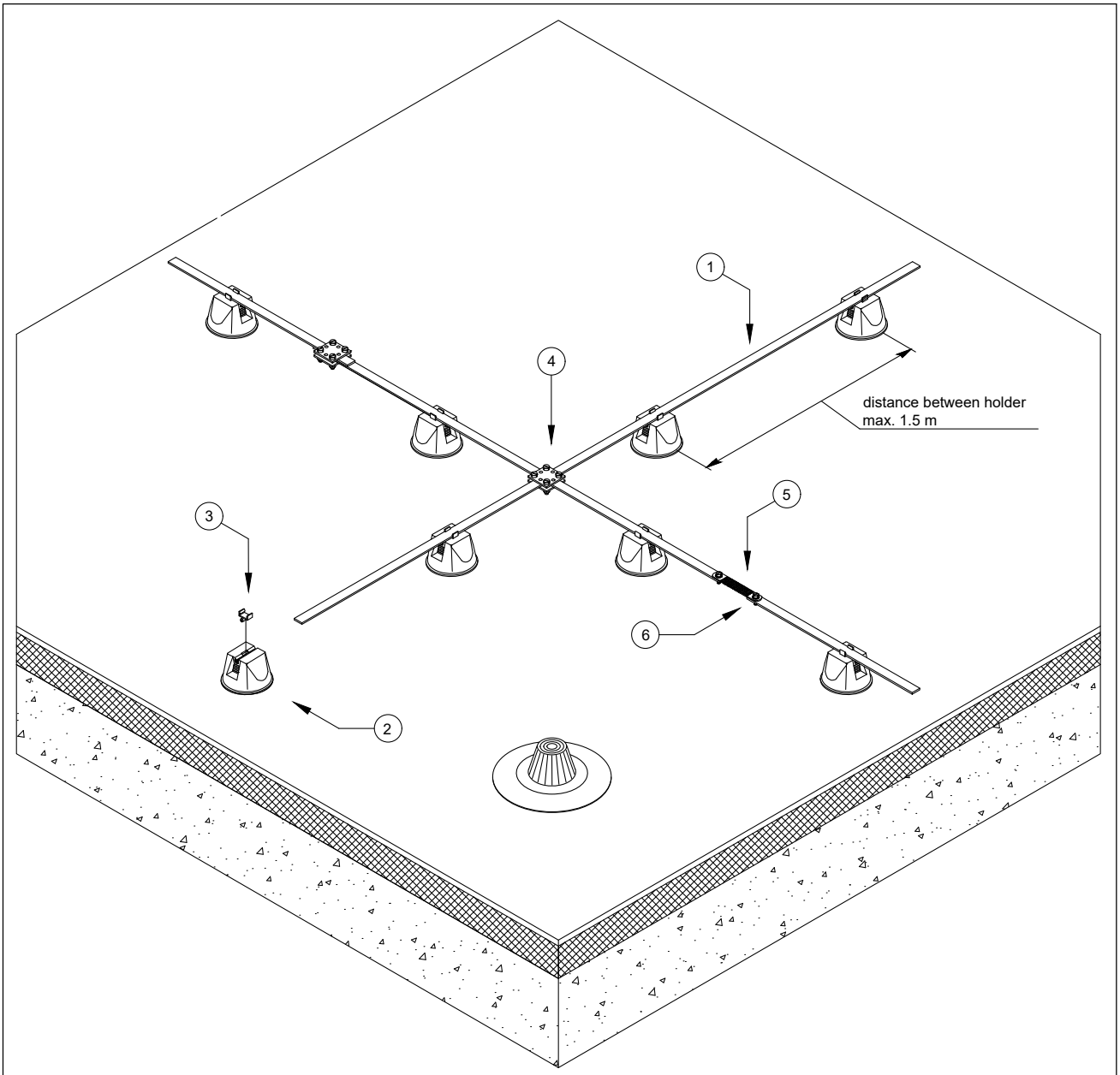
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5218885	165 MBG HFL	Flat conductor adapter for roof conductor holder	
4	5314658	256 A-DIN 30 FT	DIN cross-connector for flat conductor	
5	5331501	856	Connection and expansion strip	
6	3160734	SKS 10x25 F	Hexagonal bolt with nut and washer	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.06	Project No.:
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Status:			Comment: Installation of a lightning protection grid with flat conductor on the roof surface			
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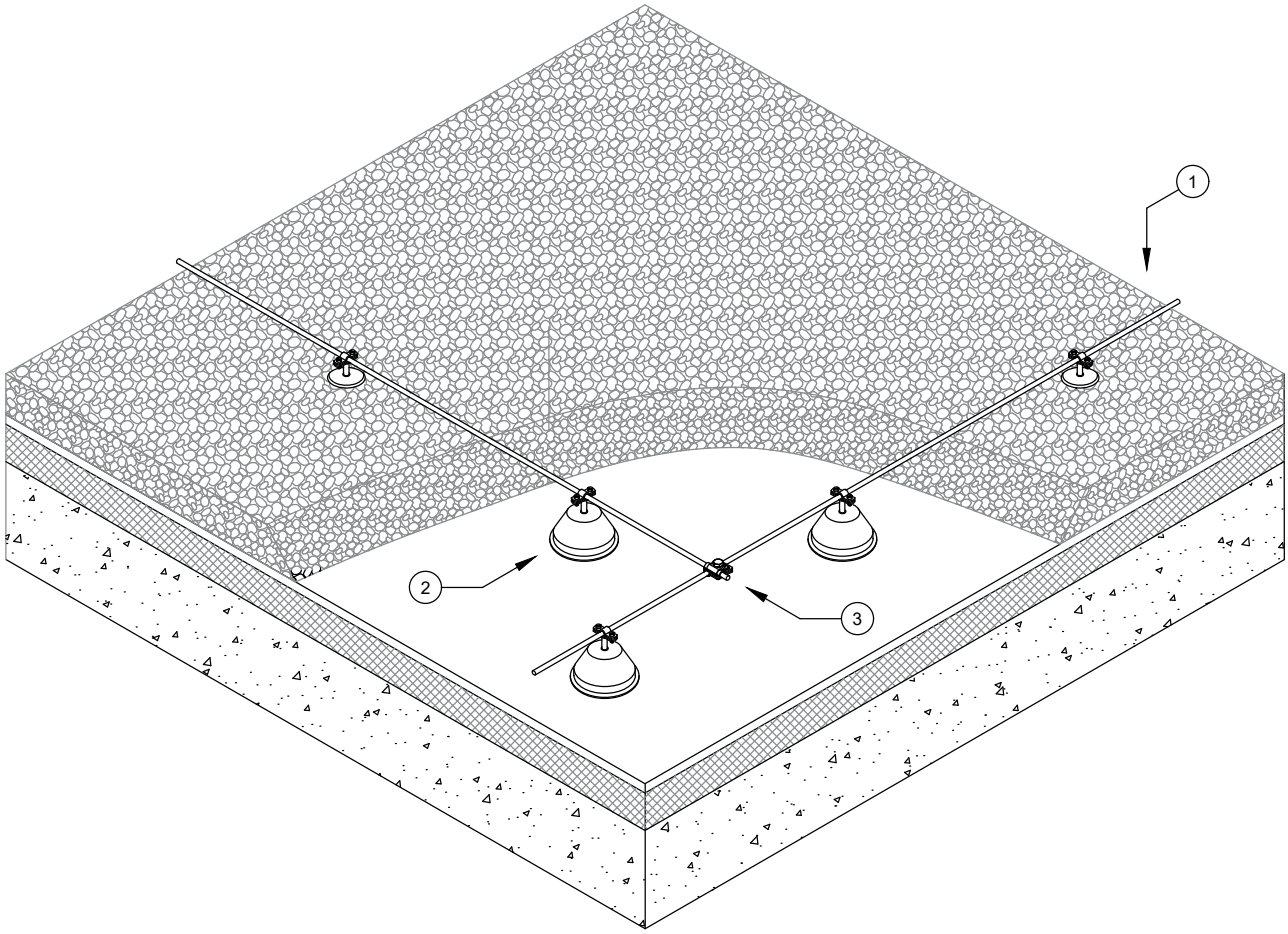
Ind.	Amendment typical		Date:	Name:		

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218977	165 KRB SO	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.07	Project No.:	
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Editor:						
Status:			Comment: Installation of lightning protection grid with round conductor on the surface of the bulk roof			
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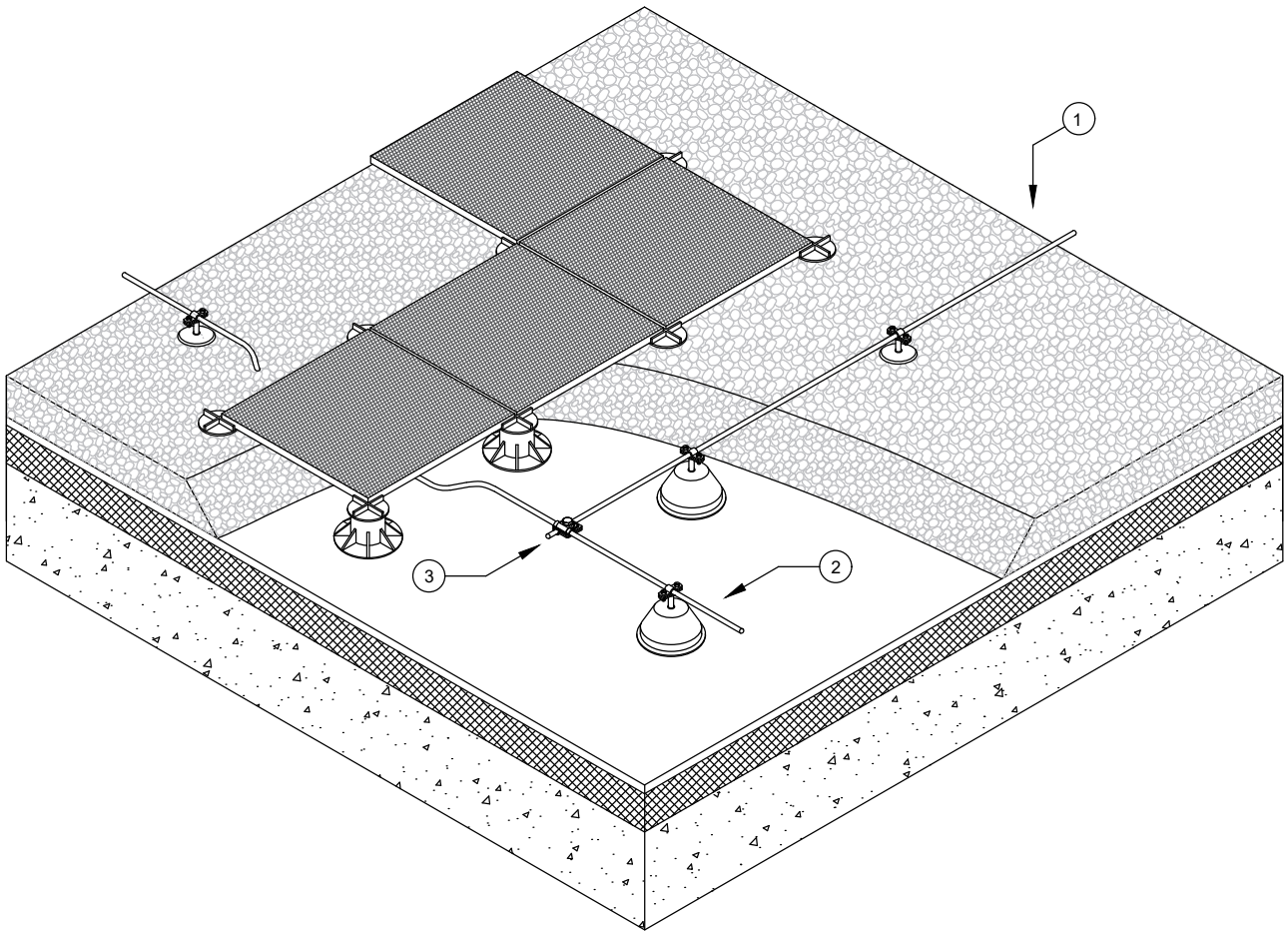
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218977	165 KRB SO	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.08	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Installation of lightning protection grid with round conductor on the surface of the bulk roof			
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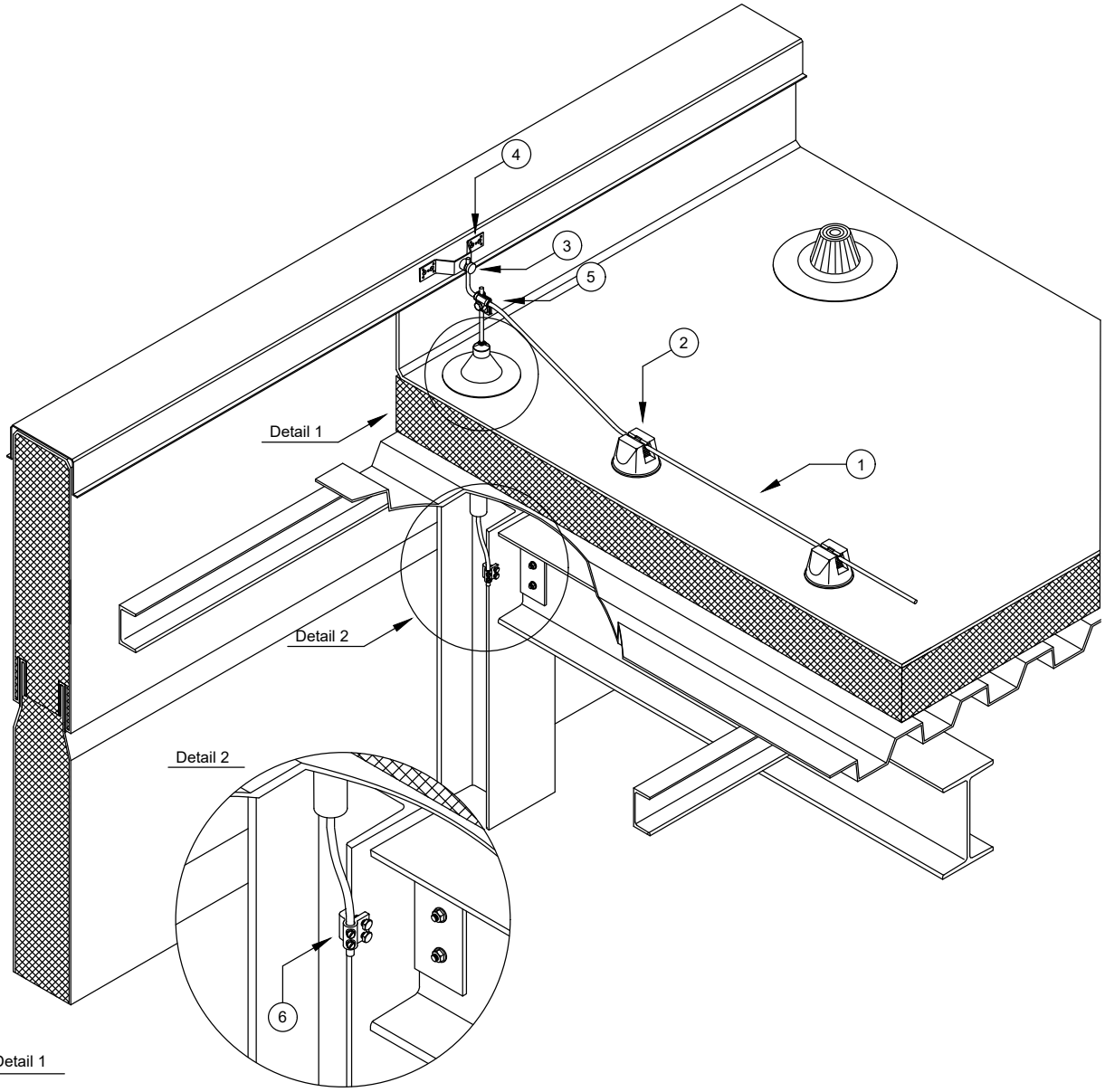
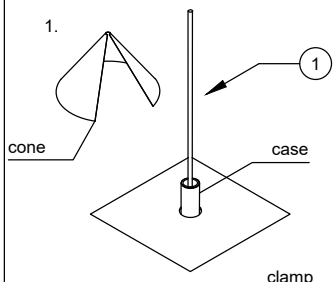
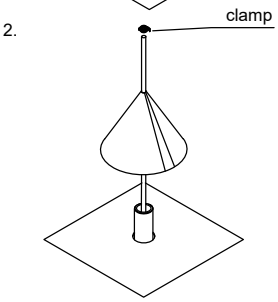
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



Detail 1

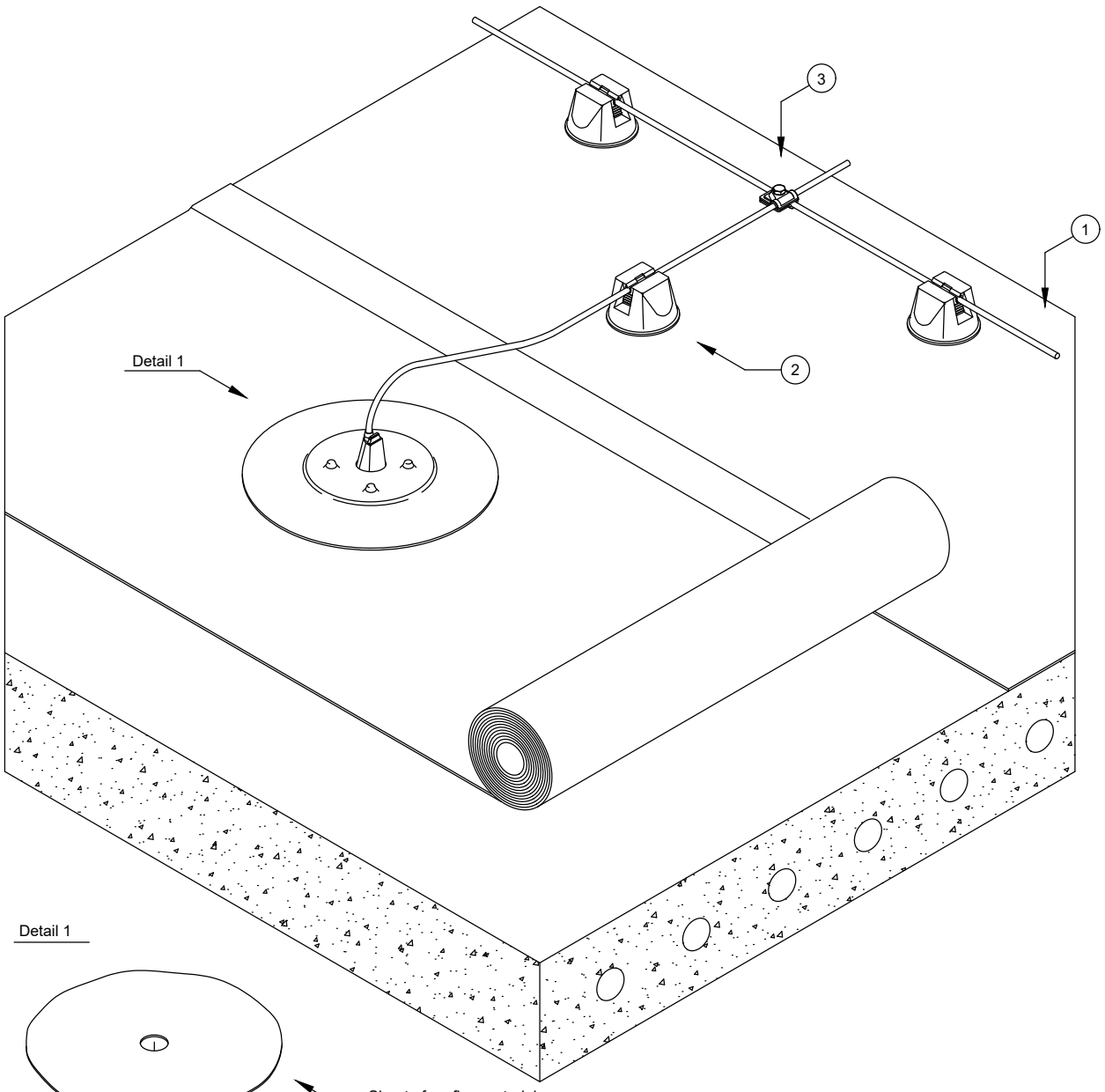




	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
4	5320712	288 DIN	Connection and bridging component	
5	5311519	249 8-10 ALU	Vario quick connector	
6	5318084	272 8	Connection terminal to 14 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.09	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:			Comment: Descent of the round conductor through the membrane roof to the metal column of the building.			
Status:						
	— — —				OBO BETTERMANN	Scale: / Sheet size:
	— — —					Sheet: / of:
Ind.	Amendment typical		Date:	Name:		

1 External lightning protection systems for flat roofs

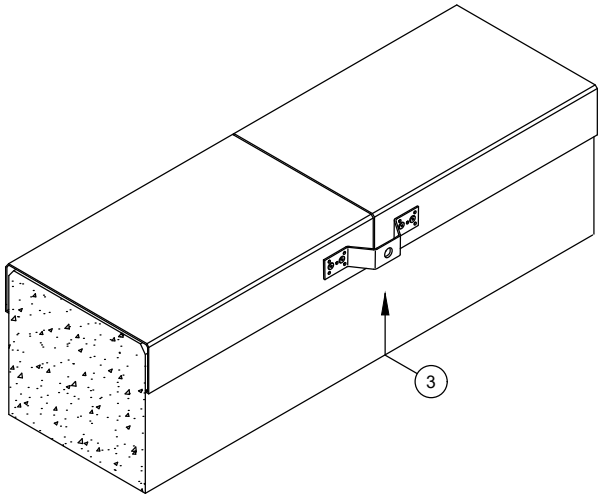


	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5201101	330 K	Roof penetration	

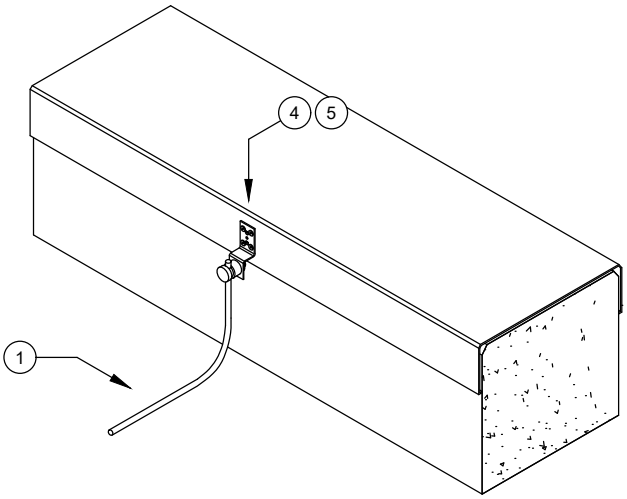
Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.10	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs				
Creator:							
Editor:							
Status:			Comment: Descent of the round conductor through the tarred roofing felt.				
	— — —				OBO BETTERMANN	Scale:	Sheet size:
	— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:			

1 External lightning protection systems for flat roofs

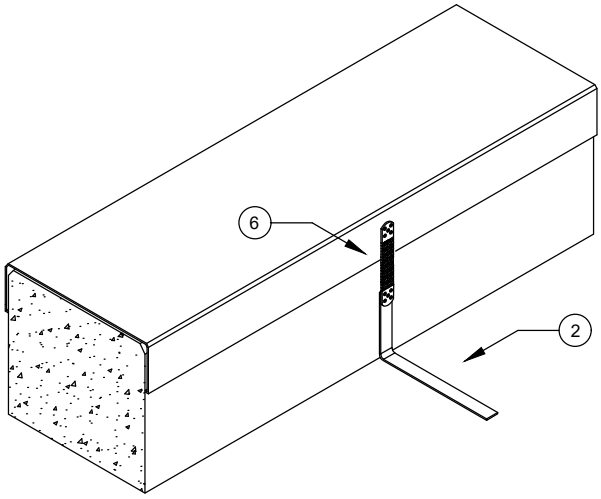
(1) Mounting on 2 blind rivets d = 6 mm



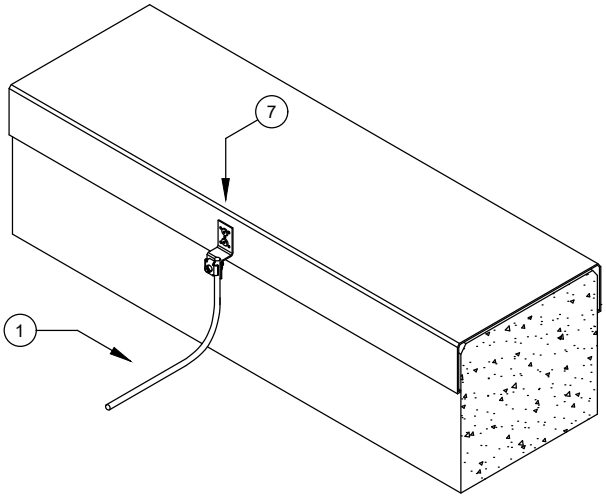
(2) Mounting on 4 blind rivets d = 5 mm



(3) Mounting on 5 blind rivets d = 3,5 mm



(4) 2 blind rivets made of stainless steel VA d = 6,3 mm



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
3	5320712	288 DIN	Connection and bridging component	
4	5320704	287	Connection component	
5	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
6	5331501	856	Connection and expansion strip	
7	5320707	287 DCT	Connection component with double crossbar	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.11	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs				
Creator:							
Editor:							
Status:			Comment: Methods of connecting the metal parapet wall to the lightning protection grid using rivets.				
	— — —				OBO BETTERMANN	Scale:	Sheet size:
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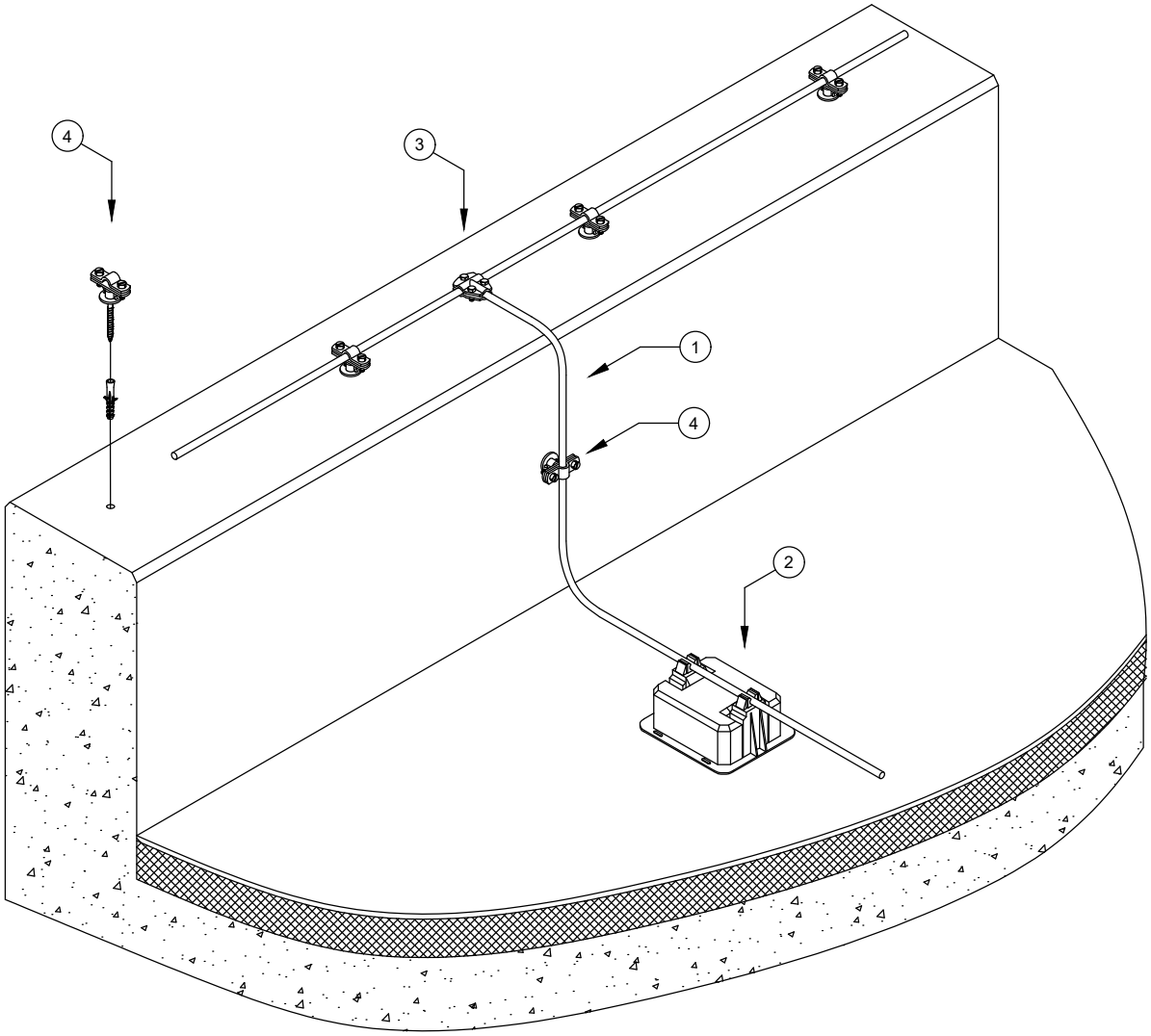
Ind.	Amendment typical		Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218997	165 R-8-10	Roof conductor holder for flat roofs	
3	5311209	247 8-10 FT	T connector Rd 8-10 mm, triple -screwed	
4	5230322	113 B-Z-HD	Conductor bracket with crossbar, wood screw, plastic anchor	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.12	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor to a flat parapet wall.			
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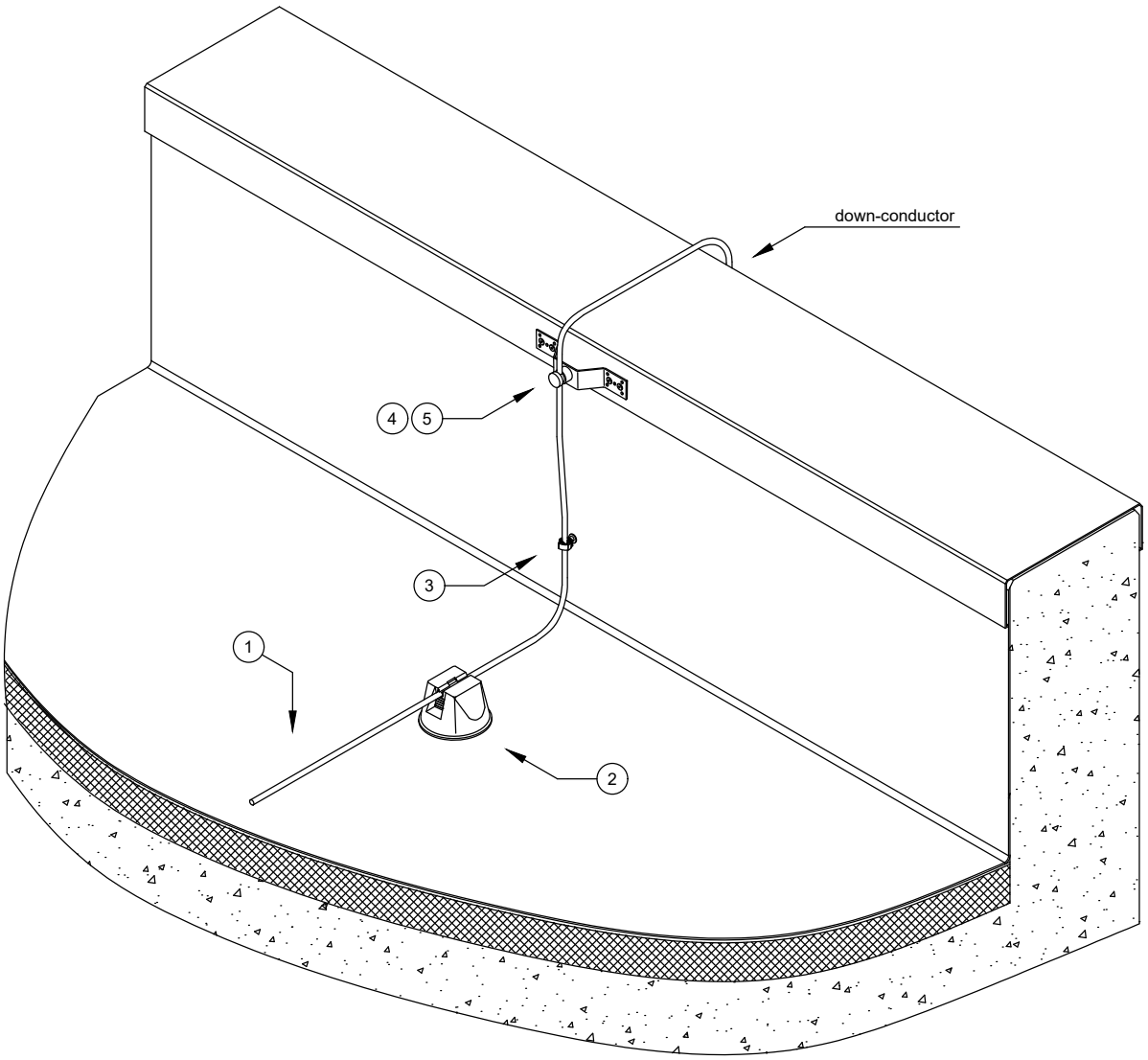
Ind.	Amendment typical		Date:	Name:		

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5207444	177 20 M8	Universal cable bracket	
4	5320712	288 DIN	Connection and bridging component	
5	5304164	5001 N-FT	Connector, Rd 8-10 mm with pressure trough	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.13	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor to a metal parapet wall.			
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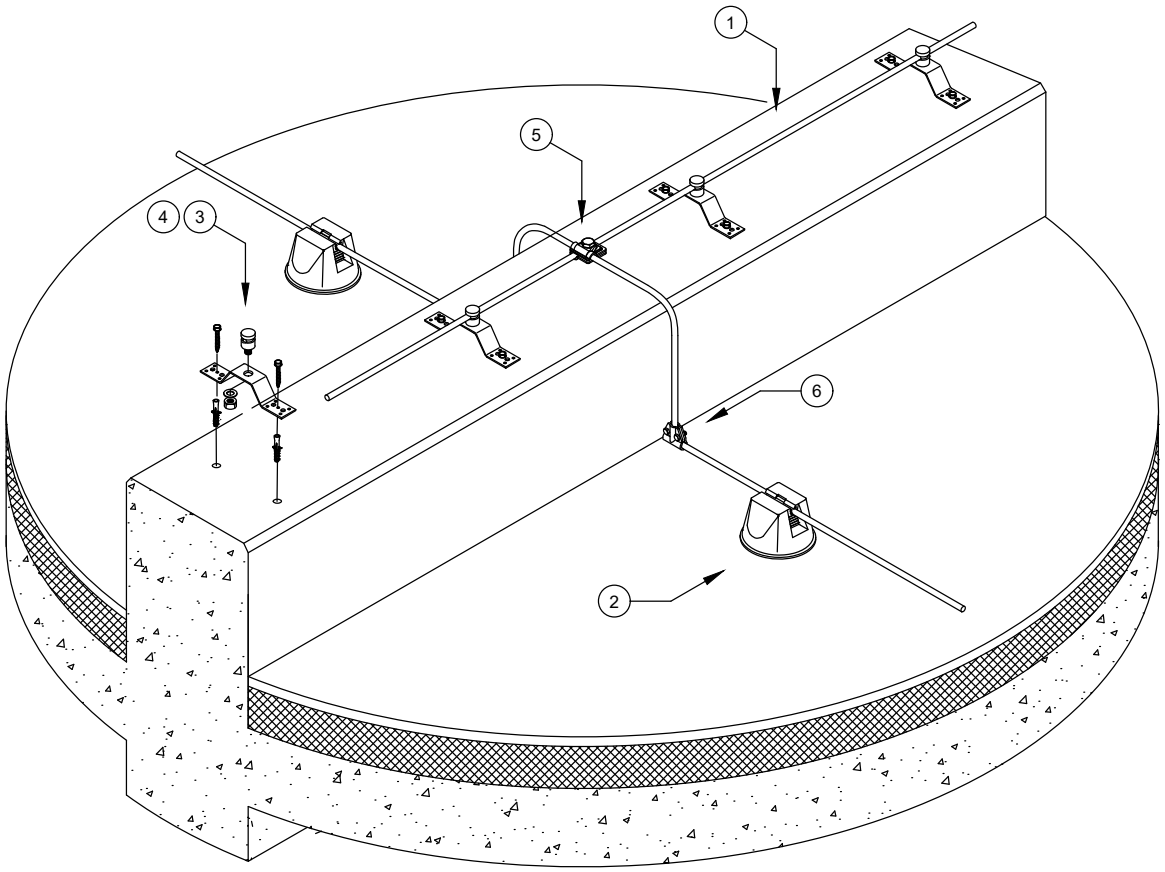
Ind.	Amendment typical		Date:	Name:		

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5320712	288 DIN	Connection and bridging component	
4	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
5	5311519	249 8-10 ALU	Vario quick connector	
6	5311101	245 8-10 FT	T connector Rd 8-10 mm	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.14	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:			Comment: Connecting of the lightning protection grid on a parapet wall.			
Status:						
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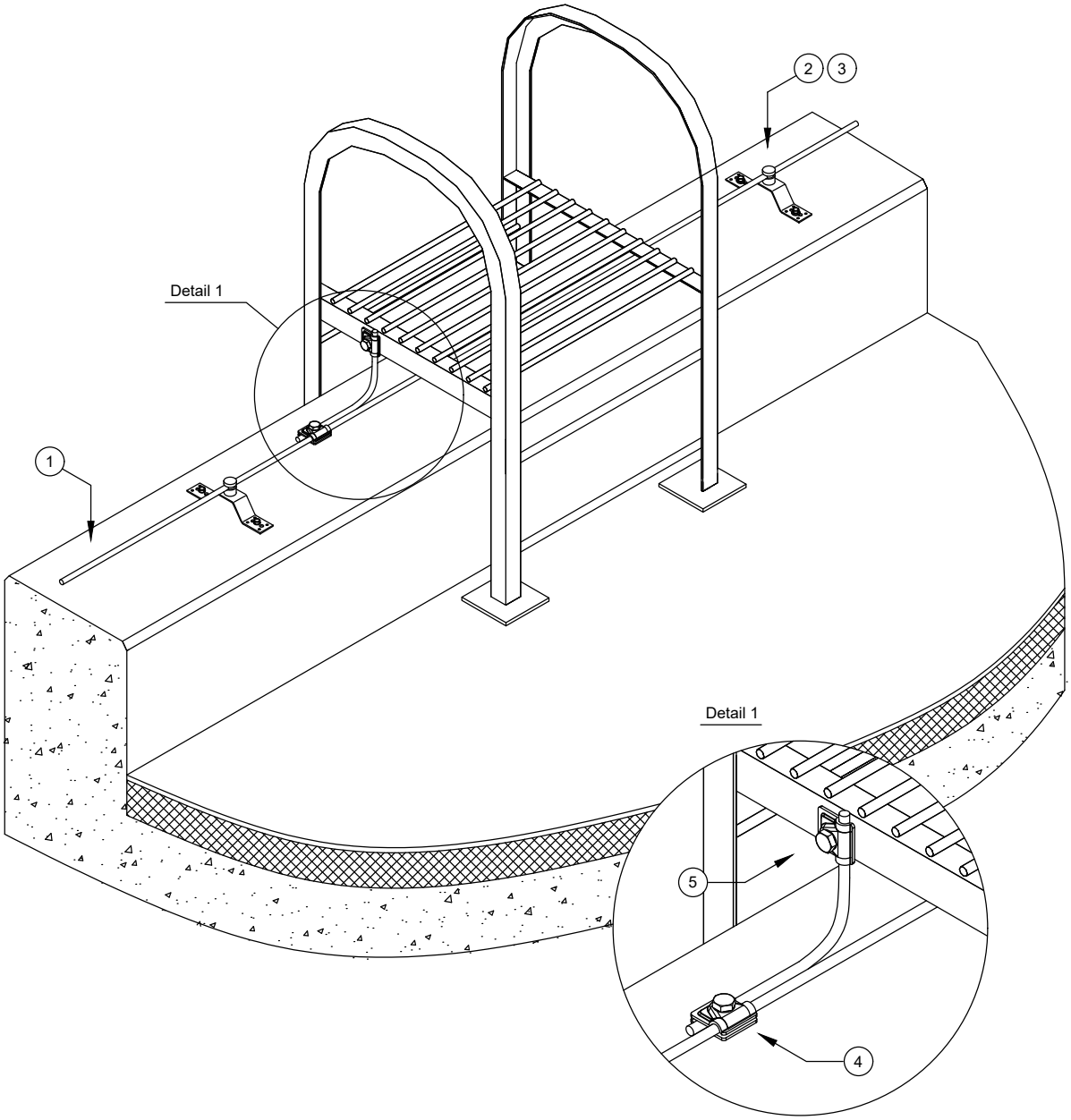
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5320712	288 DIN	Connection and bridging component	
3	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
4	5311519	249 8-10 ALU	Vario quick connector	
5	5311585	249 8-10 ALU-OT	Connection terminal, equipotential bonding, Rd 8-10 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.15	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Connecting a fire ladder to the lightning protection grid.			
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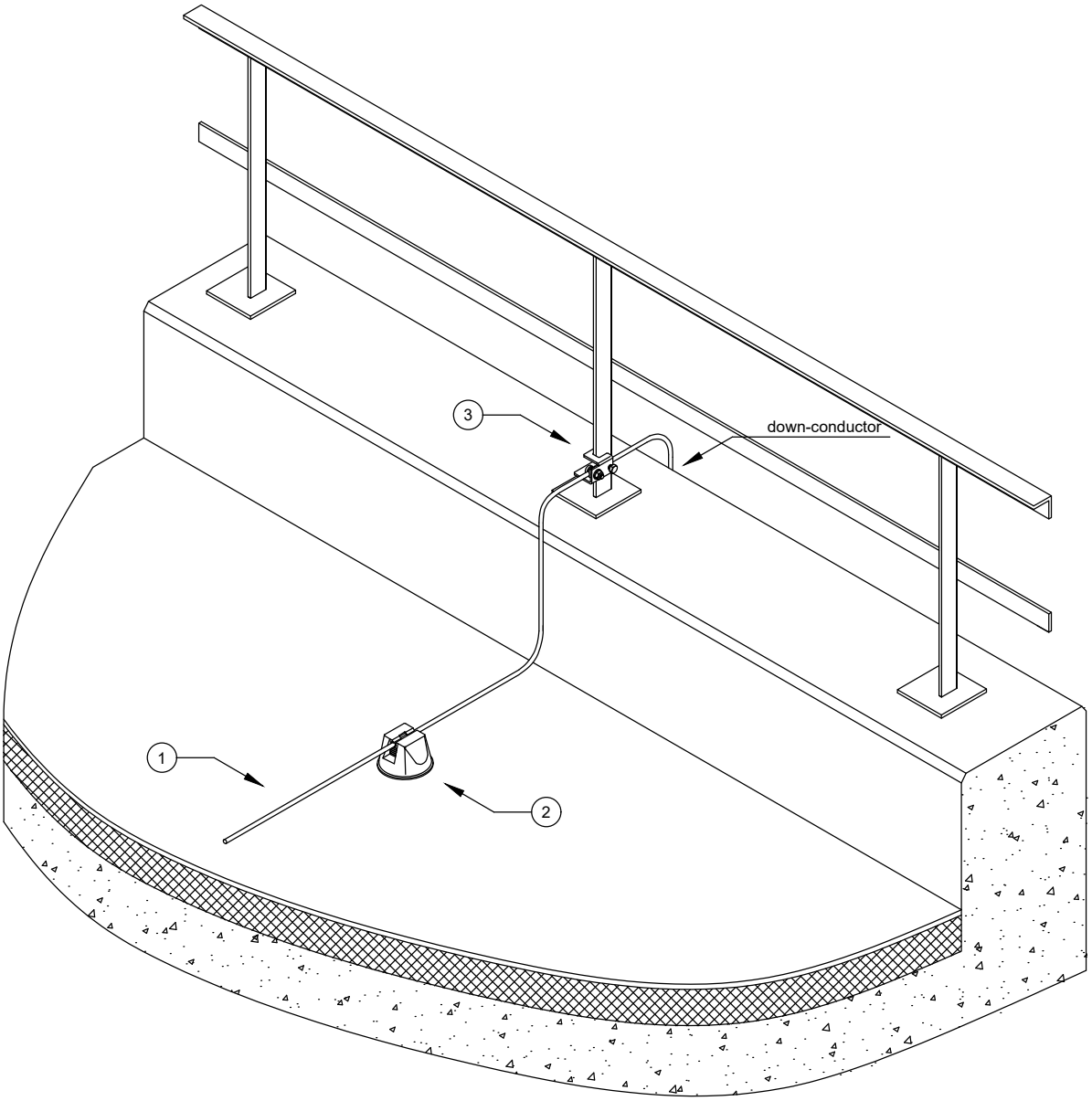
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218977	165 KRB SO	Roof conductor holder for flat roofs	
3	5304520	5010 20 FT	Construction clamp to 20 mm	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.16	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Connection of the metal handrail to the lightning protection grid.			
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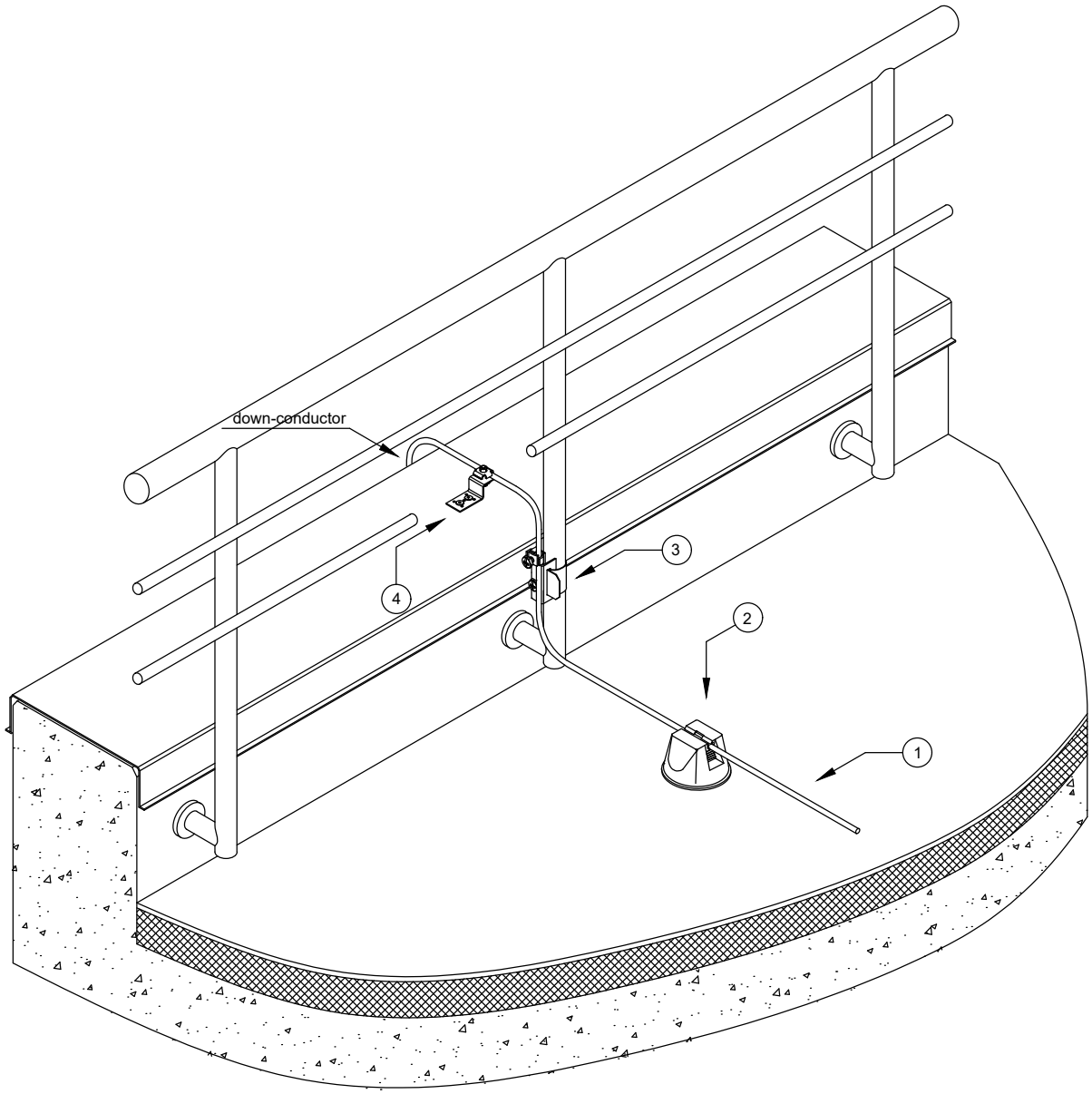
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5320712	288 DIN	Connection and bridging component	
3	5057515	927 1	Earthing pipe clamp VA	
4	5320707	287 DCT	Connection component with double crossbar	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.17	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Connection of the metal handrail to the lightning protection grid.			
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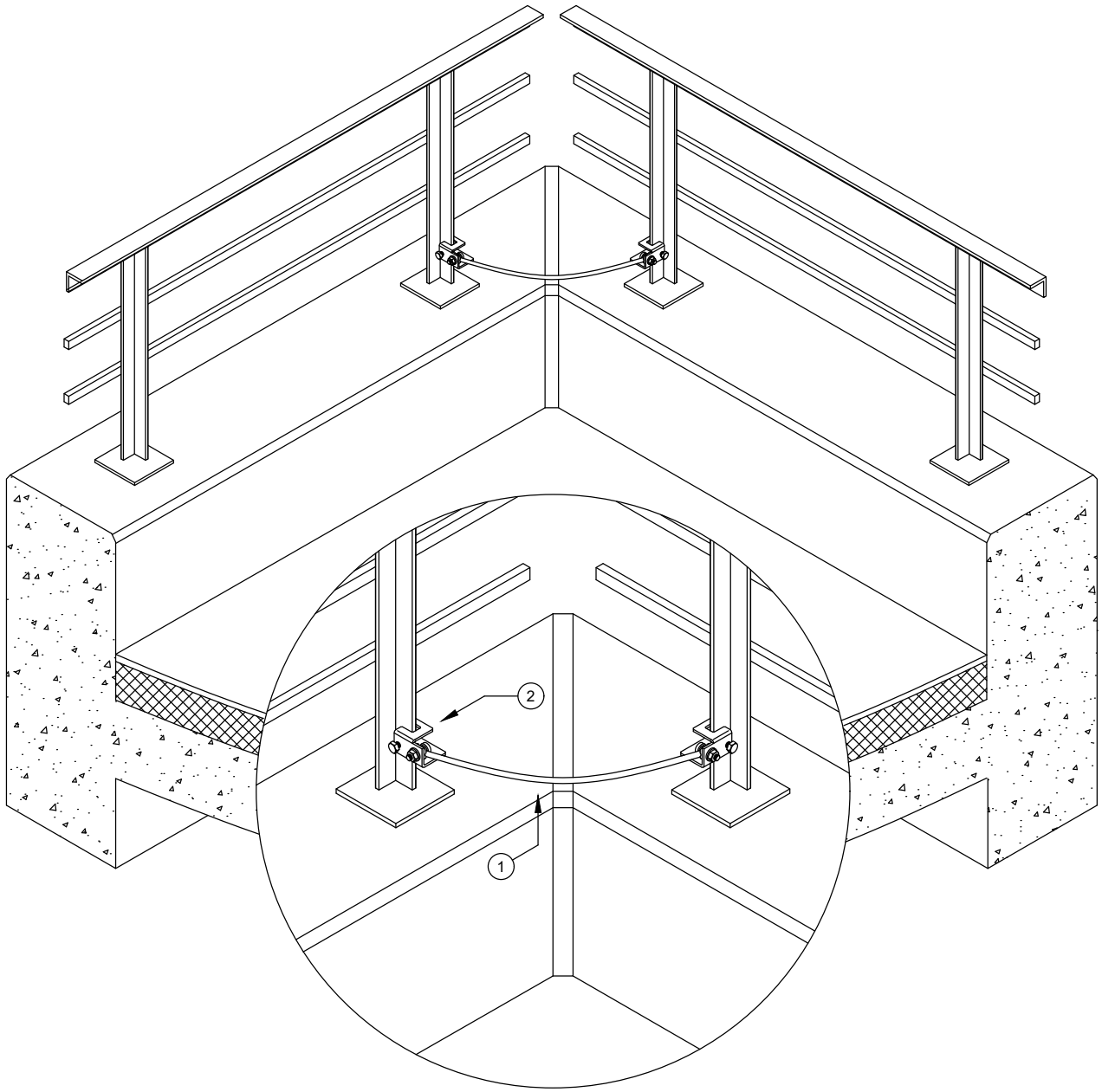
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5304520	5010 20 FT	Construction clamp to 20 mm	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.18	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Connection of the metal handrail to each other			
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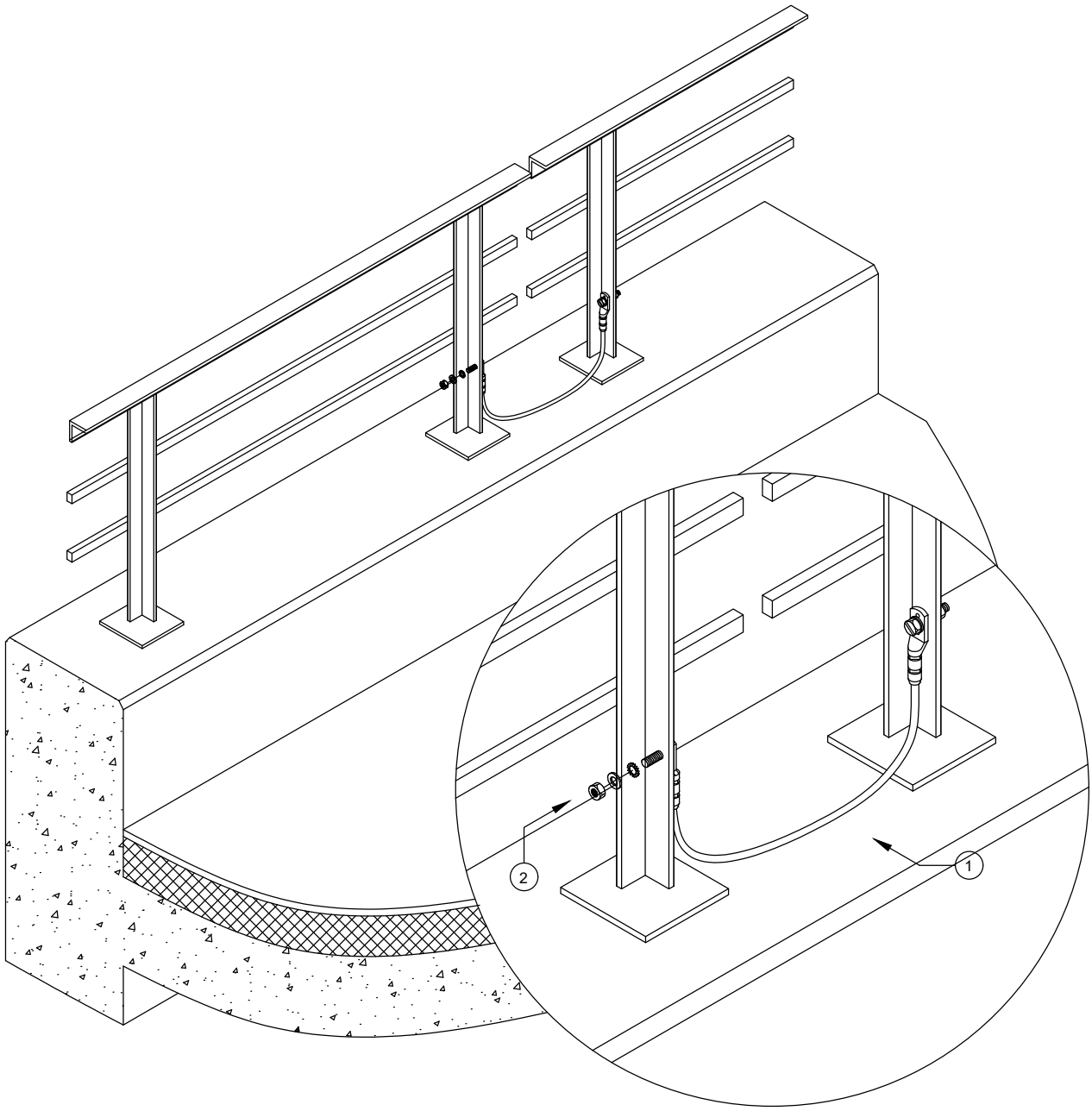
Ind.	Amendment typical		Date:	Name:		

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5331013	853 300	Bridging cable	
2	3160734	SKS 10x25 F	Hexagonal bolt with nut and washer M10	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.19	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Connection of the metal handrail to each other			
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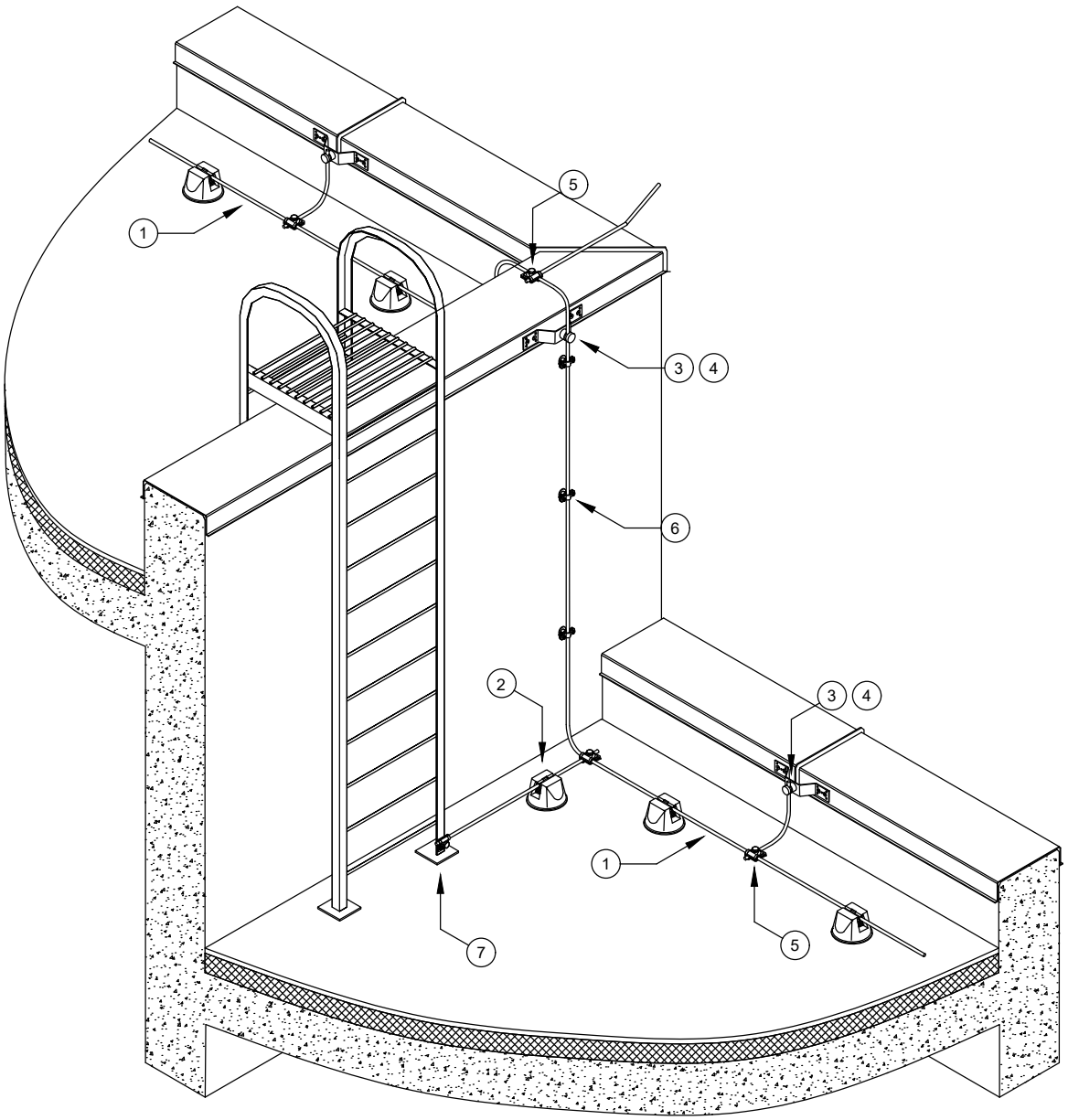
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5320712	288 DIN	Connection and bridging component	
4	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
5	5311519	249 8-10 ALU	Vario quick connector	
6	5230322	113 B-Z-HD	Cable bracket with crossbar, wood screw, plastic anchor	
7	5311585	249 8-10 ALU-OT	Connection terminal, equipotential bonding, Rd 8-10 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.20	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor to a metal roof parapet. Protection of corners and edges of the building.			

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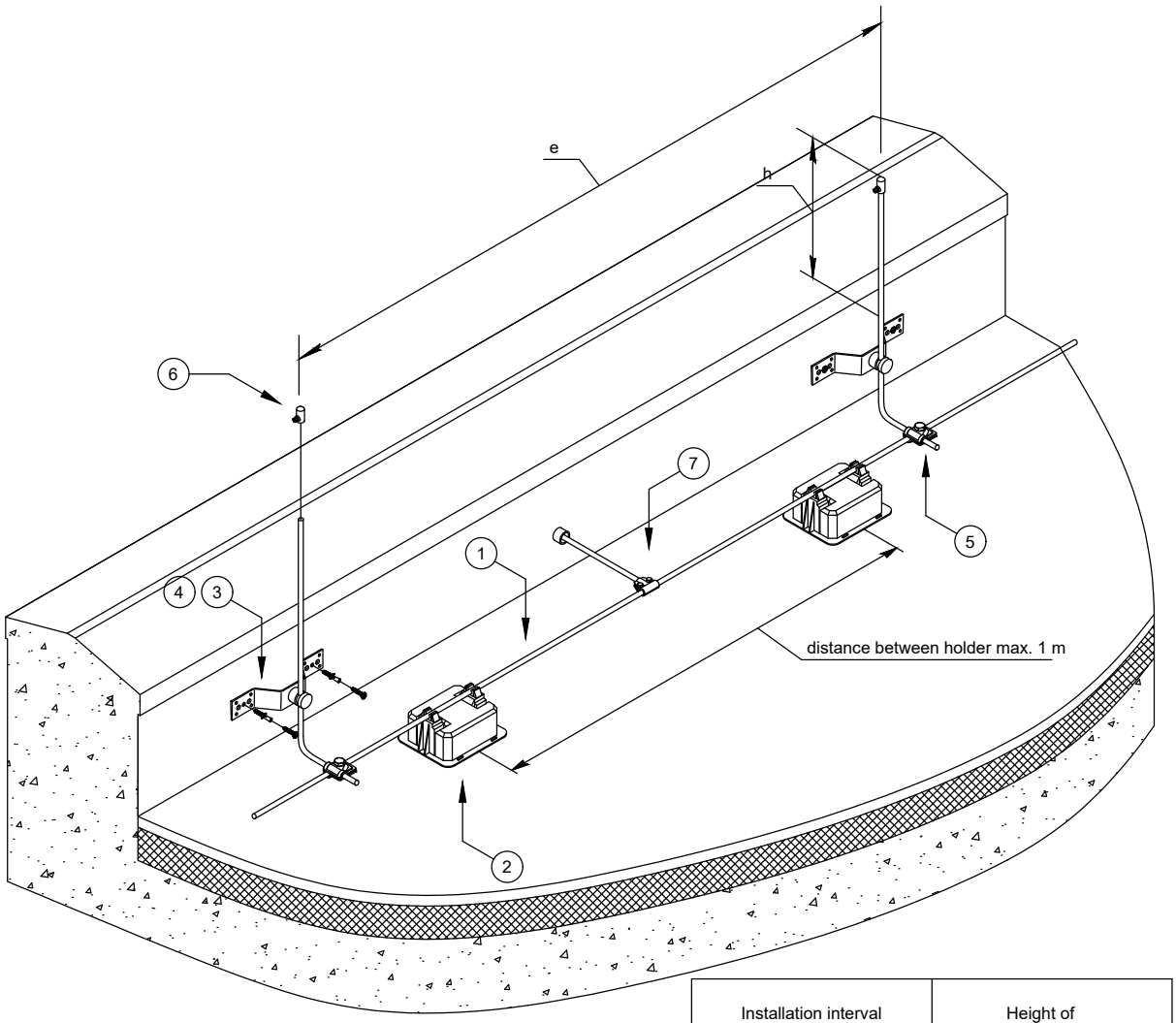
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



Installation interval of interception tip, e	Height of interception tip, h
3 m	0,15 m
4 m	0,25 m
5 m	0,35 m
6 m	0,45 m

	Item No.	Designation	Description	Q-ty
1	5021050	RD 8-FT 50	Round conductor, galvanised steel	
2	5218997	165 R-8-10	Roof conductor holder for flat roofs	
3	5320712	288 DIN	Connection and bridging component	
4	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
5	5311500	249 8-10 ST	Vario quick connector	
6	5405068	120 A	Air-termination tip	
7	5311101	245 8-10 FT	T connector Rd 8-10 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.21	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Protection of the flat parapet of the building by means of interception tips.			

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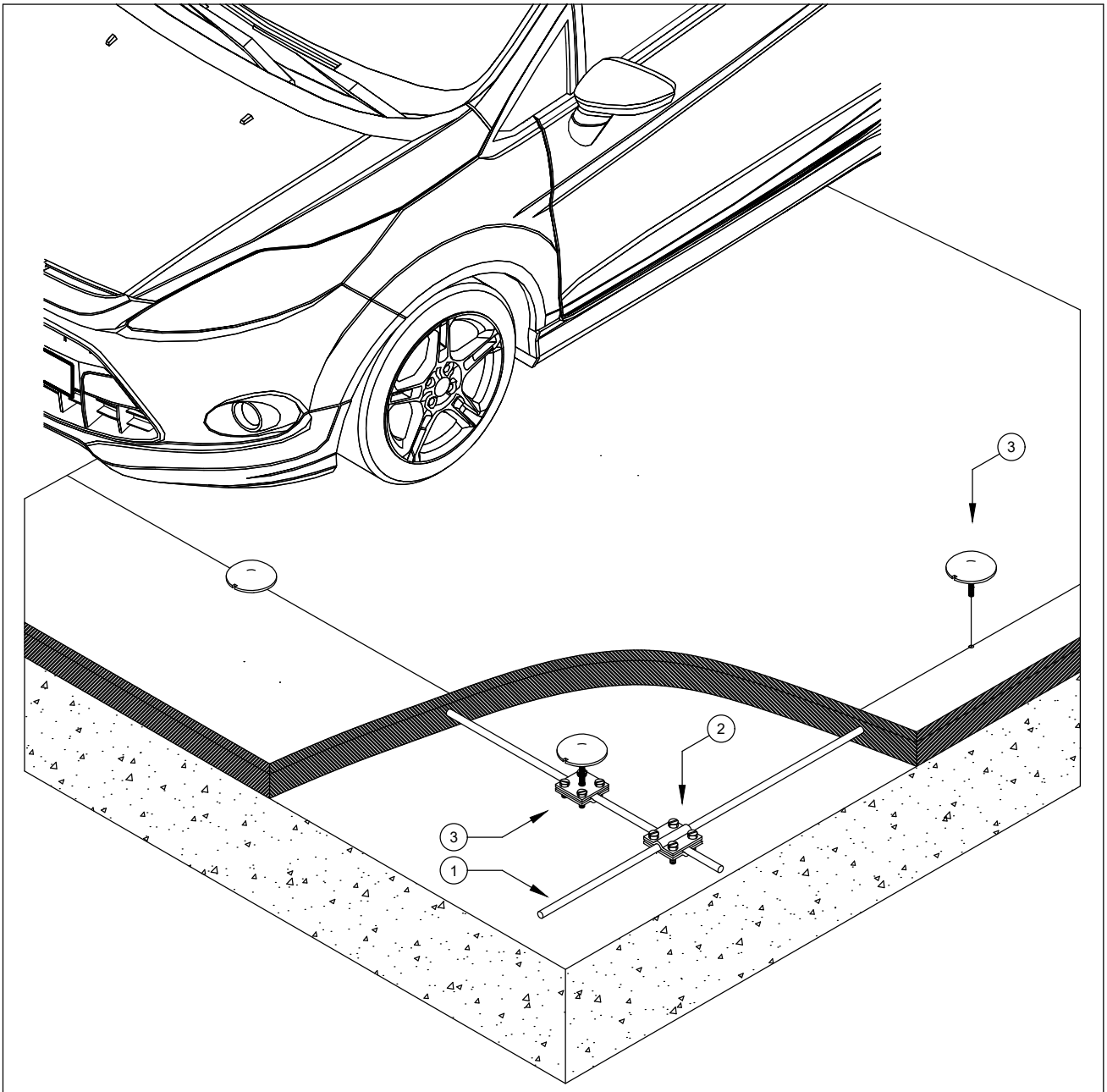
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021647	RD 10 - V4A	Round conductor, stainless steel	
2	5312318	252 8-10 V4A	Cross-connector	
3	5405769	128 F	Mushroom-shaped air -termination with connectors	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.22	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Lightning protection of the parking lot on the roof of the building. Laying conductors in a waterproofing coating			
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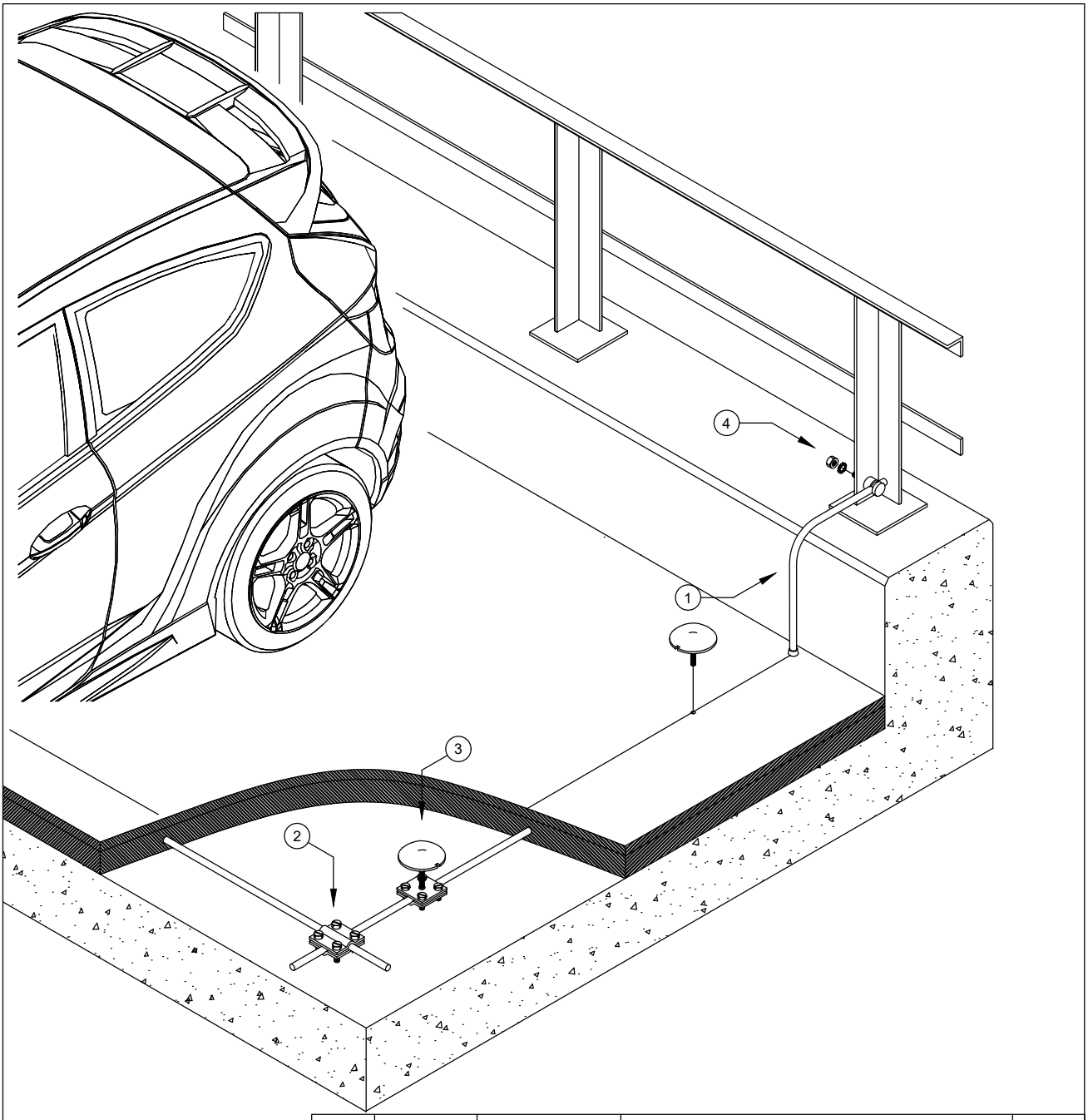
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021647	RD 10 - V4A	Round conductor, stainless steel	
2	5312318	252 8-10 V4A	Cross-connector	
3	5405769	128 F	Mushroom-shaped air -termination with connectors	
4	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T1.23	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Lightning protection of the parking lot on the roof of the building. Laying conductors in a waterproofing coating			
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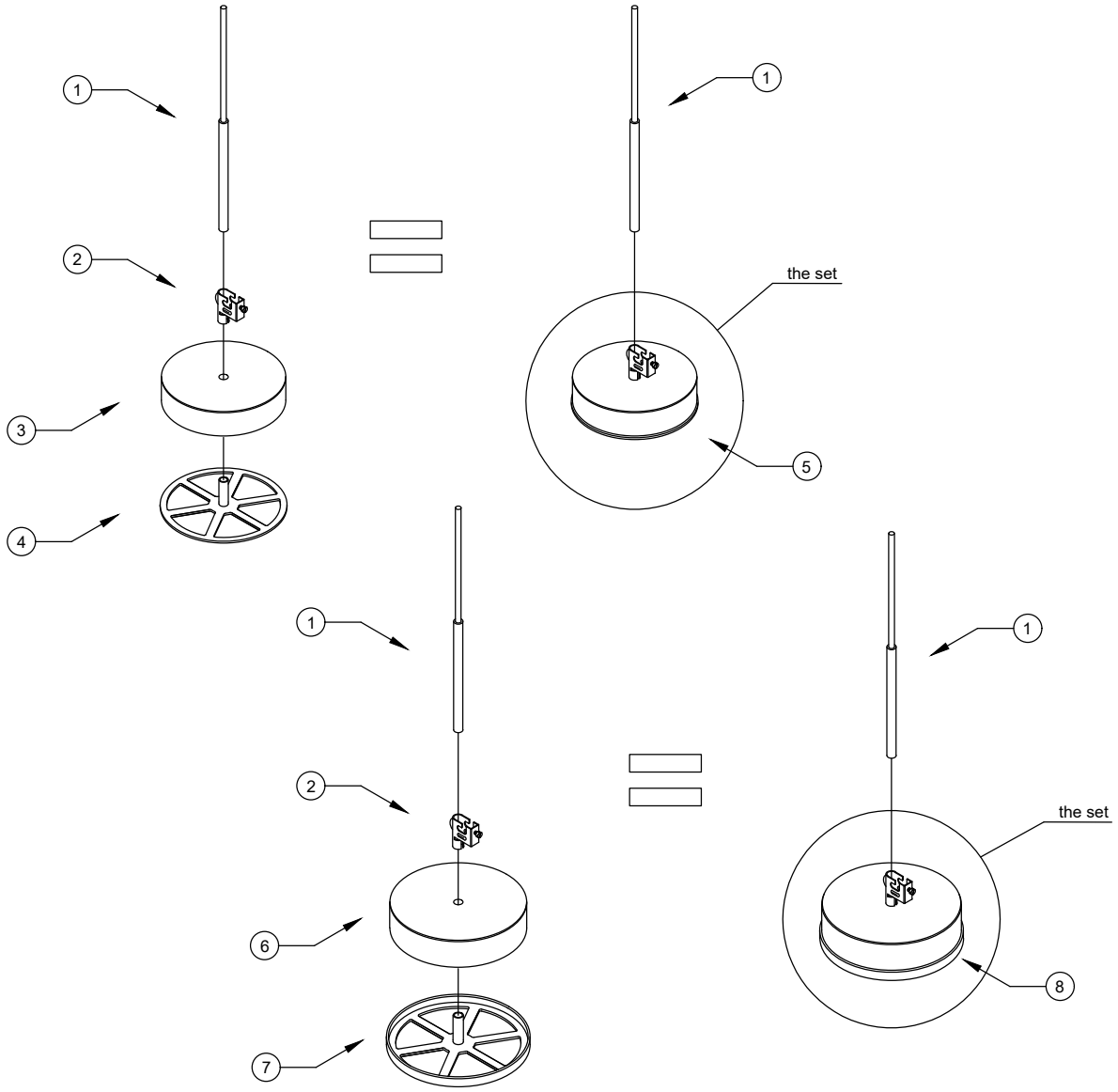
Ind.	Amendment typical		Date:	Name:		

Notes



	Item No.	Designation	Description	Q-ty
1	5401980	101 VL1500	Tapered pipe air termination rod	
2	5403219	F-FIX-KL	Terminal for FangFix system	
3	5403117	F-FIX-S10	Concrete block for FangFix system 10 kg	
4	5403124	F-FIX-B10	Base for FangFix system 10 kg	
5	5403103	F-FIX-10	Stand for FangFix system 10 kg	
6	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
7	5403225	F-FIX-B16	Base for FangFix system 16 kg	
8	5403200	F-FIX-16	Stand for FangFix system 16 kg	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.01	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Assembly of the FangFix lightning system.			
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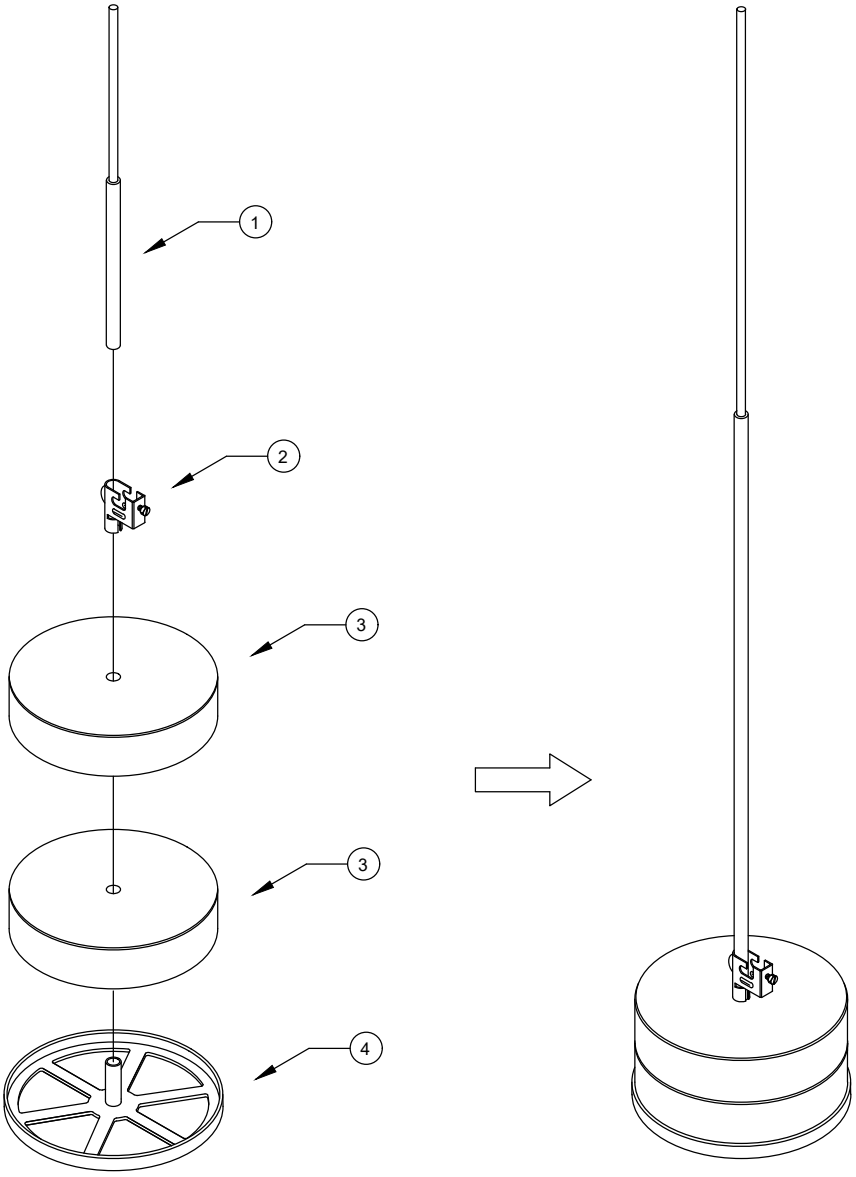
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5401983	101 VL2000	Tapered pipe air-termination rod	
2	5403219	F-FIX-KL	Terminal for FangFix system	
3	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
4	5403225	F-FIX-B16	Base for FangFix system 16 kg	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.02	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Installation of additional FangFix system supports depending on the wind load.			
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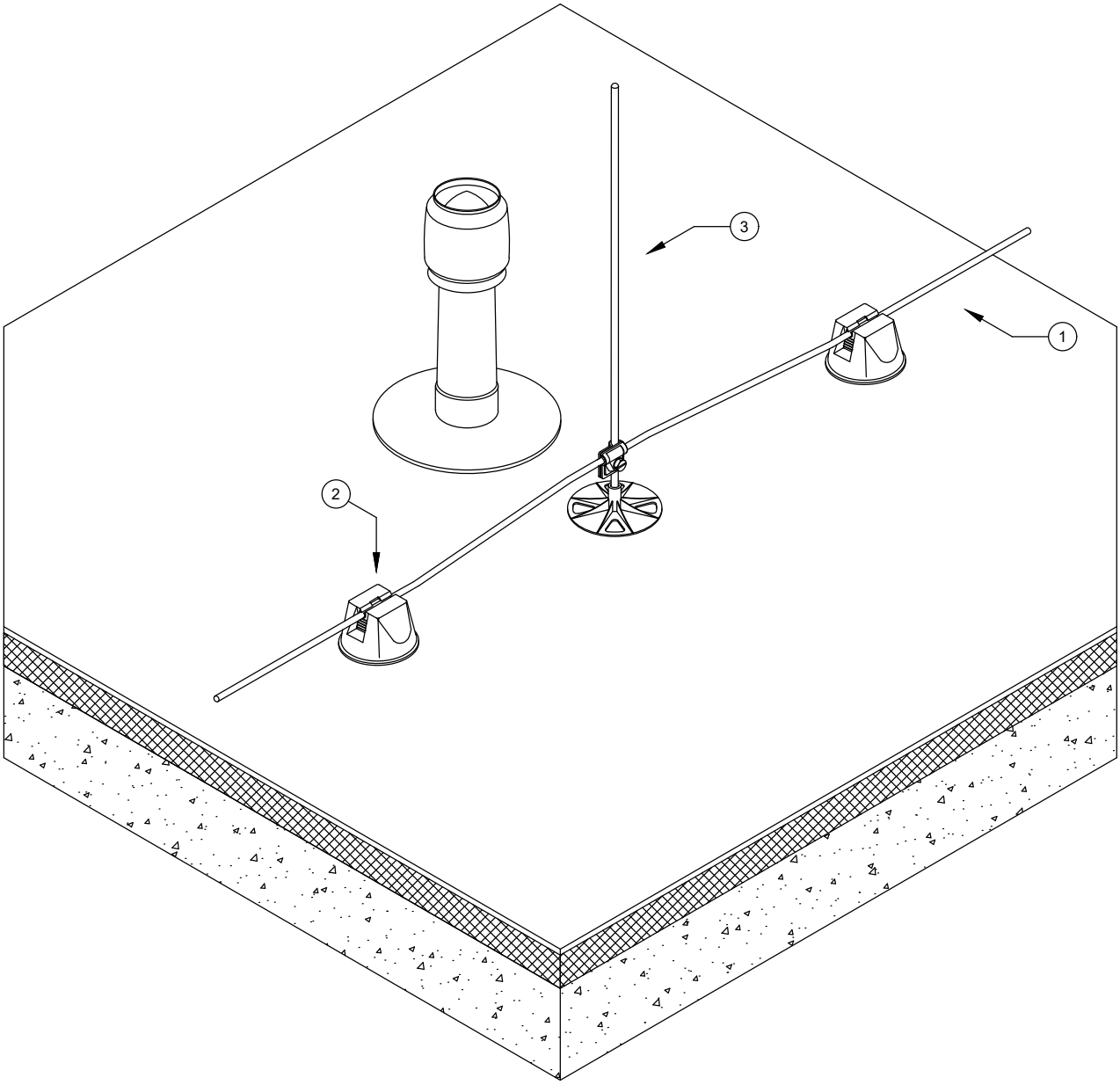
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5403308	F-FIX-JUNIOR	Stand for FangFix Junior system	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.03	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of the roof aerator. Installation of an interception rod.			
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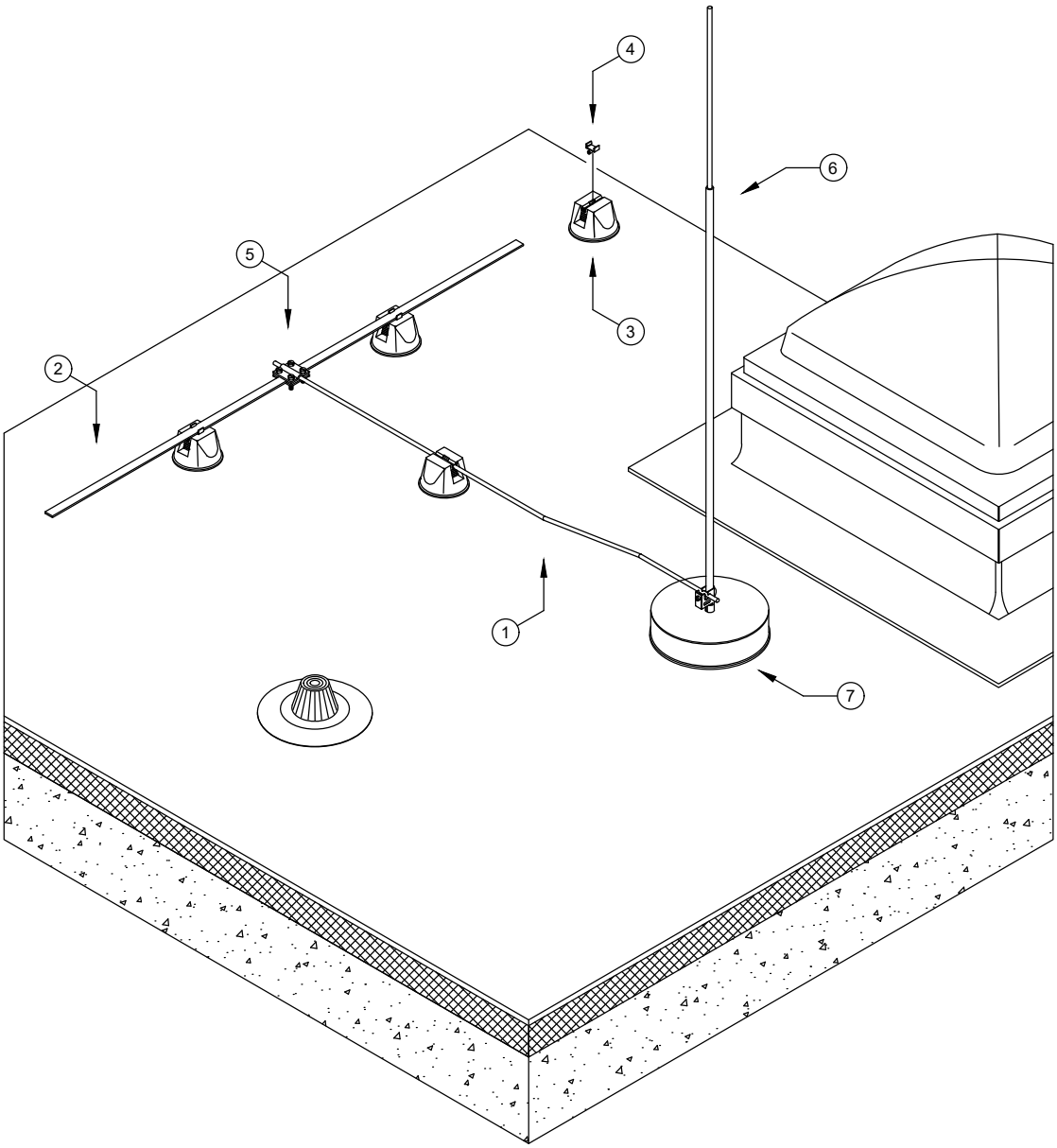
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
3	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
4	5218885	165 MBG HFL	Flat conductor adapter for roof conductor holder	
5	5312655	252 8-10xFL30FT	Cross-connector for round and flat conductors	
6	5401983	101 VL2000	Tapered pipe air-termination rod	
7	5403200	F-FIX-16	Stand for FangFix system 16 kg	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.04	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection for a skylight. Installation of an interception rod.			
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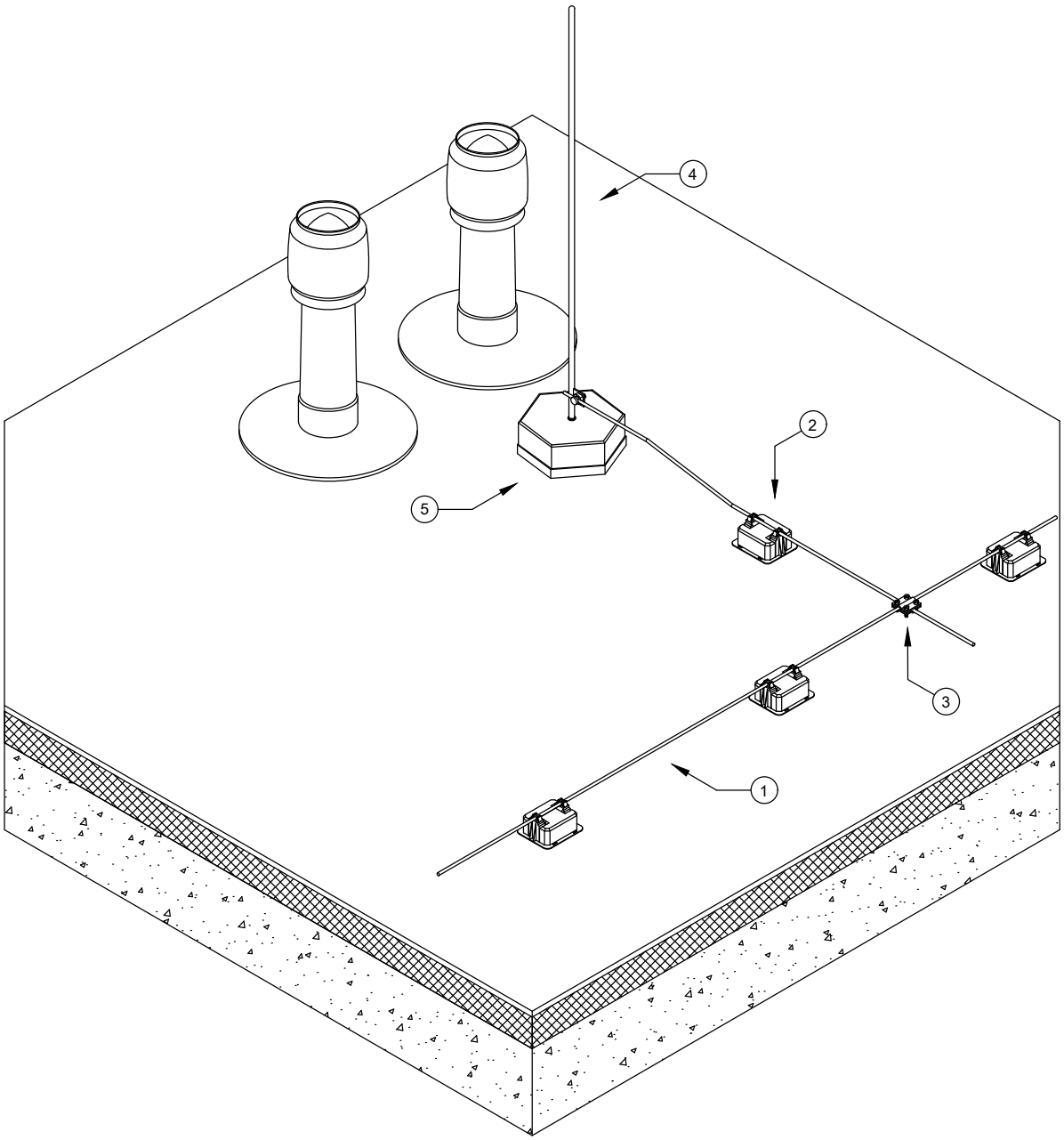
Ind.	Amendment typical		Date:	Name:		

External lightning protection systems for flat roof equipment



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218997	165 R-8-10	Roof conductor holder for flat roofs	
3	5312604	253 8x8	Cross-connector Rd 8-10 mm	
4	5402859	101 A-L150	Air-termination rod, one end rounded with connection strap	
5	5402891	101 ST	Stand 6,9 kg with female thread	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.05	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of several roof aerators. Installation of an interception rod.			
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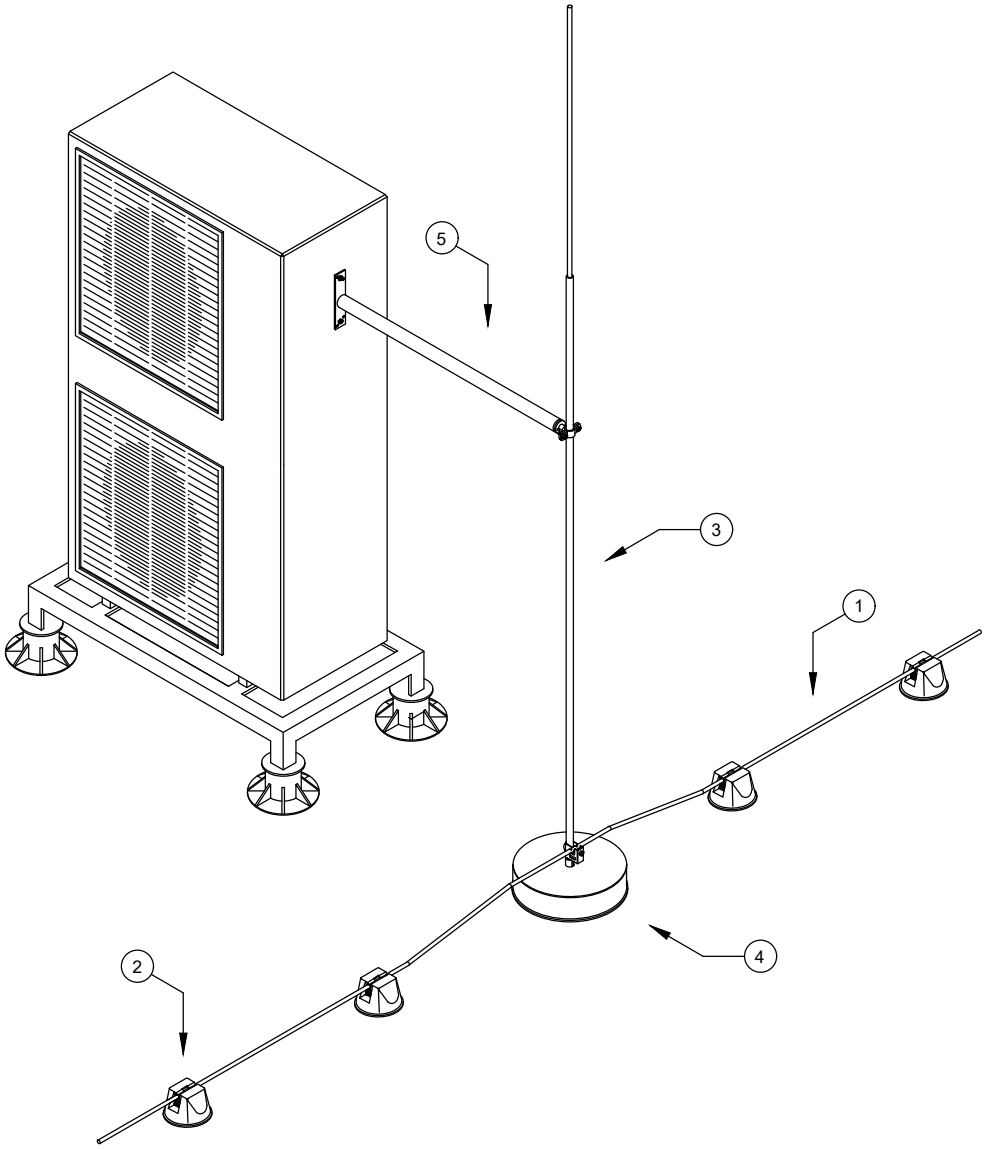
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5401989	101 VL3000	Tapered pipe air-termination rod	
4	5403200	F-FIX-16	Stand for FangFix system 16 kg	
5	5408806	ISO-A-500	Insulated spacer	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.06	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of outdoor unit the air-condition. Installation of an interception rod with an insulated spacer.			
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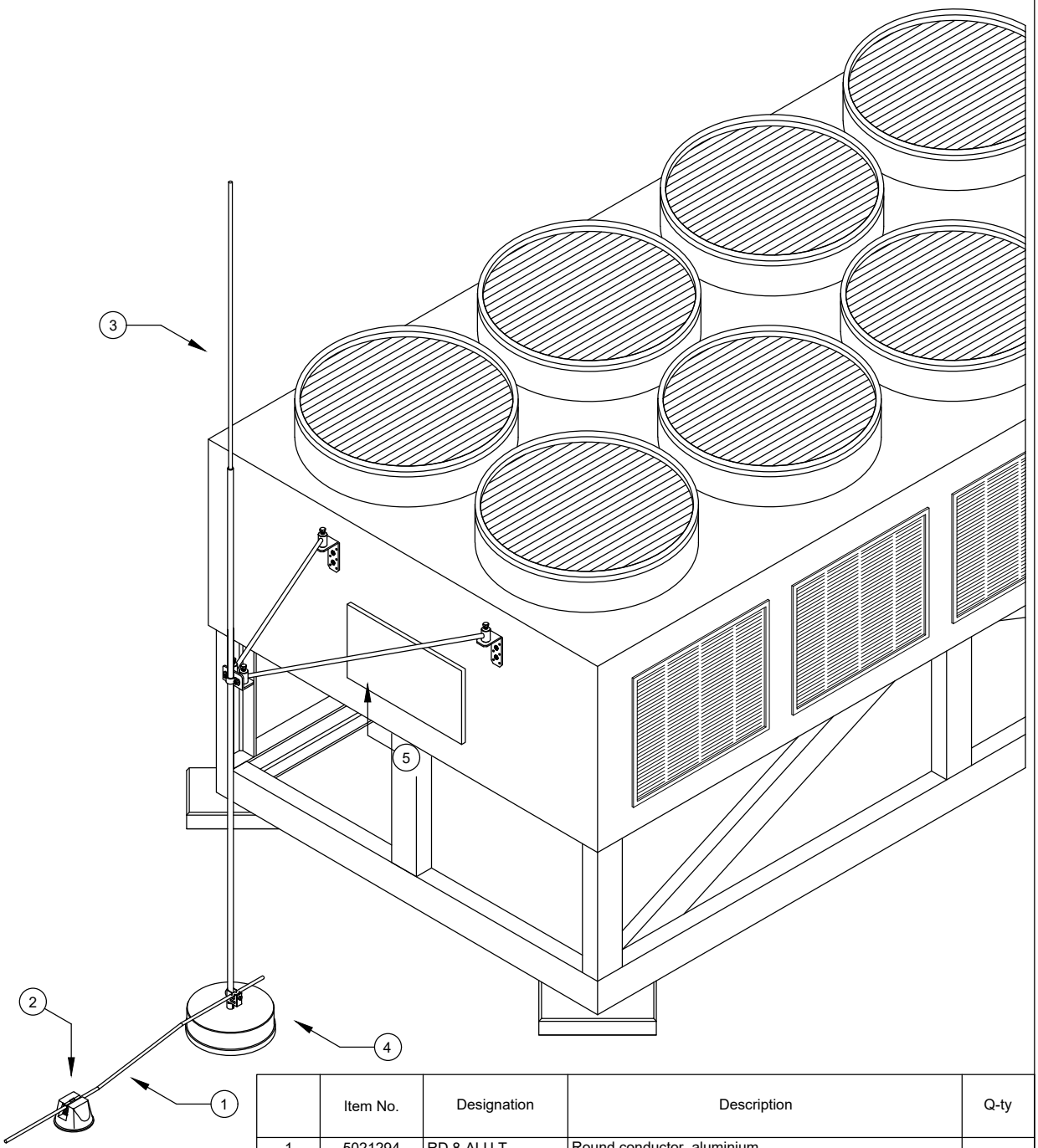
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5401995	101 VL4000	Tapered pipe air-termination rod	
4	5403200	F-FIX-16	Stand for FangFix system 16 kg	
5	5408978	101 VS-16	Insulated lightning protection set, V fastening	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.07	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of chiller system. Installation of an interception rod with a V-fastening spacer.			
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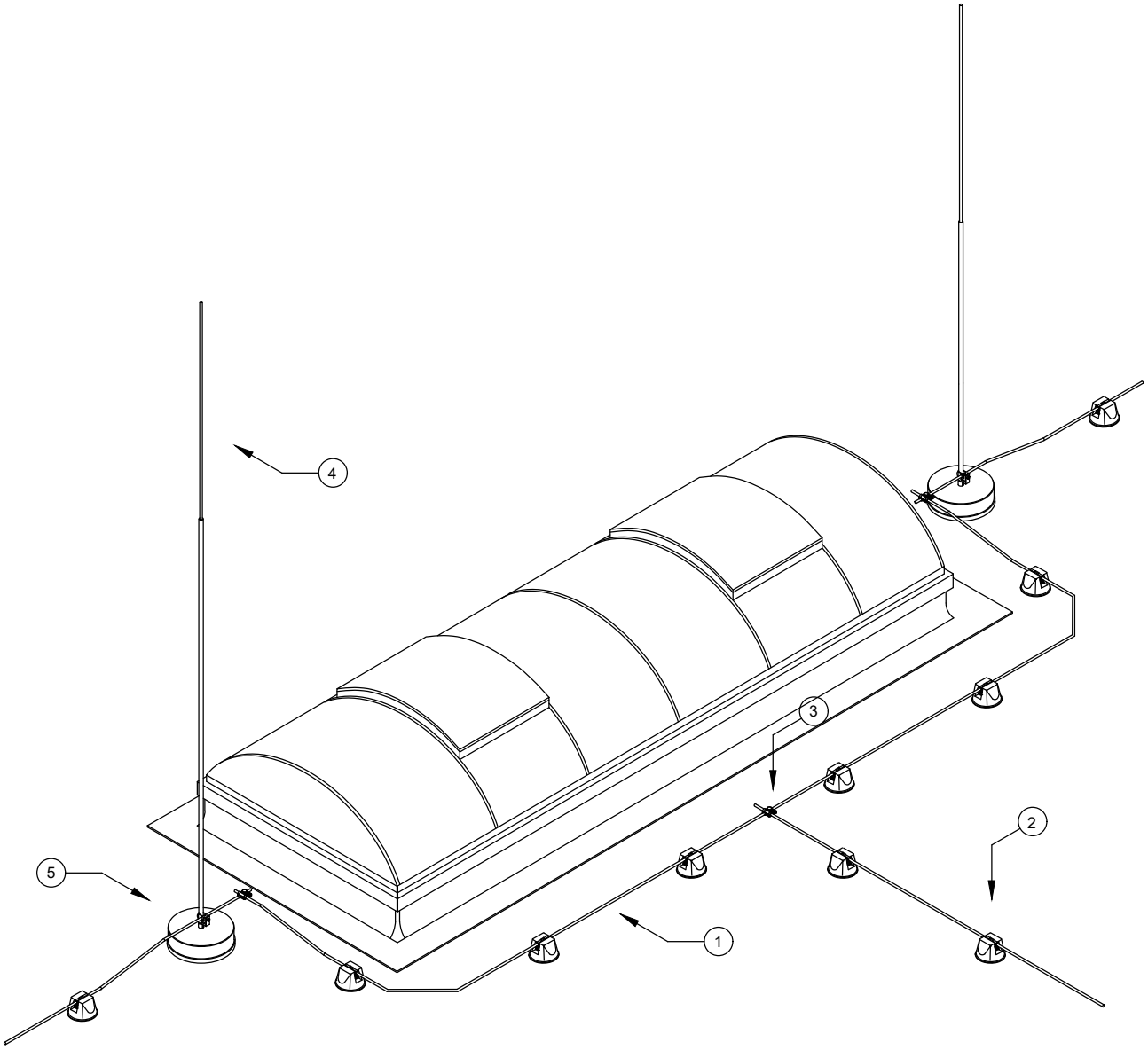
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5401983	101 VL2000	Tapered pipe air-termination rod	
5	5403200	F-FIX-16	Stand for FangFix system 16 kg	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.08	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of a flat roof light dome. Installation of several interception rods.			
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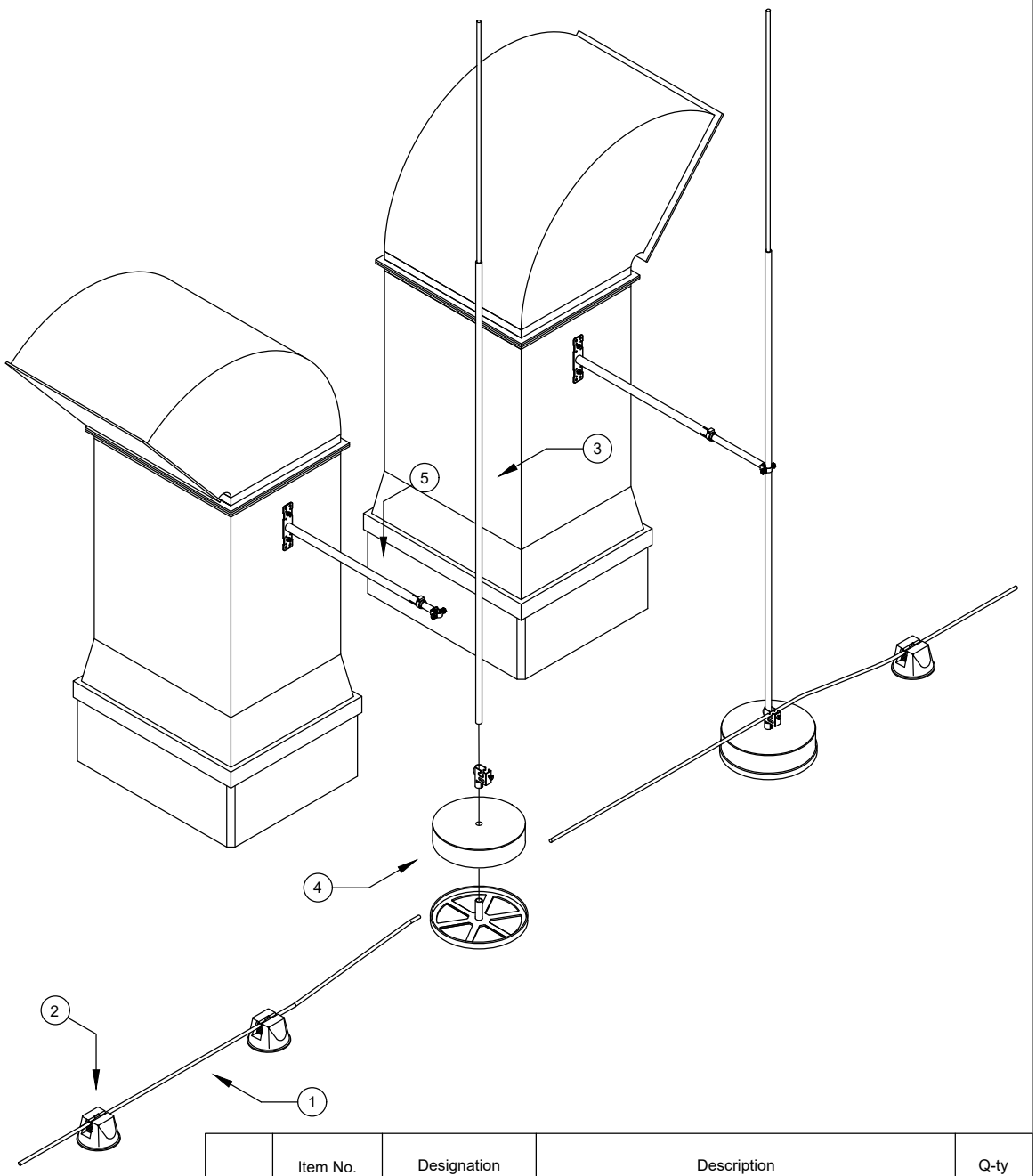
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5401989	101 VL3000	Tapered pipe air-termination rod	
4	5403200	F-FIX-16	Stand for FangFix system 16 kg	
5	5408852	ISAV1000W	Adjustable insulating beam-wall	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.09	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of ventilation pipes. Installation of the interception rods with adjustable spacers.			

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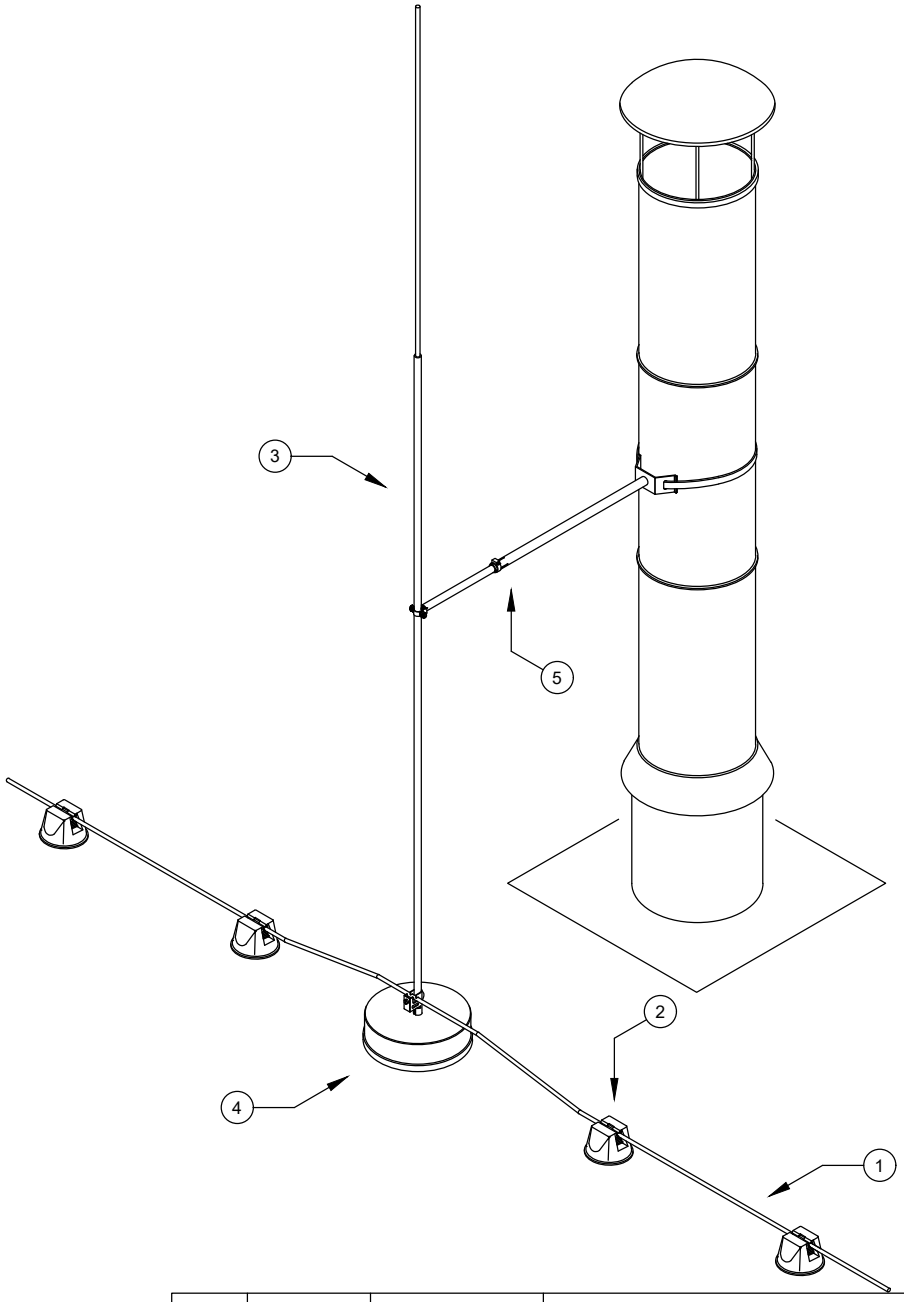
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5401989	101 VL3000	Tapered pipe air-termination rod	
4	5403200	F-FIX-16	Stand for FangFix system 16 kg	
5	5408849	ISAV1000R	Adjustable insulating beam-wall	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.10	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of a chimney. Installation of an interception rod with adjustable spacer.			
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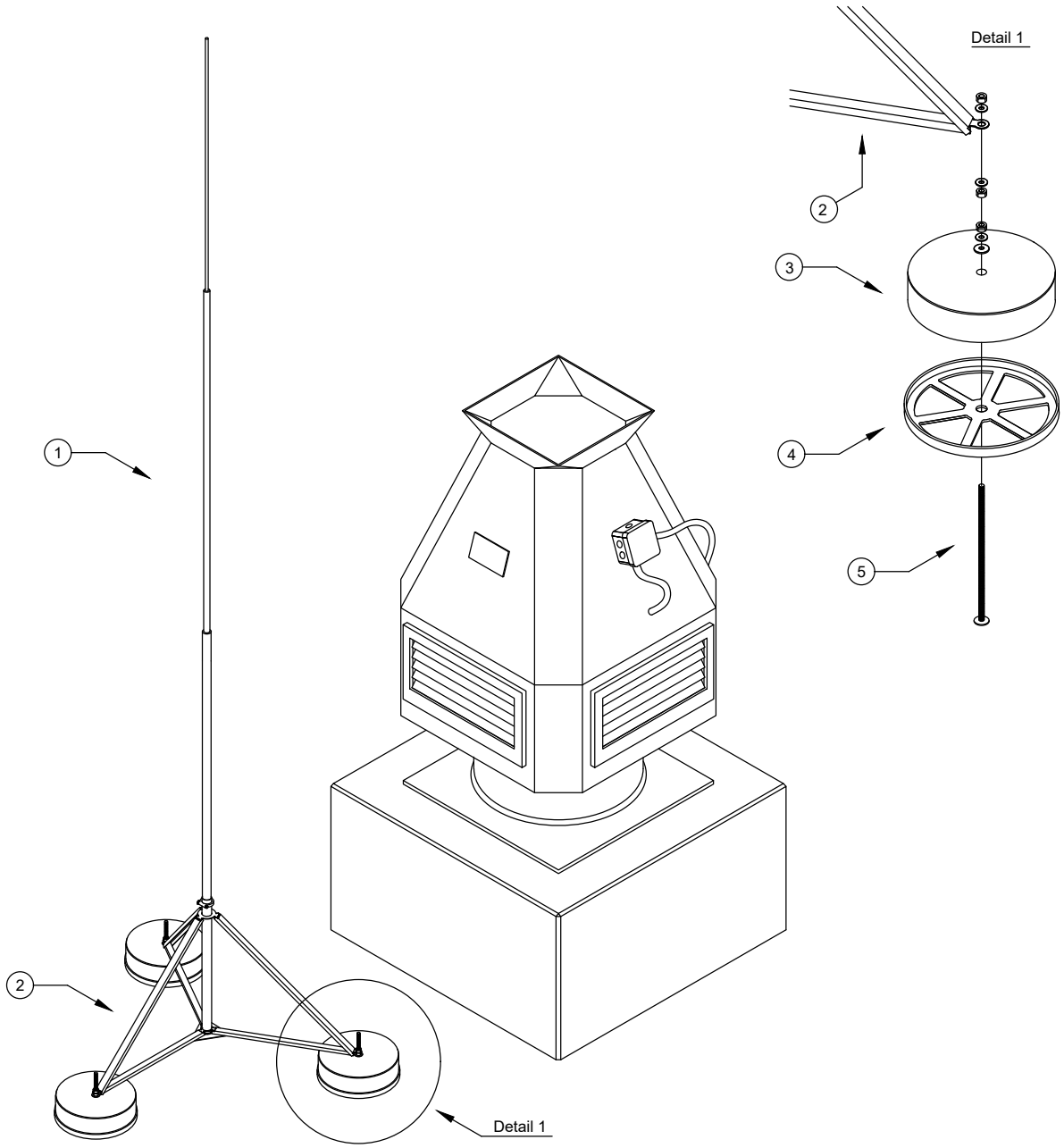
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5402868	101 3B-5000	isFang air-termination rod	
2	5408966	isFang 3B-100 AL	isFang air-termination rod stand	
3	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
4	5403238	F-FIX-B16 3B	Base for FangFix system	
5	5408971	isFang 3B-G1	isFang-3B threaded rod	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.11	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of ventilation system. Installation of an interception rod on an interception rod stand.			
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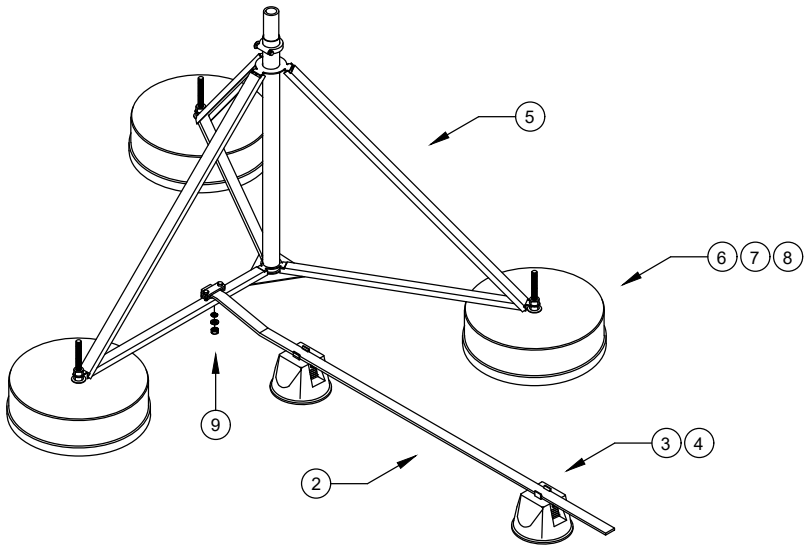
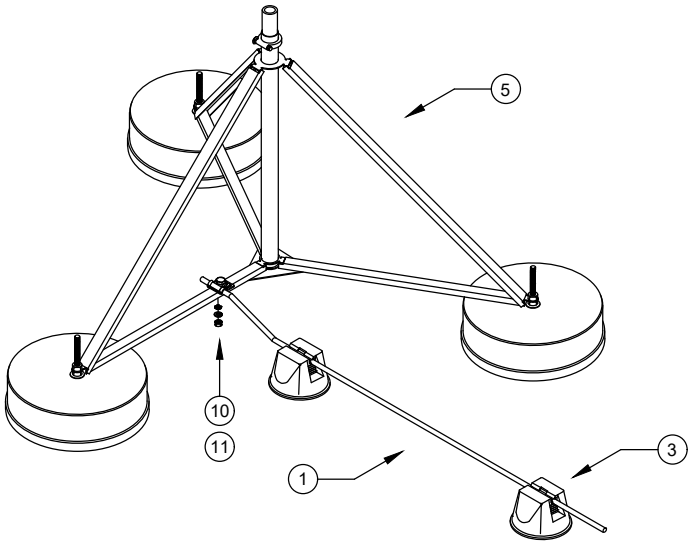
Ind.	Amendment typical	Date:	Name:			





	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
3	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
4	5218885	165 MBG HFL	Flat conductor adapter for roof conductor holder	
5	5408966	isFang 3B-100 AL	isFang air-termination rod stand	
6	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
7	5403238	F-FIX-B16 3B	Base for FangFix system 16 kg	
8	5408971	isFang 3B-G1	isFang-3B threaded rod	
9	5313066	250 A-BO	Diagonal clamp with bolt	
10	5311585	249 8-10 ALU-OT	Connection terminal, equipotential bonding, Rd 8-10	
11	6408516	SKS 10x60 F	Hexagonal bolt with nut and washer M10	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.12	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Ways to connect isFang interception rod stand to various lightning conductors.			
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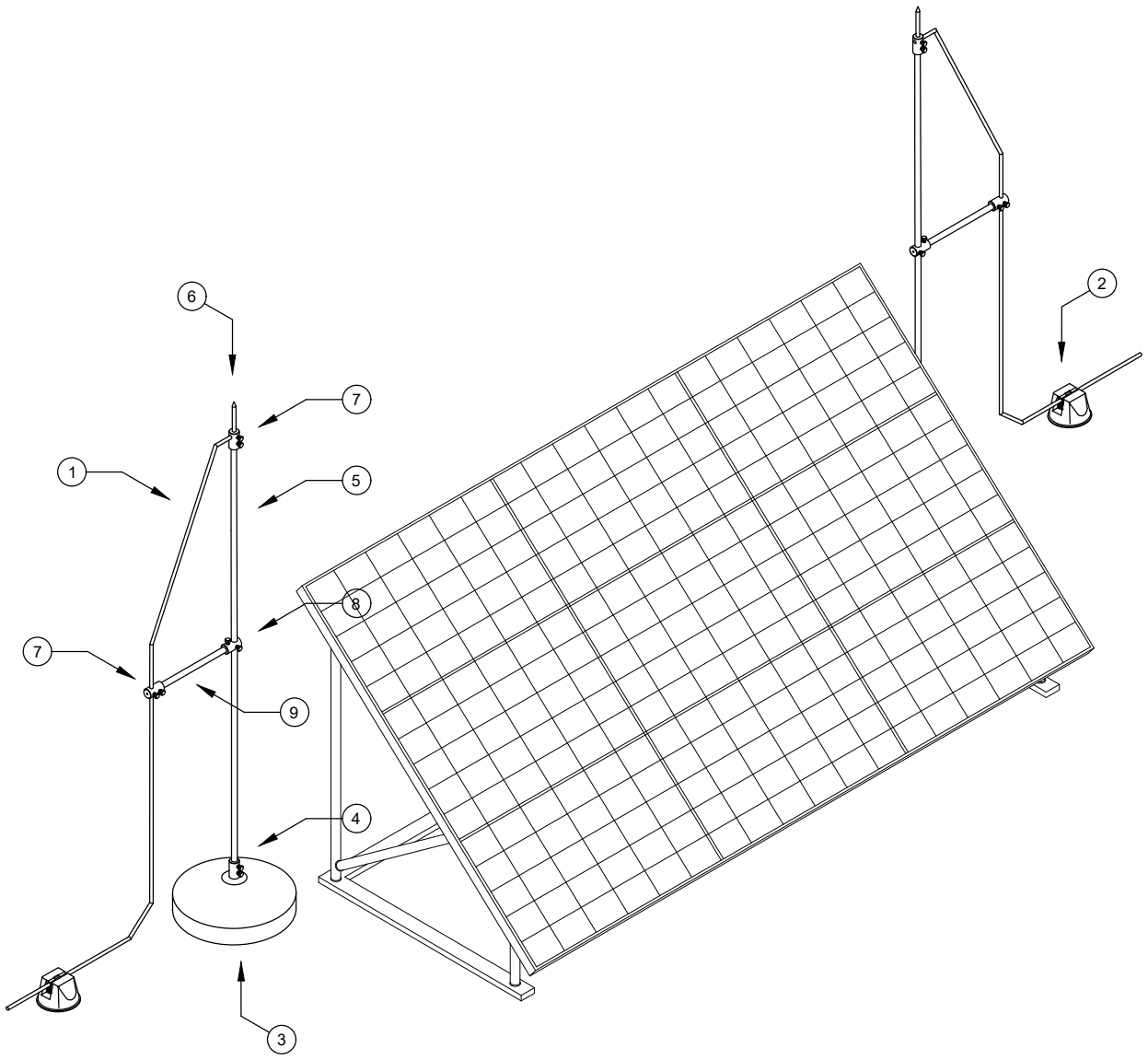
Ind.	Amendment typical		Date:	Name:		

External lightning protection systems for flat roof equipment



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5402958	101 B2-16 M16	Stand 16 kg with female thread	
4	5408350	101 A-M16	Connection piece	
5	5408105	101 20-3000	Insulating rod	
6	5408458	101 ISP M10	Air-termination tip	
7	5408393	101 IES	End piece	
8	5408156	101 IT	T connector	
9	5408107	16-750	Insulating rod	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.13	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection for photovoltaic system. Installation of an insulated protection system.			

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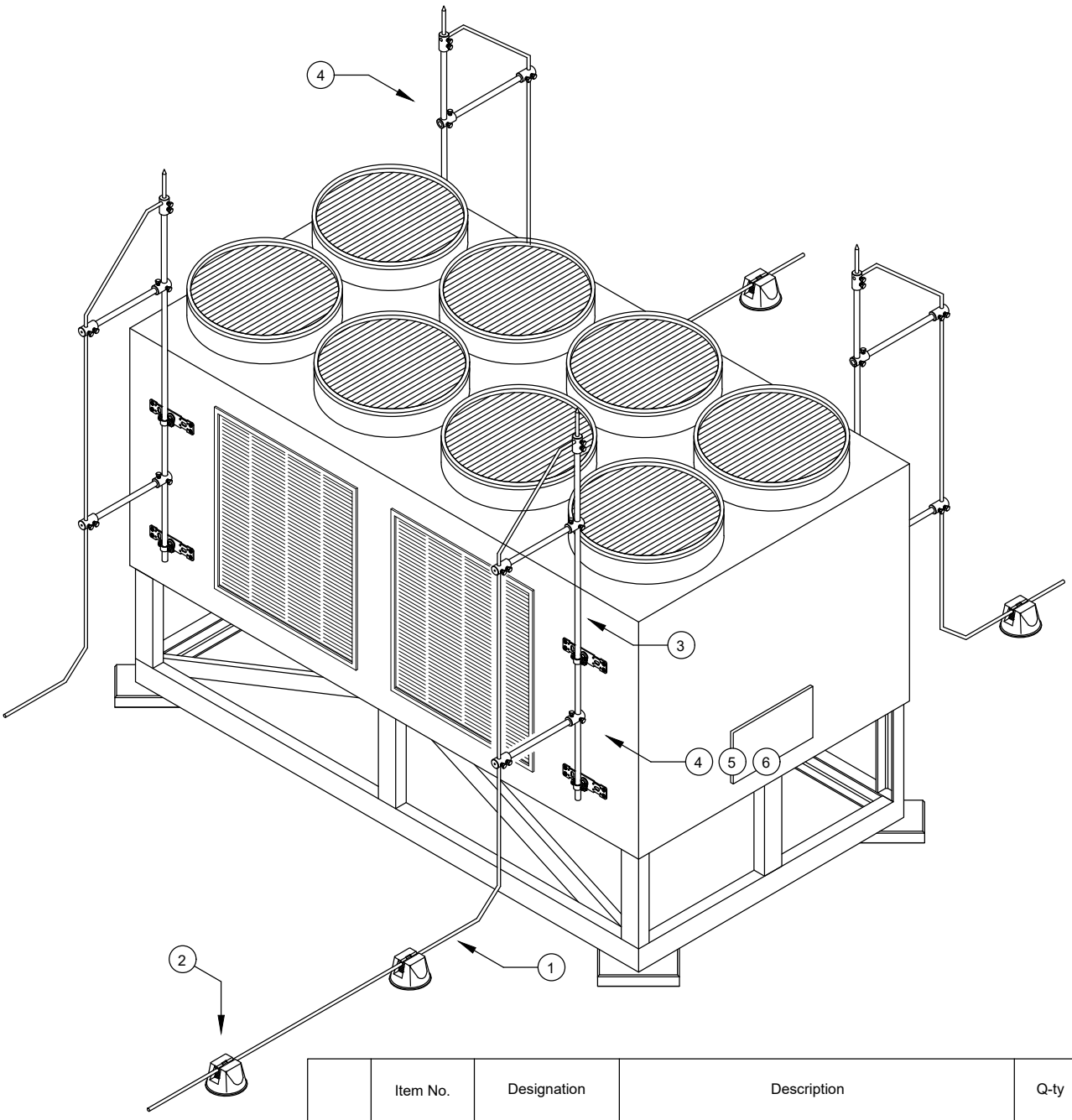
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5408976	101 3-ES-16	Insulated lightning protection set, 3-corner fastening	
4	5408158	101 IT-16	T connector	
5	5408107	101 16-750	Insulating rod	
6	5408395	101 IES-16	End piece	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.14	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of chiller system. Installation of the set of insulated lightning protection.			

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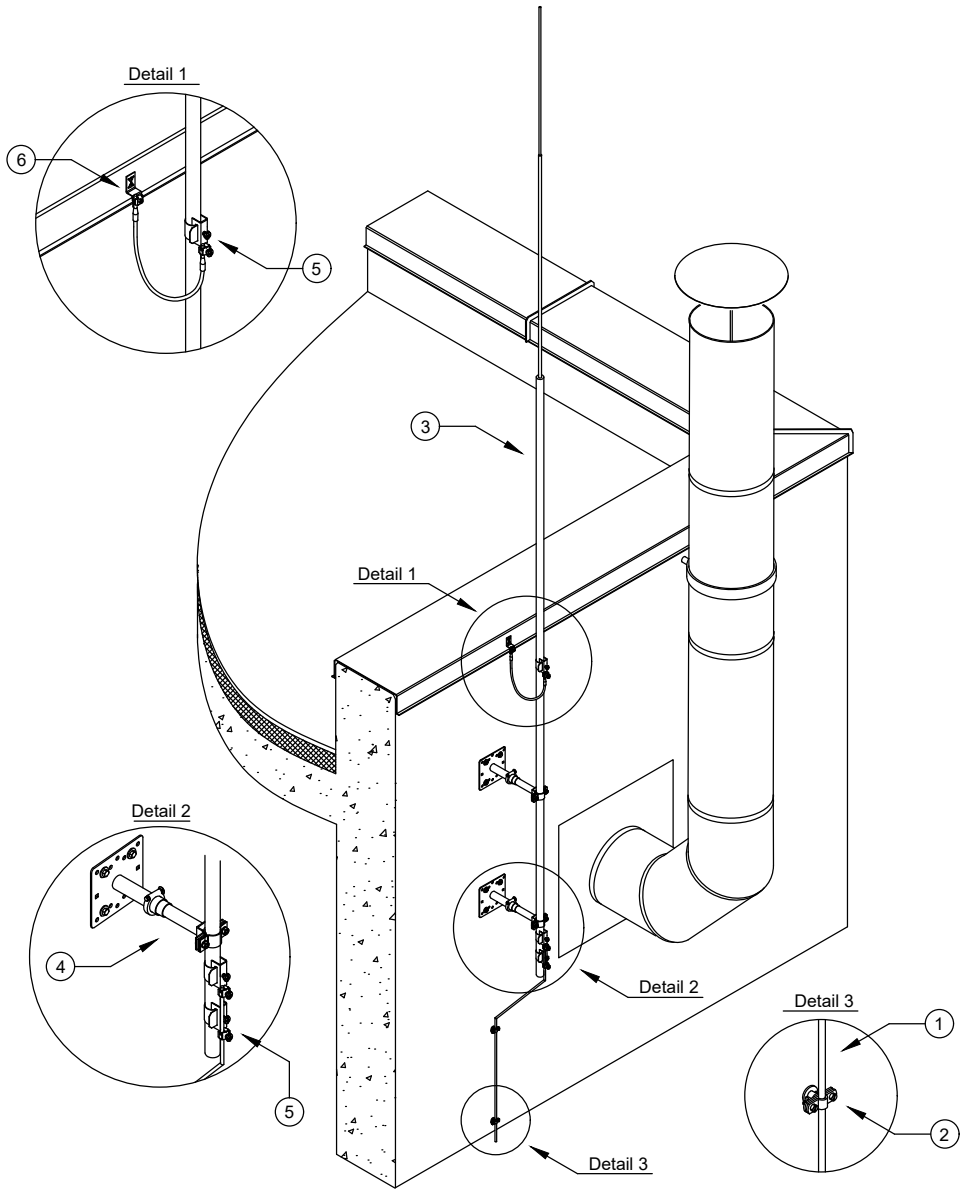
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5230322	113 B-Z-HD	Cable bracket with crossbar, wood screw, plastic anchor	
3	5402864	101 3B-4000	isFang air-termination rod	
4	5408954	isFang TW200	isFang support for wall mounting	
5	5057515	927 1	Earthisng pipe clamp VA	
6	5320707	287 DCT	Connection component with double crossbar	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.15	Project No.:	
	Date:	Name:	Description: The external lightning protection system for flat roof equipment				
Creator:							
Editor:							
Status:			Comment: Lightning protection of a chimney. Installation of an isFang interception rod on the wall of the building.				
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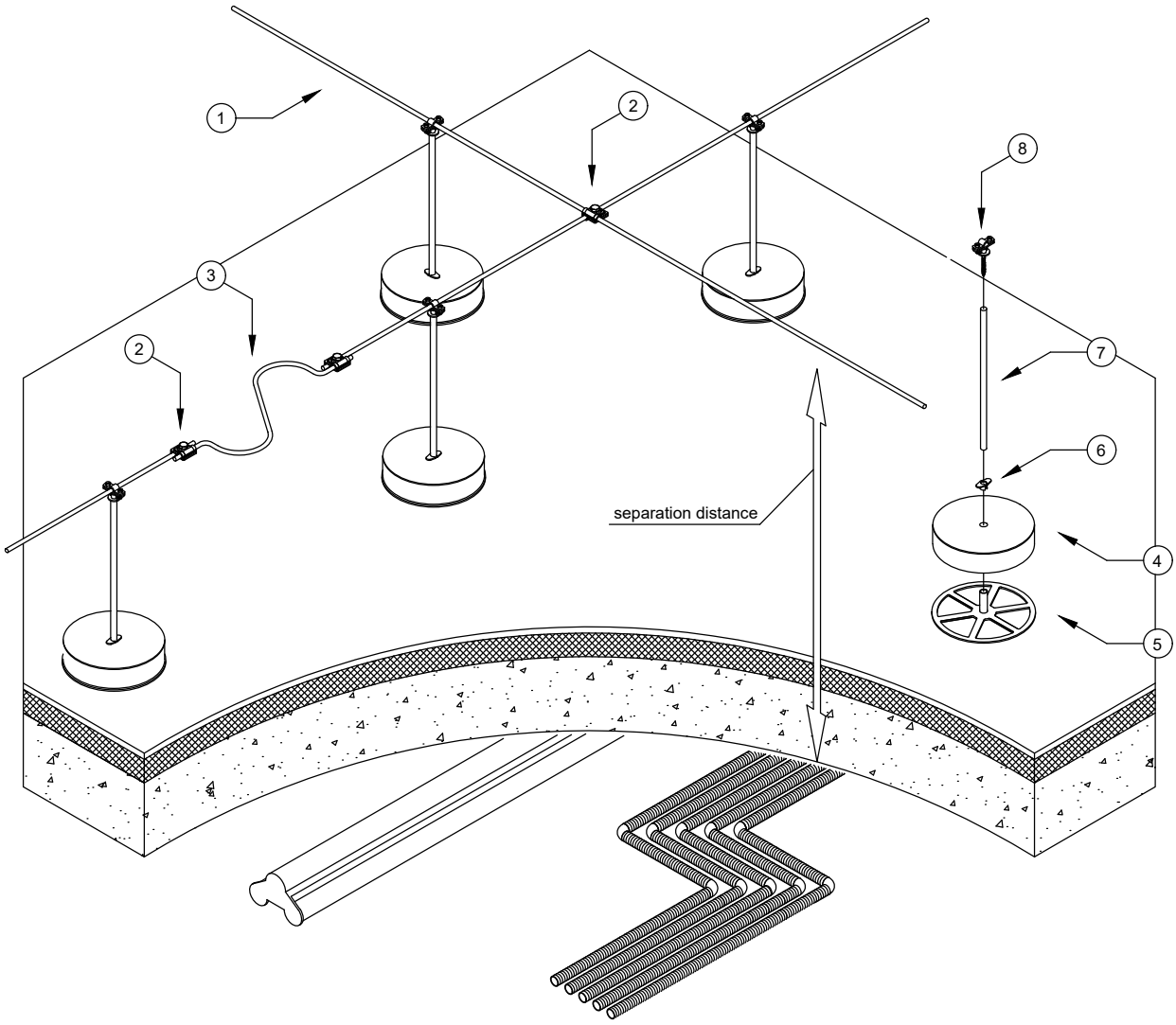
Ind.	Amendment typical		Date:	Name:			

2 External lightning protection systems for flat roof equipment



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5311519	249 8-10 ALU	Vario quick connector	
3	5218926	172 AR	Expansion piece	
4	5403117	F-FIX-S10	Concrete block for FangFix system 10 kg	
5	5403124	F-FIX-S10	Base for FangFix system 10 kg	
6	5408101	101 RH-16	FangFix reducing sleeve	
7	5408107	101 16-750	Insulating rod	
8	5229960	113 Z8-10	Cable bracket	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.16	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Installation of a lightning mesh grid on the roof surface observing the separation distance.			

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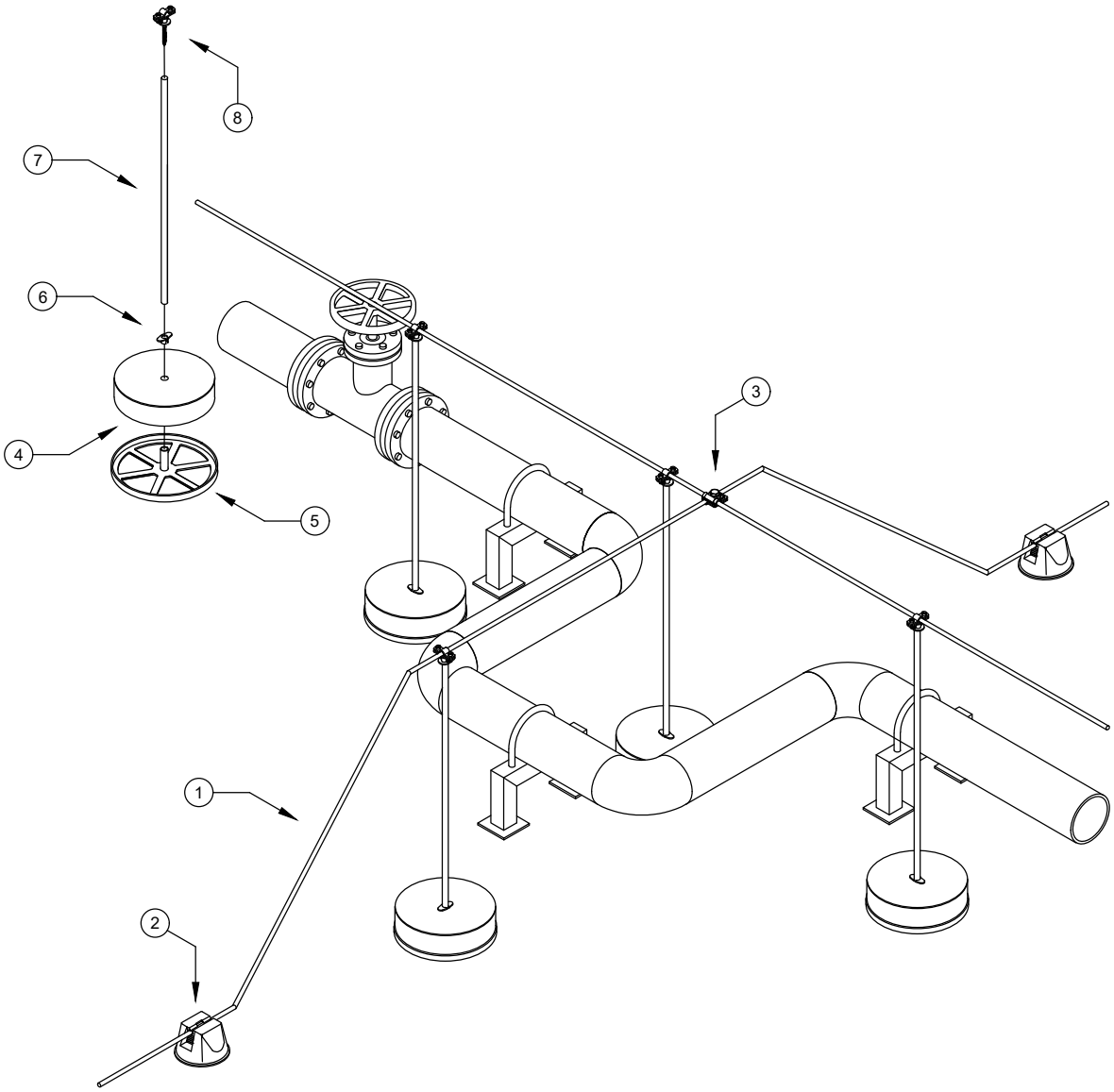
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5403117	F-FIX-S10	Concrete block for FangFix system 10 kg	
5	5403124	F-FIX-S10	Base for FangFix system 10 kg	
6	5408101	101 RH-16	FangFix reducing sleeve	
7	5408108	101 16-1500	Insulating rod	
8	5229960	113 Z8-10	Cable bracket	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.17	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of gas pipe on a rooftop. Installation of the lightning mesh grid on the roof surface observing the separation distance.			

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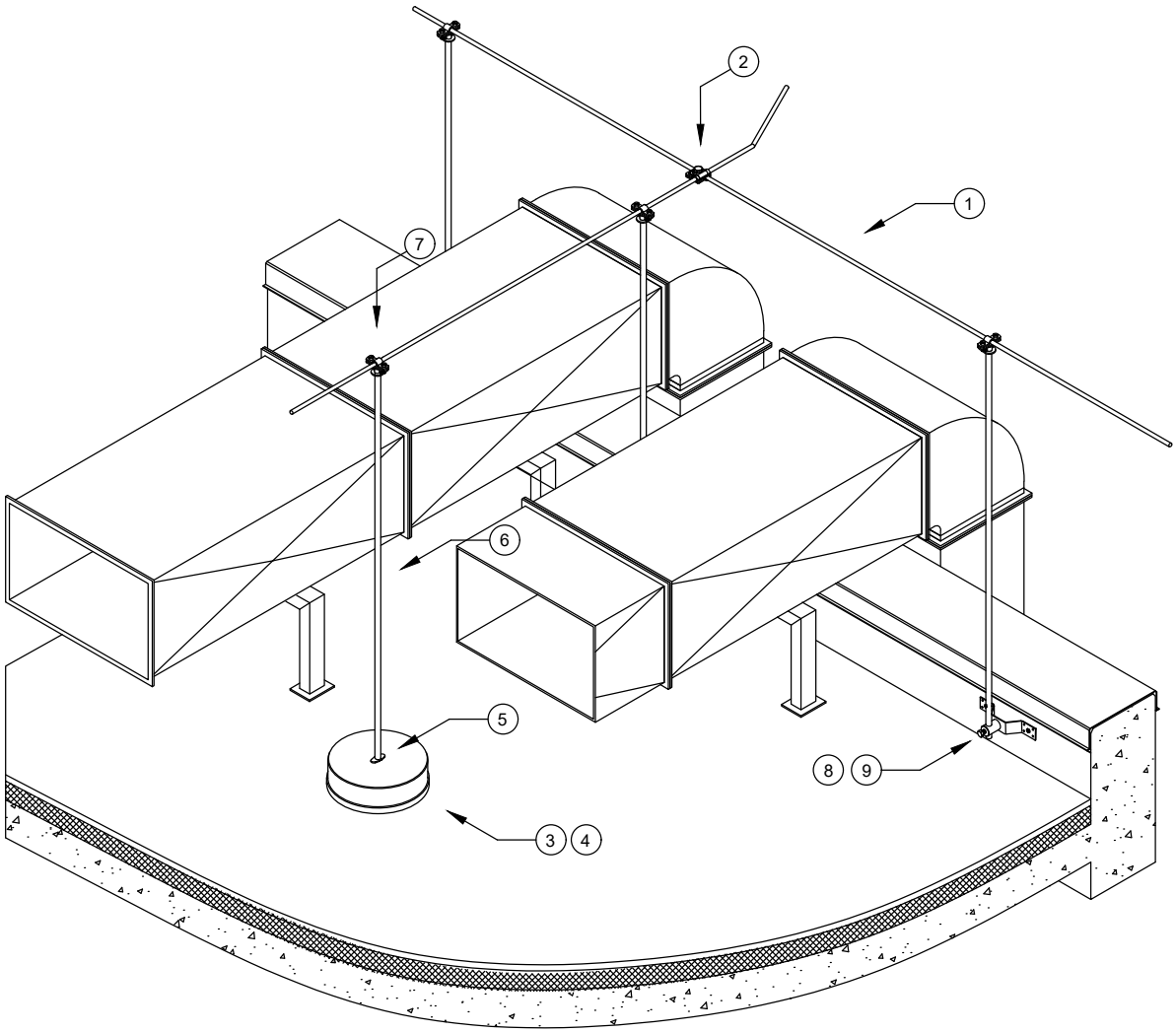
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5311519	249 8-10 ALU	Vario quick connector	
3	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
4	5403235	F-FIX-B16	Base for FangFix system 16 kg	
5	5408101	101 RH-16	FangFix reducing sleeve	
6	5408108	101 16-1500	Insulating rod	
7	5229960	113 Z8-10	Cable bracket	
8	5320712	288 DIN	Bridging cable	
9	5408988	101 BB-16	Fastening bolts	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.18	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of ventilation duct on a rooftop. Installation of the lightning mesh grid on insulated rods.			

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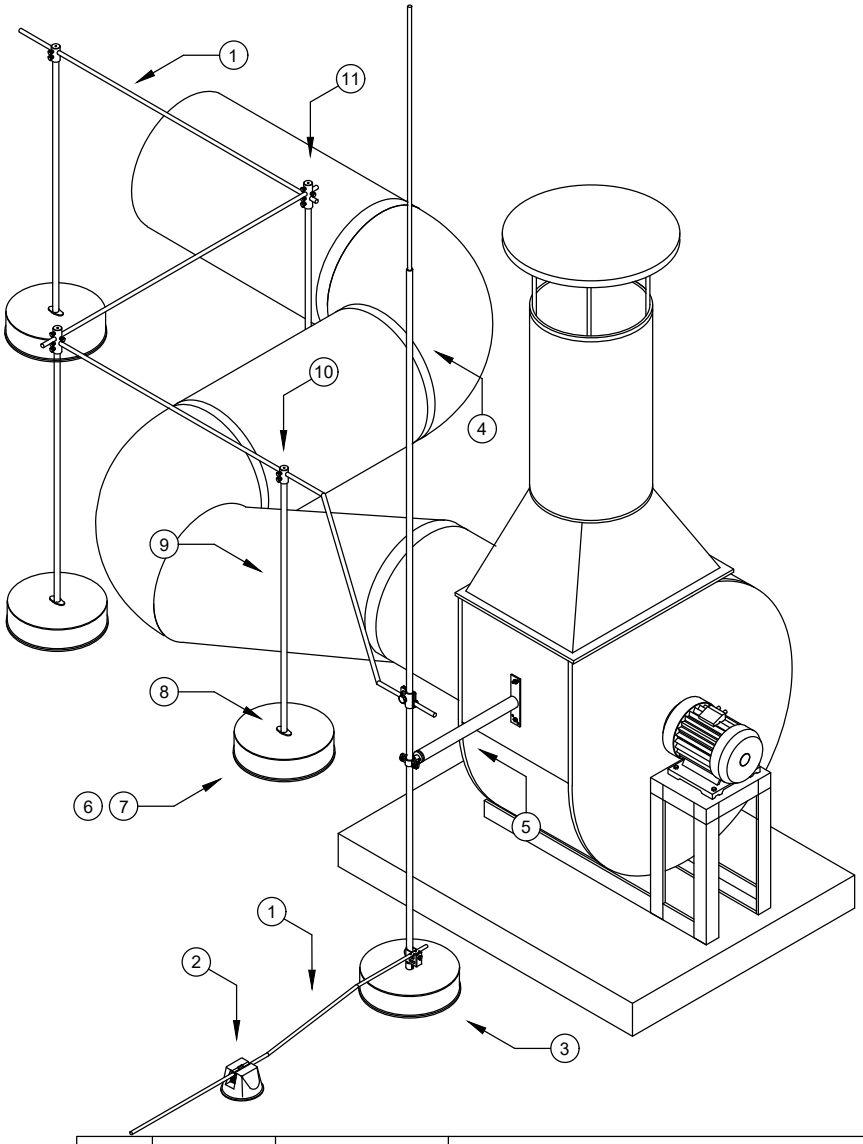
2 External lightning protection systems for flat roof equipment



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5403200	F-FIX-16	Stand for FangFix system 16 kg	
4	5401993	101 VL3500	Tapered pipe air-termination rod	
5	5408806	ISO-A-500	Insulated spacer	
6	5403117	F-FIX-S10	Concrete block for Fangix system 10 kg	
7	5403124	F-FIX-B10	Base for FangFix system 10 kg	
8	5408101	101 RH-16	FangFix reducing sleeve	
9	5408108	101 16-1500	Insulating rod	
10	5408395	101 IES	End piece	
11	5408245	101 IDK	DK connector	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T2.19	Project No.:
	Date:	Name:	Description: The external lightning protection system for flat roof equipment			
Creator:						
Editor:						
Status:			Comment: Lightning protection of ventilation system on the rooftop. Installation of the insulated lightning protection system.			
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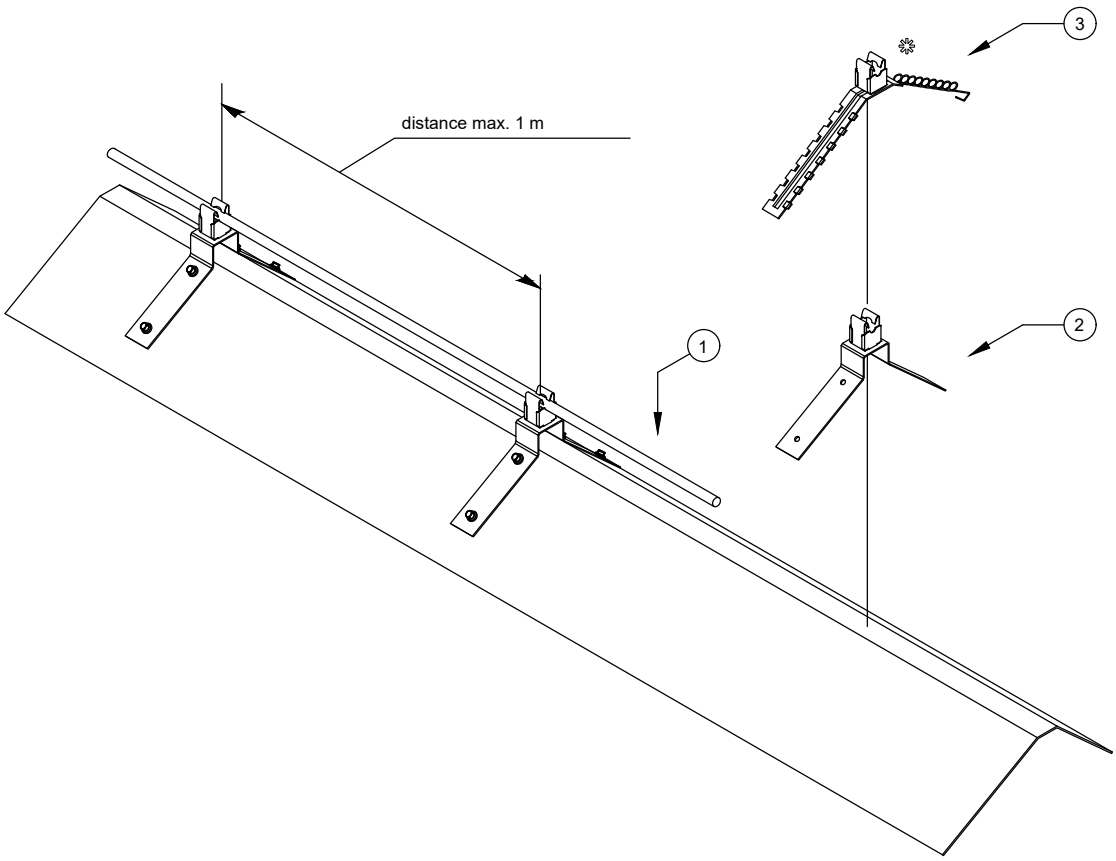
Ind.	Amendment typical		Date:	Name:		

Notes



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202510	132 P VA	Roof conductor holder for ridge tiles	
3*	5203015	132 U	Ridge conductor holder with tensioning spring 8 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.01	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing the round conductor on the ridge and hips of the pitched roof ridge. Simple ridge cover.			
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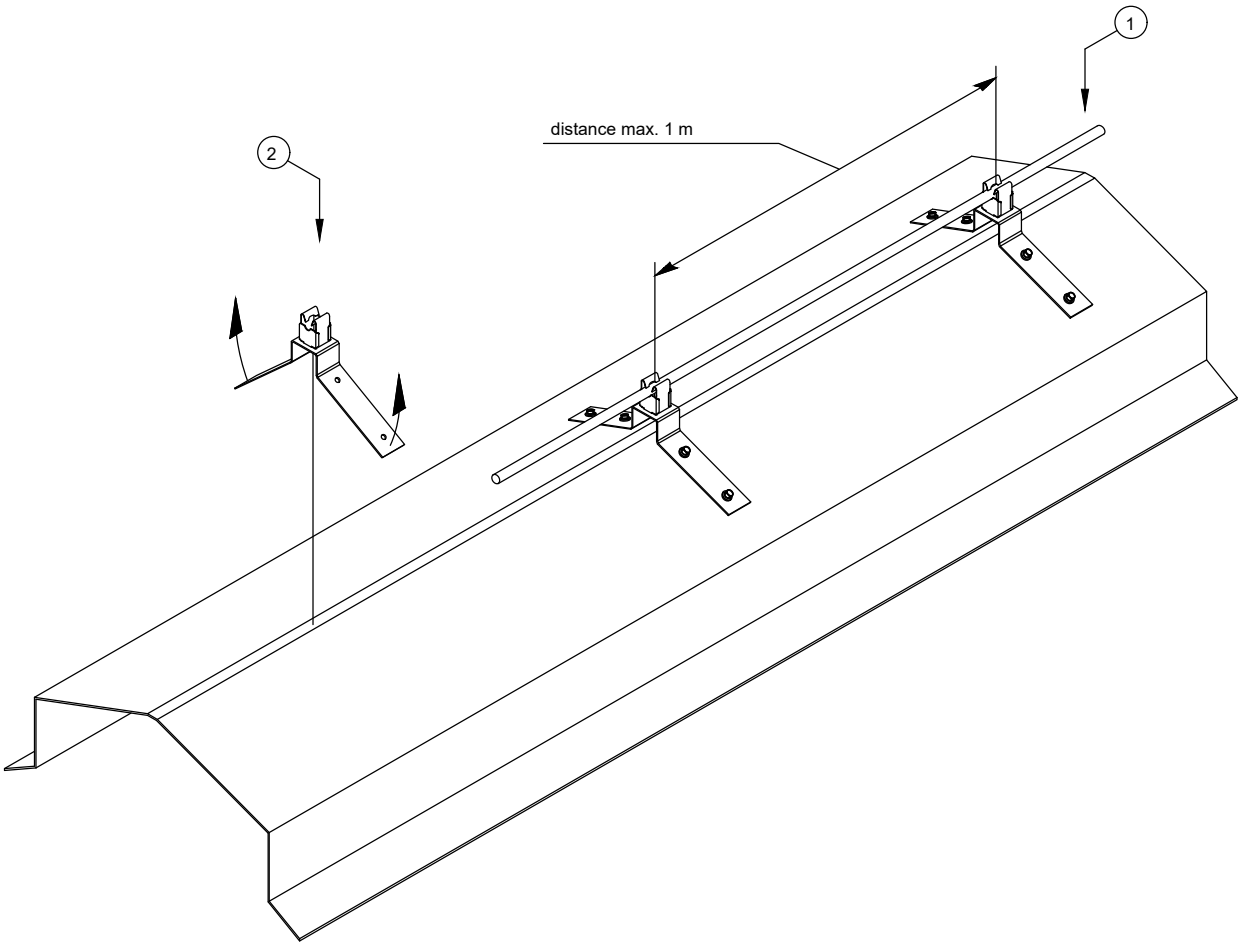
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202510	132 P VA	Roof conductor holder for ridge tiles	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.02	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof ridge. Angle ridge cap.			
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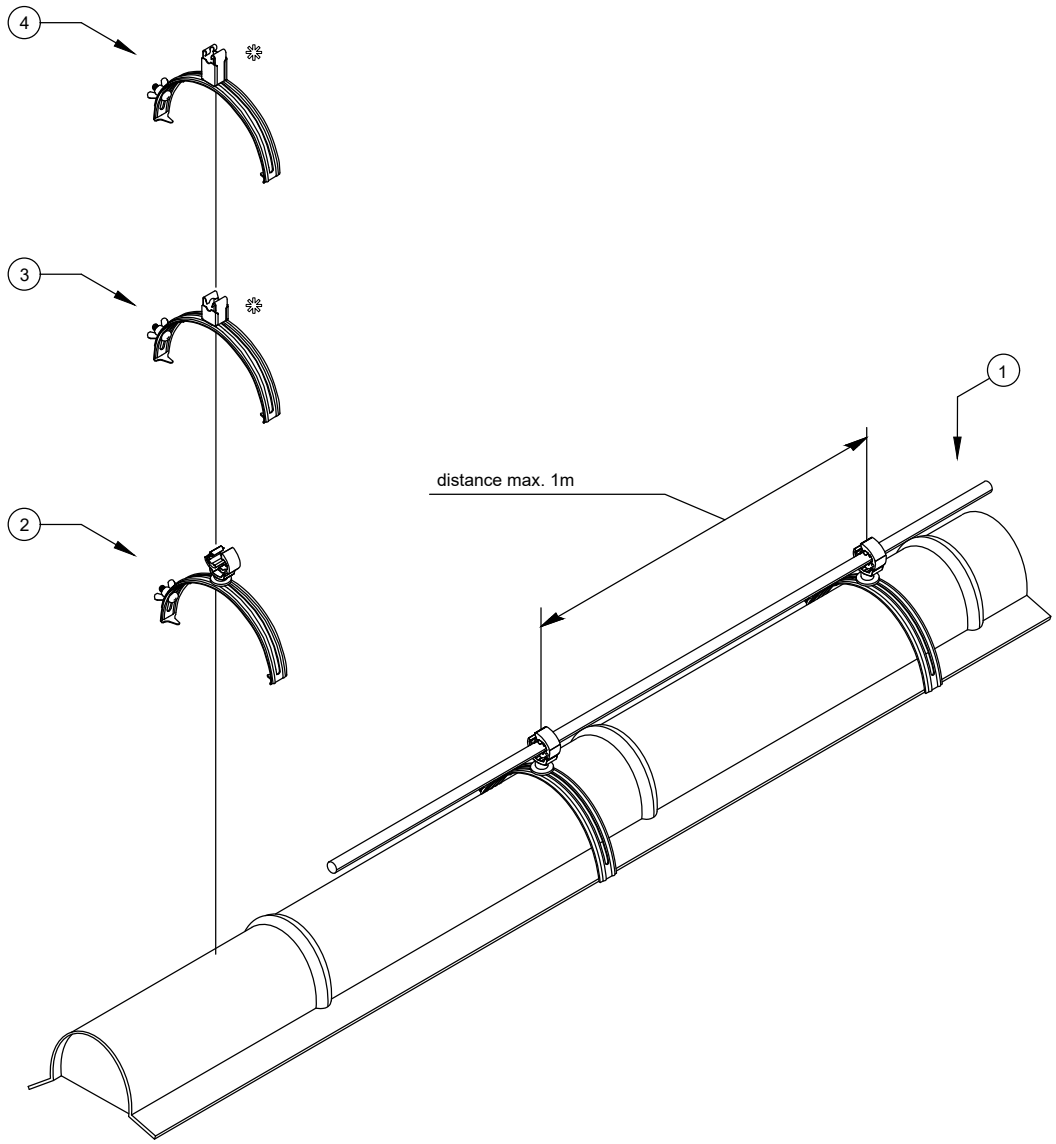

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K VA	Roof conductor holder for ridge tiles	
3*	5202833	132 VA	Roof conductor holder for rodge tiles	
4*	5202836	132 VA 35	Roof conductor holder for ridge tiles	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.03	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof. A tiled ridge			
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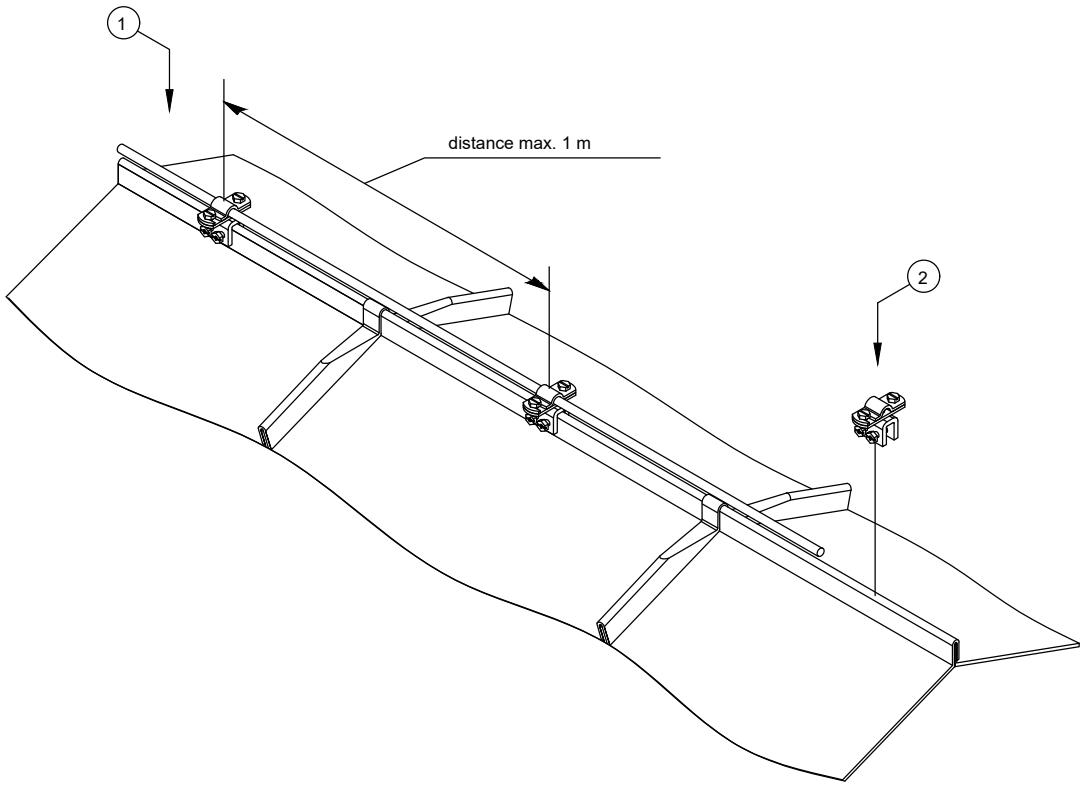
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5317208	270 8-10 VA	Folding clamp Rd 8-10 to 10 mm plate thickness	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.04	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof. A folding ridge.			
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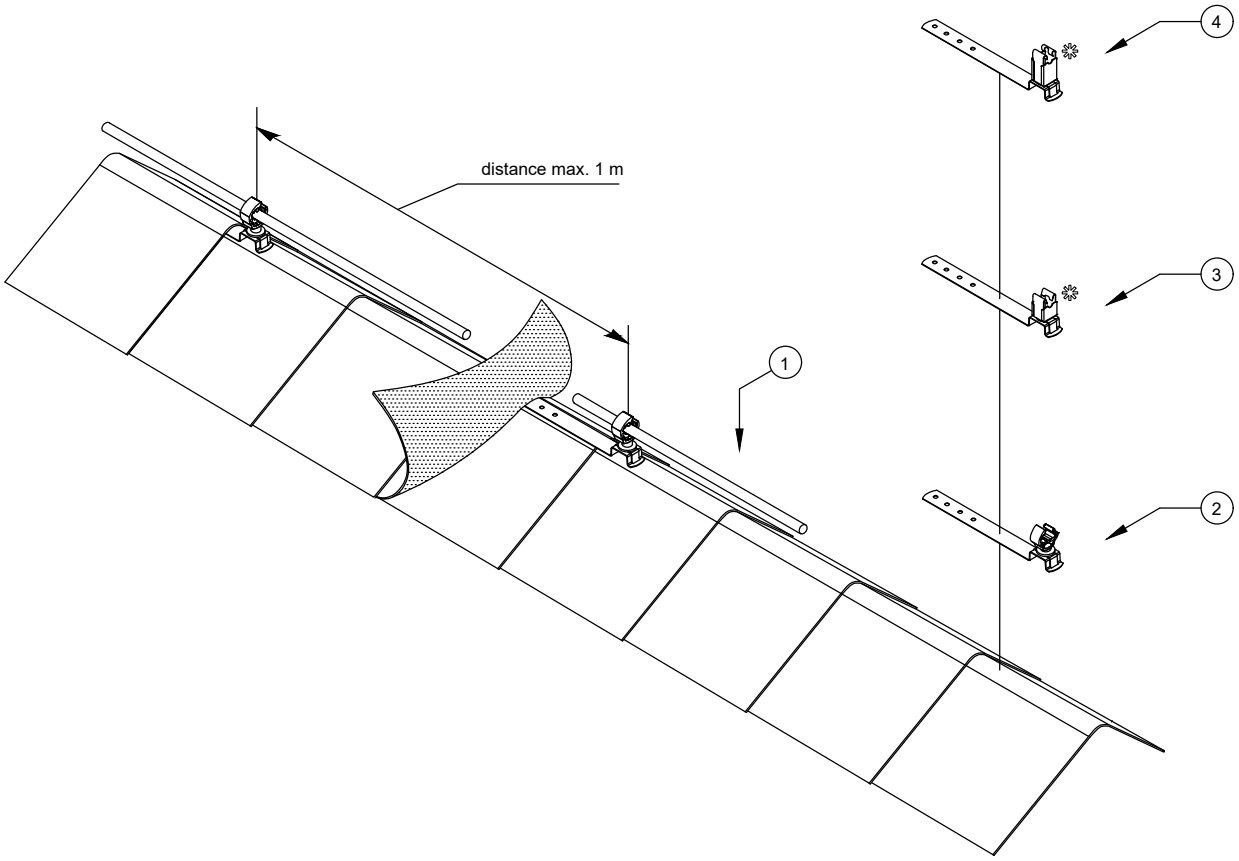
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5215544	157 FK VA 230	Roof conductor holder for tiled roofs	
3*	5215552	157 F VA 230	Roof conductor holder for tiled roofs	
4*	5215555	157 F VA 230 35	Roof conductor holder for tiled roofs	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.05	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof. The soft tiled ridge.			
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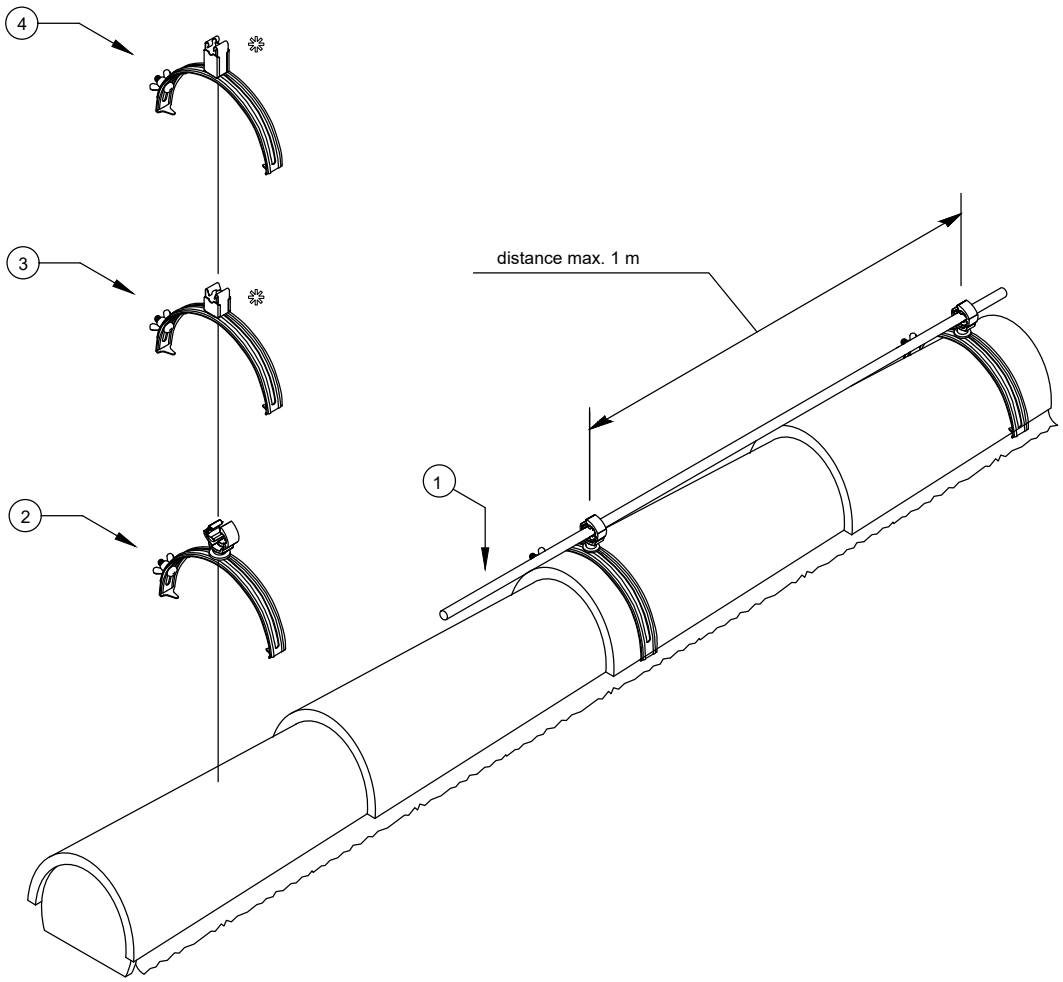
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K VA	Roof conductor holder for ridge tiles	
3*	5202833	132 VA	Roof conductor holder for rodge tiles	
4*	5202836	132 VA 35	Roof conductor holder for ridge tiles	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.06	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof. Ceramic ridge.			
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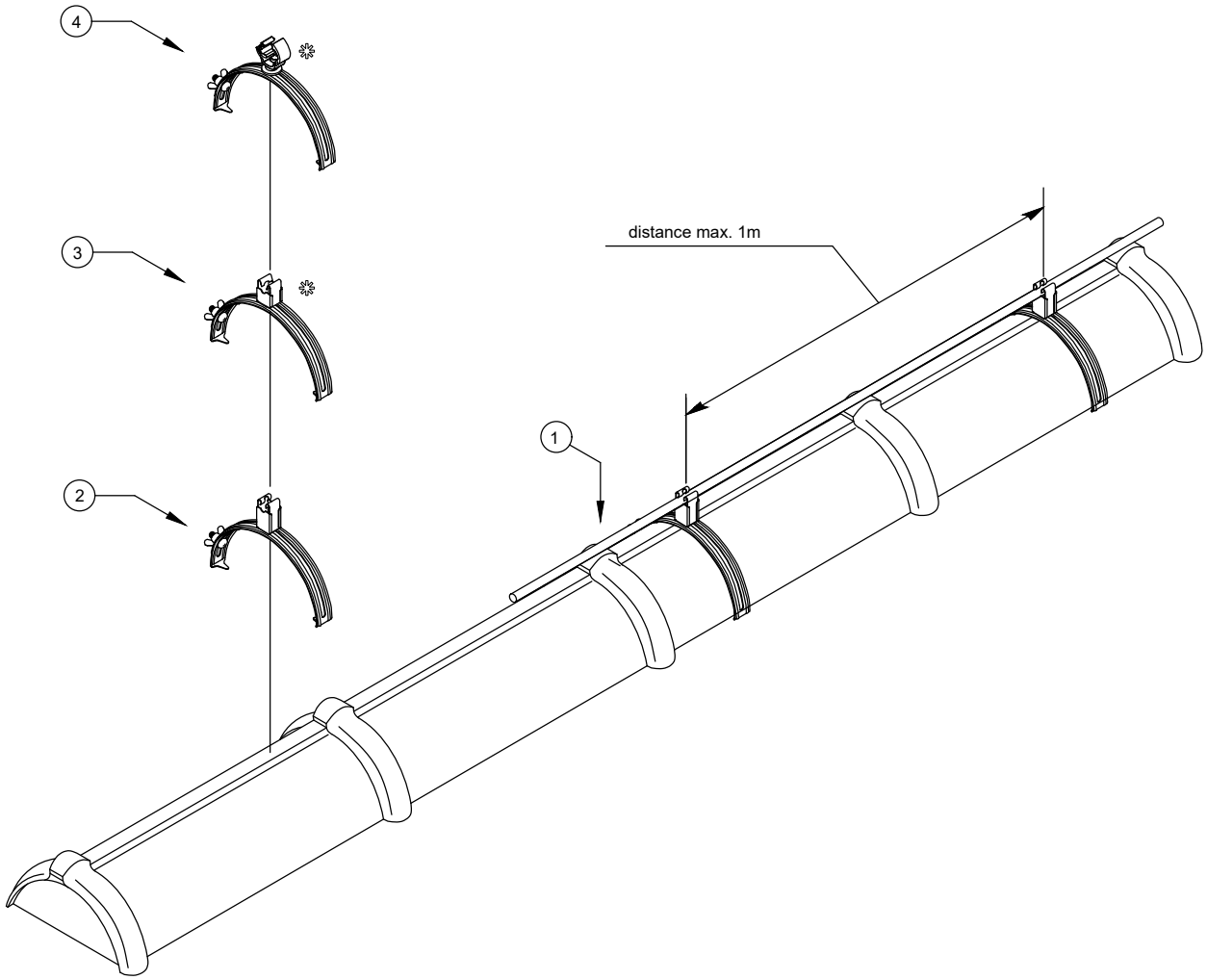
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202836	132 VA 35	Roof conductor holder for ridge tiles	
3*	5202833	132 VA	Roof conductor holder for rodge tiles	
4*	5202515	132 K VA	Roof conductor holder for ridge tiles	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.07	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing a round conductor on the ridge and hips of the pitched roof. The ridge is ceramic.			
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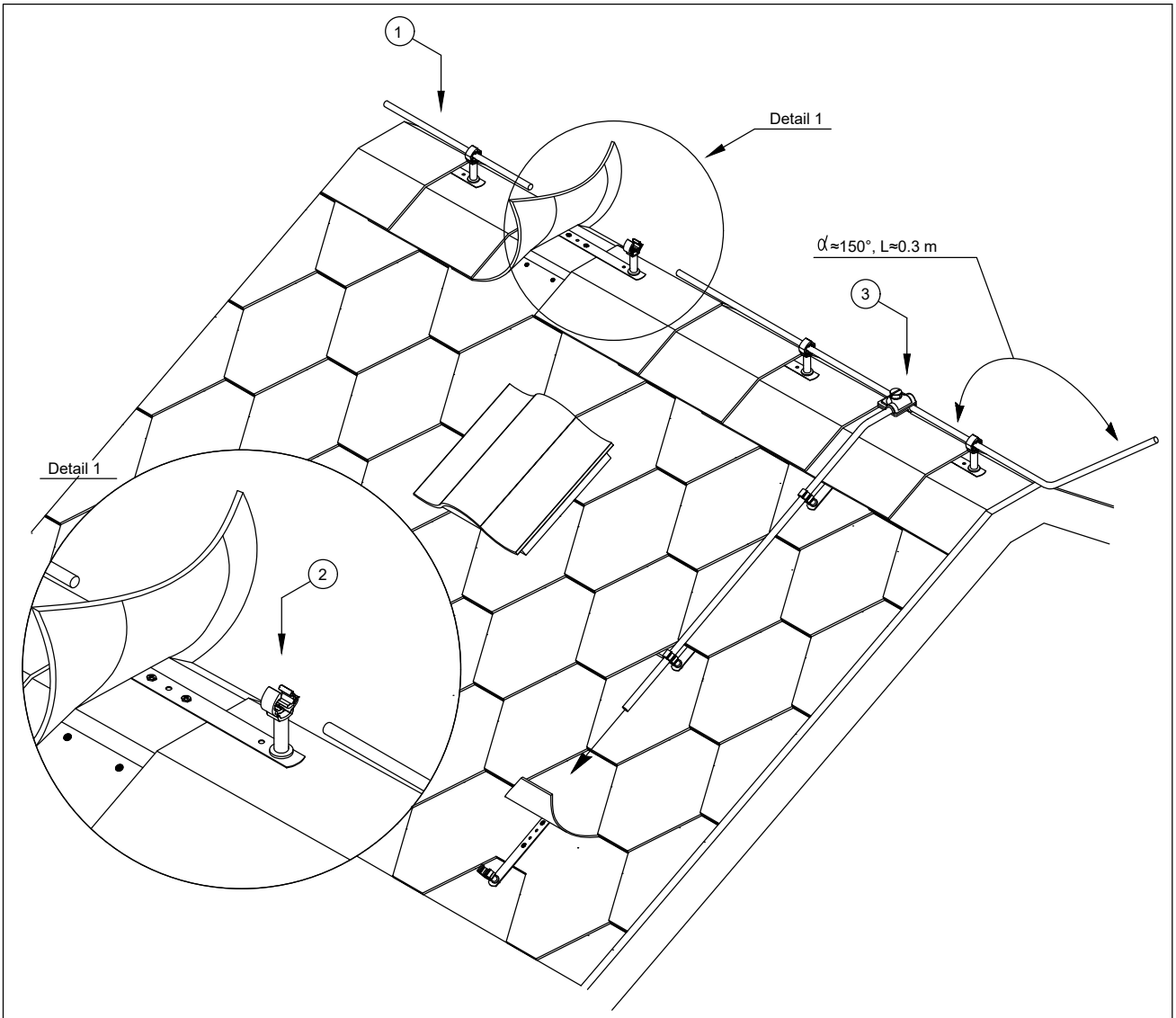
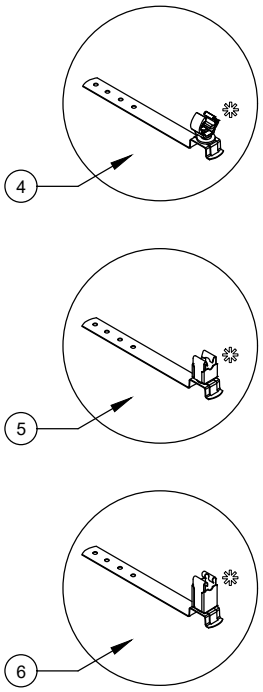
Ind.	Amendment typical	Date:	Name:			



Replacement options:



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5215307	157 ND-VA	Roof conductor holder for tiled and stated roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4*	5215544	157 FK-VA 230	Roof conductor holder for tiled roofs	
5*	5215552	157 F-VA 230	Roof conductor holder for tiled roofs	
6*	5215555	157 F-VA 230 35	Roof conductor holder for tiled roofs	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.08	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Soft shingles.			

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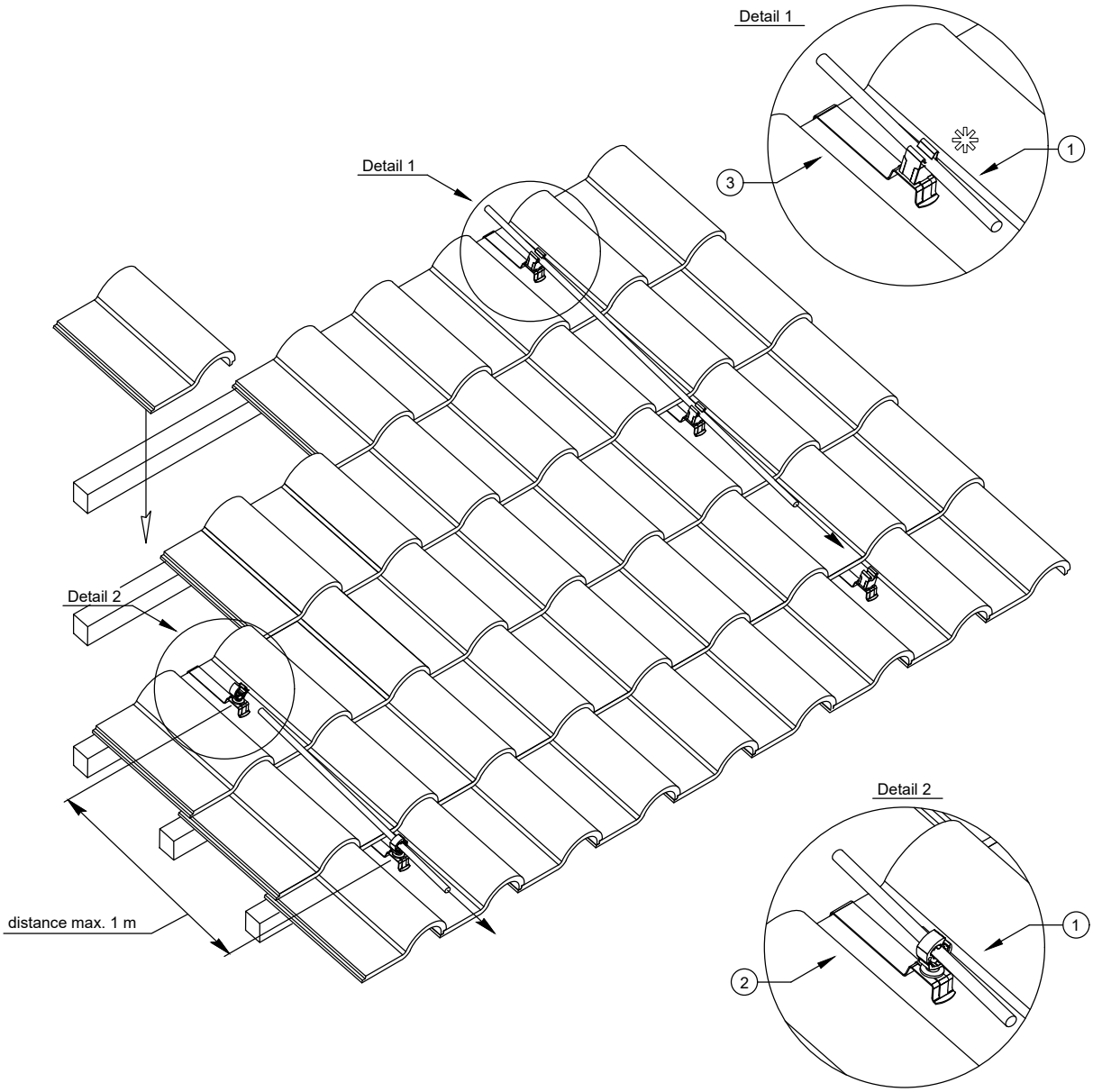
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5215668	157 IK-VA	Roof conductor holder for tiled roofs	
3*	5215625	157 I-VA	Roof conductor holder for tiled roofs	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.09	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Ceramic tiles.			
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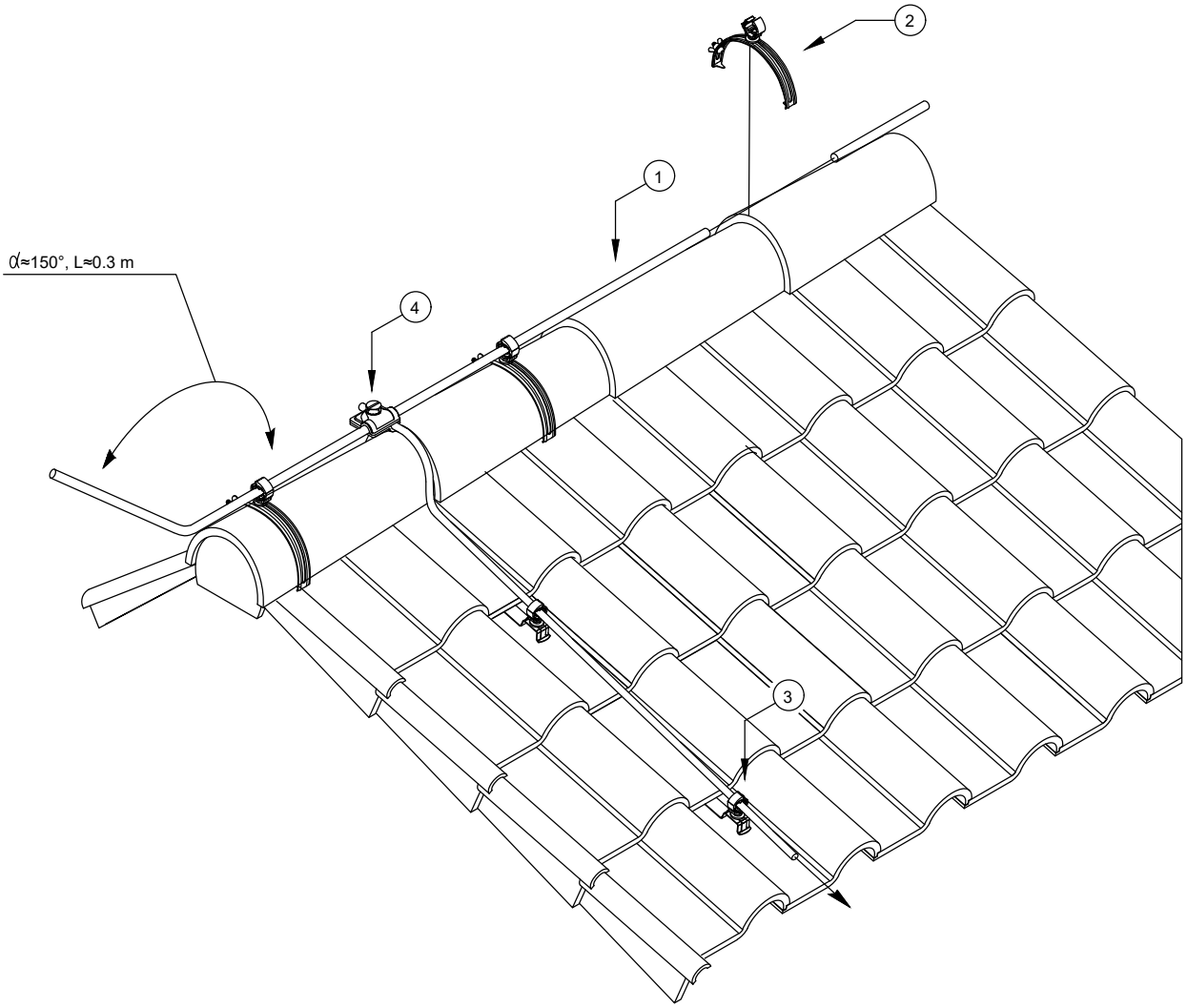
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K-VA	Roof conductor holder for ridge tiles	
3	5215668	157 IK-VA	Roof conductor holder for tiled roofs, angled	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.10	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Ceramic tiles.			
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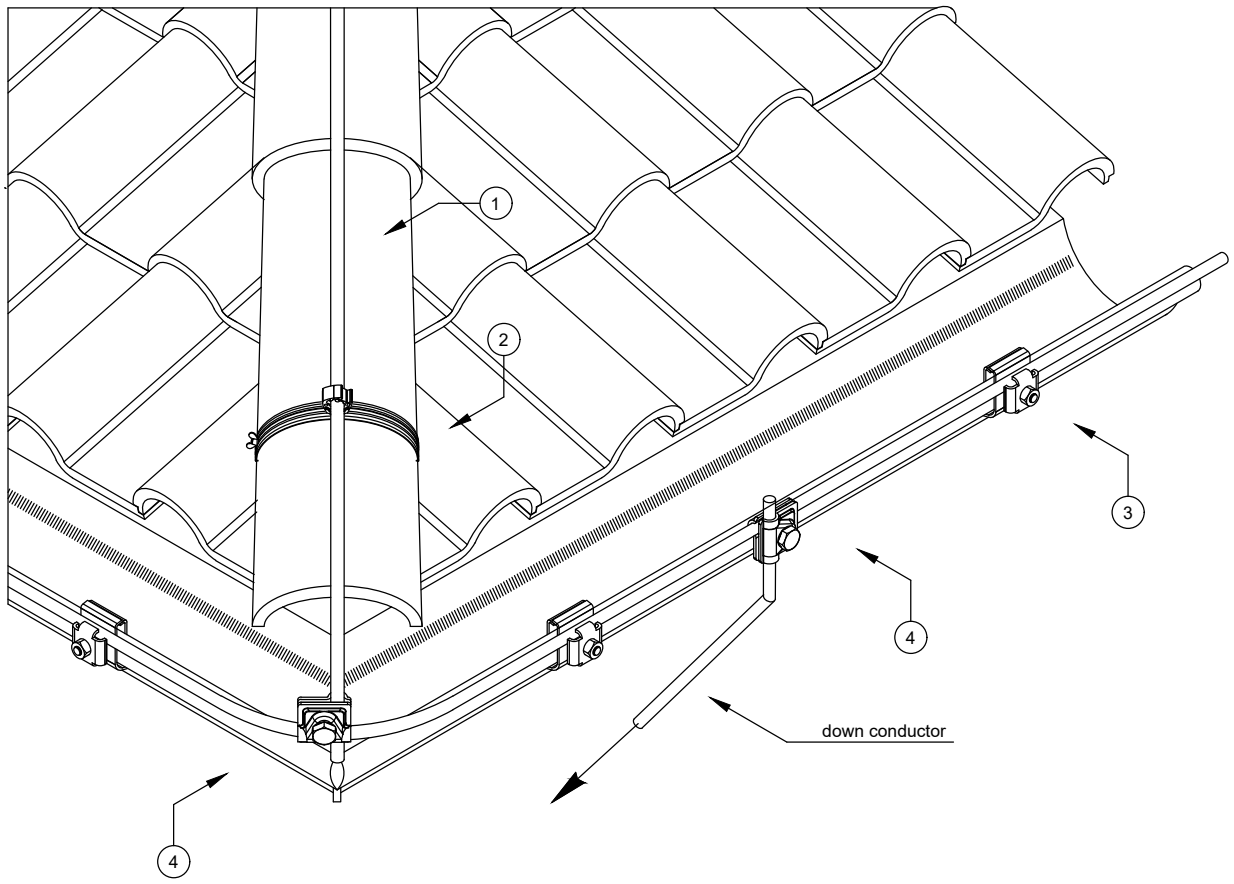
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K-VA	Roof conductor holder for ridge tiles	
3	5316459	RK-FIX VA	Gutter clamp RK-FIX	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.11	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing the round conductor to the gutter.			
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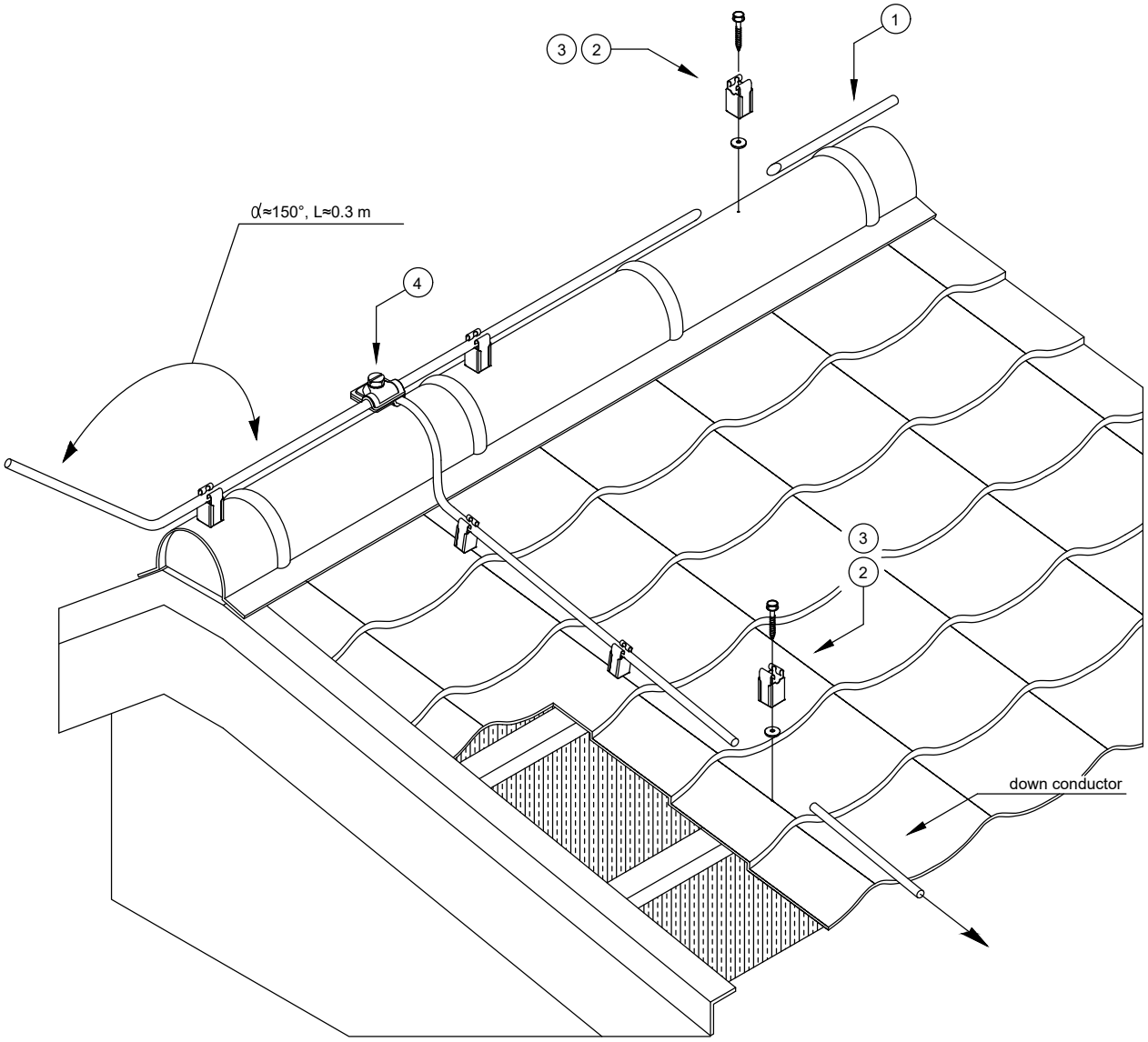
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207342	177 35 VA M6	Screwless cable bracket, raised construction type	
3			Drilling screw with hexagonal head with rubber washer	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.12	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Metal tiles.			
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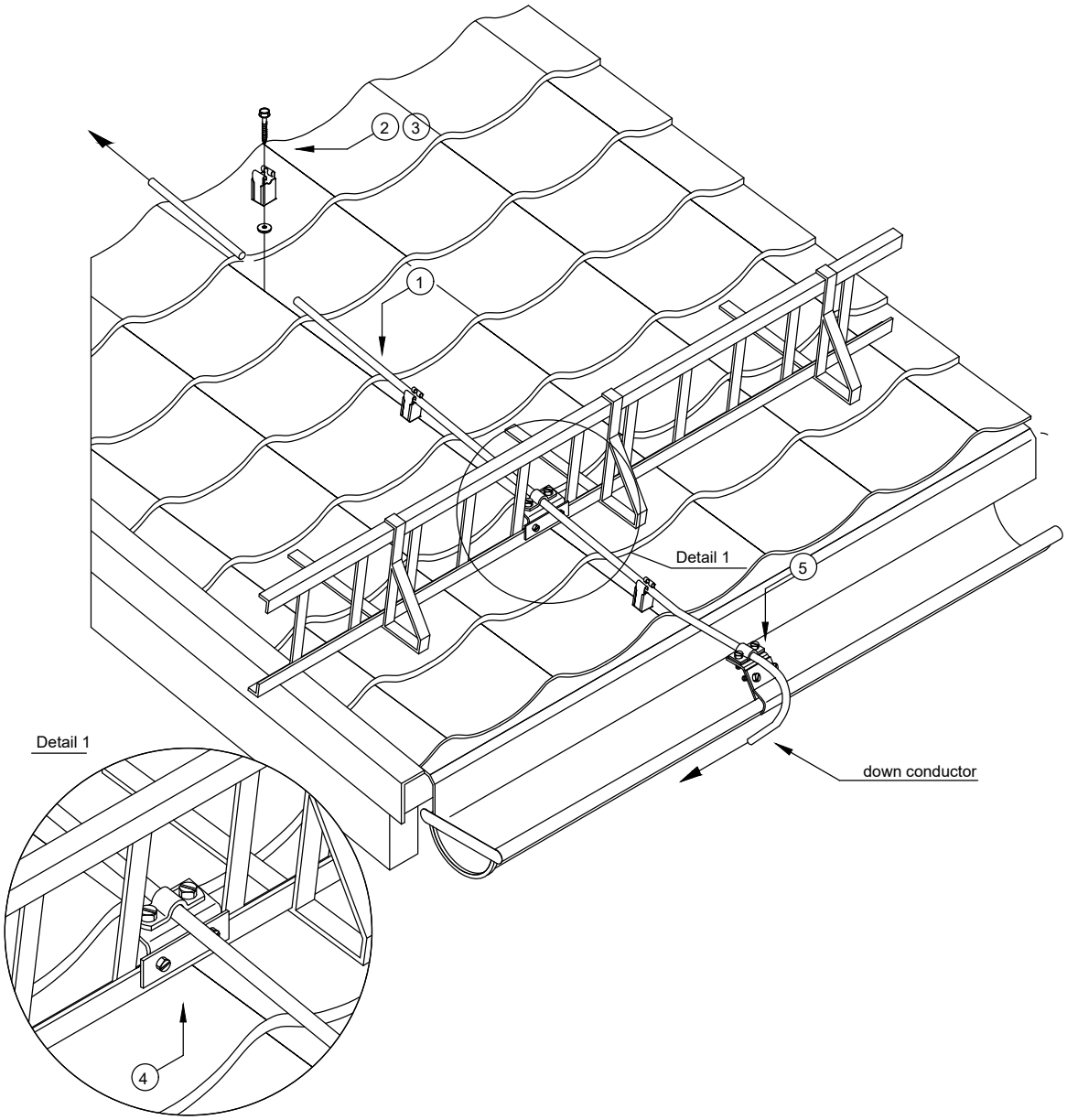
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207342	177 35 VA M6	Screwless cable bracket, raised construction type	
3			Drilling screw with hexagonal head with rubber washer	
4	5316510	264	Snow catching grate clamp	
5	5316014	262	Roof gutter clamp for all bead thicknesses	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.13	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Connection the conductor to the snow holding fence.			
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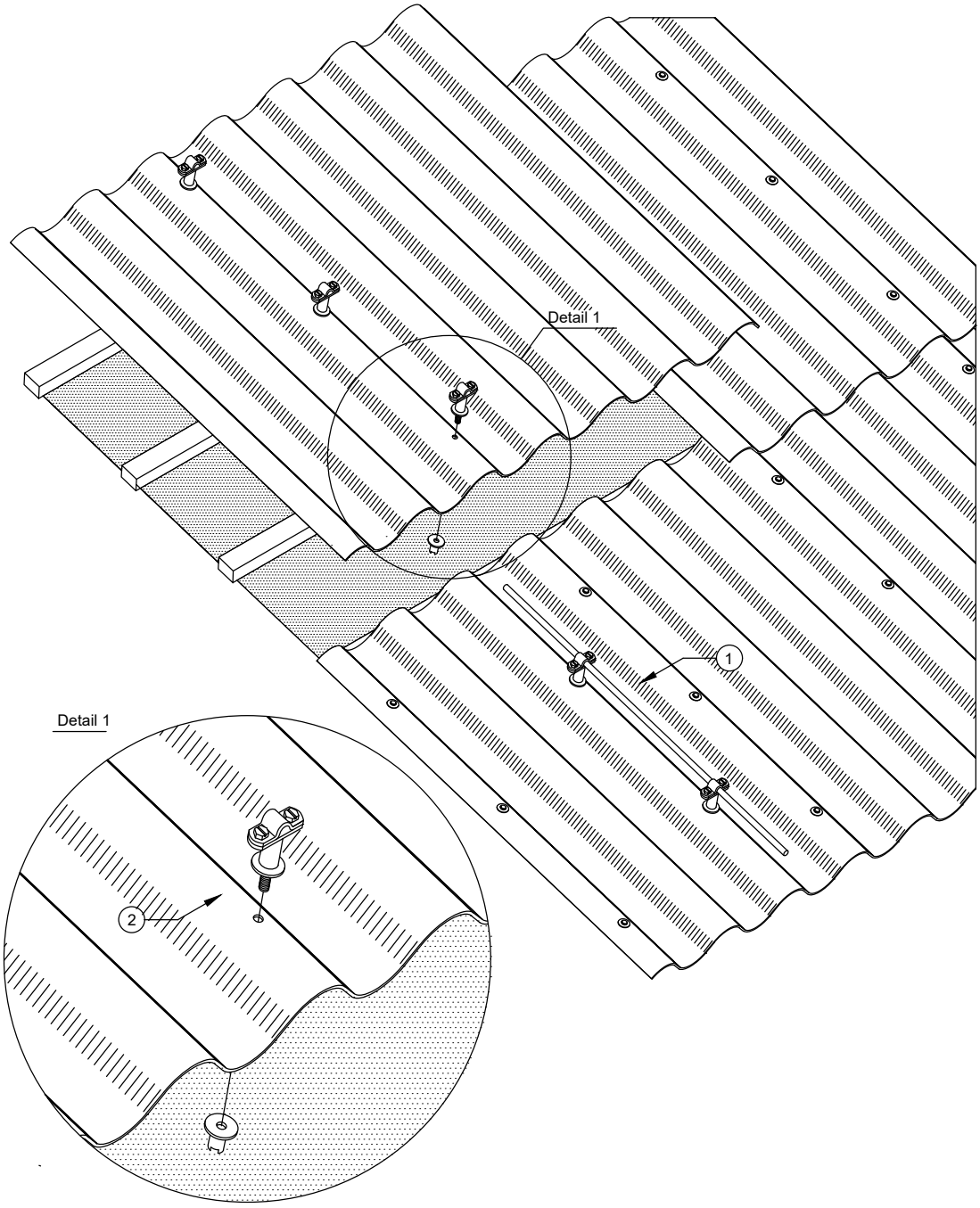
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202248	133 A	Roof conductor holder for tiled, stated and corrugated roofs	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.14	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Slate roof.			
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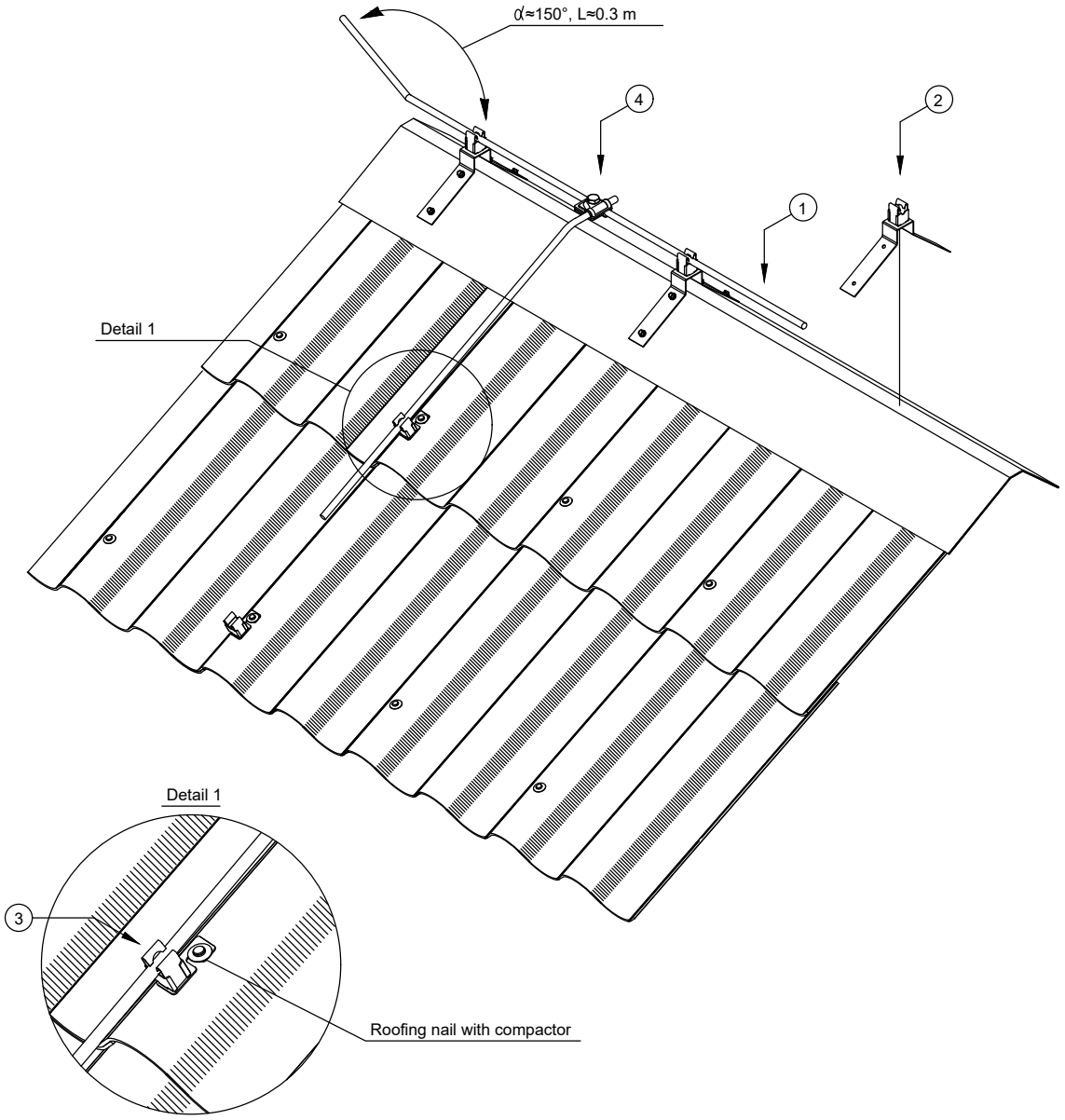
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202510	132 P VA	Roof conductor holder for ridge tiles, metal roofs	
3	5217075	159 VA-V	Roof conductor holder for tiled, slated and corrugated roofs	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.15	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Slate roof.			
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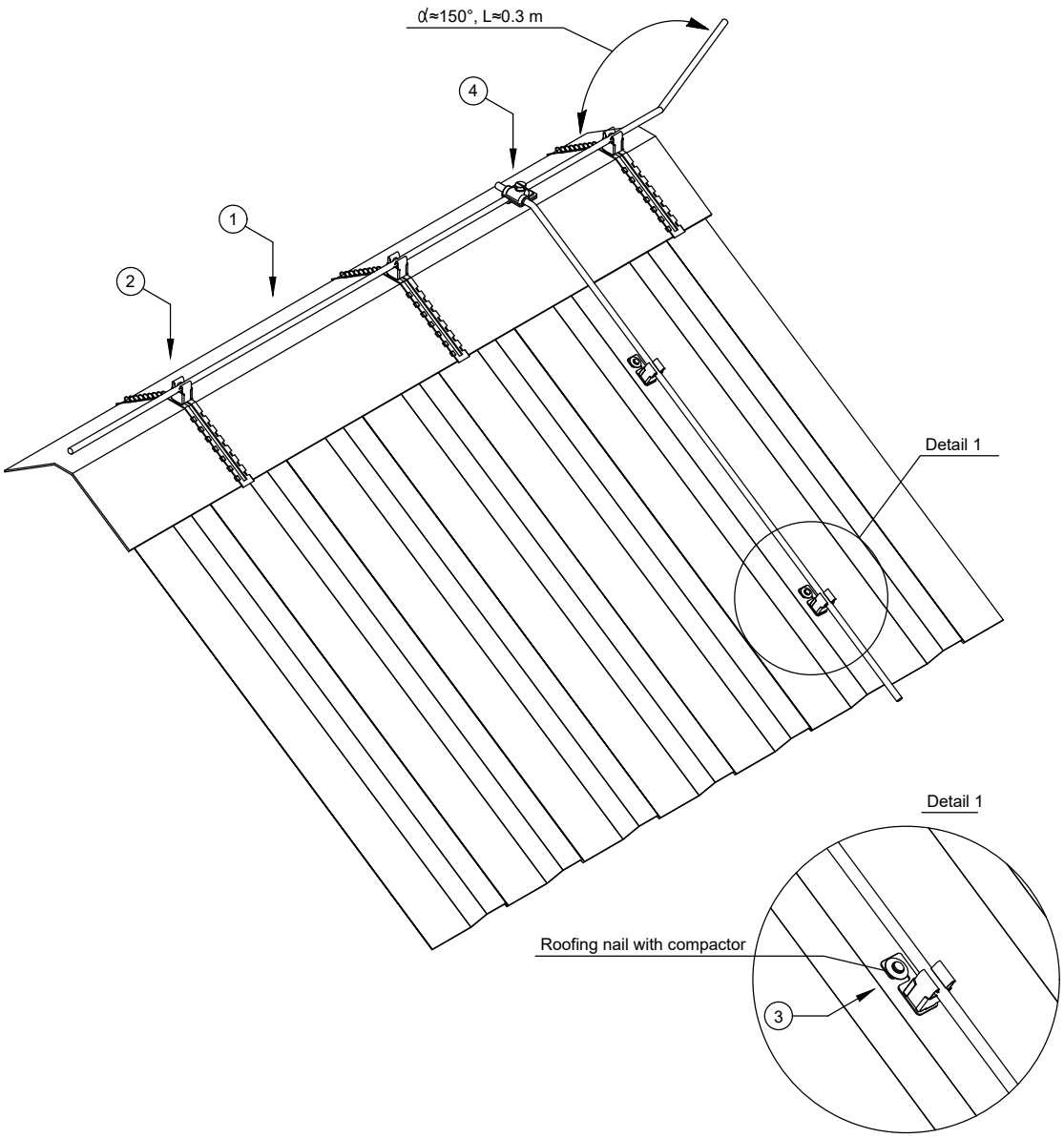
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5203015	132 U	Ridge conductor holder with tensioning spring	
3	5217075	159 VA-V	Roof conductor holder for tiled, slated and corrugated roofs	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.16	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Trapezoidal sheet metal roof.			
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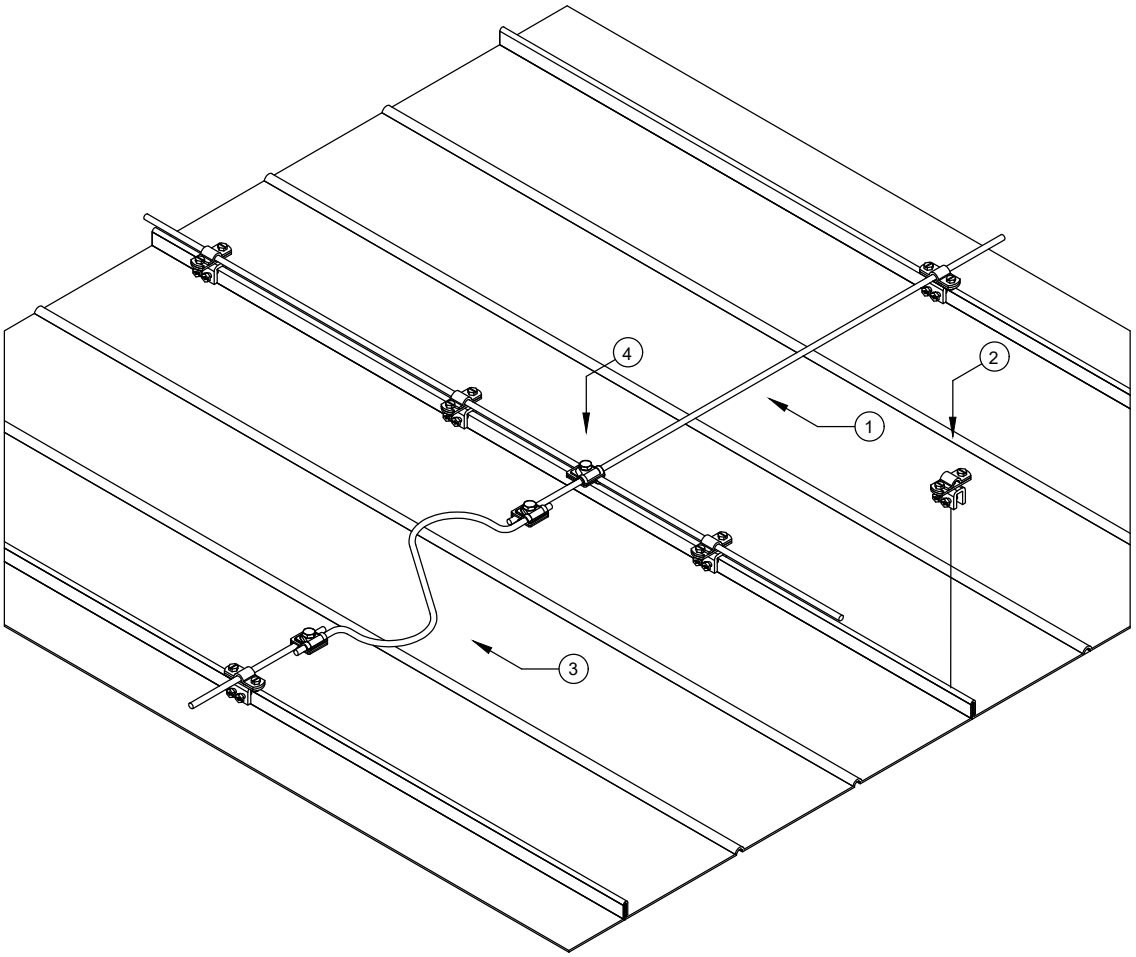
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5317208	270 8-10 VA	Folding clamp Rd 8-10 mm plate thickness	
3	5218926	172 AR	Expansion piece	
4	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.17	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fixing of the round conductor on the surface of the pitched roof. Folded roof.			
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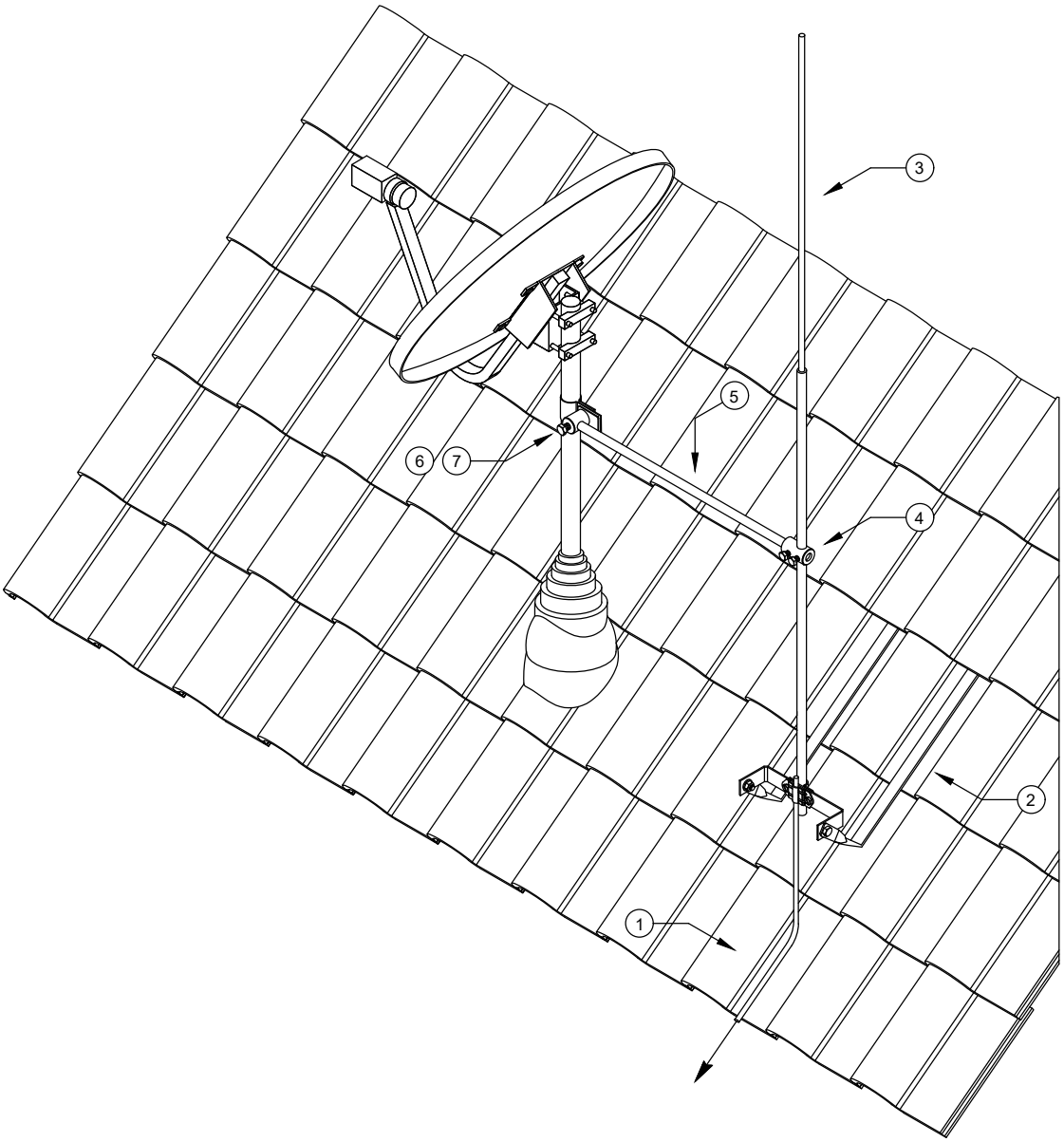
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5403335	SD-Fix	Air-termination rod holder for sloping roof	
3	5401983	101 VL2000	Tapered pipe air-termination rod	
4	5408158	101 IT-16	T connector	
5	5408107	101 16-750	Insulating rod	
6	5102197	303 DIN-2	Pipe clamp	
7	5408988	101 BB-16	Fastening bolts	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.18	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Fastening the lightning interception rod to the satellite antenna			
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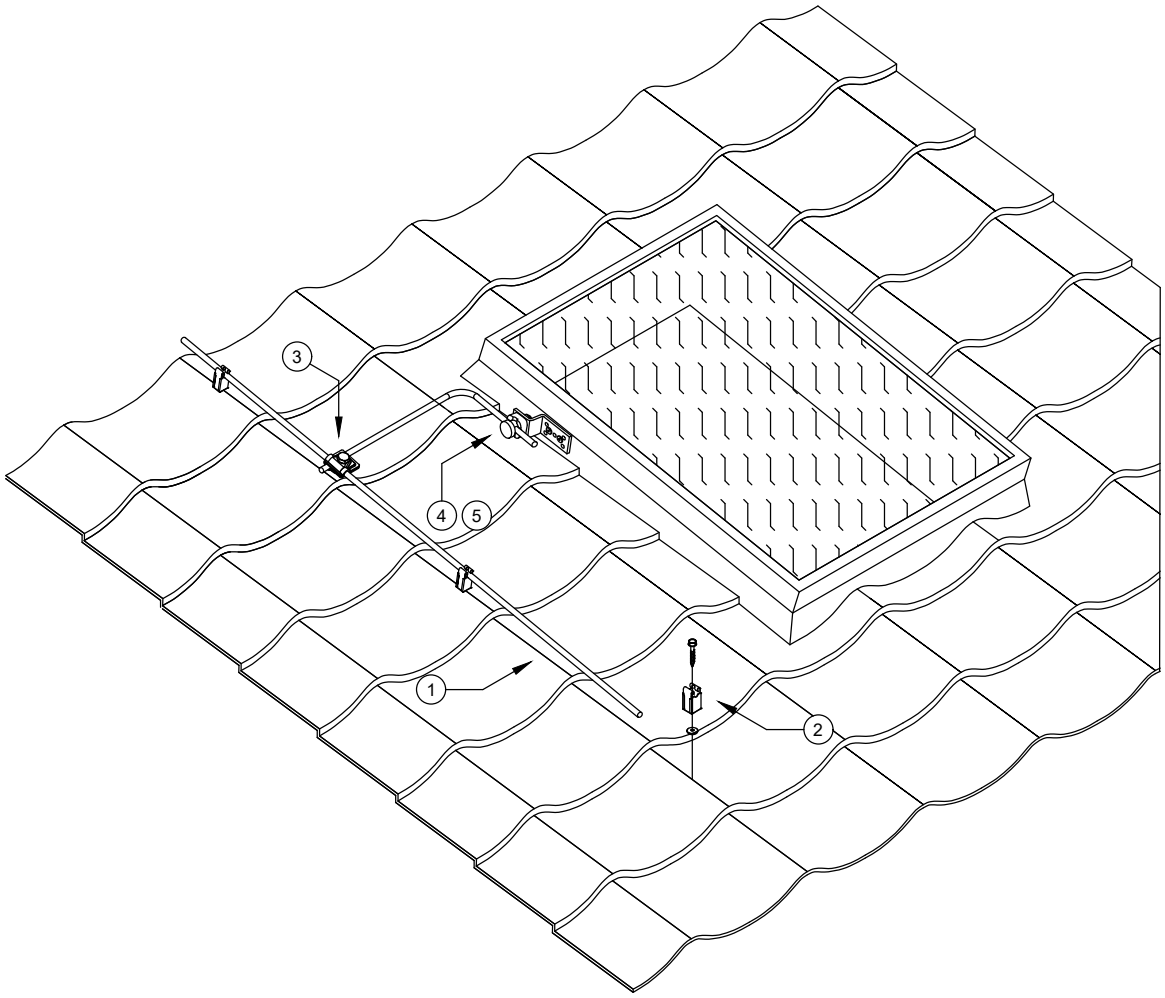
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207342	177 35 VA M6	Screwless cable bracket, raised construction	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5320704	287	Connection component	
5	5304105	5001 DIN-FT	Connector Rd 8-10 mm, single	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.19	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Connecting the metal frame of the window to the lightning protection grid.			
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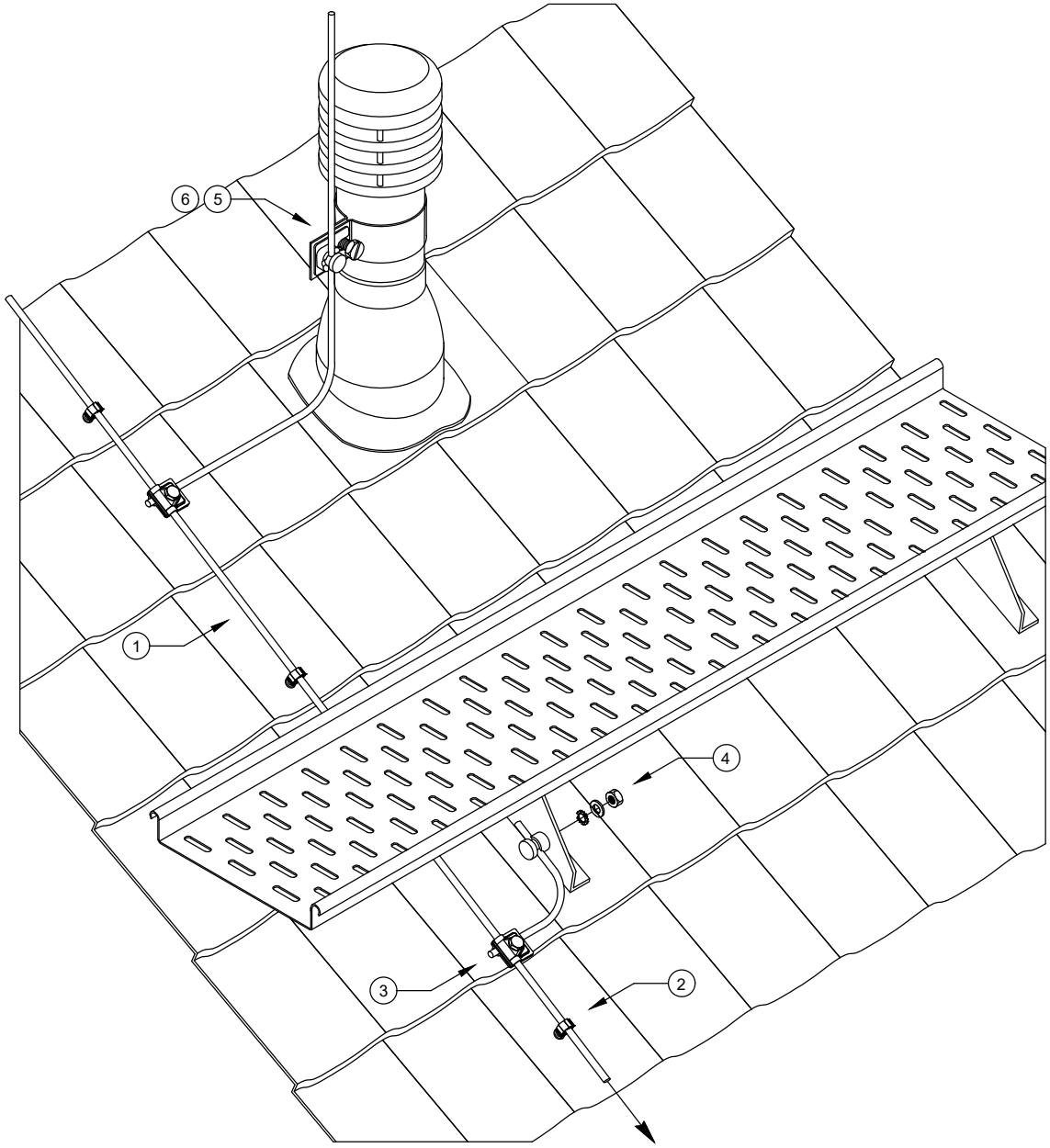
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207460	177 30 M8	Universal cable bracket	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5304176	5001 N-VA	Connector, Rd 8-10 mm with pressure trough	
5	5350123	301 DIN - 120	Downspout clamp	
6	5304105	5001 DIN-FT	Connector Rd 8-10 mm, single	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.20	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Connecting the transition bridge to the lightning protection grid			

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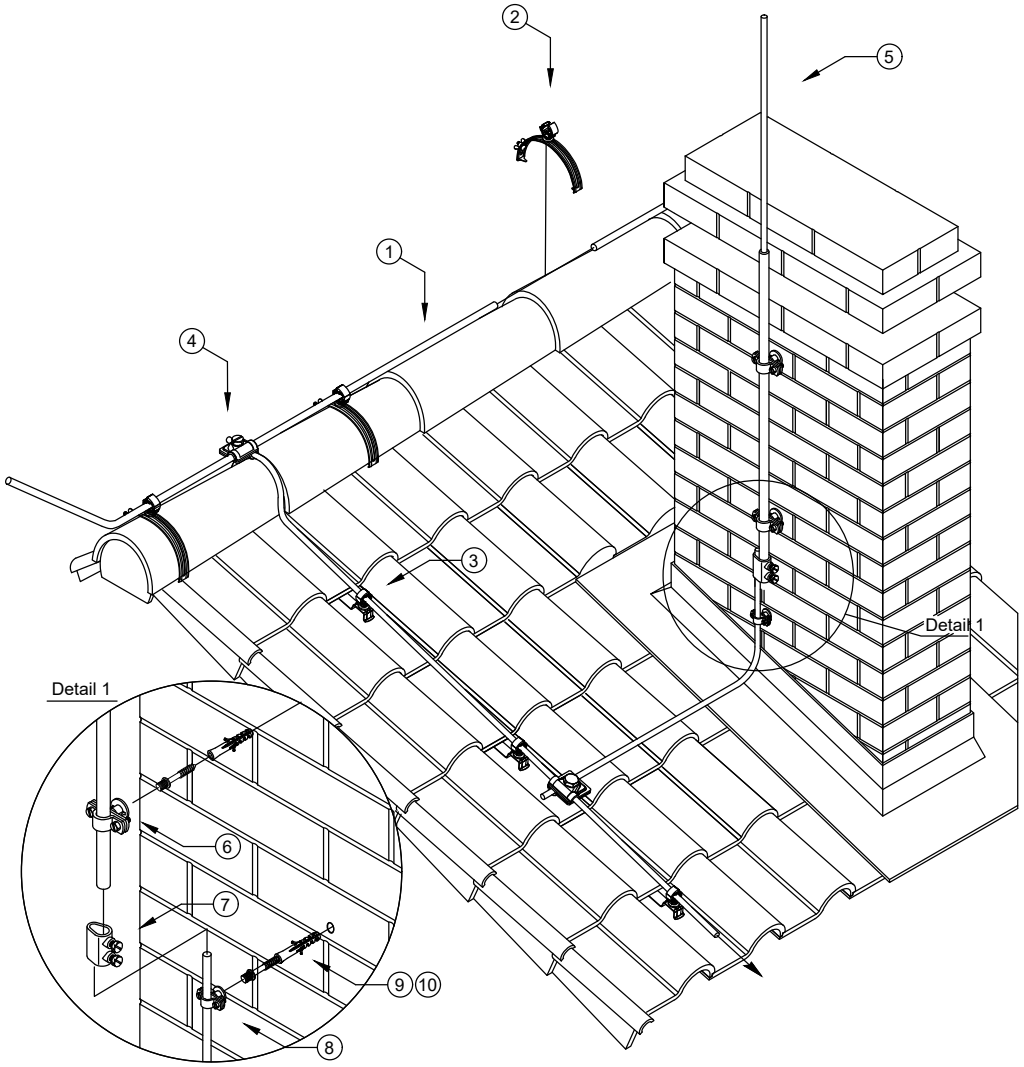
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K-VA	Roof conductor holder for ridge tiles	
3	5215668	157 IK-VA	Roof conductor holder for tiled roofs, angled	
4	5311519	249 8-10 ALU	Vario quick connector	
5	5401986	101 VL2500	Tapered pipe air-termination rod	
6	5412609	113 Z-16	Rod holder for 16 mm air-termination rods	
7	5335140	223 O DINZN	Separating piece, open	
8	5229960	113 Z8-10	Cable bracket with crossbar Rd 8-10 mm	
9	3133230	985 M8 35	Screw-in anchor with M8 thread	
10	2349086	910 N 8x40 GRW	Angler spreading anchor	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.21	Project No.:
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Lightning protection for the chimney. Installation of a interception rod on a brick surface.			

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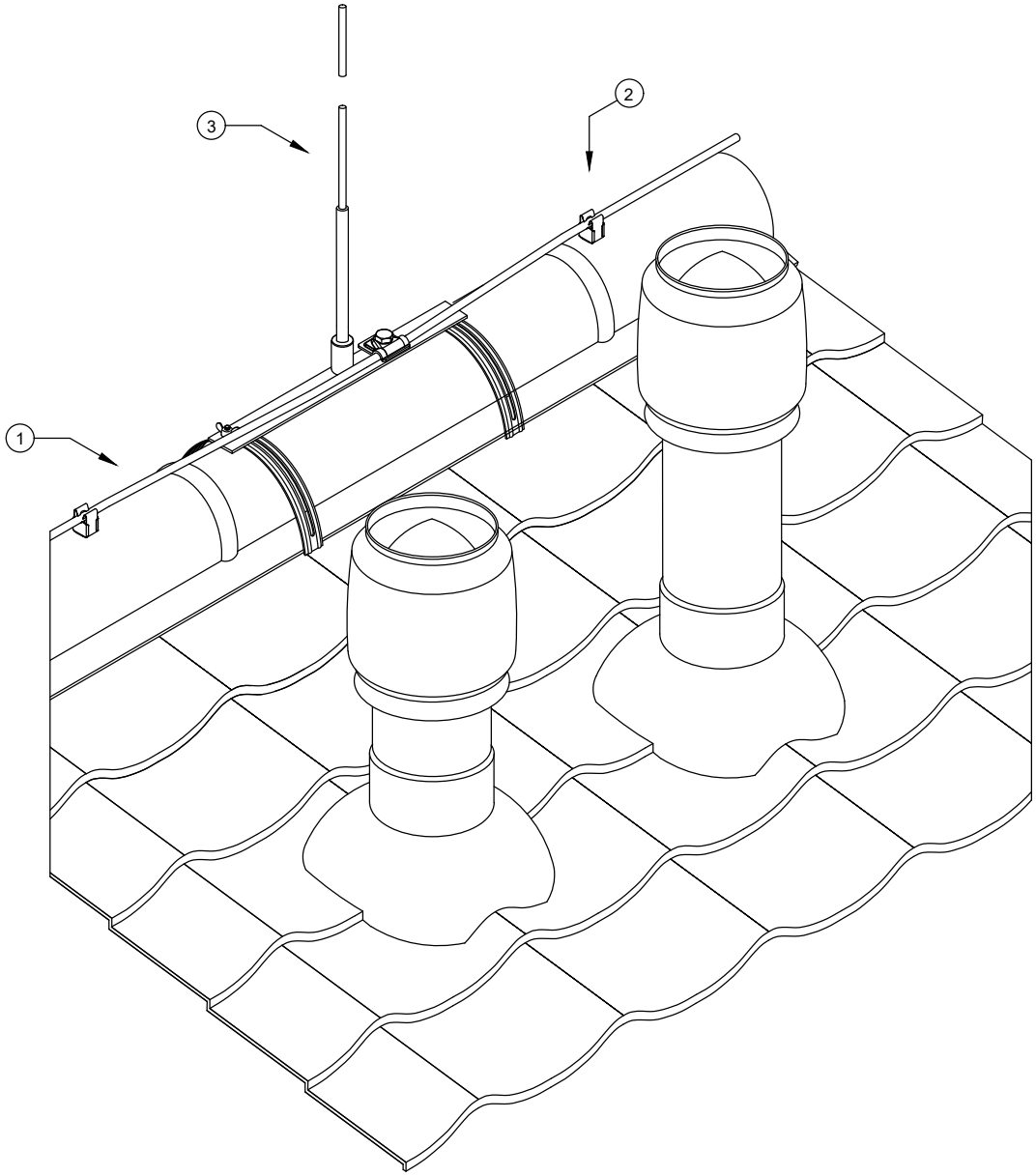
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207347	177 20 VA M8	Screwless cable bracket for Rd 8 mm, through-way Ø 7 mm	
3	5403330	F-FIX-132	Air-termination rod holder for ridge tiles	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.22	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Lightning protection for roof fans. Installation of the interception rod on the roof ridge.			
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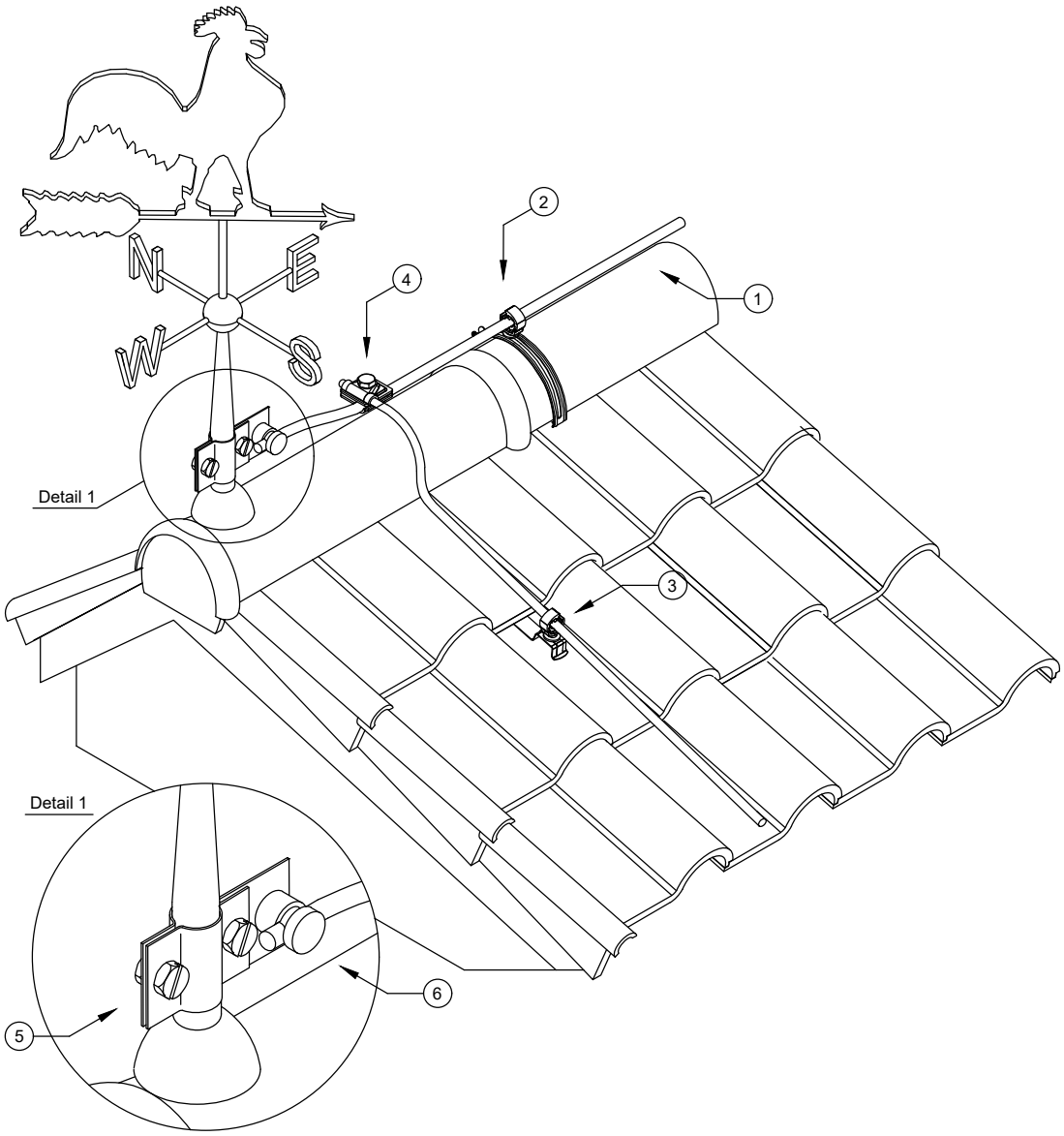
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5202515	132 K-VA	Roof conductor holder for ridge tiles	
3	5215668	157 IK-VA	Roof conductor holder for tiled roofs, angled	
4	5311519	249 8-10 ALU	Vario quick connector	
5	5102138	303 DIN-1 1/4	Pipe clamp	
6	5304164	5001 N-FT	Connector, Rd 8-10 mm with pressure trough	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.23	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Lightning protection of weather vane. Connection to the lightning protection grid.			
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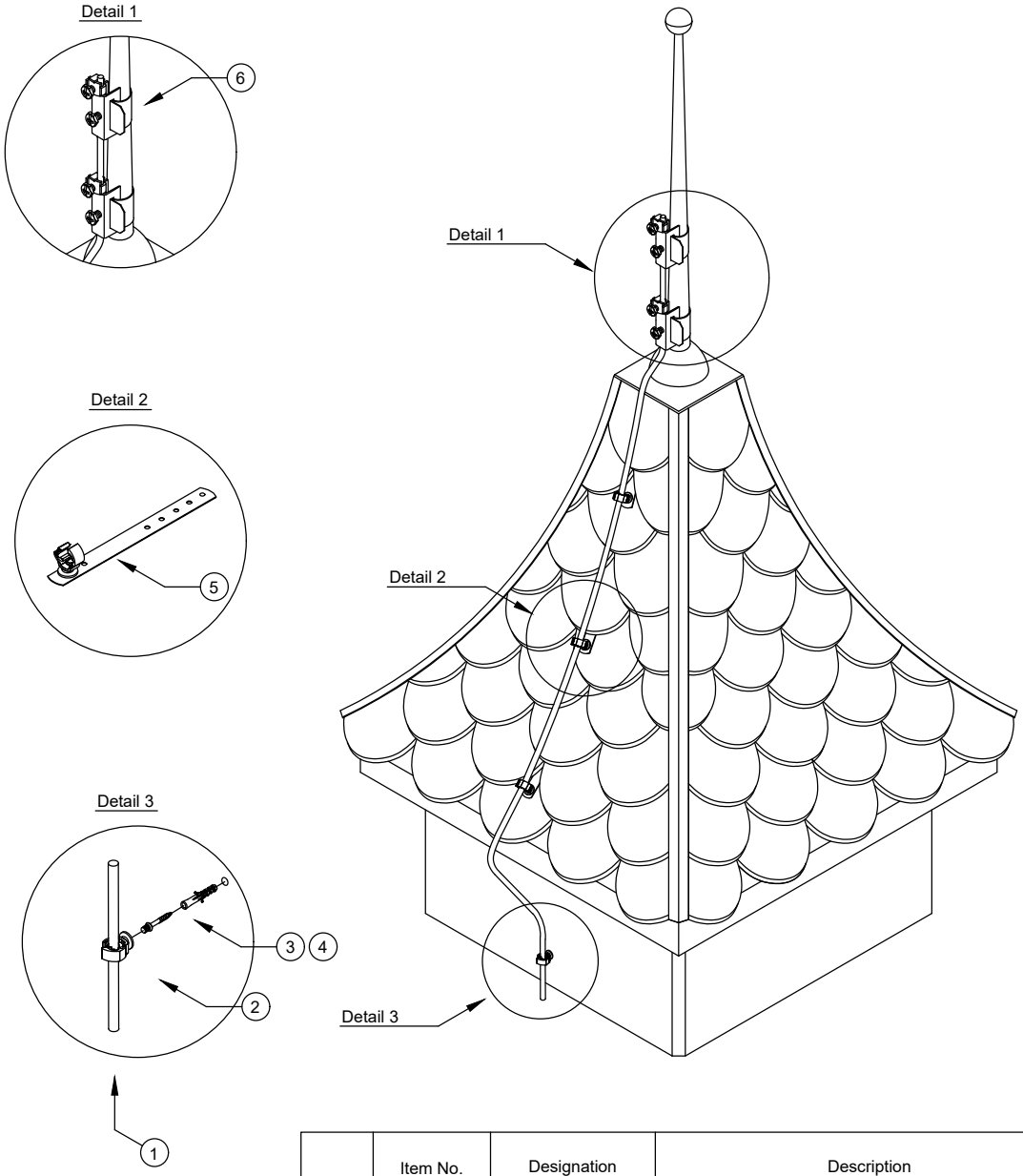
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207444	177 20 M8	Universal cable bracket Rd 8-10 mm	
3	3133320	985 M8 35	Screw-in anchor with M8 thread	
4	2349086	910 N 8x40 GRW	Angler spreading anchor	
5	5215277	157 NB-VA	Roof conductor holder for tiled and slated roofs,	
6	5057523	927 2	Earthing pipe clamp VA	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T3.24	Project No.:	
	Date:	Name:	Description: The external lightning protection system for pitched roof.			
Creator:						
Editor:						
Status:			Comment: Lightning protection for the pyramidal roof. Using the spire as a natural lightning interception rod.			
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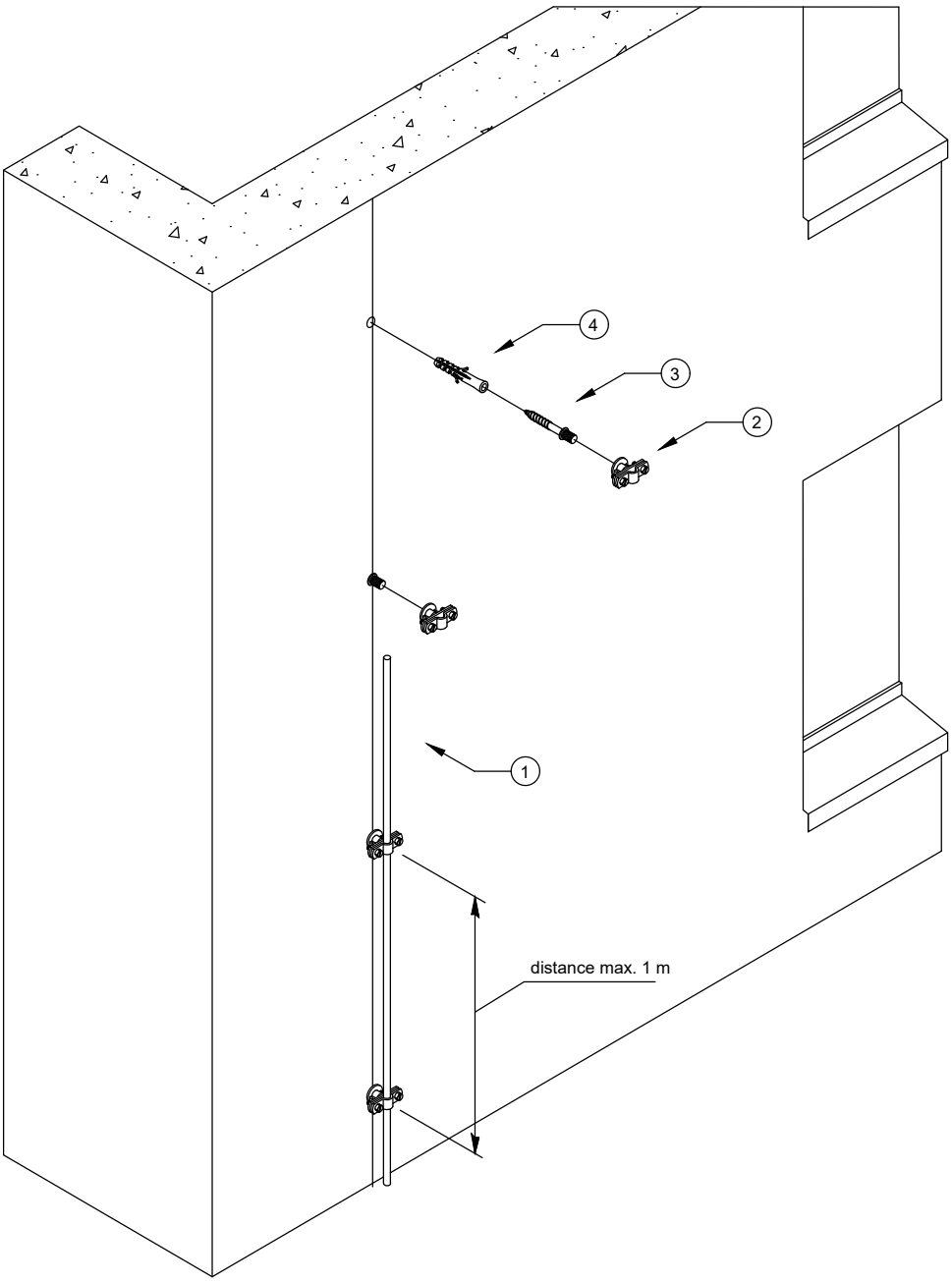
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5229960	113 Z8-10	Cable bracket with crossbar Rd 8 -10 mm	
3	3133230	985 M8 35	Screw-in anchor with M8 thread	
4	2349086	910 N 8x40 GRW	Angler spreading anchor	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.01	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying a round conductor on the wall surface			
— — —					Scale:	Sheet size:
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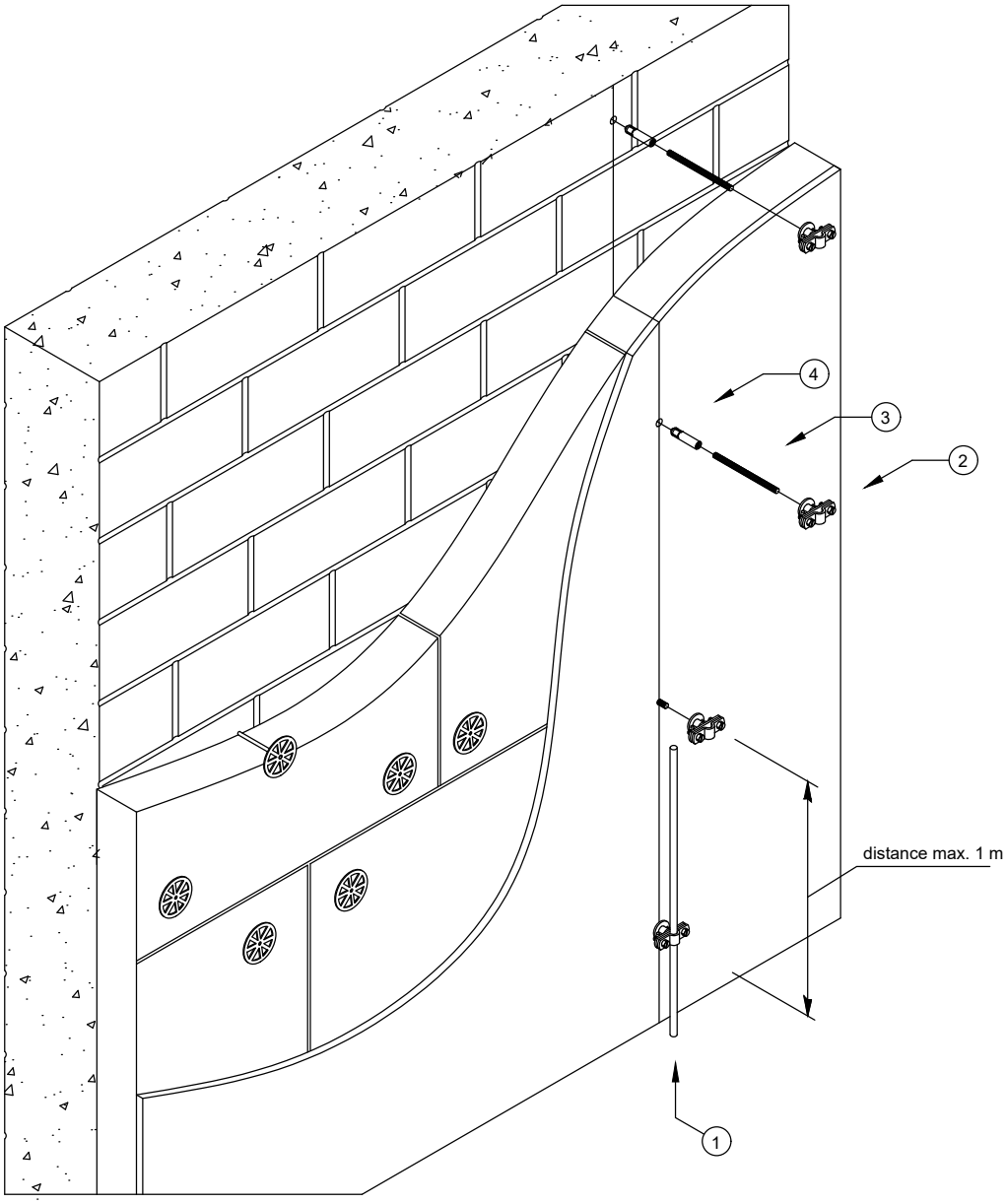
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5229960	113 Z8-10	Cable bracket with crossbar Rd 8 -10 mm	
3	3141128	TR M8 1M G	Threaded rod G 1000	
4	3492910	E M 8x40	Drop-in anchor E	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.02	Project No.:
	Date:	Name:	Description:			
Creator:			The external lightning protection system Down-conductors			
Editor:						
Status:			Comment: Laying a round conductor over an insulated wall surface.			

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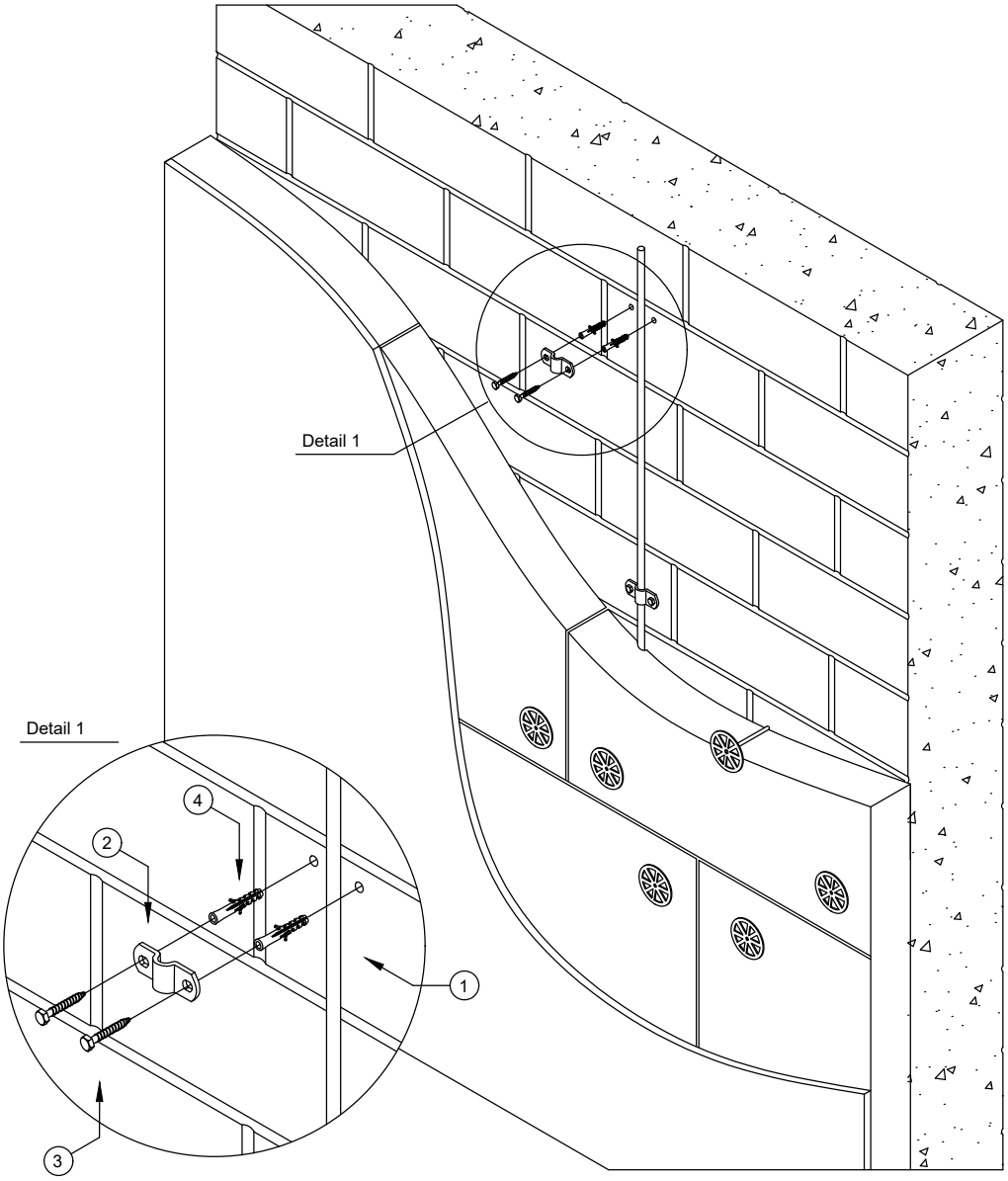
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5228123	156 K 8-10 ST	Crossbar for Rd 8-10 mm	
3	3188043	HHWS 6x40 G	Hexagonal wood screw DIN 571	
4	2349086	910 N 8x40 GRW	Angler spreading anchor	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.03	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying a round conductor over a wall surface under heat insulation.			

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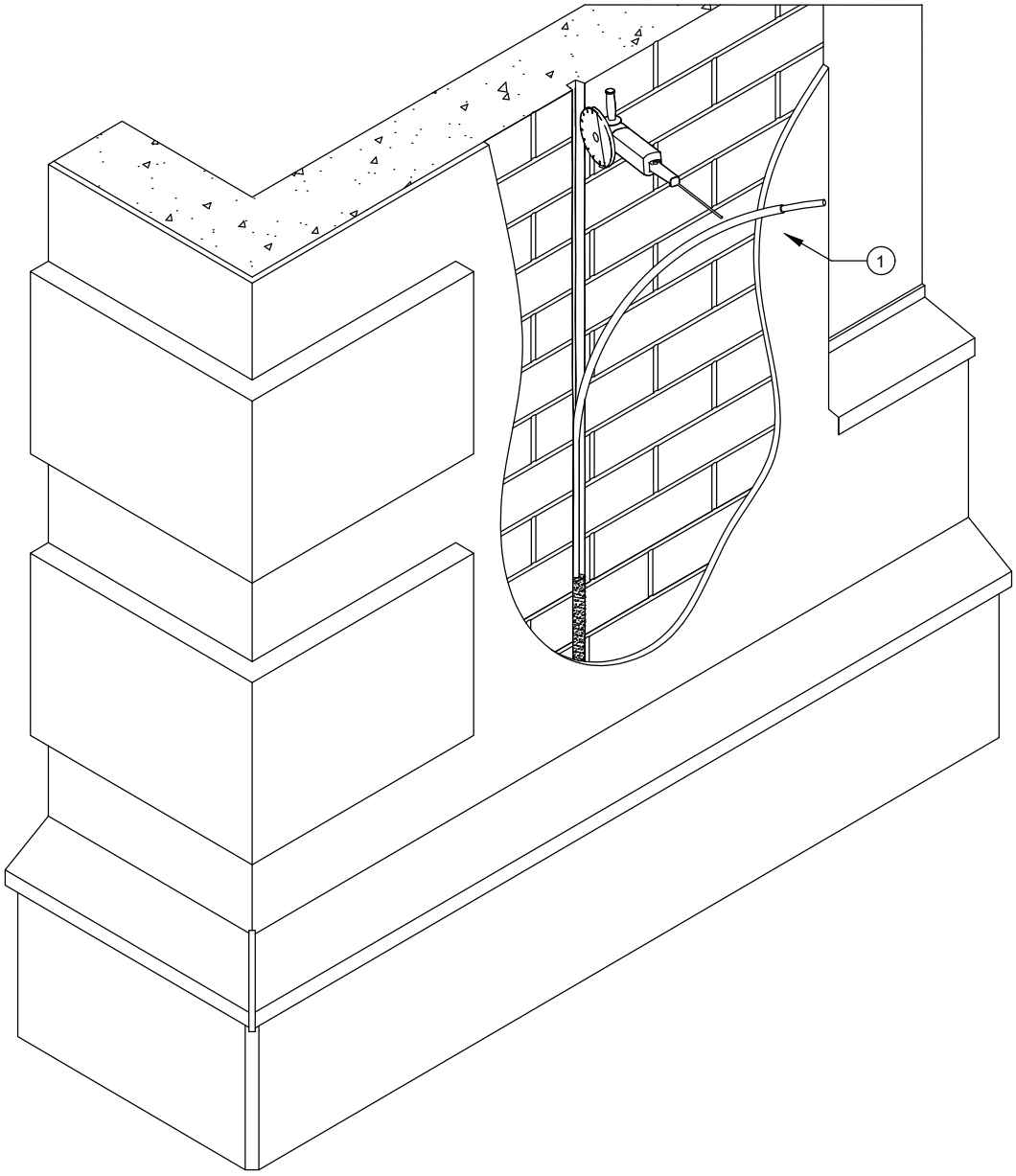
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021332	RD 8-PVC	Round conductor, aluminium with PVC sheathing	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.04	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying a round conductor in a groove under a building plaster			
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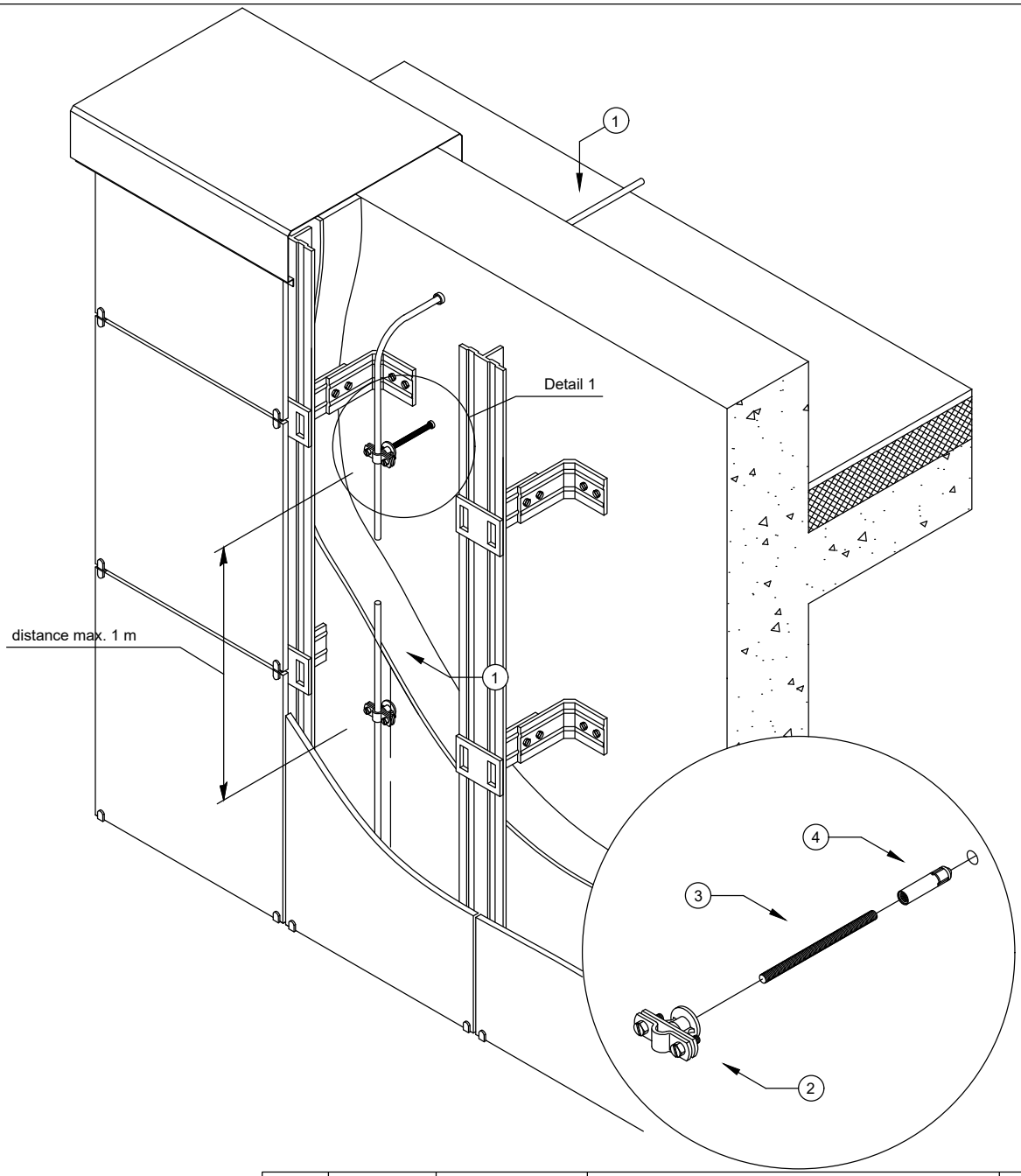
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5229960	113 Z8-10	Cable bracket with crossbar Rd 8 -10 mm	
3	3141128	TR M8 1M G	Threaded rod G 1000	
4	3492910	E M 8x40	Drop-in anchor E	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.05	Project No.:	
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying the round conductor behind the cladding of the ventilated facade. Exit to the roof surface.			
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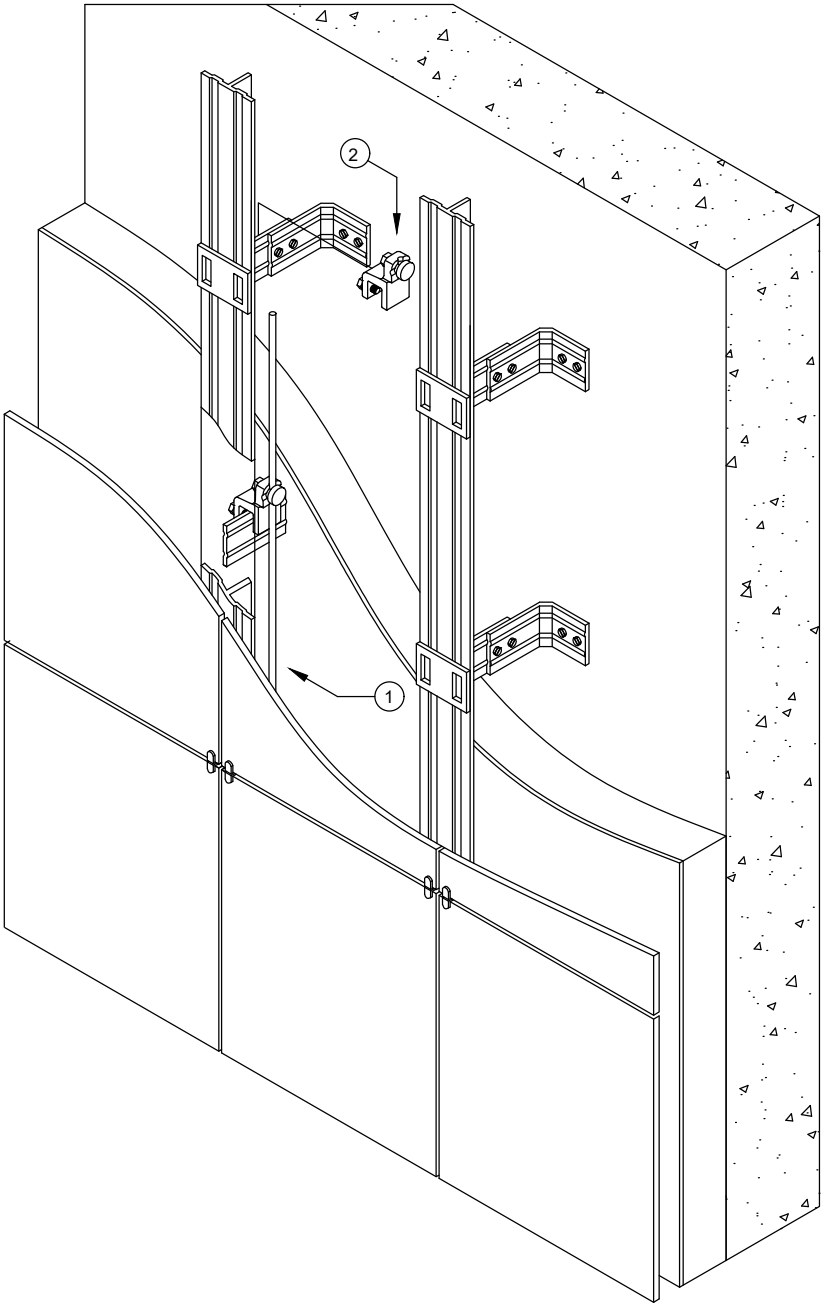
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021332	RD 8-PVC	Round conductor, aluminium with PVC sheathing	
2	5304504	5004 DIN-FT 20	Folding and construction clamp, 10-20 mm	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.06	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying the round conductor behind the cladding of the ventilated facade. Mounting to brackets.			
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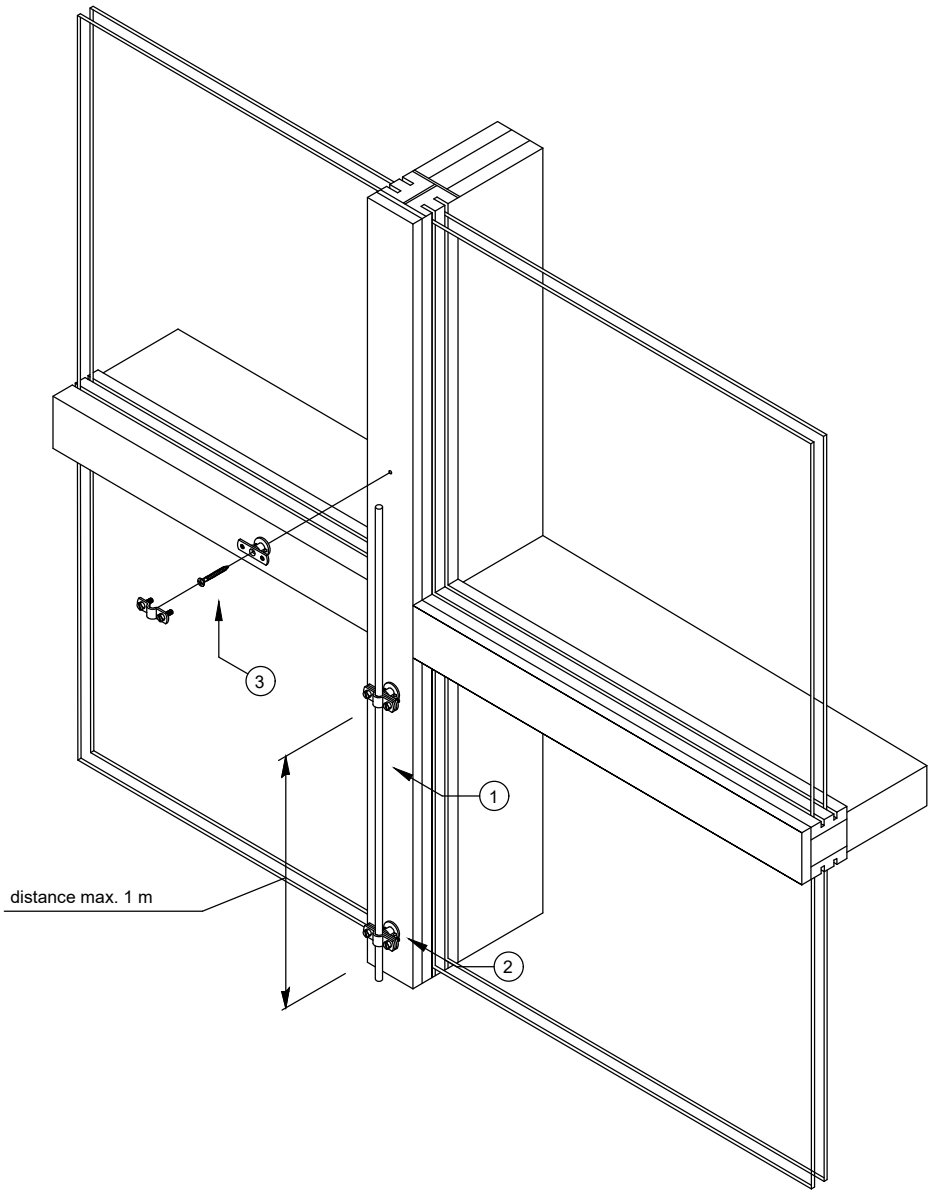
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5229960	113 Z8-10	Cable bracket with crossbar Rd 8 -10 mm	
3	3192644	4759 6.0x60	Sprint screw, with Philips slot	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.07	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying the round conductor on the glass facade. Mounting to a metal frame.			
— — —					Scale:	Sheet size:
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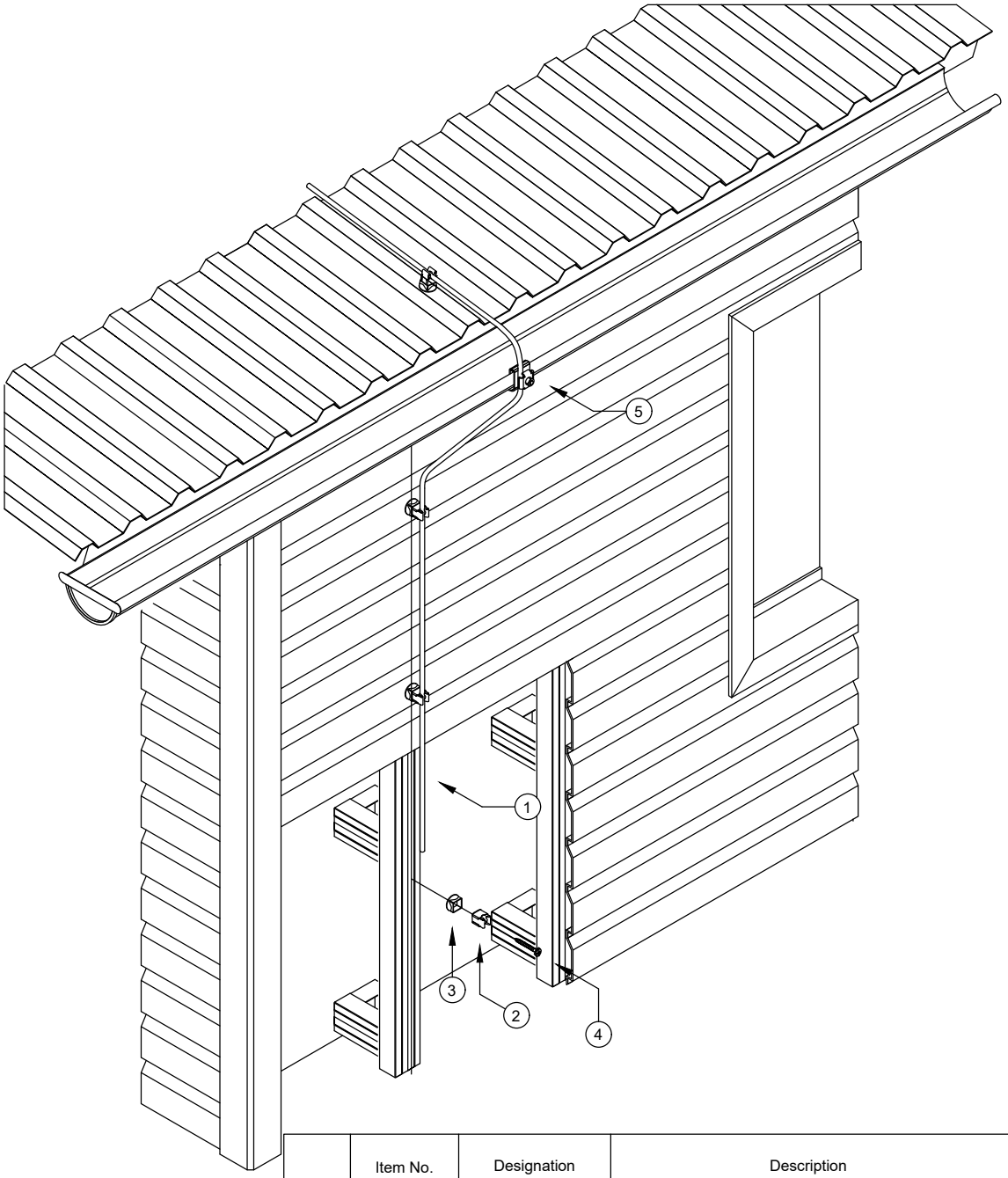
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5207347	177 20 VA M8	Screwless cable bracket for Rd 8 mm, through-way Ø 7 mm	
3	5207371	177 U	Washer for cable bracket	
4	3195635	4758 5.0x30	Golden sprint, with Philips screw	
5	5316450	RK-FIX	Gutter clamp RK-FIX	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.08	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying the round conductor on the siding. Fastening to the rack profiles of the frame.			
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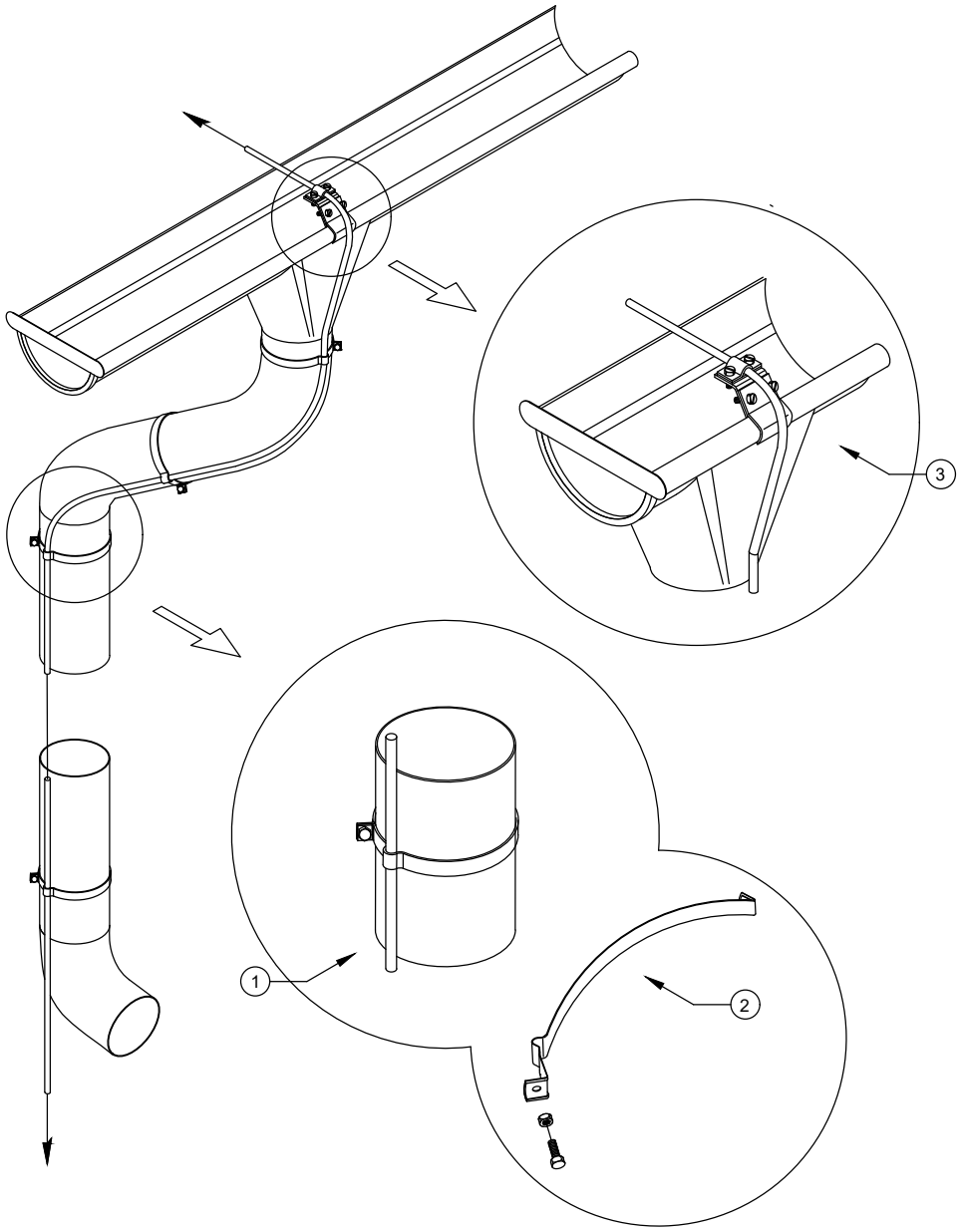
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5351375	301 S-AL-120	Downspout clamp for routing Rd 8-10 mm behind pipe	
3	5316014	262	Roof gutter clamp for all bead thicknesses	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.09	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying the round conductor along a gutter pipe.			
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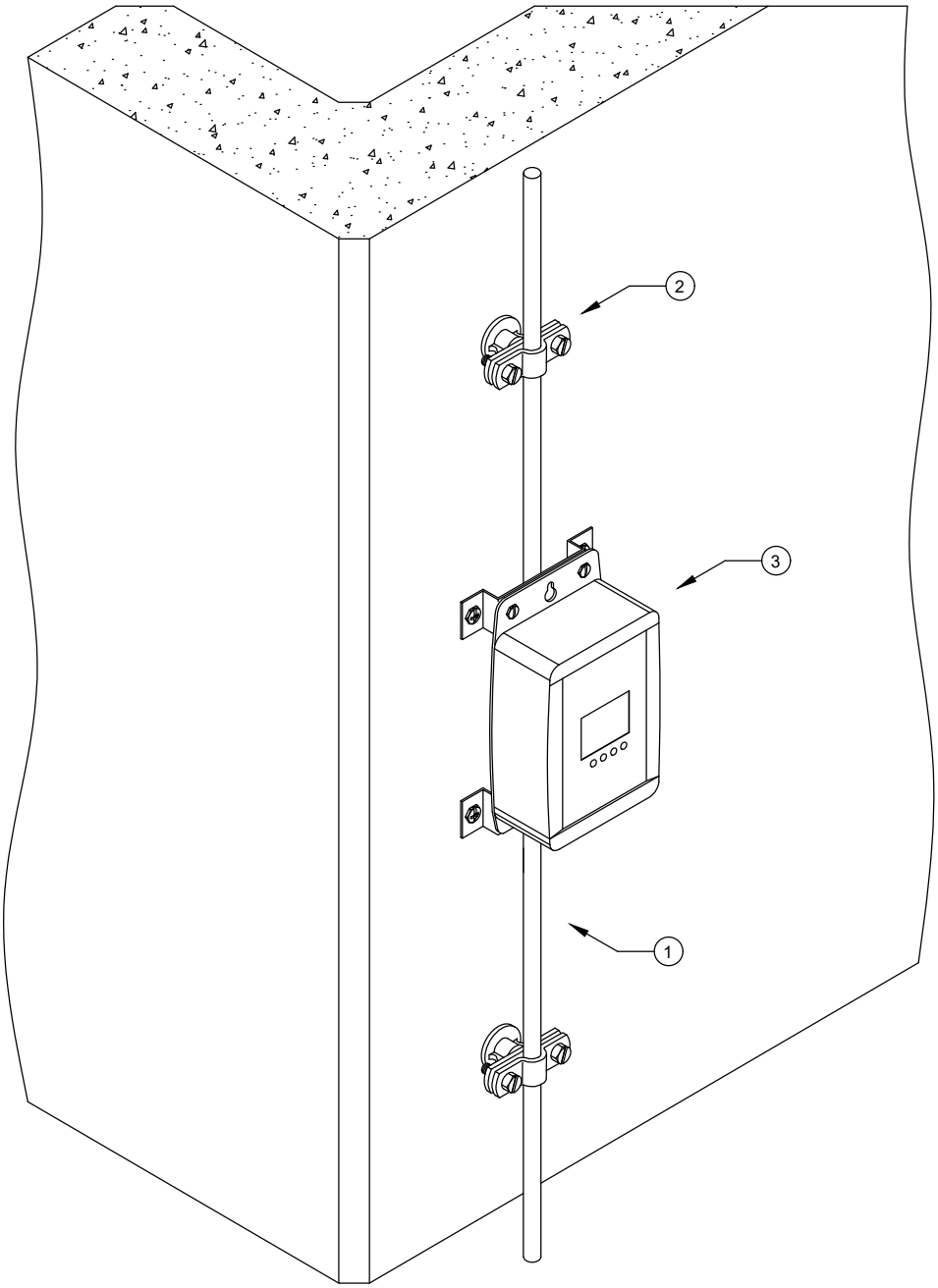
Ind.	Amendment typical		Date:	Name:		

Notes

5 Lightning strike counter



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5230322	113 B-Z-HD	Cable bracket with crossbar, wood screw, plastic anchor	
3	5091722	LSC I+II	Lightning strike counter	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.10	Project No.:
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Installation of the lightning strikes counter on a down conductor			
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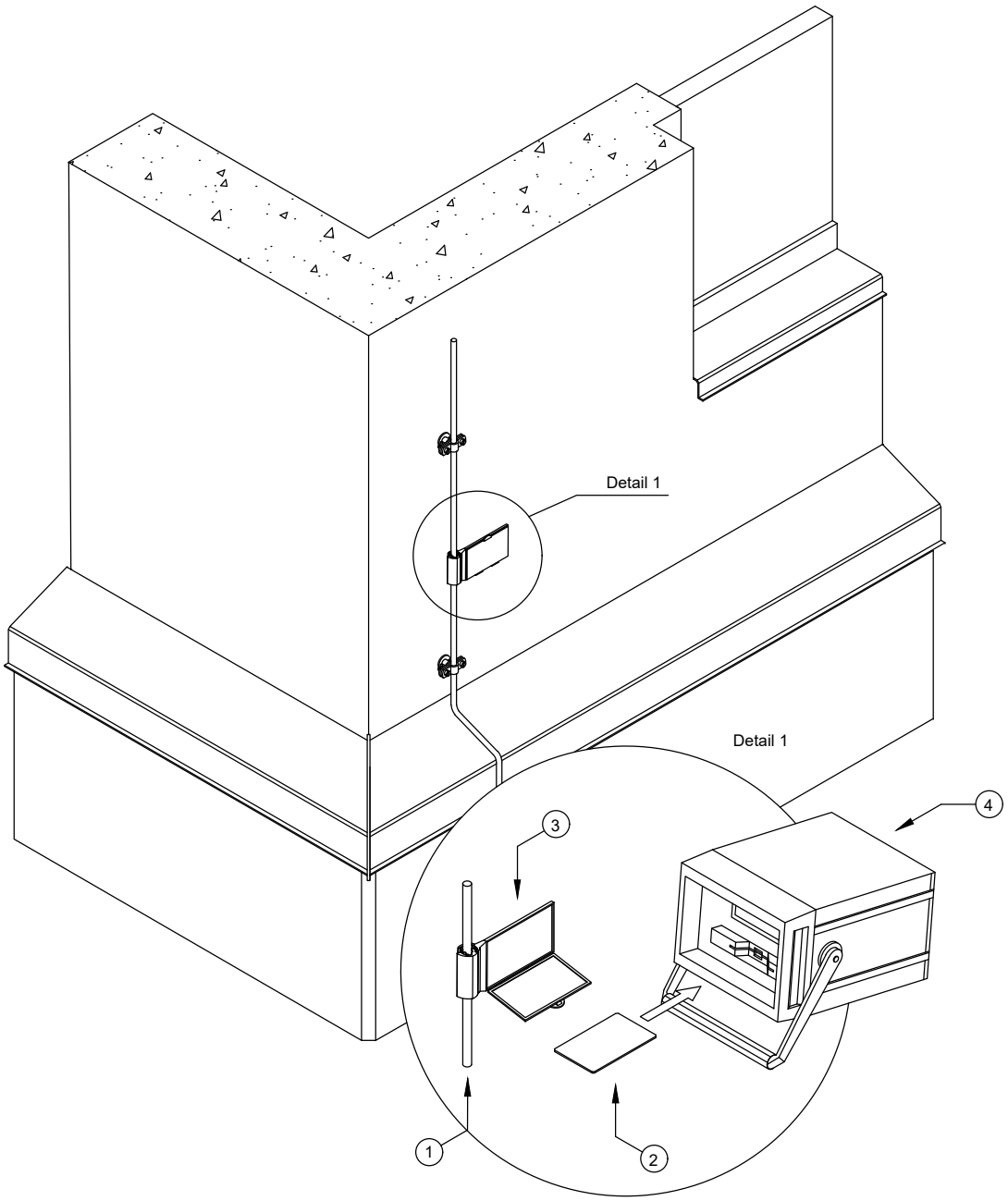
Ind.	Amendment typical		Date:	Name:		

Lightning strike counter



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5091438	PCS	Magnetic card PCS	
3	5091527	PCS-H	Magnetic card holder PCS-H	
4	5091683	PCS-CS-D	Card reader PCS-CS..	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T4.11	Project No.:	
	Date:	Name:	Description: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Installation of a magnetic card for recording of lightning strikes on the down conductor.			
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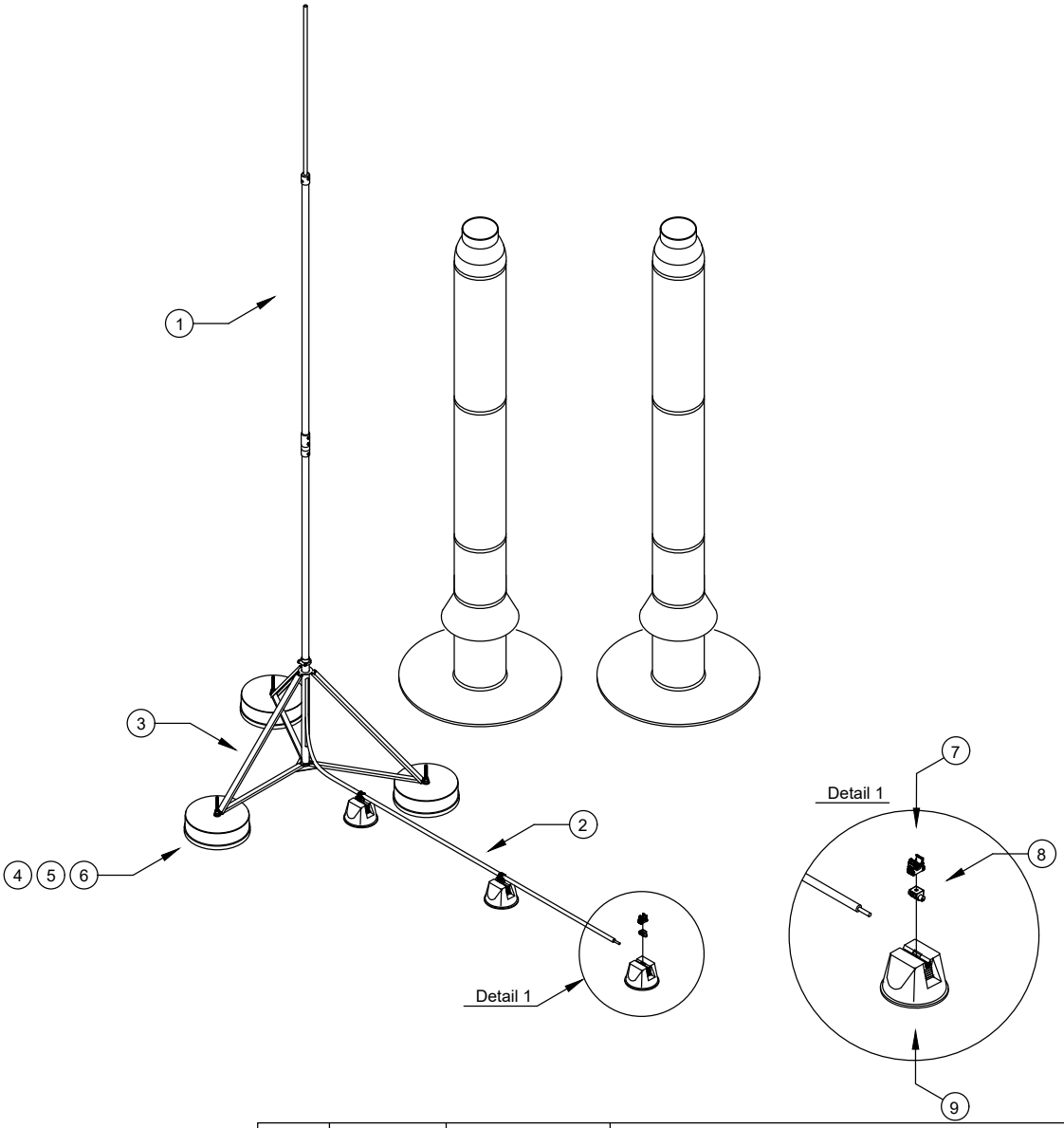
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5408938	isFang IN-A 4000	isFang, insulated air-termination rod for inner-routed isCon	
2	5408002	isCon Pro+ 75 SW	isCon conductor	
3	5408930	isFang 3B-100-A	isFang air-termination rod stand with side exit	
4	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
5	5403238	F-FIX-B16 3B	Base for FangFix system 16 kg for mounting the isFang tripod	
6	5408971	isFang 3B-G1	isFang-3B threaded rod	
7	2153726	M-Quick M25 LGR	Multi-Quick clip	
8	5218882	165 MBG UH	Universal flat conductor adapter for roof conductor holder	
9	5218700	165 MBG 8-10	Roof conductor holder for flat roofs	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.01	Project No.:	
	Date:	Name:	Description: Isolated lightning protection system				
Creator:							
Editor:							
Status:			Comment: Lightning protection for flammable gas ejection pipes (EX-areas). Installation the insulated interception rod on a tripod.				
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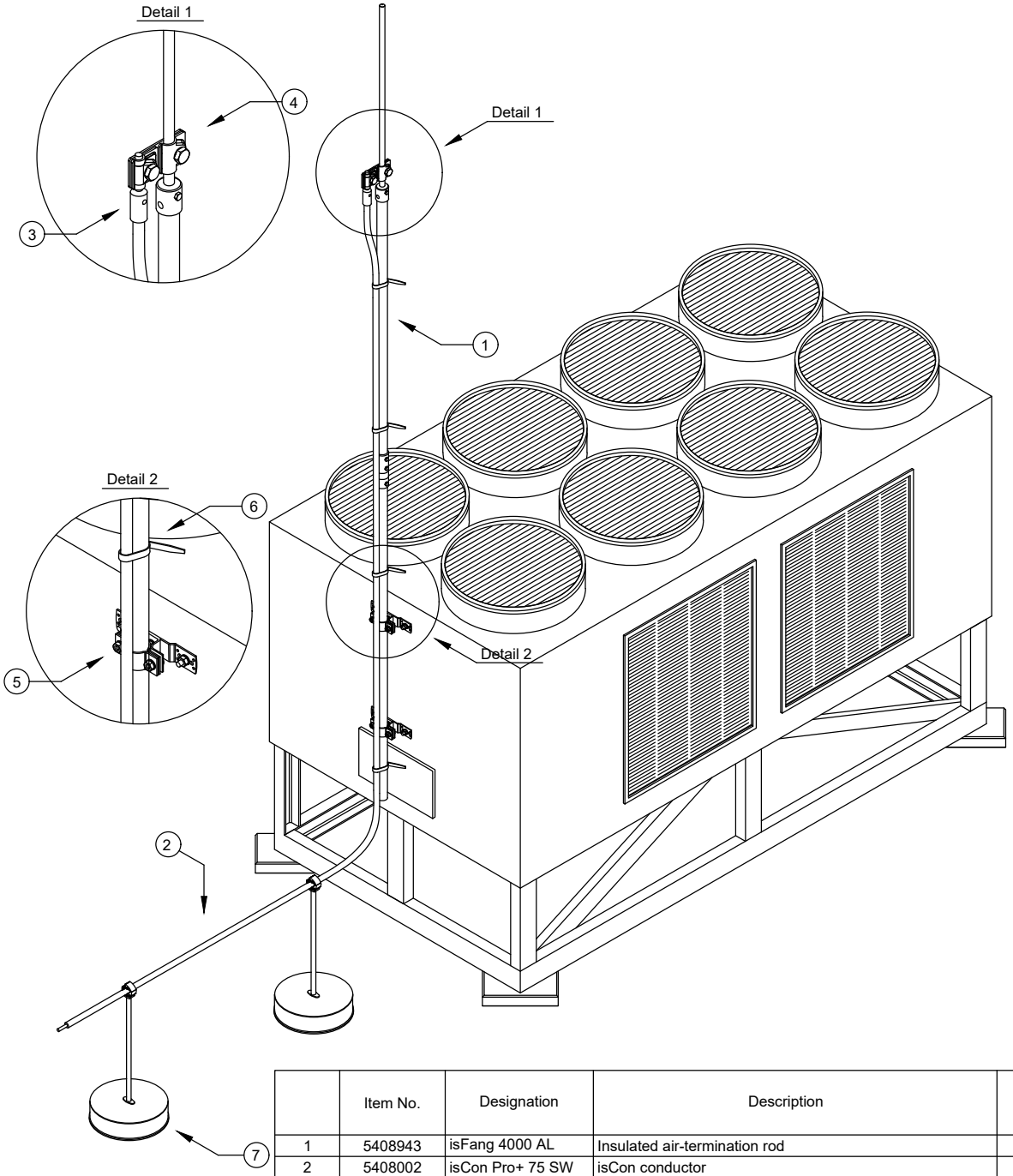
Ind.	Amendment typical		Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5408943	isFang 4000 AL	Insulated air-termination rod	
2	5408002	isCon Pro+ 75 SW	isCon conductor	
3	5408022	isCon connect	isCon-Connection element	
4	5408026	isCon AP1-16 VA	Connection plate for one isCon conductor	
5	5408952	isFang TW30	isFang support for wall mounting	
6	2331924	565 7,6x380 SWUV	Cable tie, black, UV and weather-resistant	
7	5408043	isCon DH	Spacer	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.02	Project No.:	
	Date:	Name:	Description: Isolated lightning protection system				
Creator:							
Editor:							
Status:			Comment: Lightning protection of chiller. Installation of the insulated interception rod on the surface of the installation.				
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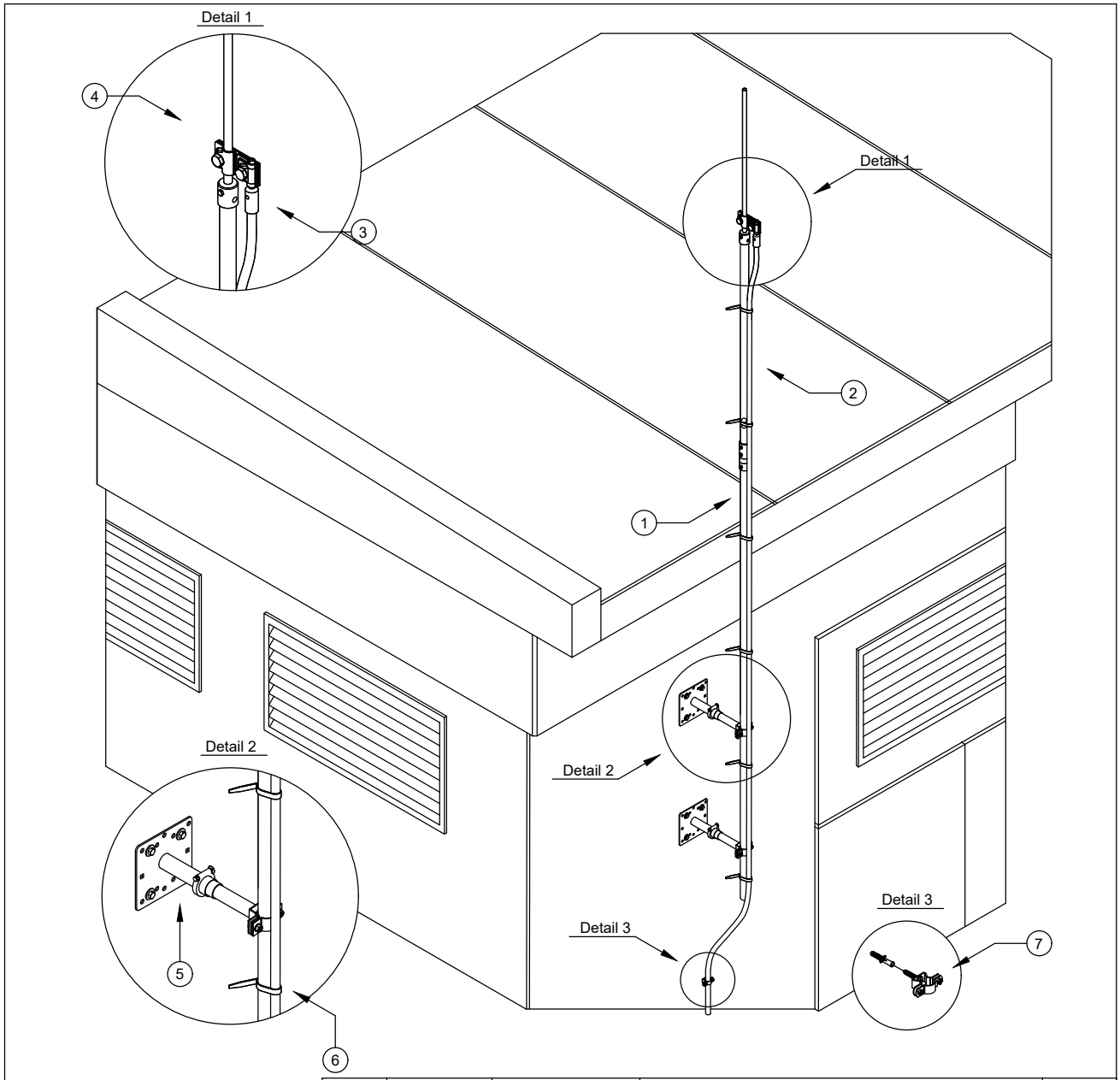
Ind.	Amendment typical		Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5408943	isFang 4000 AL	Insulated air-termination rod	
2	5408002	isCon Pro+ 75 SW	isCon conductor	
3	5408022	isCon connect	isCon-Connection element	
4	5408026	isCon AP1-16 VA	Connection plate for one isCon conductor	
5	5408954	isFang TW200	isFang support for wall mounting	
6	2331924	565 7,6x380 SWUV	Cable tie, black, UV and weather-resistant	
7	5408056	isCon H VA	VA cable bracket for isCon conductor	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.03	Project No.:
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:						
Status:			Comment: Lightning protection of a modular power plant. Installation of insulated interception rod on the wall of an object.			
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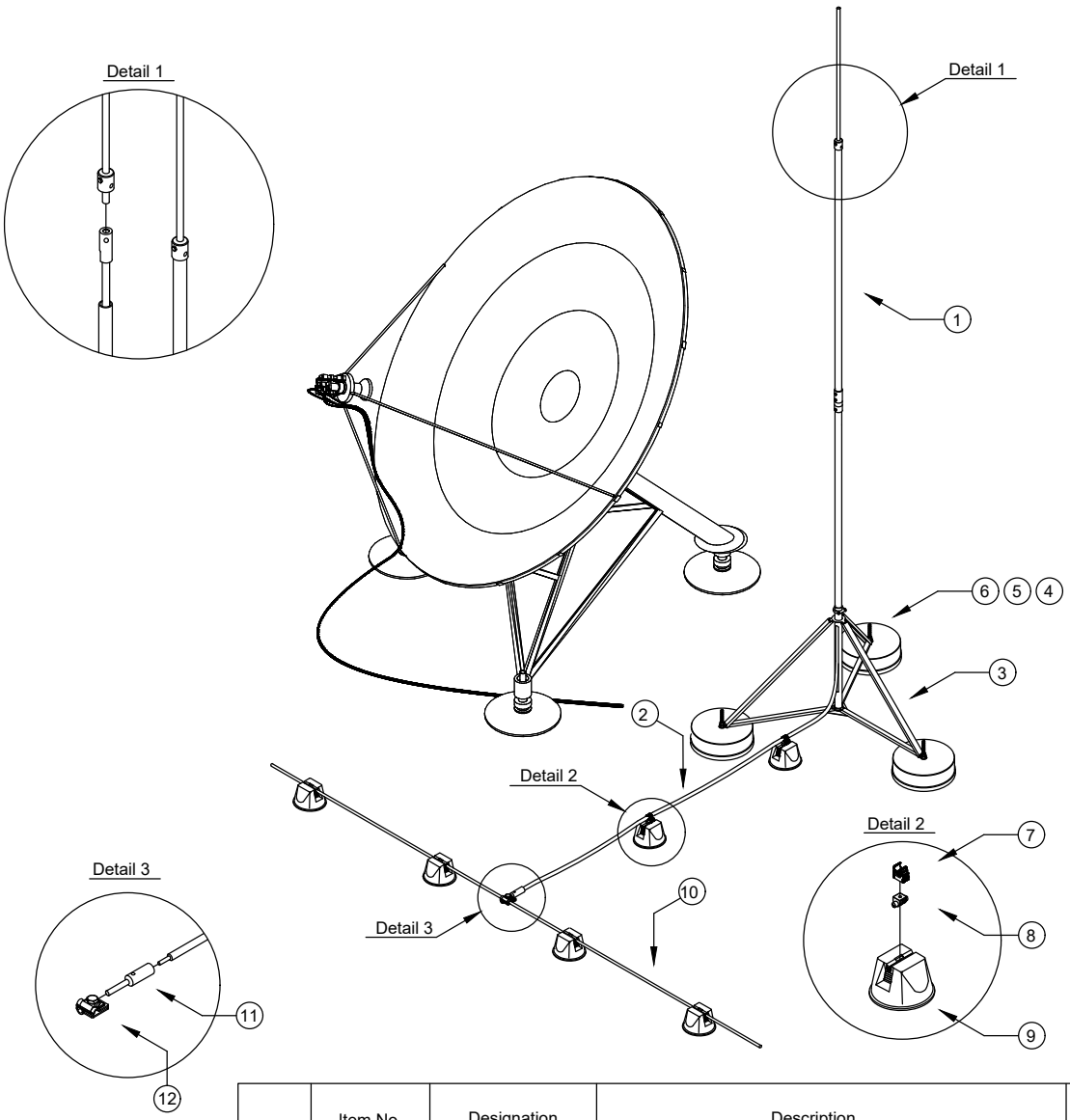
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5408938	isFang IN-A 4000	isFang, insulated air-termination rod for inner-routed isCon	
2	5408002	isCon Pro+ 75 SW	isCon conductor	
3	5408930	isFang 3B-100-A	isFang air-termination rod stand with side exit	
4	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
5	5403238	F-FIX-B16 3B	Base for FangFix system 16 kg for mounting the isFang tripod	
6	5408971	isFang 3B-G1	isFang-3B threaded rod	
7	2153726	M-Quick M25 LGR	Multi-Quick clip	
8	5218882	165 MBG UH	Universal flat conductor adapter for roof conductor holder	
9	5218700	165 MBG 8-10	Roof conductor holder for flat roofs	
10	5021294	RD 8 ALU-T	Round conductor, aluminium	
11	5408022	isCon connect	isCon-connection element	
12	5311519	249 8-10 ALU	Vario quick connector	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.04	Project No.:
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:						
Status:			Comment: Lightning protection of the satellite antenna. Installation of insulated interception rod on a tripod.			
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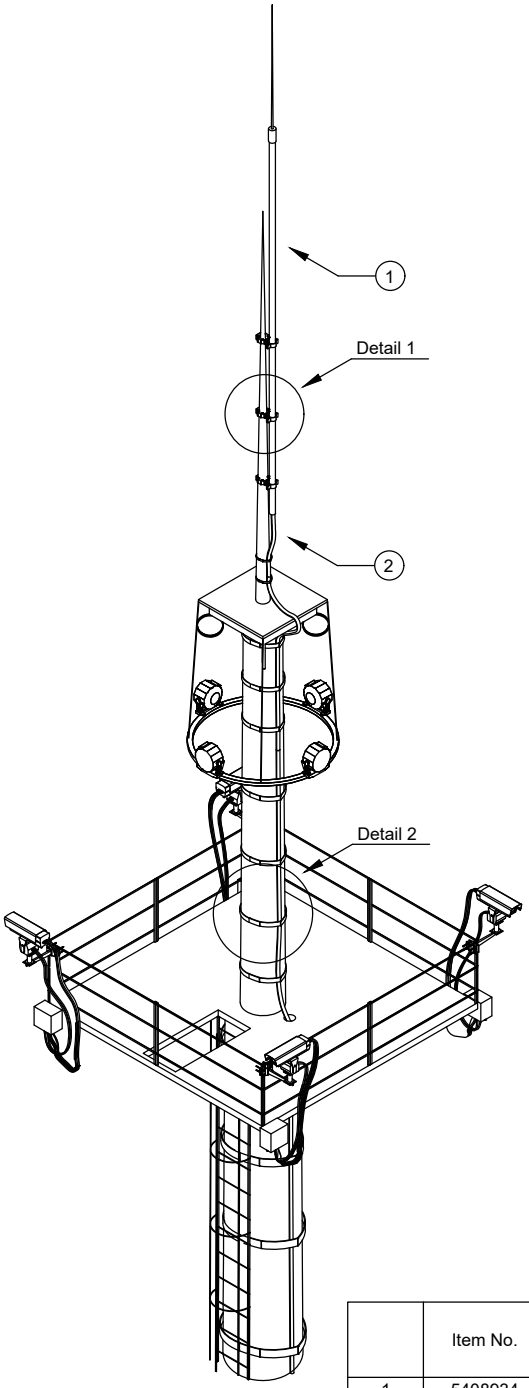
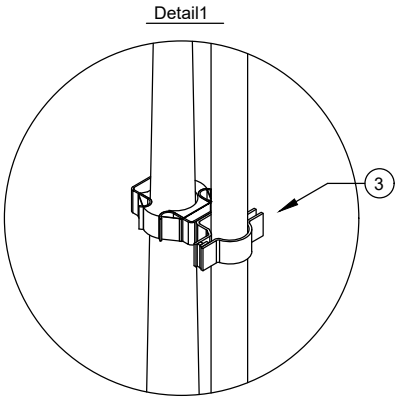
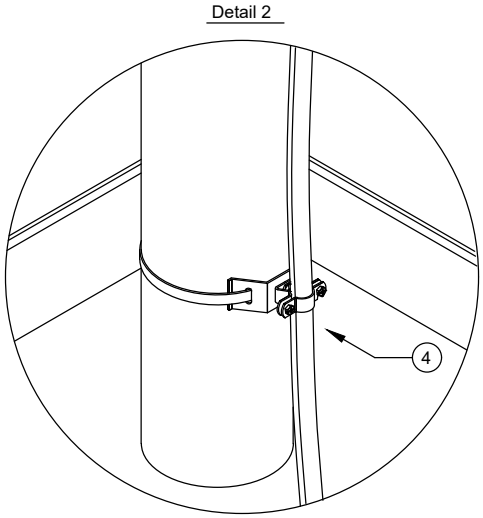
Ind.	Amendment typical		Date:	Name:		







	Item No.	Designation	Description	Q-ty
1	5408934	isFang IN 4000	Insulated air-termination rod	
2	5408002	isCon Pro+ 75 SW	isCon conductor	
3	5408956	isFang TR100	isFang support for pipe mounting	
4	5408052	isCon HS VA	VA cable bracket with tightening strap	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.05	Project No.:	
	Date:	Name:	Description: Isolated lightning protection system				
Creator:							
Editor:							
Status:			Comment: Lightning protection for the floodlight mast. Installation of insulated interception rod to the spire.				
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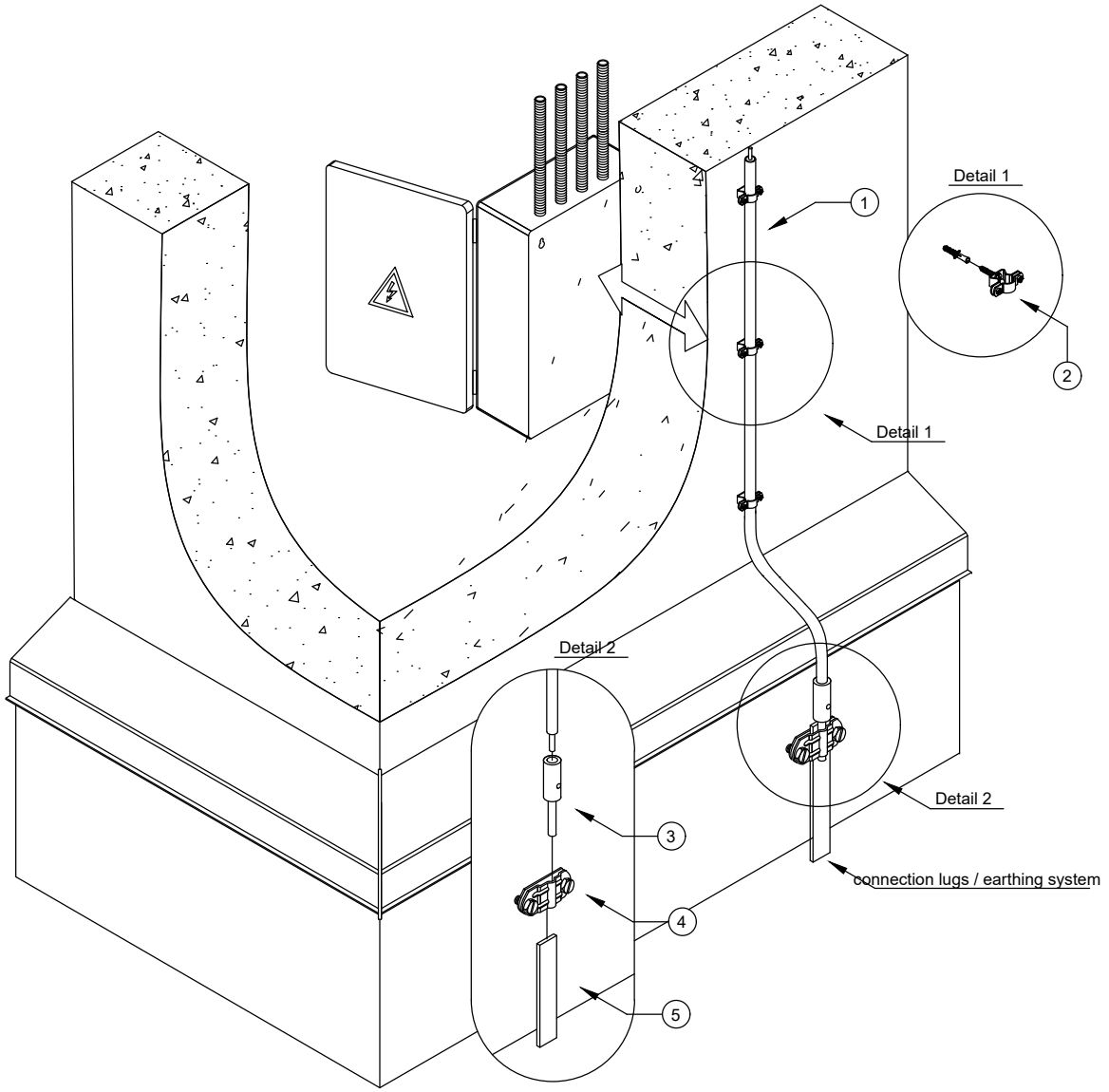
Ind.	Amendment typical		Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5408002	isCon Pro+ 75 SW	isCon conductor	
2	5408056	isCon H VA	VA cable bracket for isCon conductor	
3	5408022	isCon connect	isCon-Connection element	
4	5336457	233 A VA	Separating piece for Rd 8-10 and FL 30-40 mm	
5	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.06	Project No.:
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:						
Status:			Comment: Laying isCon conductor on the wall of a building to an earthing system.			

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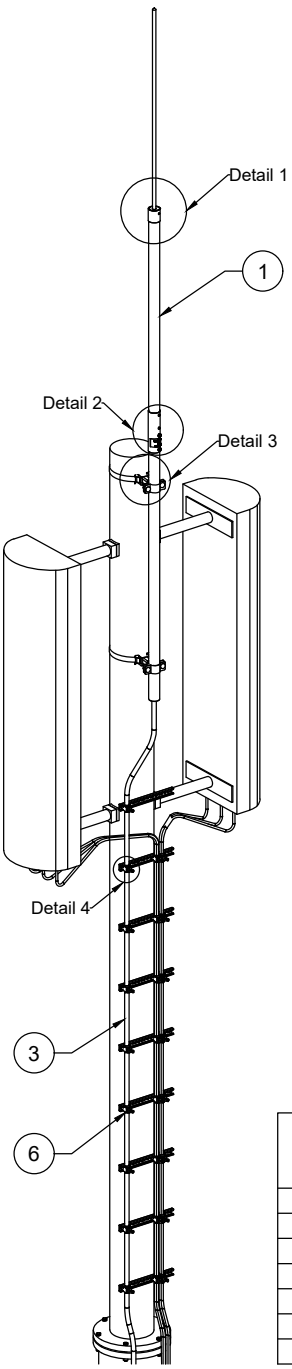
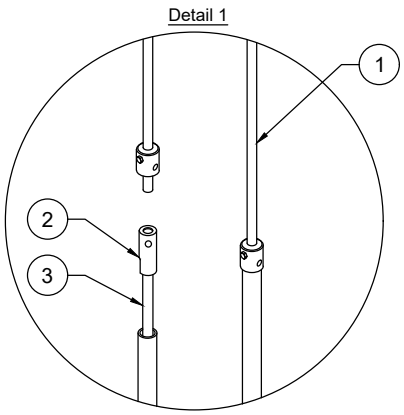
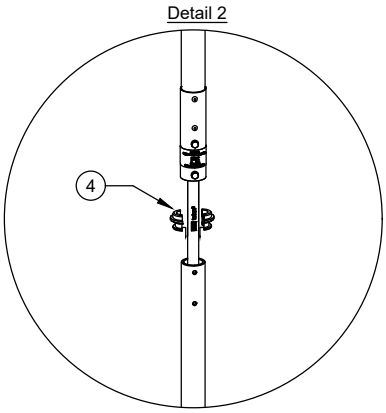
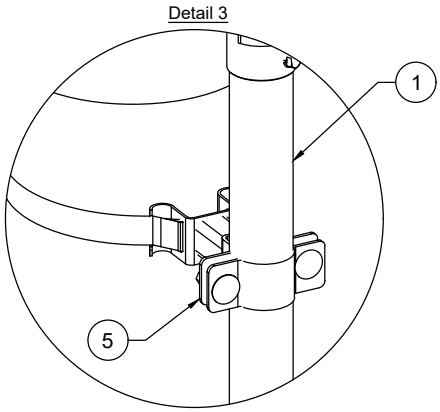
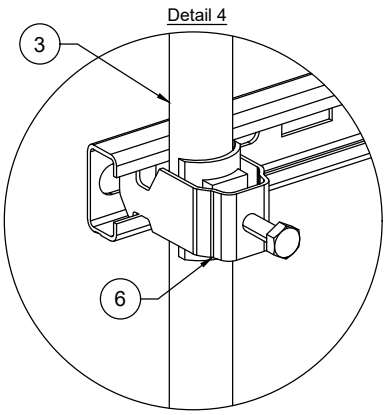
Ind.	Amendment typical	Date:	Name:			











	Item No.	Designation	Description	Q-ty
1	5408854	isFang IN L4	Insulated air-termination rod	
2	5408019	isCon IN con 2	Connection element	
3	5408008	isCon Pro 75 SW	isCon conductor	
4	5408032	isCon IN PAE 2	Potential connection	
5	5408955	isFang TR100 100	isFang support for spaced pipe mounting	
6	1160222	2056 22 FT	Clamp clip	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.07	Project No.:
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:			Comment: Lightning protection of mobile phone antenna			
Status:						

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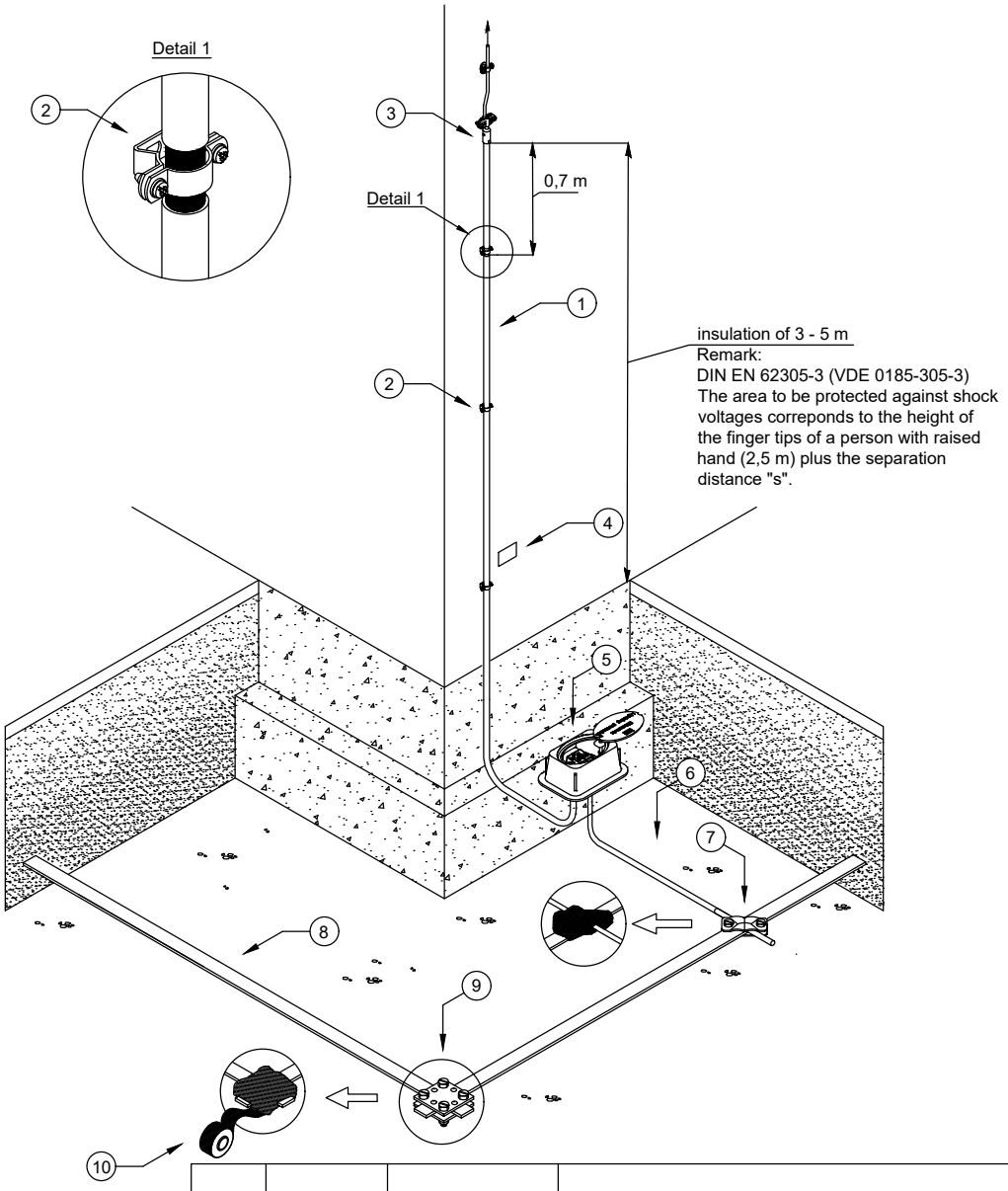
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5407997	isCon Pro+ 75 GR	isCon conductor, professional light grey	
2	5408056	isCon H VA	VA cable bracket for isCon conductor	
3	5408022	isCon connect	isCon-connection element	
4	5408059	isCon HWS EN	Information panel	
5	5106003	5700 SP	Inspection pit with integrated separation piece	
6	5021642	RD 10 V4A	Round conductor, stainless steel	
7	5312925	250 V4A	Cross connector for flat and round conductors	
8	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
9	5314659	256 A-DIN 30 V4A	DIN cross-connector for flat conductor	
10	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:			PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.08	Project No.:
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:						
Status:			Comment: Laying isCon conductor on the wall of a building to an earthing system. Installation of the measuring point at a height of 3-5 m due shock voltages.			

					Scale:	Sheet size:
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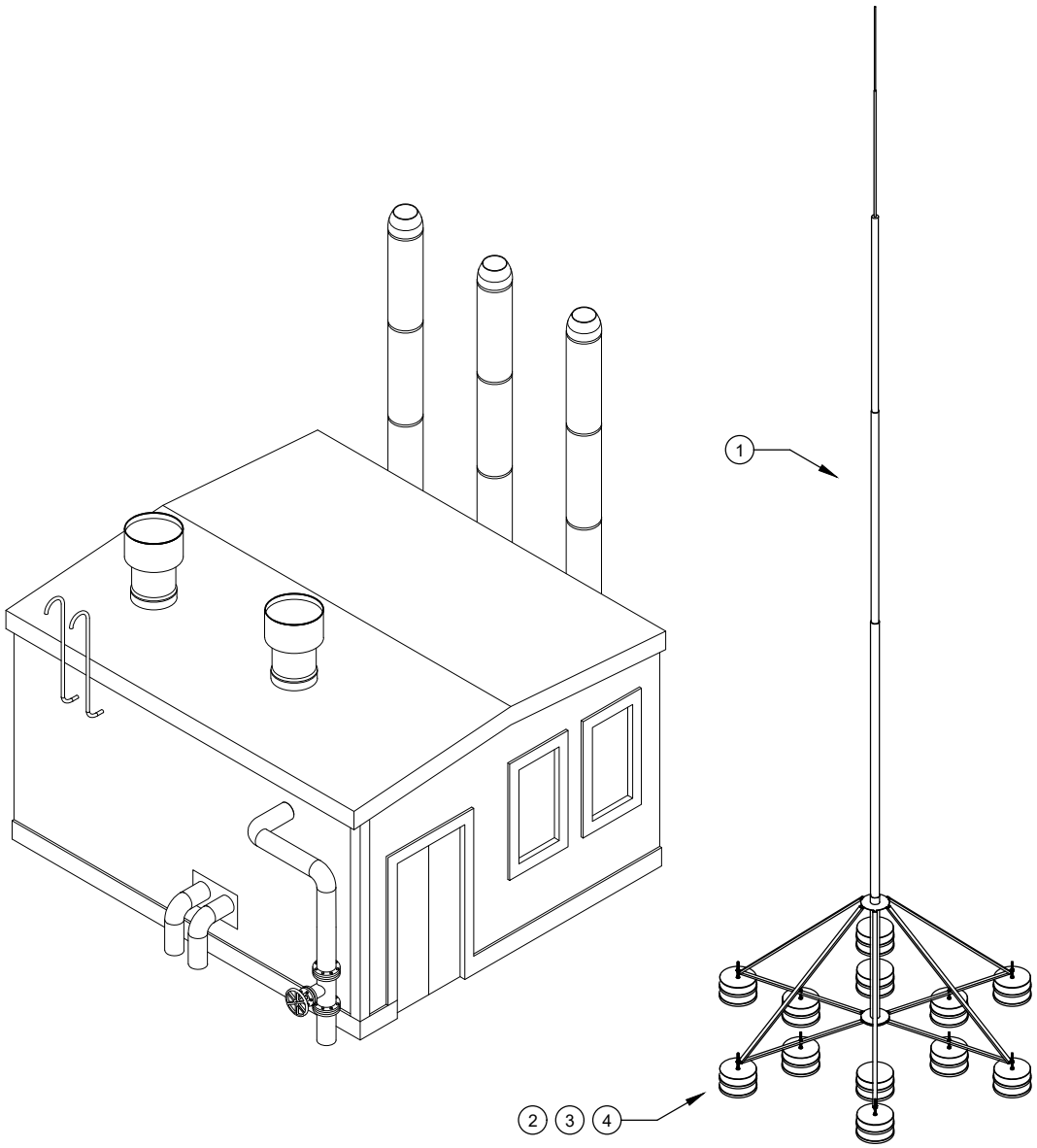
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5400810	irod 10	10 m air-termination rod with 6 legged	
2	5403227	F-FIX-S16	Concrete block for FangFix-System 16 kg	
3	5403238	F-FIX-B16 3B	Base for FangFix system 16 kg	
4	5408905	isFang 3B-150	isFang-3B threaded rod	

Drawing-No.:		PE 02	PF 250	Typical-No.: OBO-TBS-250-T7.09	Project No.:	
	Date:	Name:	Description: Isolated lightning protection system			
Creator:						
Editor:						
Status:			Comment: Lightning protection with tele interception rod systems. Installation of the Irod10 mast			
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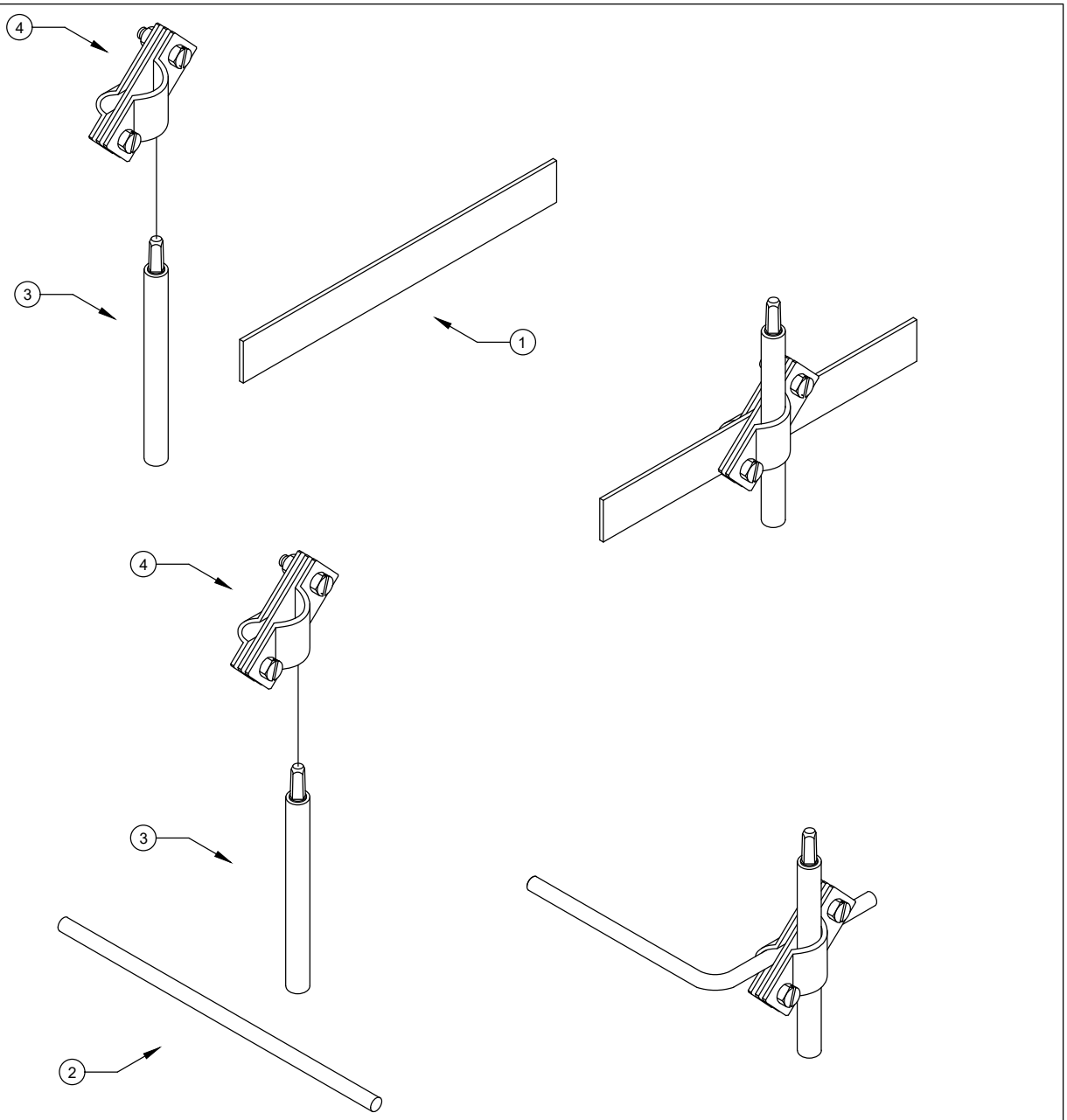
Ind.	Amendment typical	Date:	Name:			

Notes



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5021103	RD 10	Round conductor, galvanised steel	
3	5000017	219 20 OMEX FT	OMEX earthing rod	
4	5001641	2760 20 FT	Connection clamp for earth rod, universal	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.01	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Connection of round and flat conductors with earthing rod.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
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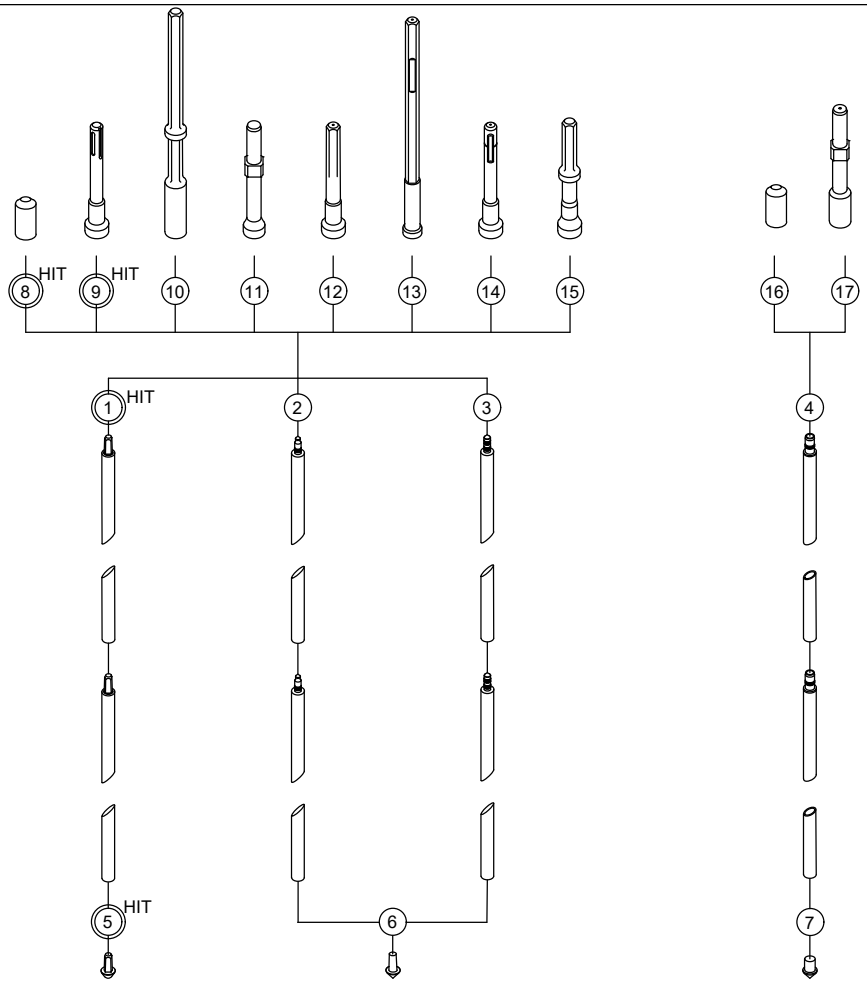
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5000017	219 20 OMEX FT	OMEX earthing rod	
2	5000947	219 20 BP FT	BP earthing rod	
3	5000742	219 20 ST FT	Earthing rod for standard applications	
4	5000300	LE ERDER FT	LightEarth earthing rod	
5	3041204	1819 20	Driving spike for OMEX earth rod	
6	3041212	1819 20BP	Driving spike for ST and BP earth rod	
7	3041409	LE SPITZE	Driving spike for LightEarth earth rod	
8	3042200	1820 20	Impact head for earthing rods ST, BP and OMEX	
9	3044904	2536 20	Hammer insert, type 2536, for earthing rods ST, BP and OMEX	
10	3043312	2510 20	Hammer insert, type 2510, for earthing rods ST, BP and OMEX	
11	3043703	2520 20	Hammer insert, type 2520, for earthing rods ST, BP and OMEX	
12	3043401	2530 20	Hammer insert, type 2530, for earthing rods ST, BP and OMEX	
13	3043908	2531 20	Hammer insert, type 2531, for earthing rods ST, BP and OMEX	
14	3043916	2535 20	Hammer insert, type 2535, for earthing rods ST, BP and OMEX	
15	3043207	2500 20	Hammer insert, type 2500, for earthing rods ST, BP and OMEX	
16	3042308	LE KOPF	Impact head for LightEarth earthing rod	
17	3043602	LE HAMMER-SDS-M	Hammer insert for LightEarth earthing rod	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.02	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:			Comment: Types of earthing rods and accessories for their mounting			
Status:						
— — —			OBO BETTERMANN	Scale:	Sheet size:	
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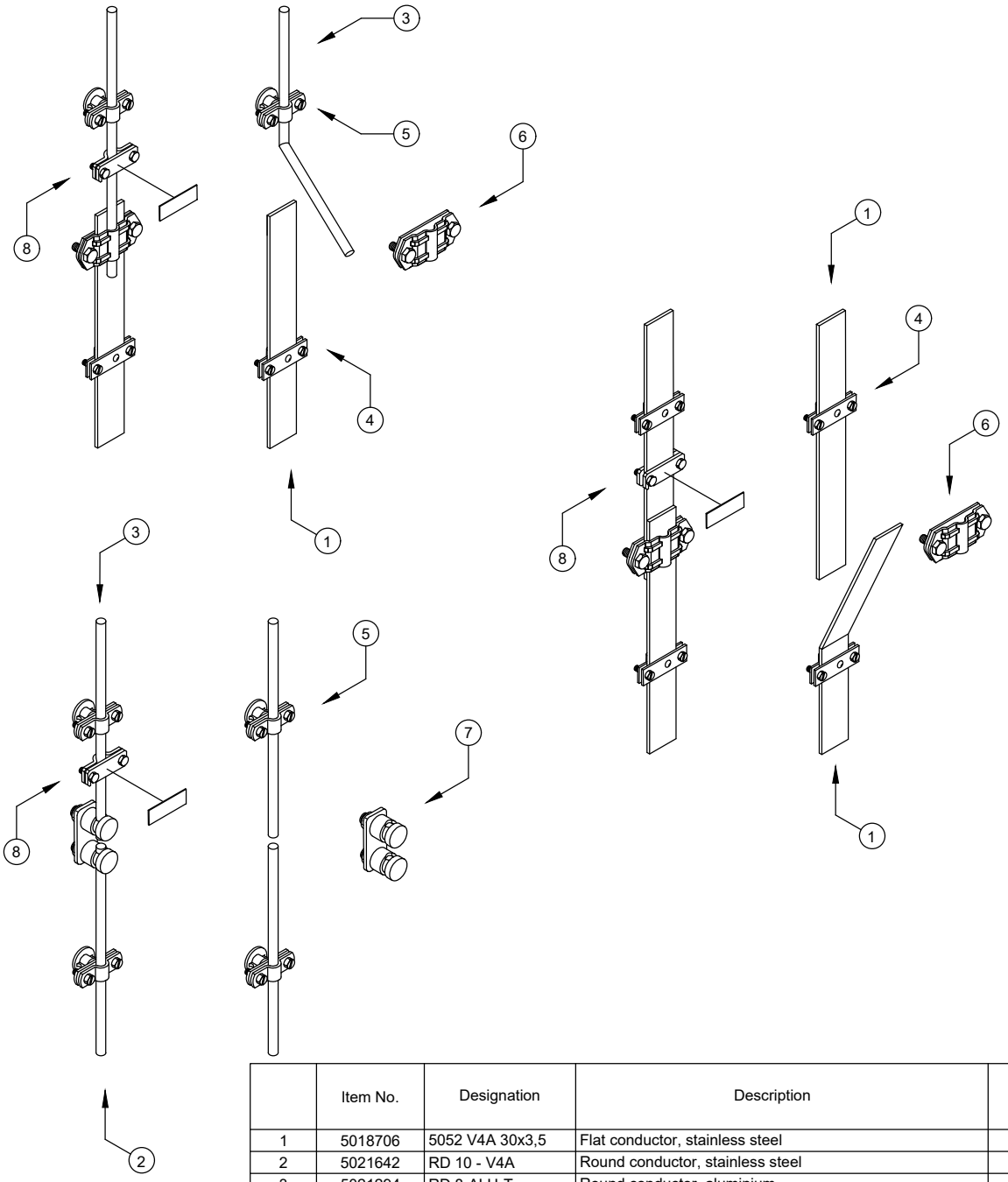
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	5021642	RD 10 - V4A	Round conductor, stainless steel	
3	5021294	RD 8-ALU-T	Round conductor, aluminium	
4	5032539	832 30	Spacer clip for flat conductor, with fastening hole Ø 7 mm	
5	5229960	113 Z8-10	Cable bracket with crossbar Rd 8-10 mm	
6	5236457	233 A VA	Separating piece for Rd 8-10 and FL 30-40 mm	
7	5304270	5002 N-VA	Connector, Rd 8-10 mm, double, with pressure through	
8	3049256	311 N-ALU 8-10	Number plates	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.03	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Options for organizing the separation point of the down-conductors and the earth lead for different types of conductors.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
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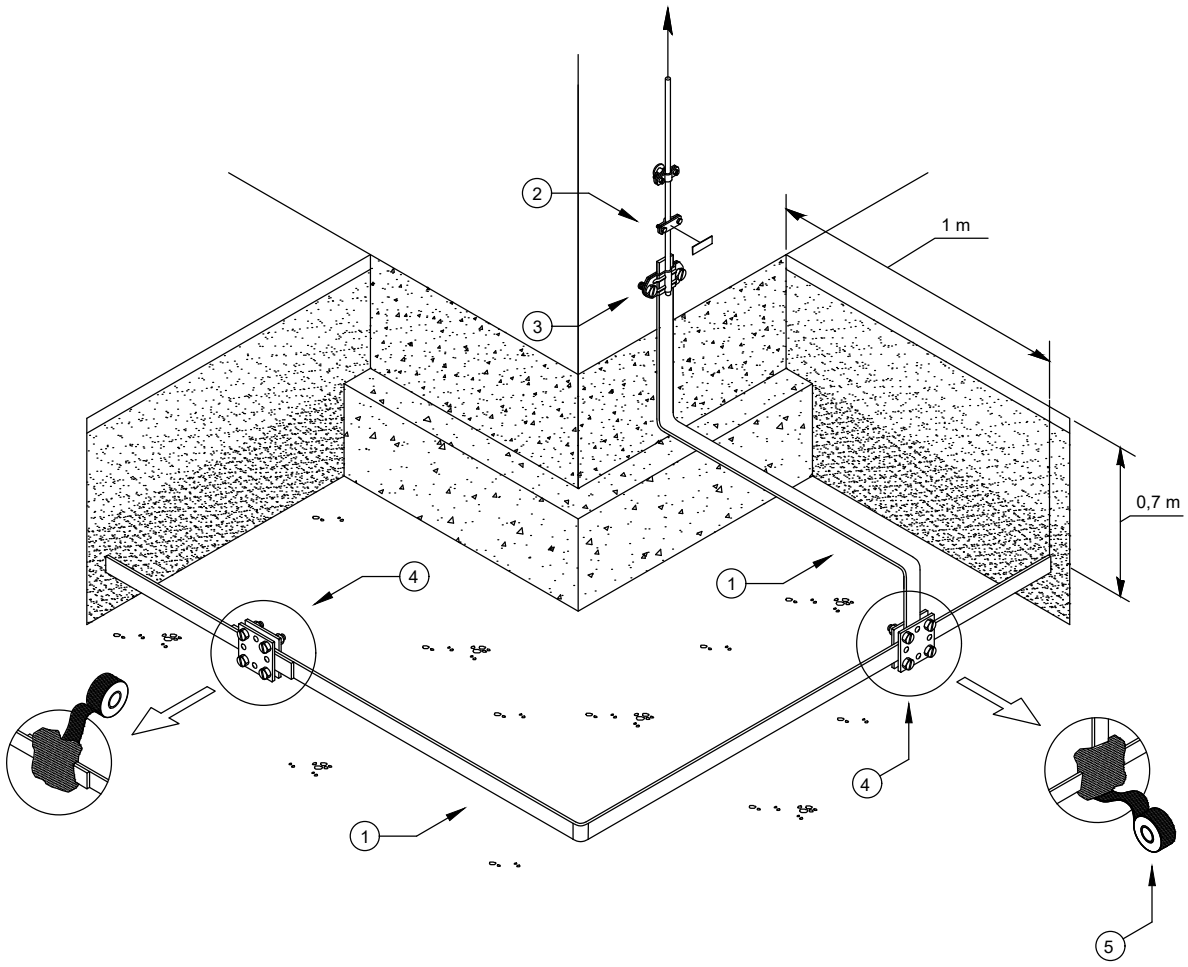
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	3049256	311 N-ALU 8-10	Number plates	
3	5336341	233 VA	Separating piece for Rd 8-10 and FL 30 mm	
4	5314659	256 A-DIN 30V4A	DIN cross-connector for flat conductor	
5	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.04	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Laying a flat conductor around the perimeter of the building as a earth lead.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
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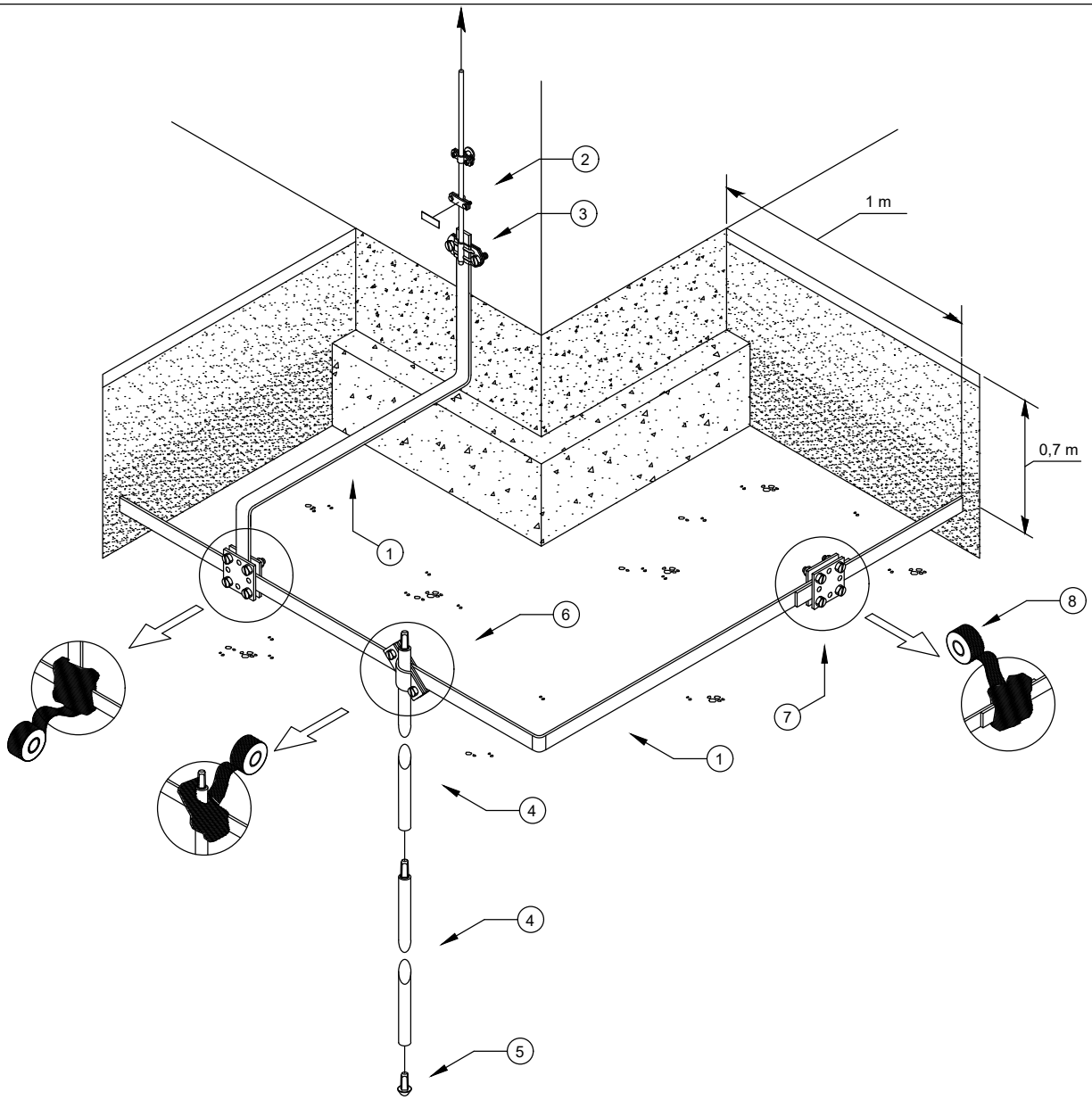
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	3049256	311 N-ALU 8-10	Number plates	
3	5336341	233 VA	Separating piece for Rd 8-10 and FL 30 mm	
4	5000858	219 20 BP V4A	BP earthing rod	
5	3041212	1819 20BP	Driving spike for ST and BP earth rod	
6	5001633	2760 20 V4A	Connection clamp for earth rod, universal	
7	5314659	256 A-DIN 30 V4A	DIN cross- connector for flat conductor	
8	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.05	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Laying a flat conductor around the perimeter of the building in combination with earthing rod.			
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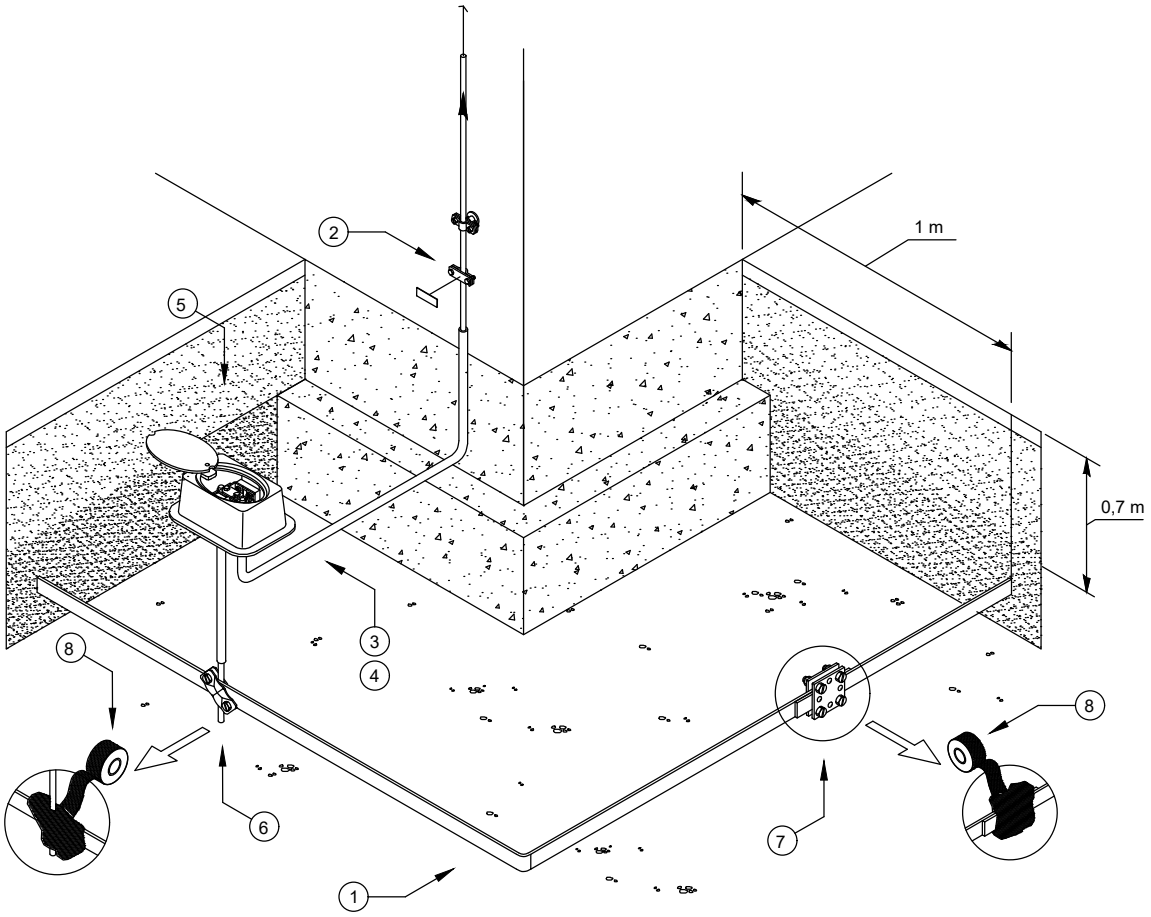
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	3049256	311 N-ALU 8-10	Number plates	
3	5021081	RD 8 FT	Round conductor, galvanised steel	
4			Shrink tubing (corrosion protection)	
5	5106003	5700 SP	Inspection pit with integrated separation piece	
6	5313023	250 A-VA	Diagonal clamp for flat conductors and round conductors	
7	5314659	256 A-DIN 30 V4A	DIN cross-connetor for flat conductor	
8	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.06	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Installation of a inspection pit between the earthing systems and down-conductors.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
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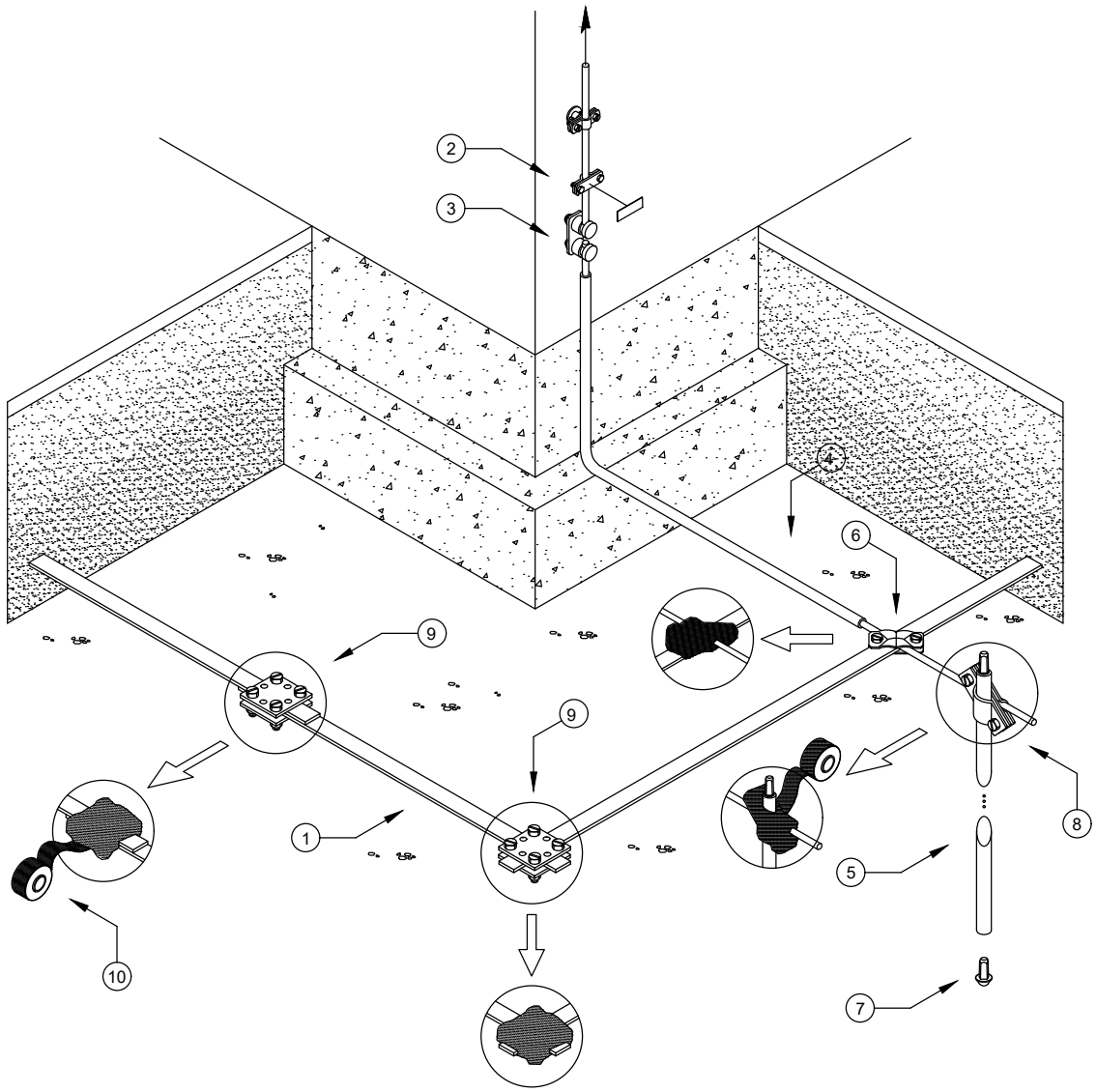
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	3049256	311 N-ALU 8-10	Number plates	
3	5304270	5002 N-VA	Connector, Rd 8-10 mm, double, with pressure trough	
4	5021162	RD 10 PVC	Round conductor, galvanised steel with PVC jacketing	
5	5000858	219 20 BP V4A	BP earthing rod	
6	5313023	250 A-VA	Diagonal clamp for flat conductors and round conductors	
7	3041212	1819 20 BP	Driving spike for ST and BP earth rod	
8	5001633	2760 20 V4A	Connection clamp for earth rod, universal	
9	5314659	256 A-DIN 30 V4A	DIN cross-connector for flat conductor	
10	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.07	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Laying a flat conductor around the perimeter of the building in combination with earthing rod.			
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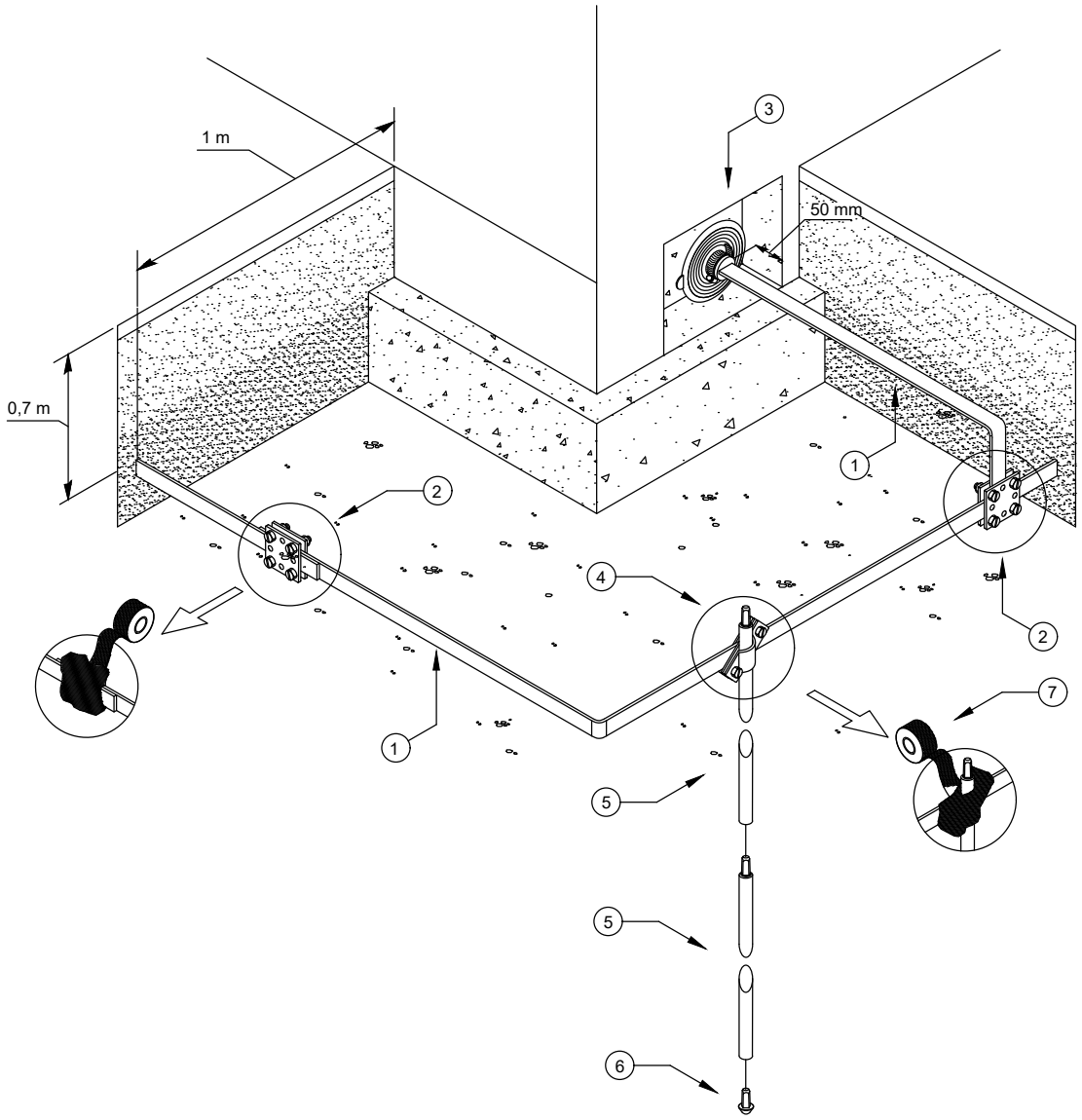
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5018706	5052 V4A 30x3,5	Flat conductor, stainless steel	
2	5314659	256 A-DIN 30 V4A	DIN cross-connector for flat conductor	
3	2360043	DW FL 30x3,5	Sealing sleeve for flat conductors	
4	5001633	2760 20 V4A	Connection clamp for earth rod, universal	
5	5000858	219 20 BP V4A	BP earthing rod	
6	3041212	1819 20 BP	Driving spike for ST and BP earth rod	
7	2360055	356 50	Plastic corrosion protection strip	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.08	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Connecting the main earthing busbar (MEB) outside to the buildings earthing system.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
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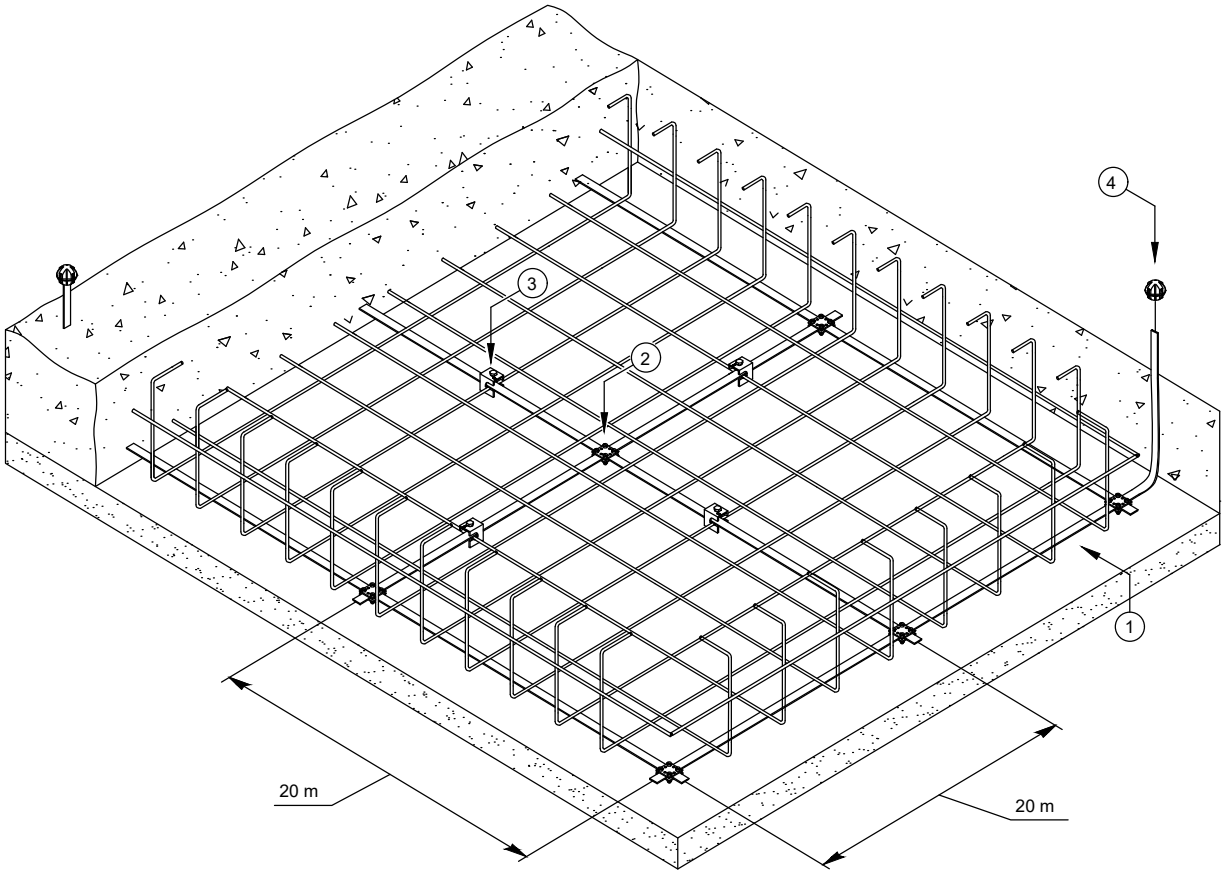
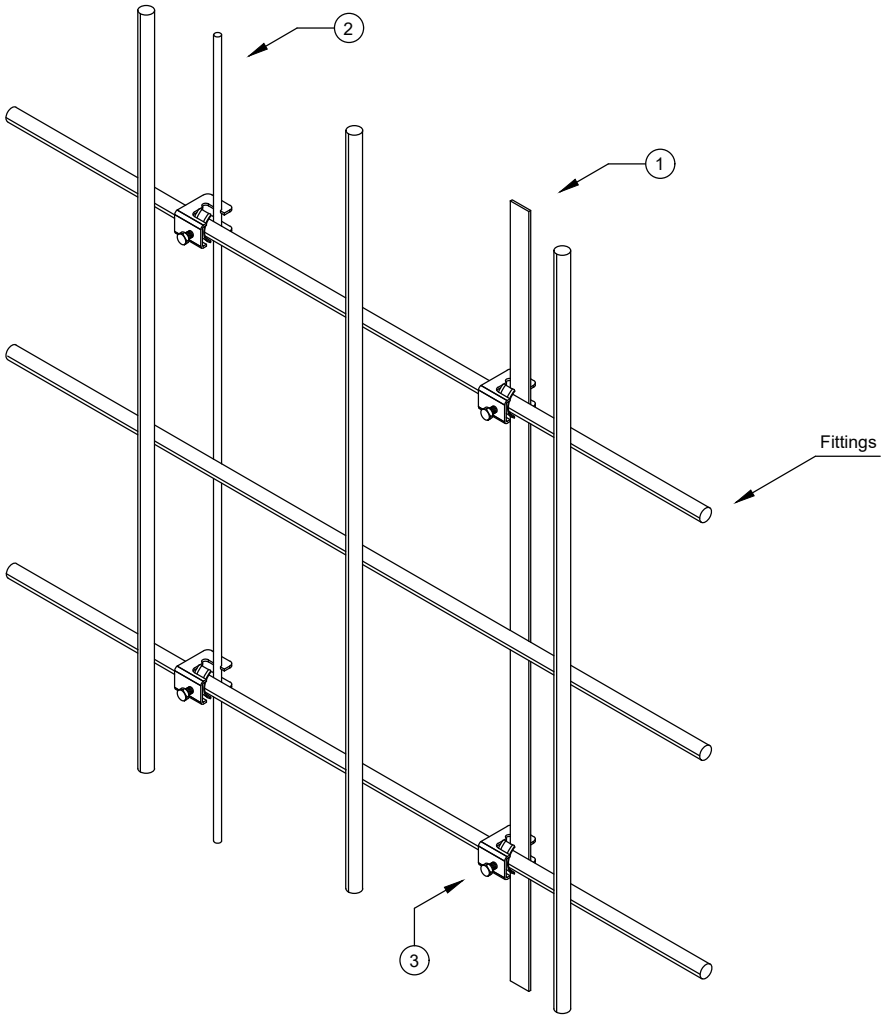
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5314658	256 A-DIN 30 FT	DIN cross-connector for flat conductor	
3	5014468	1814 FT	Connection terminal for reinforced steels	
4	5018014	ProtectionBall	Protective cap for connection lugs, reflective	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.09	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Foundation earthing system. Fixing of flat conductors to fittings.			
Ind.	Amendment typical	Date:	Name:	OBO BETTERMANN	Scale:	Sheet size:
					Sheet:	of:



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5021103	RD 10	Round conductor, galvanised steel	
3	5014469	1814 FT D37	Connection terminal for large reinforced steels	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.10	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Foundation earthing system. Fixing of flat conductors and round conductors to fittings.			
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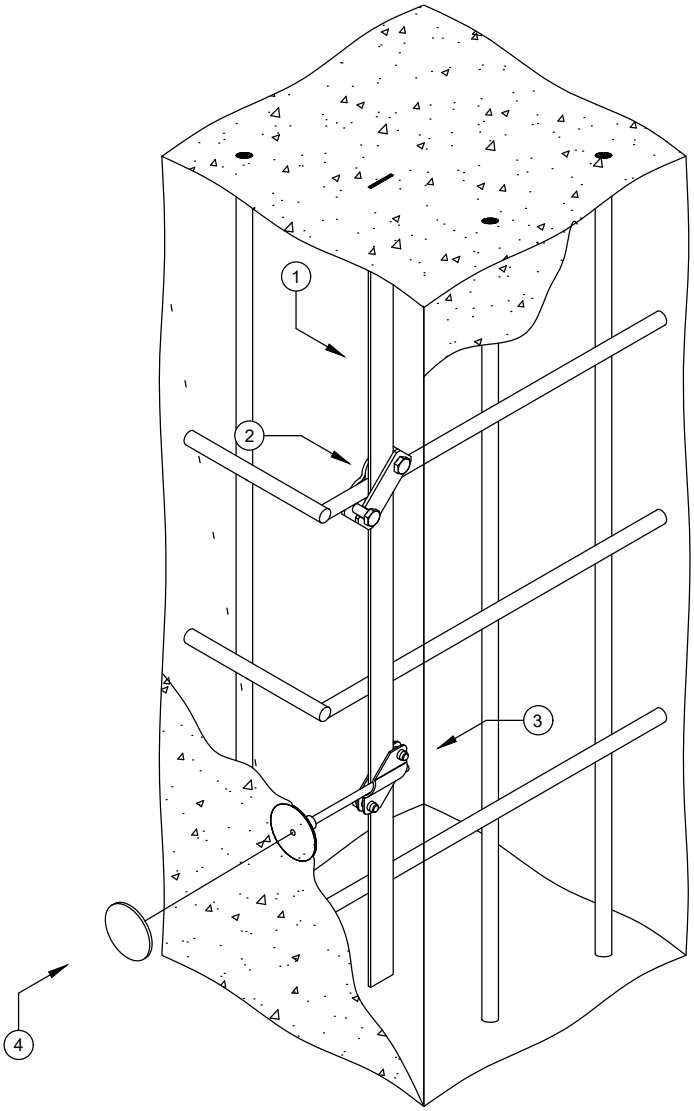
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5313031	250 AS-FT	Diagonal clamp for flat conductors and round conductors	
3	5312925	250 V4A	Cross-connector for flat conductors and round conductors	
4	5420022	205 DG L180 V4A	Fixed earthing point	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.11	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Foundation earthing system. Output of the connection point to the surface.			
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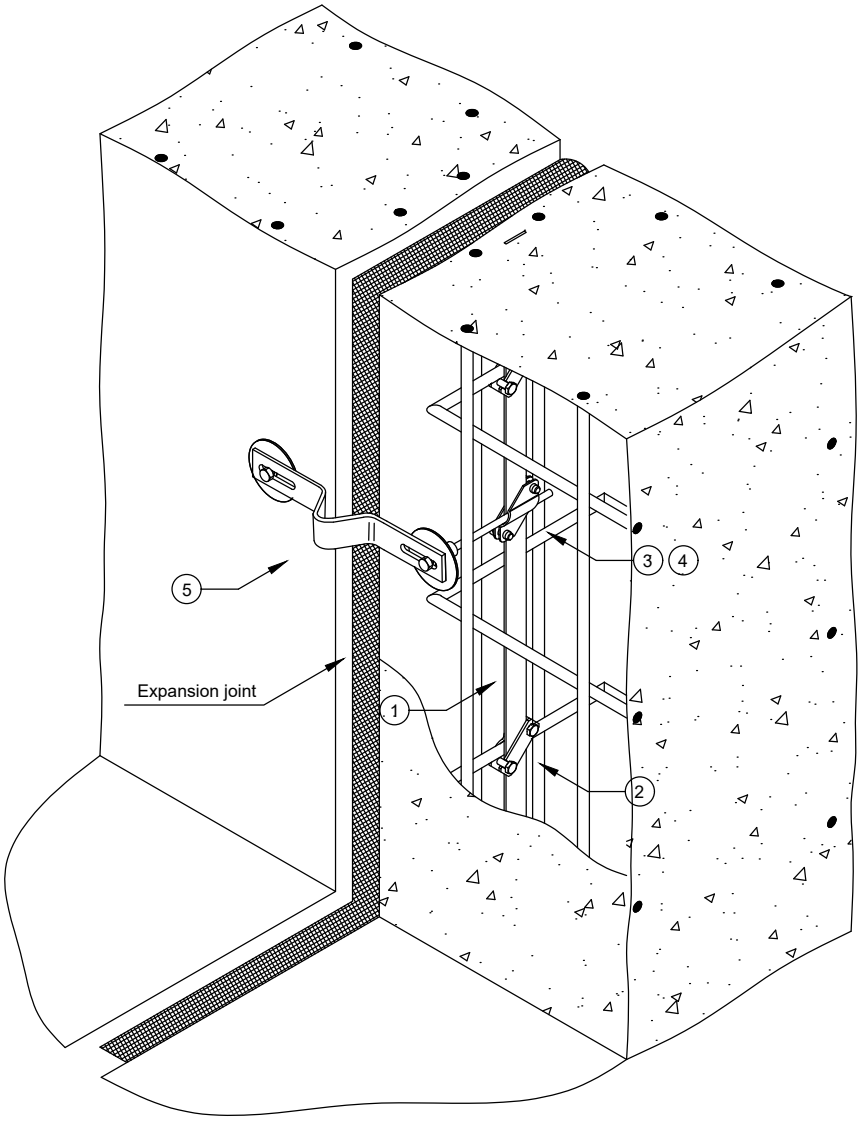
— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5313031	250 AS-FT	Diagonal clamp for flat conductors and round conductors	
3	5312925	250 V4A	Cross-connector for flat conductors and round conductors	
4	5420022	205 DG L180 V4A	Fixed earthing point	
5	5016142	1807	Expansion piece	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.12	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Foundation earthing system. Installation of a compensator at a deformation joint.			
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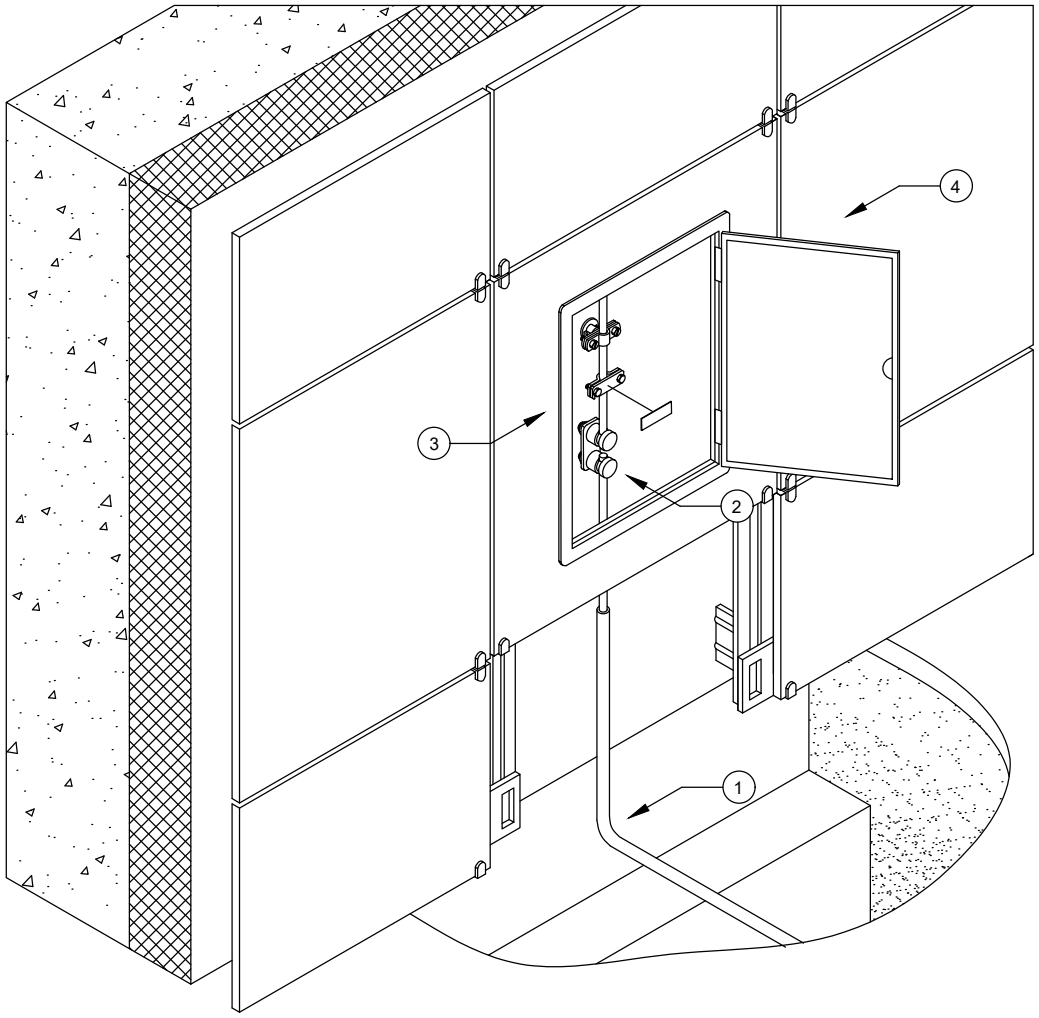
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021162	RD 10 PVC	Round conductor, galvanised steel with PVC jacketing	
2	5304270	5002 N-VA	Connector, Rd 8-10 mm double, with pressure trough	
3	3049256	311 N-ALU 8-10	Number plates	
4	5106141	5800 VA	Inspection door	

Drawing-No.:			PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.13	Project No.:
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Installation of the inspection door on the cladding of the ventilated facade.			
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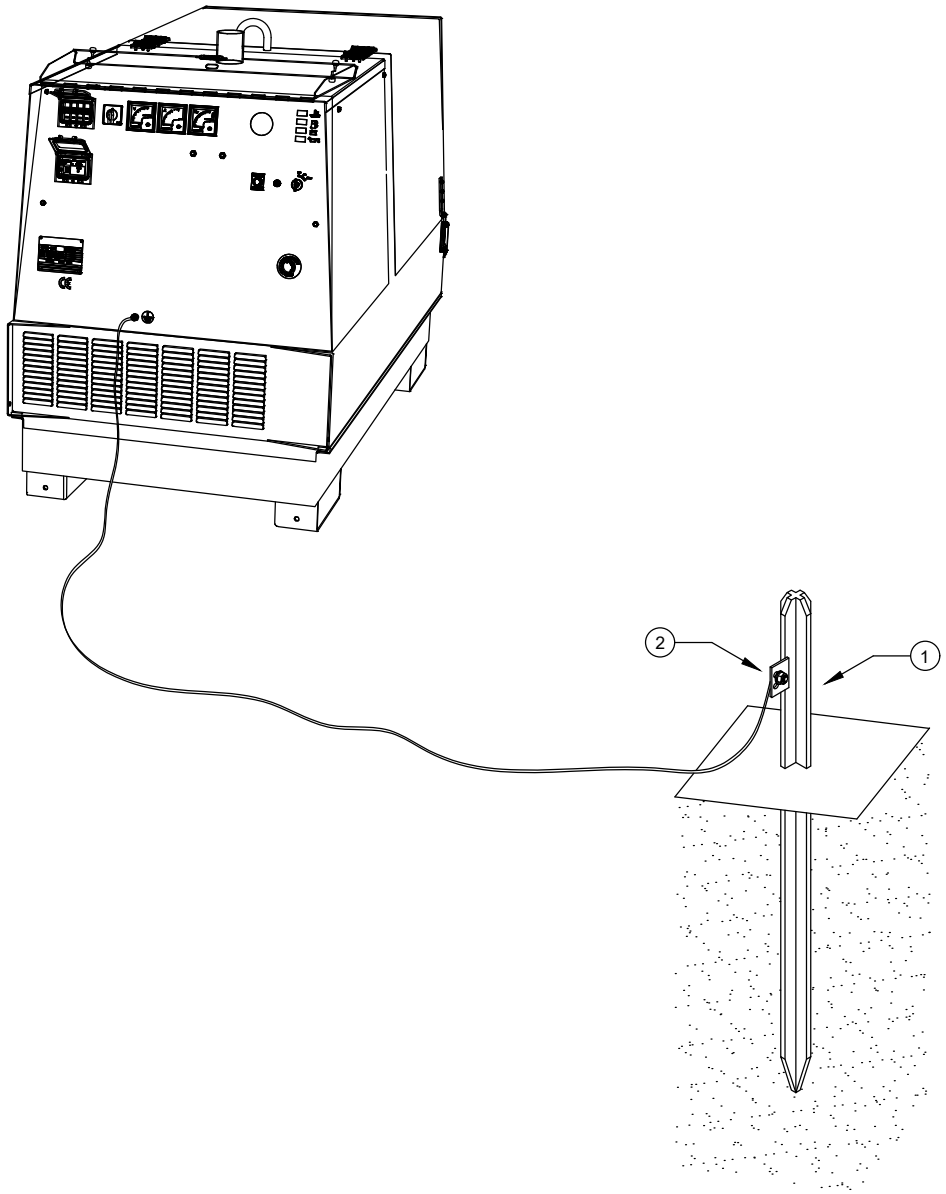
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5003040	213 3000 DIN	Profile earthing rod with connecting lug	
2	5040507	928	Earthing terminal for fastening on earthing strap	

Drawing-No.:		PE 02	PF 200	Typical-No.: OBO-TBS-200-T5.14	Project No.:	
	Date:	Name:	Description: Earthing systems			
Creator:						
Editor:						
Status:			Comment: Portable grounding of equipment.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
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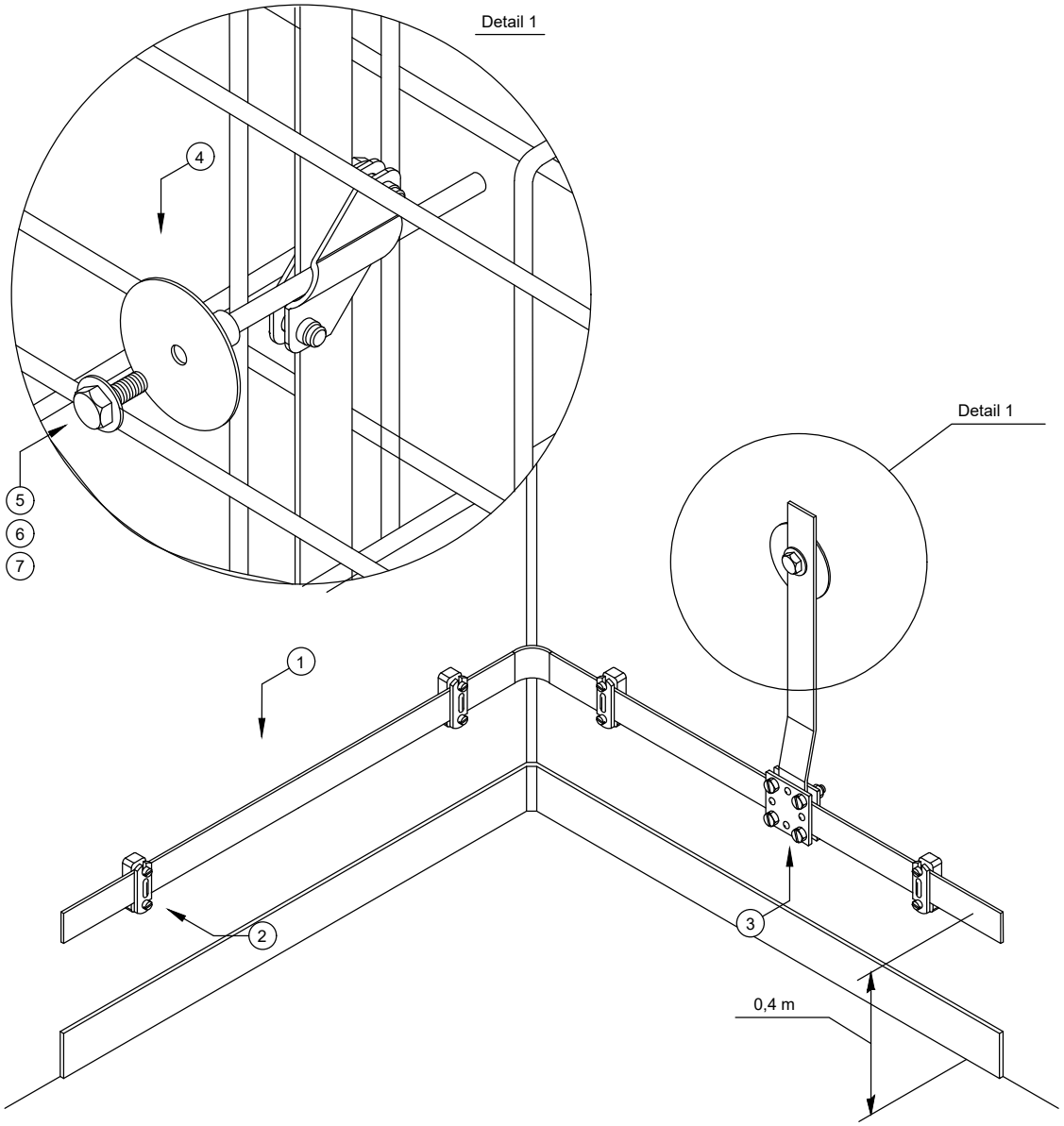
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5033039	833 35	Spacer clip for flat conductor, with polyamide base	
3	5314658	256 A-DIN 30 FT	DIN cross-connector for flat conductor	
4	5420024	205 DG L180 FT	Fixed earthing point	
5	3060203	HHS M10x20 G	Hexagonal bolt ISO 4017	
6	3402460	966 M10 F	Washer F	
7	3404102	SWS M10 G	Serrated washer DIN 6798 G	

Drawing-No.:			PE 02	PF 150	Typical-No.: OBO-TBS-150-T6.01	Project No.:
	Date:	Name:	Description: Equipotential bonding system			
Creator:						
Editor:						
Status:			Comment: Mounting the equipotential bonding bus. Connection to the foundation earthing system on the wall.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
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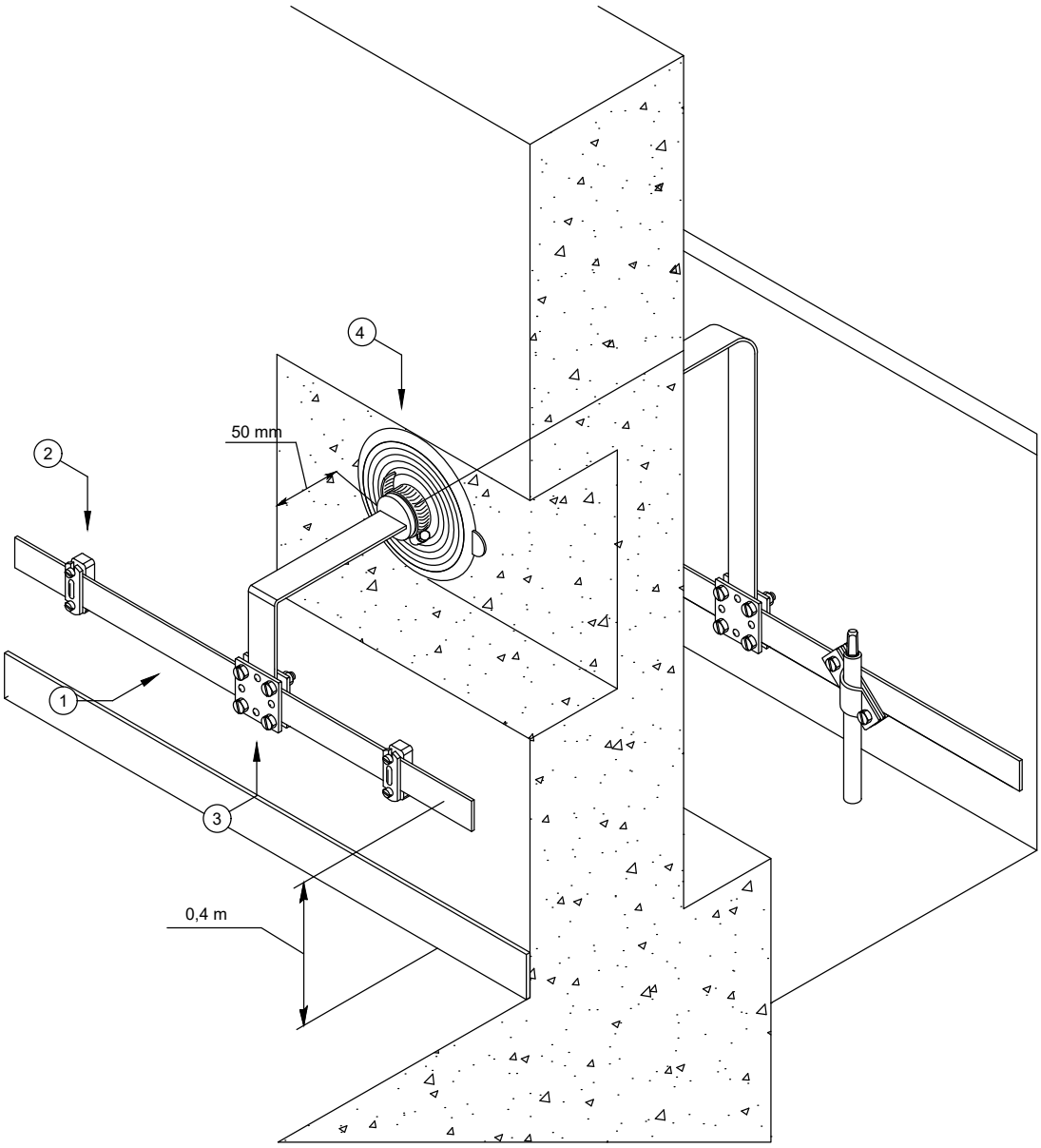
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5033039	833 35	Spacer clip for flat conductor, with polyamide base	
3	5314658	256 A-DIN 30 FT	DIN cross-connector for flat conductor	
4	2360043	DW FL30x3,5	Sealing sleeve for flat conductors	

Drawing-No.:		PE 02	PF 150	Typical-No.: OBO-TBS-150-T6.02	Project No.:	
	Date:	Name:	Description: Equipotential bonding system			
Creator:						
Editor:						
Status:			Comment: Mounting the equipotential bonding bus. Output to external earthing system.			
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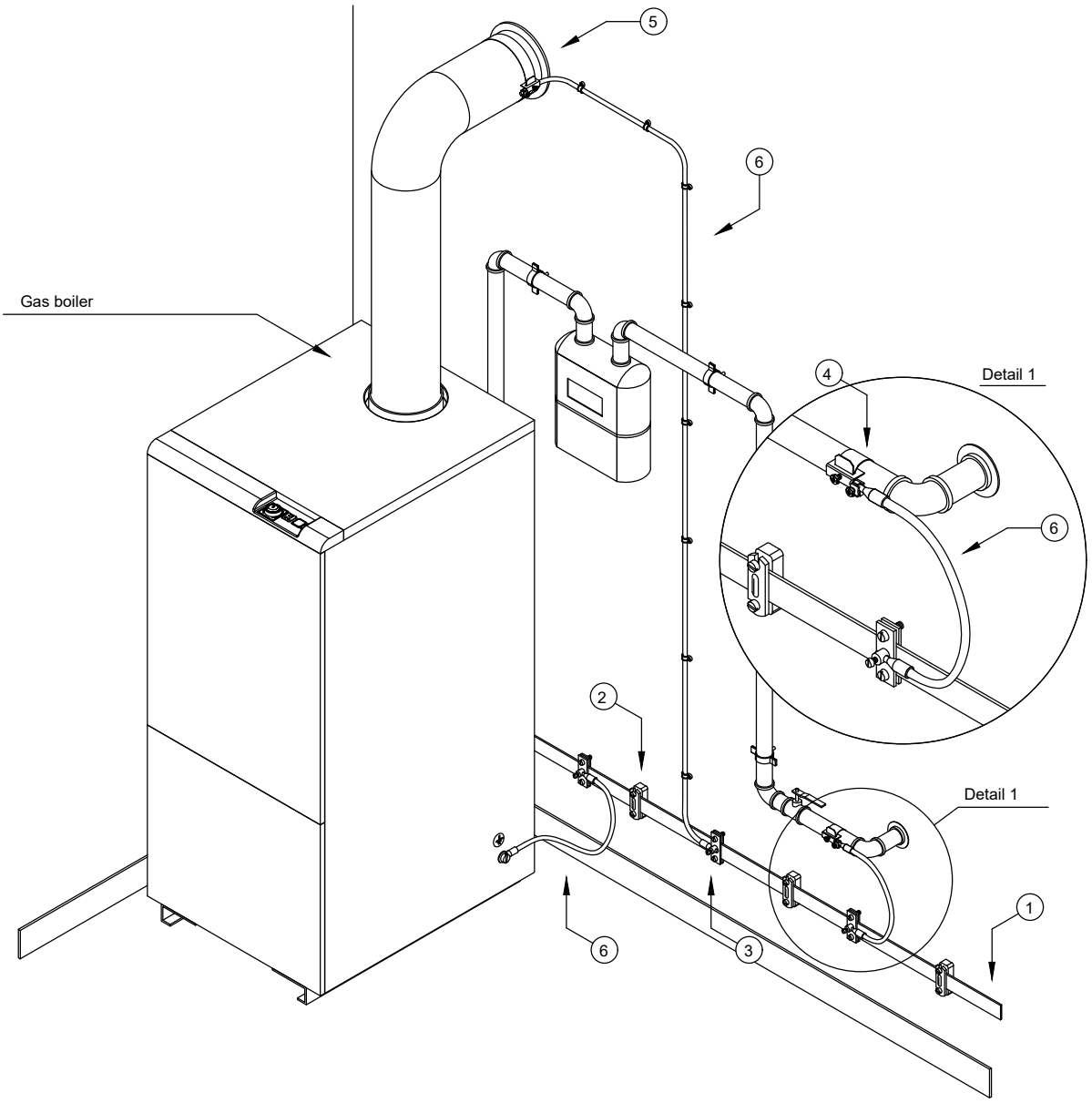
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5033039	833 35	Spacer clip for flat conductor, with polyamide base	
3	5043107	939	Earthing terminal for cables and flat conductors	
4	5057523	927 2	Earthing pipe clamp VA	
5	5057558	927 4	Earthing pipe clamp VA	
6			Earthing cable min. 6 mm²	

Drawing-No.:			PE 02	PF 150	Typical-No.: OBO-TBS-150-T6.03	Project No.:
	Date:	Name:	Description: Equipotential bonding system			
Creator:						
Editor:			Comment: Connection of the gas boiler to the equipotential bonding bus.			
Status:						
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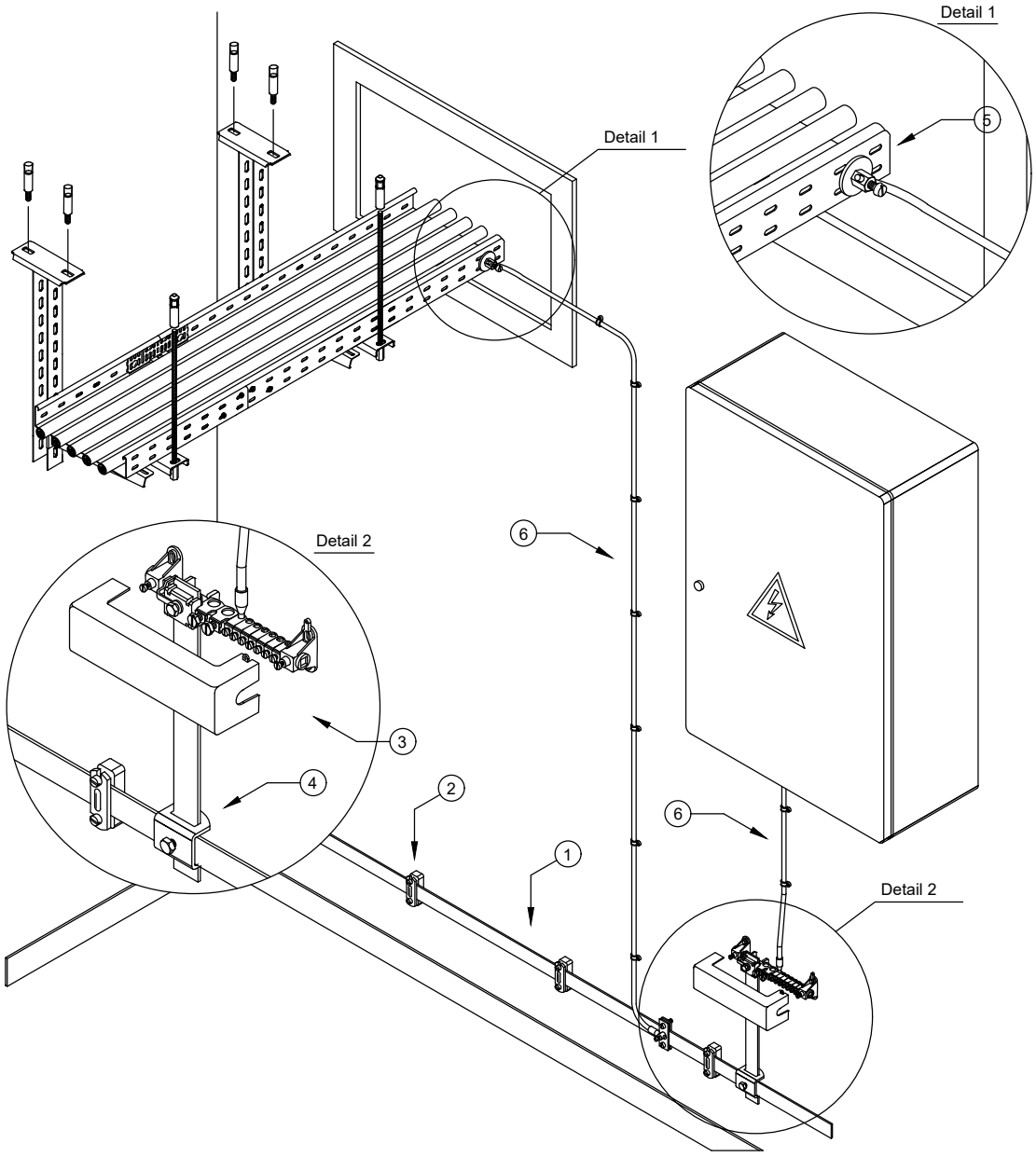
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5033039	833 35	Spacer clip for flat conductor, with polyamide base	
3	5015650	1801 VDE	Equipotential bonding rail for indoors, VDE tested	
4	5014425	1813 KL	Variable earthing terminal	
5	5040507	928	Earthing terminal for fastening on earthing strap	
6			Earthing cable min. 6 mm²	

Drawing-No.:			PE 02	PF 150	Typical-No.: OBO-TBS-150-T6.04	Project No.:
	Date:	Name:	Description: Equipotential bonding system			
Creator:						
Editor:						
Status:			Comment: Connection the sub-distributor and cable tray systems to the equipotential bonding rail.			

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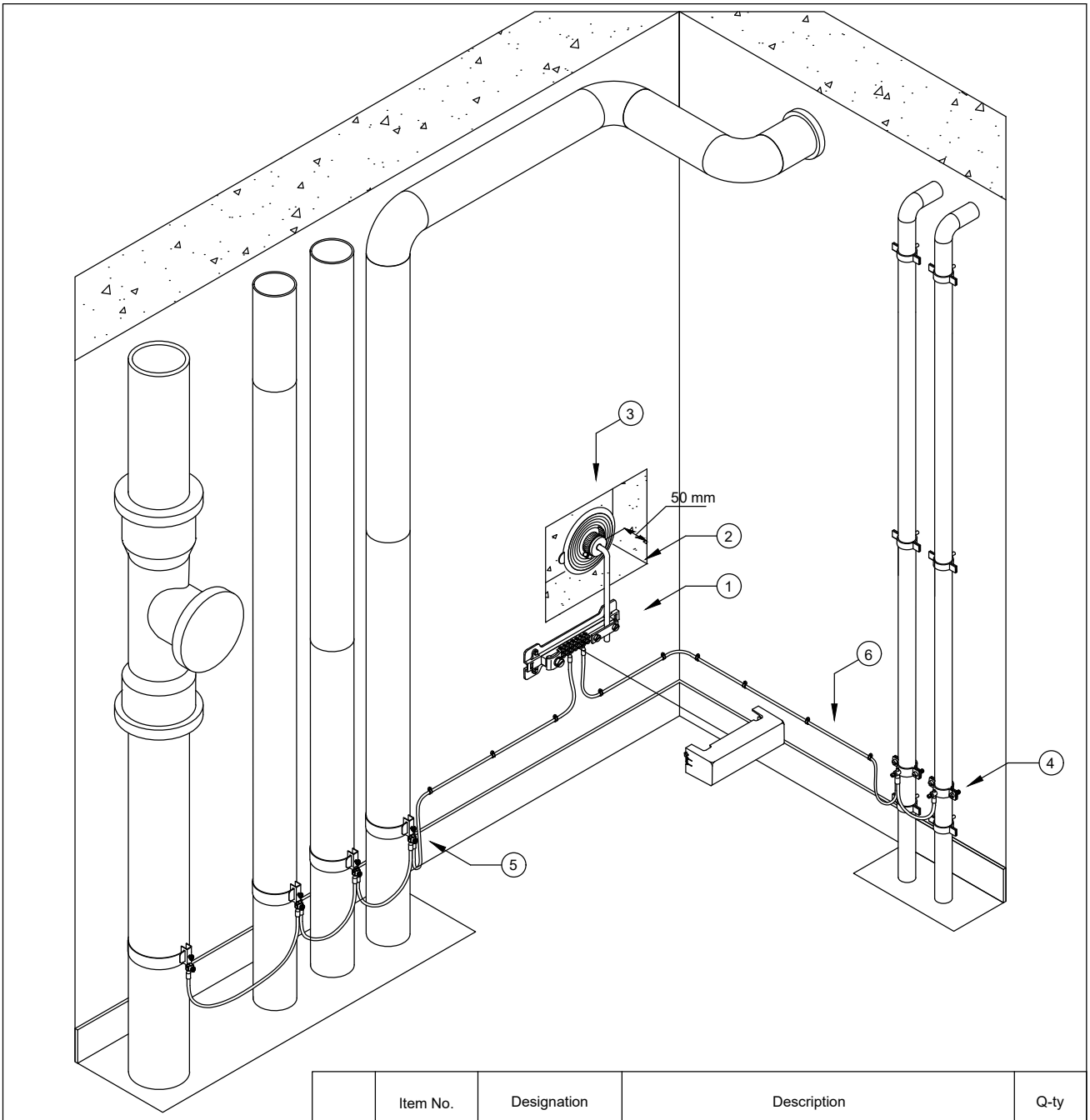
	— — —				Sheet:	of:
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5015081	1809 M	Equipotential bonding rail with metal base plate	
2	5021103	RD 10	Round conductor, galvanised steel	
3	2360041	DW RD10	Sealing sleeve for round conductors	
4	5040159	925 1 1/2	Earthing clamp, type 925	
5	5057558	927 4	Earthing pipe clamp VA	
6			Earthing cable min. 6 mm²	

Drawing-No.:		PE 02	PF 150	Typical-No.: OBO-TBS-150-T6.05	Project No.:	
	Date:	Name:	Description: Equipotential bonding system			
Creator:						
Editor:						
Status:			Comment: Connection of water and heating pipes to a equipotential bonding rail.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
— — —					Sheet:	of:
Ind.	Amendment typical	Date:	Name:			

Notes

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Customer Service

South Africa

O-line (Pty) Ltd Johannesburg
Reg No 1982/000082/07
P.O. Box 6457
Johannesburg 2000
14/16 Prop Street
Selby Ext. 11
Johannesburg 2001
South Africa
Tel: (+27) 011-378-3700
email: o-line@o-line.com

O-line Pretoria
P.O.Box 2039
Silverton 0127
The Willows Business Park
219 Battery Street
Silverton
South Africa
Tel: (+27) 012-803-1803
email: o-linepta@o-line.com

O-line Kwazulu-Natal
Reg No 1982/000082/07
P.O.Box 2534
New Germany 3620
13 Young Road
Westmead 3610
South Africa
Tel: (+27) 031-705-6355
email: o-linekzn@o-line.com

O-line Cape Town
Reg No 1985/000416/07
P.O.Box 506
Eppindust 7475
Unit 1, 17 Hewett Avenue
Epping Industria 2
7460
Tel: (+27) 021-531-9071
email: o-linecpt@o-line.com

O-line Gqeberha
P.O.Box 1352
Gqeberha 6000
Unit 10, BMI Complex
26 Patterson Road
North End
Gqeberha 6001
South Africa
Tel: (+27) 041-486-3674
email: o-linepe@o-line.com

O-line Bloemfontein
P.O.Box 29809
Danhof 9310
Eland Street
Eland Industrial Park
Unit 11
Quaggafontein
Bloemfontein 9301
South Africa
Tel: (+27) 051-432-0707
email: o-linebfn@o-line.com

International

O-line Mocambique Limitada
Reg No. 2009/1001240/68
Rua Beliluana
Parcela 510
Djuba, Matola- Rio
Tel: (+258) 21 730 243
email: o-linemz@o-line.com

OBO Bettermann Ghana
Reg No. CS036372016
Plot No. 53
Flower Pot
Spintex Road
Accra
Ghana
Tel: (+233) 501 522 488
email: obo.ghana@obo-bettermann.com

www.o-line.com