OBO-Typicals

Detaljni crtež montaže

sistema protivpožarne zaštite, uzemljenja
i izjednačavanja potencijala

OBO BETTERMANN

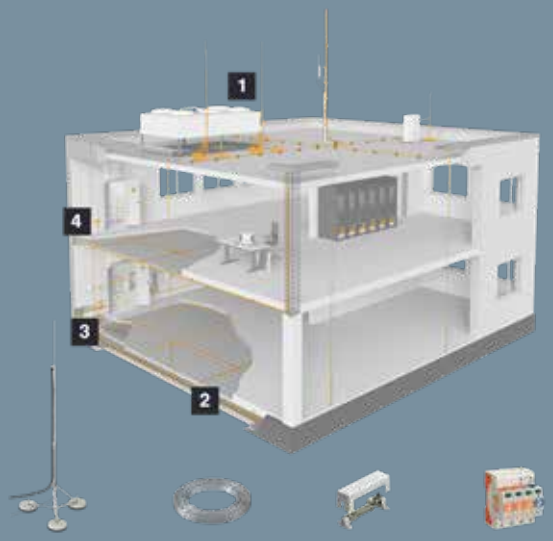
Osnovno znanje

Osnove standardnog planiranja

Vaš pomoćnik za planiranje i praktično sprovođenje aktuelnih normi i pravilnika.

Sa inovativnom OBO tehnikom protiv:

- Opasnost od struje groma i indukovanih napona
- Oštećenja usled vatre, eksplozije, korak napona, kontakt napona, itd.
- Povrede osoba, oštećenja zgrada i delova zgrada



1 Sistemi za hvatanje, ispravljanje i odvođenje
2 Sistemi uzemljenja
3 Sistemi izjednača-vanja tencijala
4 Sistemi prenaponske zaštite

Štiti

Pincip „Zaštićeni sa četiri strane“:
Samo usklađena zaštita je prava zaštita. Upoznajte se sa zadacima pojedinačnih sistema na video snimku.

OBO ACADEMY

Connect to knowledge

Od teorijske osnove do konkretne primene – širimo znanje obukama na lokalu:

- Normativne osnove
- Analize rizika, klase gromobranske zaštite, sistemi gromobranske zaštite
- Zahtevi u pogledu uzemljenja za vertikalne uzemljivače, prstenaste uzemljivače i temeljne uzemljivače
- Opasnosti od atmosferskog pražnjenja i prenapona
- Zone gromobranske zaštite i tehnologije odvođenja
- Zaštitno i funkcijsko izjednačavanje potencijala
- Primeri primene, informacije za instalaciju, pomoć za planiranje, praktična pitanja

Sistemi uzemljenja

Temelj gromobranske i prenaponske zaštite

Zahtevi u pogledu uzemljivača prema IEC/EN 62305-3

Tip A
- Horizontalni uzemljivač
- Vertikalni uzemljivač (dubinski uzemljivač)

Tip B
- Prstenasti uzemljivač (površinski uzemljivač)
- Temeljni uzemljivač

Raspored uzemljivača tipa A (horizontalni i vertikalni uzemljivači)

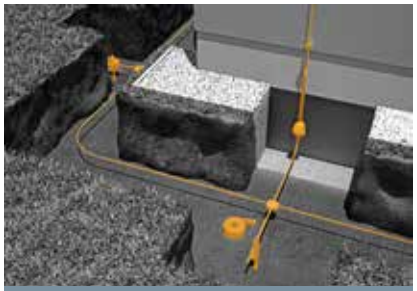
Za raspored tipa A minimalan broj je dva uzemljivača. Kao minimalna dužina za uzemljivač tipa A važi, na primer za klasu zaštite III, dužina od 2,5 m pri vertikalnoj ugradnji i 5 m pri horizontalnoj ugradnji.

Horizontalni uzemljivač
u formi zraka, prstena i mreže. Kao materijal koristi se okrugli ili trakasti materijal koji se uobičajeno postavlja na dubinu od 0,5 m do 1,0 m (u zavisnosti od lokalne dubine zamrzavanja).

Vertikalni uzemljivač
kao okrugli i profilni čelik koji se obično postavlja vertikalno na veće dubine.
U zavisnosti od zemlje, podležu više ili manje jakoj koroziji. Zbog toga je važno obratiti pažnju na to da li se radi o uzemljivaču sa temeljom (V4A) ili samo o gromobranskom uzemljivaču (nije obavezno potreban V4A).

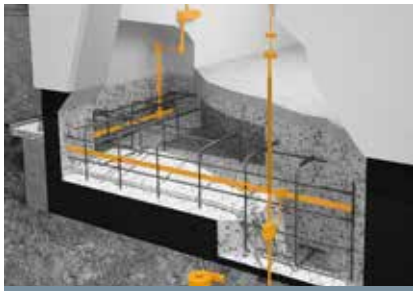
Raspored uzemljivača tipa B (temeljni uzemljivač, prstenasti uzemjivač)

Kako bi temeljni uzemljivač bio zaštićen od korozije, sa svih strana mora da bude okružen betonom od najmanje 5 cm. Na taj način dobija skoro neograničen vek trajanja. Kao materijal za temeljni uzemljivač koristi se čelik. Čelik može da bude pocinkovan ili nepocinkovan.
Kada uzemljivač ne može da se stavi u temelj zgrade ili se izvede iz temelja, mora da se koristi okrugli ili trakasti materijal od antikorozivnog oplemenjenog čelika (V4A).
Okrugli čelik mora da ima prečnik od najmanje 10 mm. Kod trakastih čelika dimenzije moraju da iznose najmanje 30 x 3 mm.



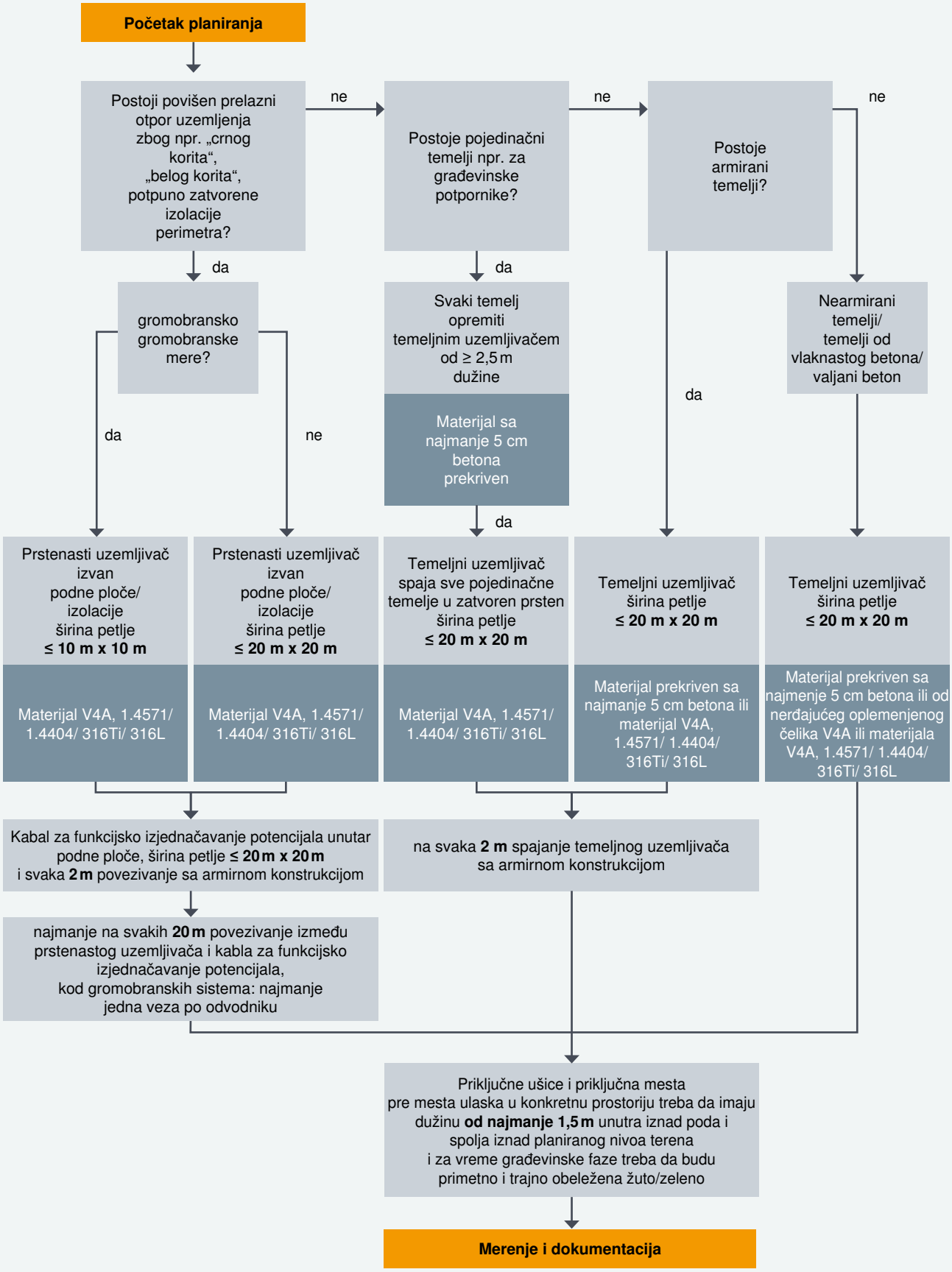
Typ A – Vertikalni uzemljivač sa izjednačavanjem potencijala

Tip B – prstenasti uzemljivač



Typ B – temeljni uzemljivač

Pomoć za planiranje za varijantu temeljnog uzemljivača

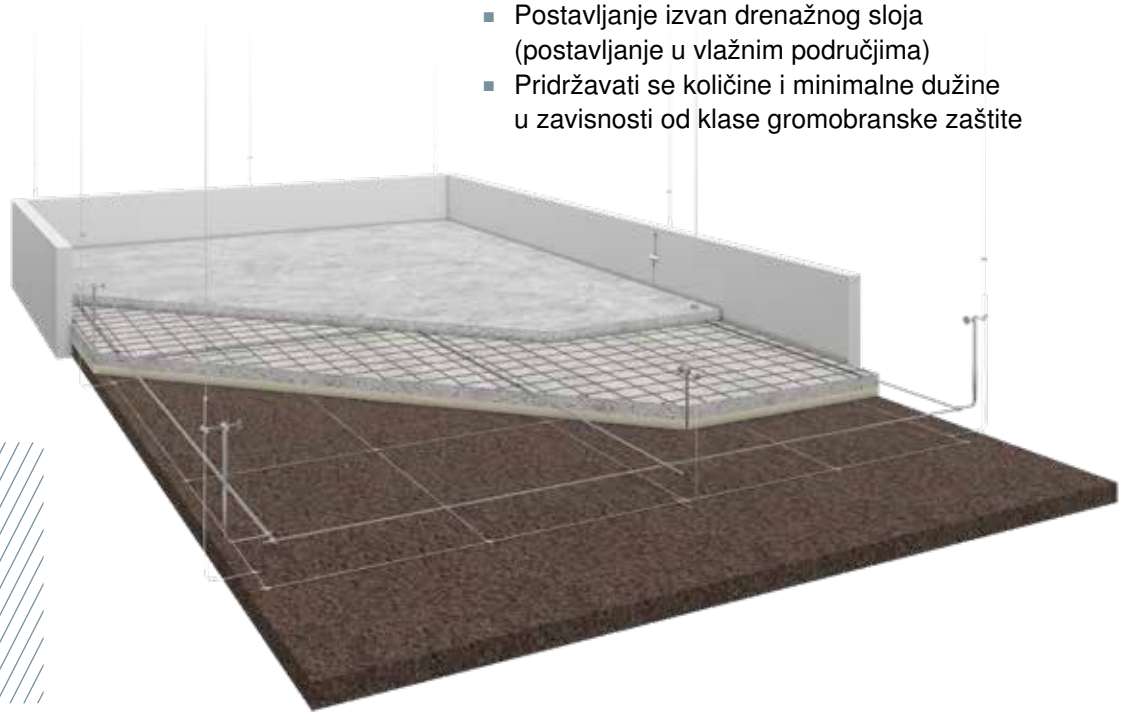


Materijal za uzemljenje za primenu u betonu:

- Najmanje sa svih strana zatvoren sa 5 cm betona
- ≤ 2 m spojiti sa armirnom konstrukcijom
- Širina petlje maks. 20 x 20 m

Materijal za uzemljenje za primenu u zemlji:

- Materijal V4A
- Stegnuti u zemlji pomoću traka za zaštitu od korozije
- Dubina postavljanja 0,5 - 1,0 m (u zavisnosti od lokalne dubine smrzavanja)
- Postavljanje izvan drenažnog sloja (postavljanje u vlažnim područjima)
- Pridržavati se količine i minimalne dužine u zavisnosti od klase gromobranske zaštite

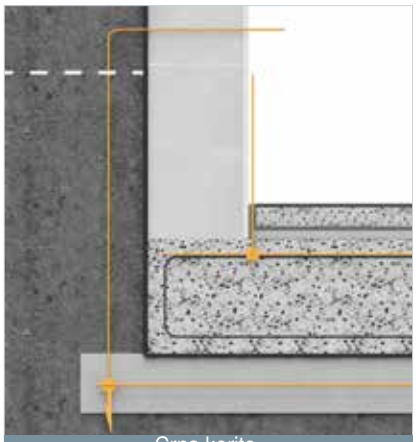


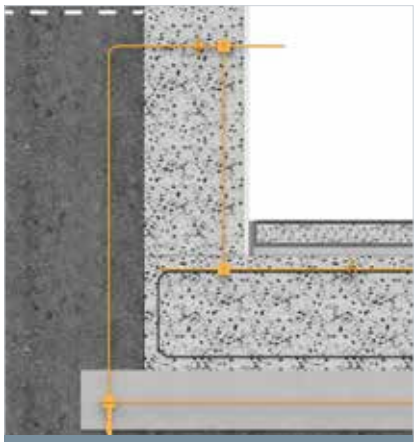
	Tip	Jedinica pakovanja	Br. art.	Opis
	RD 10 FT	80 m	5021103	Okrugla žica ∅ 10 mm FT, 50 kg/prsten (0,63 kg/m)
	5052 DIN 30X3.5	60 m	5019347	Trakasti provodnik 30x3.5 FT, 50 kg/prsten (0,84 kg/m)
	5052 DIN 40X4	40 m	5019355	Trakasti provodnik 40x4 FT, 50 kg/prsten (1,28 kg/m)
	1811	25 kom.	5014018	Odstojnik FT dužina 250 mm
	1814 FT	25 kom.	5014468	Priključna stezaljka za armirnu konstrukciju ∅ 8-14 mm
	1814 FT D37	25 kom.	5014469	Priključna stezaljka za armirnu konstrukciju ∅ 16-37 mm
	205 DG L180 A4	10 kom.	5420022	Fiksna tačka uzemljenja M10/M12 V4A
	205 DG L180 FT	10 kom.	5420024	Fiksna tačka uzemljenja M10/M12 FT
	DW RD10	10 kom.	2360041	Zaptivna manžetna za okrugli provodnik 10 mm
	252 8-10 FT	25 kom.	5312310	Ukrsna spojnica sa pregradnom pločom
	RD 10-V4A	50 m	5021642	Okrugla žica ∅ 10 mm V4A, 32 kg/prsten (0,63 kg/m)
	5052 V4A 30X3.5	25 m	5018730	Trakasti provodnik 30x3.5 V4A, 21 kg/prsten (0,83 kg/m)
	250 V4A	10 kom.	5312925	Ukrsna spojnica za trakaste i okrugle provodnike V4A
	252 8-10 V4A	10 kom.	5312318	Ukrsna spojnica sa pregradnom pločom V4A
	249 8-10 V4A	10 kom.	5311404	Vario brza spojnica okrugli/okrugli, V4A
	219 20 BP V4A	5 kom.	5000866	Vertikalni uzemljivač BP, ∅ 20 mm, dužina: 1,5 m, V4A
	1819 20BP	5 kom.	3041212	Vrh uzemljenja za vertikalni uzemljivač ST i BP
	2760 20 V4A	5 kom.	5001633	Priključna obujmica za vertikalni uzemljivač, univerzalna, V4A
	356 50	1 kom.	2360055	Traka za zaštitu od korozije, širina: 50 mm
	ProtectionBall	25 kom.	5018014	Zaštitna kapa za priključne trake

Posebni zahtevi u slučaju temelja sa zaptivkama korita i izolacijom perimetra
U slučajevima zaptivanja korita, osetljivost uzemljivača nije osigurana. Zbog toga prstenasti uzemljivač treba da se smesti izvan zaptivke korita. Obratiti pažnju na trajnu zaštitu od korozije. Neophodna je primena nerđajućih oplemenjenih čelika (V4A).

Crno korito
Ovde se radi o zaptivanju zgrade koje ne propušta vodu pod pritiskom, od različitih, višeslojnih traka od plastike ili bitumena (crni materijal.

Belo korito
Belo korito je naravljeno od vodonepropusnog betona (WU beton). Iako beton može da upije vodu, uprkos dugotrajnom delovanju vode na beton, ona ne može da prodre kroz celu debljinu, tj. sa unutrašnje strane zida ne može da dođe do stvaranja vlage.


Crna korito,
uvodnica prstenastog uzemljivača iznad najvišeg nivoa podzemnih voda


Bela korita, na vodu pod pritiskom zaptiveni prstenasti uzemljivači u podzemnim vodama


Izolovana podna ploča sa izolacijom perimetra (ovde: obeležen plavo)

izjednačavanje potencijala
Zaštita od opasnih razlika potencijala

Mora da se izradi zaštitno ujednačavanje potencijala, tako što se na glavnu šinu za uzemljenje priključe sledeći provodnici, ukoliko odgovara:

- Provodnik uzemljenja do uzemljivača sistema;
- Zaštitni provodnik glavnog provodnika (PE ili PEN provodnik);
- Provodink zaštitnog izjednačavanja potencijala od antene;
- Provodnik funkcijskog i prenaponskog uzemljivača računarske tehnike;
- Provodnik zaštitnog izjednaččavanja potencijala od gromobranskog sistema (LPS);
- Provodnik izjednačavanja potencijala od provodljivih vodovodnih cevi;
- Provodnik za zaštitno izjednačavanje potencijala od provodljivih unutrašnjih provodnika za gas;
- Provodnik zaštitnog izjednačavanja potencijala od drugih u zgradi instaliranih cevnih sistema, npr. centralno grejanje i klimatizacija, izduvni gasovi;

- Provodnik izjednačavanja potencijala od ostalih tuđih provodljivih delova ukoliko se odnosi na njih u uobičajenim stanjima primene;
- Provodnik izjednačavanja potencijala provodljivih armirnih konstrukcija za beton, gde se na njih odnosi i gde su pouzdano međusobno povezani

Proizvodi za izjednačavanje potencijala

	Tip	Jedinica pakovanja	Br. art.	Opis
	1801 VDE	1 kom.	5015650	Šina za izjednačavanje potencijala za unutrašnje oblasti sa steznom šinom - odgovara i za industriju i eksplozivna područja. 7 x 2,5-25 mm²; 2 x 25-95 mm²; 1 x FL 30 x 3,5 mm
	1809	1 kom.	5015073	Šina za izjednačavanje potencijala za unutrašnje oblasti, za privatne primene. 7 x do 25 mm²; 1 x Rd 8-10; 1 x FL 30 ili Rd 8-10
	1809 BG	1 kom.	5015502	Šina za izjednačavanje potencijala za male sisteme 3 x do 6 mm²; 2 x do 16 mm²
	1809 A	1 kom.	5015111	Šina za izjednačavanje potencijala za spoljnu oblast, UV postojana, vijci i premosnici od VA. 7 x do 25 mm²; 1 x Rd 8-10; 1 x FL 30 ili Rd 8-10
	1802 10 VA	1 kom.	5015866	Šina za izjednačavanje potencijala BigBar za industrijsku oblast (takođe odgovara i za eksplozivne oblasti) od čelika V2A, sa nogarima izolatora, 10 priključaka sa M10 vijcima
	927 1	10 kom.	5057 51 5	Obujmica za uzemljenje nerđajući čelik

Sistemi za grom. zaštitu

Gromobranska zaštita je prevetivna protivpožarna zaštita

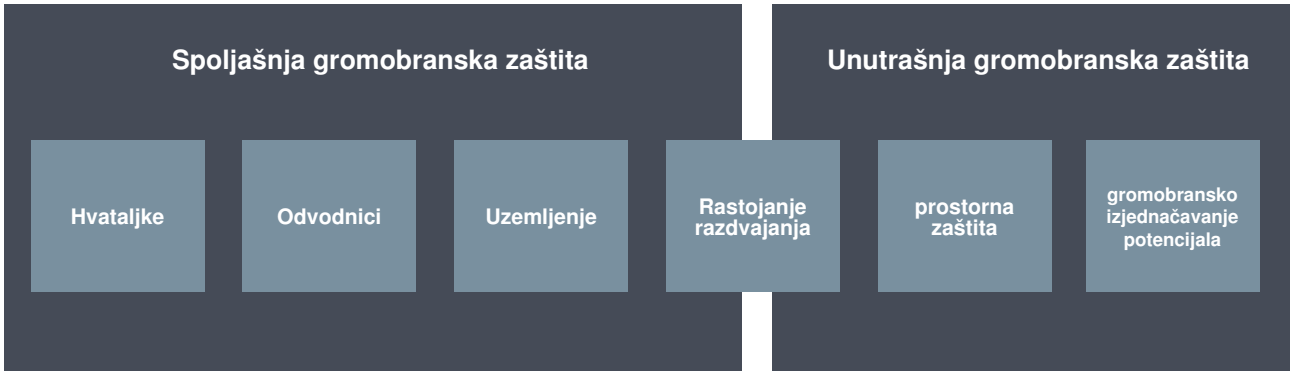
Trenutno važeća norma:
IEC/EN 62305 deo 1-4

Teil 1: Opšti principi
Deo 2: Menadžment rizika
Deo 3: Zaštita građevinskih objekata i osoba
Deo 4: Električni i elektronski sistemi u građevinskim objektima

Jedan od najznačajnih faktora procene u svakoj analizi rizika u gormobranskoj zaštiti je lokalna gustina munja na zemljinoj površini. To je izraženo u munjama po km²/godišnje i treba da se utvrdi merenjem uz pomoć postupka za lokalizaciju munja. Rezultat ove analize rizika su postojeći nivoi opasnosti I - IV. Projektant mora da realizuje odgovarajuću klasu gromobranske zaštite I - IV.

Sistemi spoljašnje i unutrašnje gromobranske zaštite

Samo koordinisano primenjene mere mogu da ponude sveobuhvatnu gromobransku zaštitu.



Klasa zaštite gromobranskog sistema
Karakteristične vrednosti gromobranskog sistema (LPS = lightning protection system) određene su karakterističnim vrednostima građevinskog objekta koji se štiti i pridržavanjem klase gromobranske zaštite.

Svaka klasa zaštite LPS-a je okarakterisana sledećim:

a) Karakteristike koje zavise od klase zaštite LPS-a:
- Karakteristične vrednosti munje
- Radijus lopte munje, širina petlji i zaštitni ugao
- Tipična rastojanja između odvodnika i prstenastih provodnika
- Rastojanje razdvajanja za izbegavanje stvaranja opasnih iskri
- Minimalna dužina uzemljivača

b) Karakteristike koje zavise od klase zaštite LPS-a:
- Izjednačavanje potencija u gromobranskoj zaštiti
- Minimalna debljina metalnih limova ili metalnih cevi u sistemima gromobranske zaštite
- Materijal, oblik i minimalne dimenzije sistema gromobranske zaštite, odvodnika i uzemljivača

Standard	Nemački dopunski list	Sadržaj
VDE 0185-305-1 (IEC 62305-1)		Gromobranska zaštita – deo 1: Opšti principi
VDE 0185-305-2 (IEC 62305-2)		Gromobranska zaštita – deo 2: Menadžment rizika
	1	Opasnost od groma u Nemačkoj
	2	Pomoć za izračunavanje procene rizika od štete za građevinske objekte
	3	Dodatne informacije za primenu EN 62305-2
VDE 0185-305-3 (IEC 62305-3)		Gromobranska zaštita – deo 3: Zaštita građevinskih sistema i osoba
	1	Dodatne informacije za primenu EN 62305-3
	2	Dodatne informacije za građevinske sisteme
	3	Dodatne informacije za ispitivanje i održavanje sistema gromobranske zaštite
	4	Primena metalnih krovova u sistemima gromobranske zaštite
	5	Gromobranska i prenaponska zaštita za PV-sisteme za snabdevanje strujom
VDE 0185-305-4 (IEC 62305-4)		Gromobranska zaštita – deo 4: Elektronski i električni sistemi u građevinskim objektima
	1	Raspodela struje groma
VDE 0675-6-11 (IEC 0675-6-11)		Uređaji za zaštitu od prenapona za niskovoltažne sisteme deo 11: Uređaji za zaštitu od prenapona za primenu u niskovoltažnim sistemima
VDE 0100-534 (IEC 60364-5-53)		Izrada niskovoltažnih sistema – deo 5-53: Izbor i izrada električnih uređaja – rastavljanje, uključivanje i upravljanje – deo 534: uređaji za zaštitu od prenapona (ÜSE)
VDE 0100-443 (IEC 60364-4-44)		Izrada niskovoltažnih sistema – deo 4-44: Zaštitne mere – zaštita kod ometajućih napona i elektromagnetnih ometajućih veličina – deo 443: Zaštita kod prenapona usled atmosferskih uticaja ili skklopnih operacija.
VDE 0100-712 (IEC 60364-7-712)		Zahtevi za poslovne prostore, prostorije i sisteme specijalne vrste – solarni fotovoltaik (PV) sistemi za snabdevanje strujom
VDE 0855-1 (IEC 60728-11)		Mreže kablova za televizijske signale, tonske signale i interaktivne usluge
VDE 0127-24 (IEC 61400-24)		Vetroenergetski sistemi – deo 24: Gromobranska zaštita

Važni standardi i propisi u pogledu gromobranske zaštite

Standardi proizvoda	Sadržaj
VDE 0185-305-1 (IEC 62305-1)	Komponente gromobranske zaštite – zahtevi u pogledu priključnih delova
VDE 0185-561-2 (IEC 62561-2)	Komponente gromobranske zaštite – zahtevi u pogledu provodnika i uzemljivača
VDE 0185-561-3 (IEC 62561-3)	Kompoente gromobranske zaštite – zahtevi u pogledu iskrišta
VDE 0185-561-4 (IEC 62561-4)	Komponente gromobranske zaštite – zahtevi u pogledu držača
VDE 0185-561-5 (IEC 62561-5)	Komponente gromobranske zaštite – zahtevi u pogledu revizionih kaseta i uvodnica uzemljivača
VDE 0185-561-6 (IEC 62561-6)	Komponente gromobranske zaštite – zahtevi u pogledu brojača munja
VDE 0185-561-7 (IEC 62561-7)	Komponente gromobranske zaštite – zahtevi u pogledu sredstava za poboljšanje uzemljenja
VDE V 0185-561-8 (IEC TS 62561-8)	Komponente gromobranske zaštite – zahtevi u pogledu komponenti za izolovani gromobranski sistem
VDE 0675-6-11 (IEC 61643-11)	Uređaji za zaštitu od prenapona za primenu u niskonaponskim sistemima – Zahtevi i ispitivanja
VDE 0845-3-1 (IEC 61643-21)	Zaštita od prenapona za primenu u mrežama za telekomunikacije i obradu signala

Standardi proizvoda za komponente gromobranske i prenaponske zaštite

Gromobranski sistemi

Planiranje sa postupcima zaštitnog ugla, lopte munje i petlje

Verovatnoća da struja groma prodre u građevinski objekat koji treba da se zaštiti značajno se smanjuje ispravnim planiranjem sistema gromobranske zaštite.

Sistem gromobranske zaštite može da bude sastavljen od bilo koje kombinacije sledećih komponenti:

- Štapne hvataljke (uključujući slobodno stojeće bandere)
- zategnuta užad
- mrežaste lestve

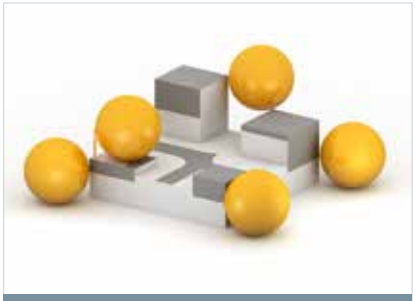
Pojedinačne štane hvataljke bi trebalo međusobno spojiti na visini krova kako bi se obezbedila podela struje.

Sistemi gromobranske zaštite moraju da se postave na građevisnski objekat u uglovima, slobodnim mestima i ivicama (pre svega na gornjim delovima fasada).

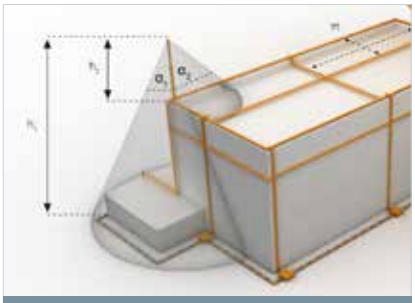
U zavisnosti od praktične procene građevinskog objekta bira se jedna ili jedna kombinacija sledećih metoda planiranja.

- Postupak kotrljajuće sfere
- Postupak zaštitnog ugla
- Postupak petlje

Metode planiranja za sisteme gromobranske zaštite



Postupak lopte groma je odgovarajući u svakom slučaju, ali naročito za kompleksne sisteme.



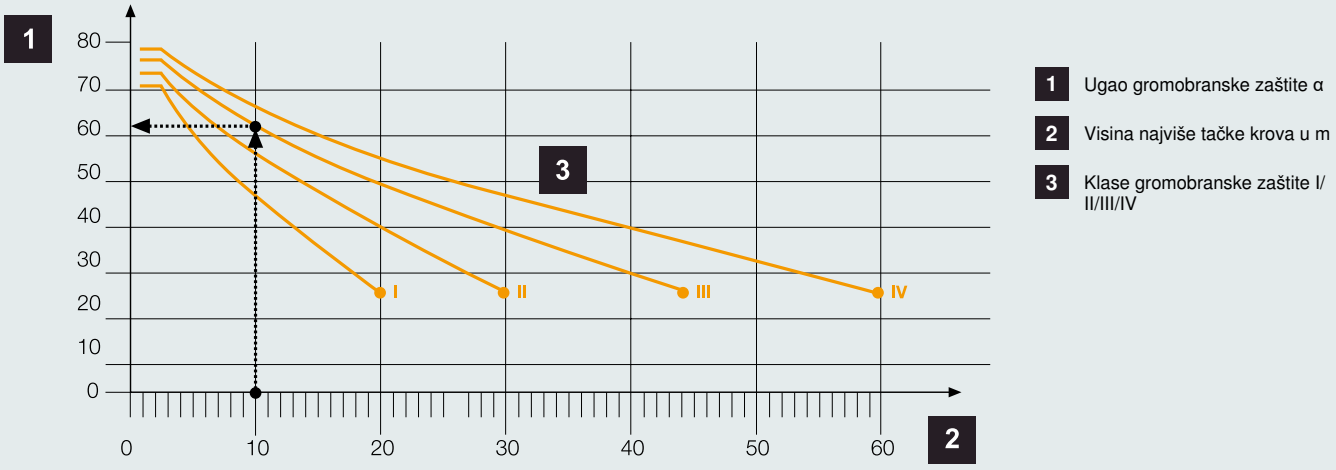
Postupak sa zaštitnim uglom je odgovarajući za zgrade jednostavnog oblika.

Postupak petlje je odgovarajući za zgrade jednostavnog oblika, npr. sa ravnim krovovima.

Osnova za izračunavanje sistema gromobranske zaštite su pri različitim postupcima zaštite radijus lopte munje, širina petlje ili zaštitni ugao α. Iz tabele, kao i iz pomoćnog dijagrama, mogu da se preuzmu osnovni podaci za konkretnu klasu gromobranske zaštite i posluže kao orijentacija za sledeće postupke zaštite.

Postupak zaštite			
Klasa gromobranske zaštite	**Radijus lopte munje r**	**širina petlje W**	**zaštitni ugao α°**
I	20 m	5 x 5 m	pogledati grafiku ispod
II	30 m	10 x 10 m	
III	45 m	15 x 15 m	
IV	60 m	20 x 20 m	

Najveće vrednosti radijusa lopte munje, širine petlje i zaštitnog ugla prema odgovarajućim klasama gromobranske zaštite LPS prema IEC/EN 62305-3



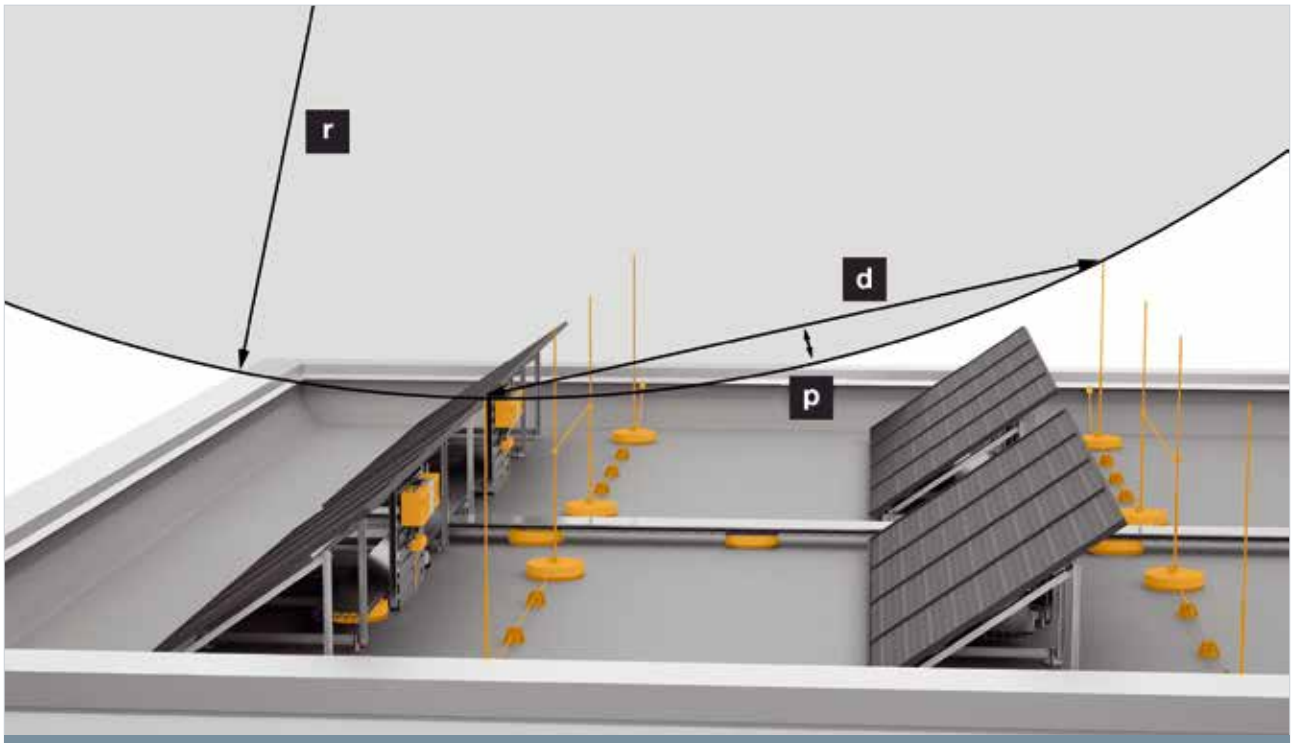
Pomoćni dijagram za utvrđivanje zaštitnog ugla prema IEC 62305

Klasa gromobranske zaštite	Zaštitni ugao α° za štapne hvataljke do 2 m dužine
I	70 °
II	72 °
III	76 °
IV	79 °

Zaštitni ugao prema klasi gromobranske zaštite u skladu sa IEC 62305-3 za štapne hvataljke do 2 m

Rolling sphere method (kotrljajuća sfera)

Kalkulacija dubine prodiranja



p Dubina prodiranja r radijus lopte munje d rastojanje gromobranskog sistema

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

Formula za izračunavanje dubine prodiranja (p)

Zaštita konstrukcije krova sa više gromobrana

Ukoliko se koristi više gromobrana da bi se zaštitio jedan objekat, potrebno je u obzir uzeti dubinu prodiranja između gromobrana. Za tačno izračunavanje koristite formulu pored. Brzi pregled možete dobiti pomoću dole prikazane tabele.

Dubina prodiranja prema klasi gromobranske zaštite

Rastojanje gromobranskog sistema (d) u m	Dubina prodiranja u m Klasa gromobranske zaštite I Sfera: R=20 m	Dubina prodiranja u m Klasa gromobranske zaštite II Sfera: R=30 m	Dubina prodiranja u m Klasa gromobranske zaštite III Sfera: R=45 m	Dubina prodiranja u m Klasa gromobranske zaštite IV Sfera: 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

Postupak zaštitnog ugla

Instalacioni princip kod zgrada sa špicastim krovom

1. korak: utvrđivanje visine zgrade

Utvrditi visinu slemena zgrade. Ova visina je polazna tačka za planiranje celokupnog gromobranskog sistema. Na slemenu se postavlja slemeni provodnik i tako obrazuje "kičmu" gromobranskog sistema.

2. korak: određivanje zaštitnog ugla α

Prenesite visinu zgrade u dijagram kako biste očitali zaštitni ugao. Zaštitni ugao preneti na zgradu.

3. korak: Delovi zgrade izvan zaštitnog ugla

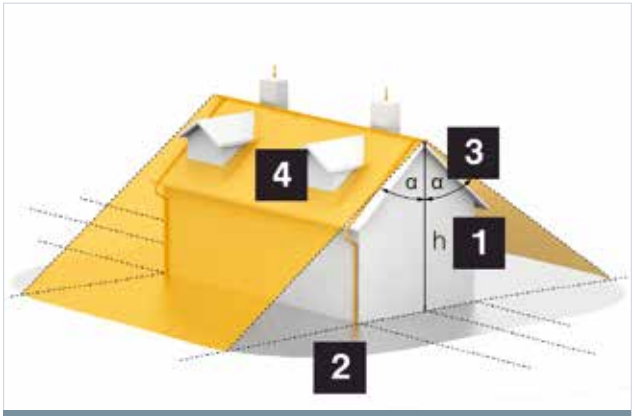
Delovi zgrade koji se nalaze izvan zaštićenog područja moraju dodatno da se zaštite. Prečnik dimnjaka u našem primeru je 70 cm što znači da mu je potreban gromobran dužine 1,5 m. Krovni prozori moraju da imaju sopstveni gromobran.

4. korak: Integracija gromobranskog sistema

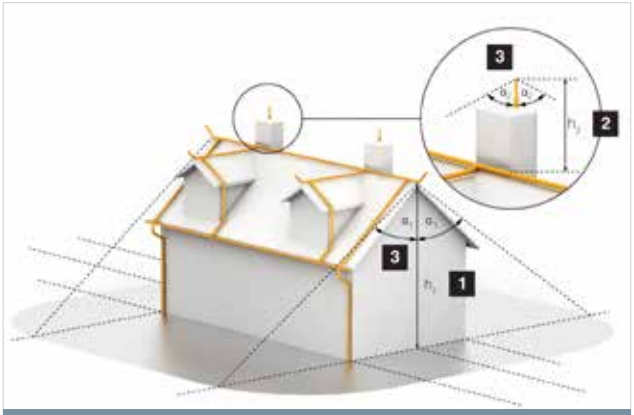
Povežite gromobranski sistem sa odvodnicima. Krajevi slemenog provodnika treba da budu duži za 0,15 m i savijeni ka gore. Na taj način su zaštićene i eventualno postojeće nadstrešnice.

Sledeće krovne konstrukcije treba zaštititi gromobranskim sistemima od direktnih atmosferskih pražnjenja:

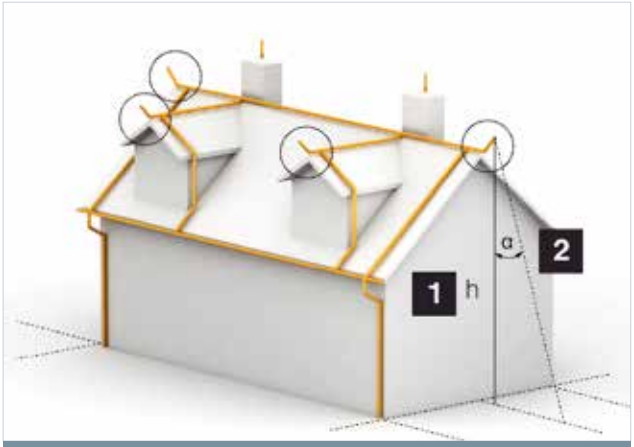
- metalni materijali visine veće od 0,3 m
- neprovodljivi materijali (npr. PVC cevi) visine veće od 0,5 m



1 Visina zgrade h 2 Zaštićeno područje
3 Zaštitni ugao α 4 Nezaštićen prozor na kosom krovu



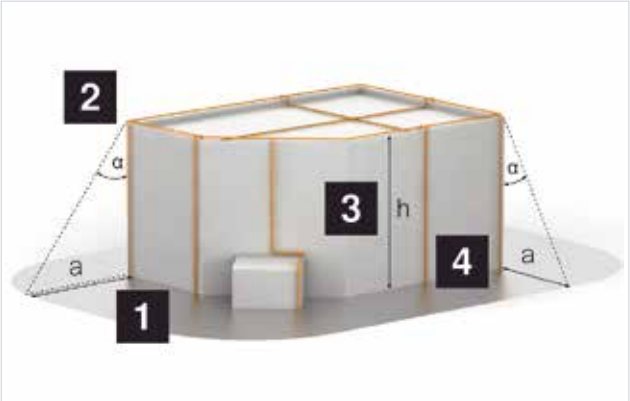
1 Visina zgrade (h1)
2 Visina štapne hvataljke (h2) 3 Zaštitni ugao α



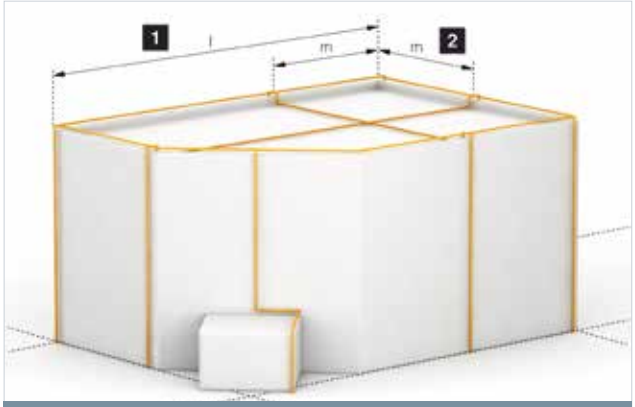
1 Visina zgrade (h) 2 Zaštitni ugao α

Postupak petlje

Instalacioni princip kod zgrada sa ravnim krovom



1 Zaštićeno područje 2 Zaštitni ugao
3 Visina zgrade 4 Rastojanje zaštićenog područja



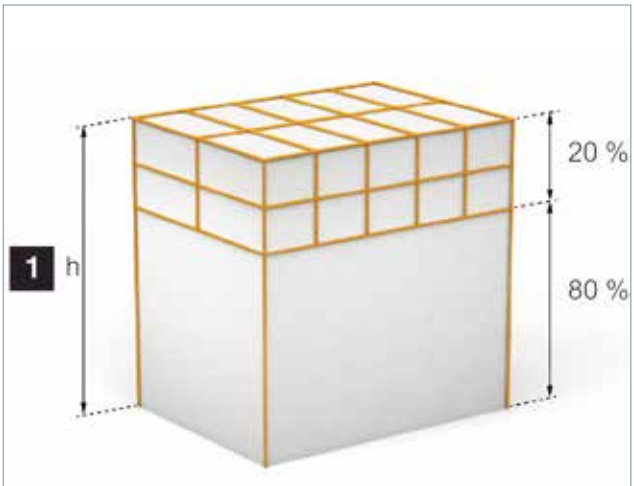
1 Dužina zgrade 2 Širina petlje

1. korak: postavljanje gromobranskog sistema

Prvo se instalira kružni provodnik na sva prioritetna udarna mesta kao što su hrbati, svodovi ili ivice. Zaštićeno područje ćete utvrditi tako što prenesete visinu zgrade u dijagram, očitate zaštitni ugao i prenesete ga na zgradu.

2. korak: Postavljanje zaštite po sistemu mreže

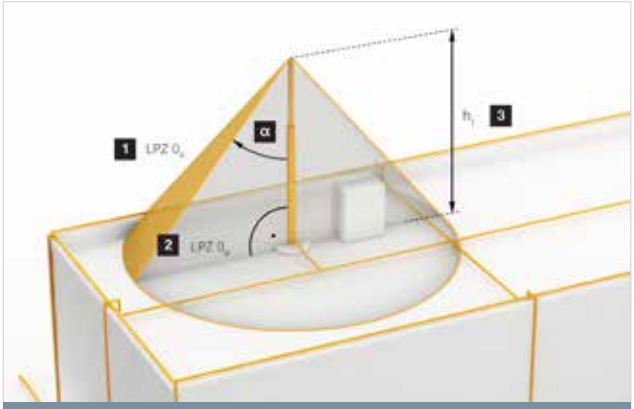
U zavisnosti od klase gromobranske zaštite zgrade važe različite dimenzije okaca mreže. Kada je ukupna dužina l kao u našem primeru veća od 20 m, potrebno je dodati rastezni komad za temperaturom uslovljene promene dužine.



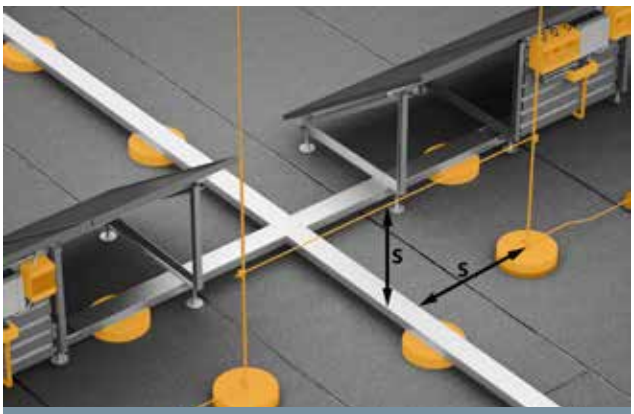
1 Visina zgrade > 60 m

3. korak: zaštita od bočnih udara

Od visine zgrade od 60 m i rizika većih oštećenja (npr. kod električnih i elektronskih sistema) preporučuje se instalacija prstenastog provodnika radi zaštite od bočnog udara.



1 Opasnost usled direktnih atmosferskih pražnjenja
2 Zaštićeno od direktnih atmosferskih pražnjenja ali ugroženo
3 Visina štapne hvataljke α Zaštitni ugao



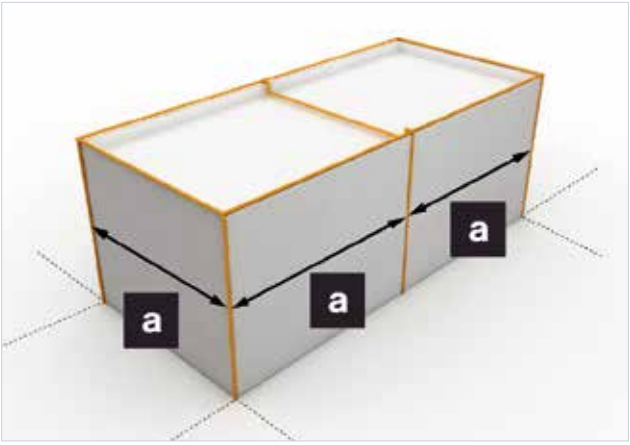
s = rastojanje razdvajanja

4. korak: zaštita krovnih konstrukcija

Dodatno moraju da se zaštite sve krovne konstrukcije preko gromobrana. U tu svrhu je neophodno voditi računa o pridržavanju rastojanja razdvajanja (s). Štapne hvataljke moraju da se postave sa rastojanjem (s) od objekta koji se štiti. Ovim rastojanjem se pouzdano sprečava prebacivanje struje groma i opasno obrazovanje varničenja.

Sistem odvodnika

Povezivanje gromobranskog sistema sa sistemom uzemljenja



Klasa gromobranske zaštite	Tipično rastojanje a
I	10 m
II	10 m
III	15 m
IV	20 m

Broj odvodnika prenapona

Broj odvodnika dobija se iz obima zgrade koja treba da se zaštiti - ali, u svakom slučaju moraju da postoje najmanje dva odvodnika. Pri tom se mora voditi računa da se put struje instalira tako da bude kratak i bez uvrtanja.

Broj odvodnika razdvojenog LPS-a

Ukoliko se gromobranski sistem sastoji od razdvojenih gromobrana (ili jednog gromobrana) koji nisu (nije) od metala ili nisu (nije) povezan/i armirnim čelikom, za svaki gromobran je potreban najmanje jedan odvodnik. Metalnim gromobranima ili gromobranima povezanim armirnim čelikom nisu potrebni dodatni odvodnici.

Raspored odvodnika prenapona

Odvodnici prenapona bi trebali da se instaliraju u blizini uglova građevine. Da bi se dobila optimalna raspodela struje, potrebno je da odvodnici prenapona budu raspoređeni po spoljašnjim zidovima građevine. Odvodnici moraju da se instaliraju pravo i vertikalno,, tako da predstavljaju najkraću moguću vezu do zemlje. Obrazovanje petlji mora da se izbegne.
Odvodnici ne smeju da se instaliraju u kanale i cevi za odvod kišnice, ni kada su obmotane izolacionim materijalom.

Izračunavanje rastojanja razdvajanja prema IEC/EN 62305-3

Koraci	
Utvrdite vrednost koeficijenta k_i	k_i zavisi od izabrane klase zaštite gromobranskog sistema: ▪ Klasa zaštite I: k_i = 0,08 ▪ Klasa zaštite II: k_i = 0,06 ▪ Klasa zaštite III: k_i = 0,04
Utvrdite vrednost koeficijenta k_c (pojednostavljen sistem)	k_c zavisi od (parcijalne) struje grma koja otiče u odvodnike: ▪ 1 odvodnik (samo u slučaju razdvojenog gromobranskog sistema): k_c = 1 ▪ 2 odvodnika: k_c = 0,66 ▪ 3 odvodnika i više: k_c = 0,44 Vrednosti važe za sve uzemljivače tipa B i uzemljivače tipa A kod kojih se otpor uzemljenja susednih elektroda uzemljenja ne razlikuje za više od vrednosti faktora 2. Kada otpor uzemljivača pojedinačnih elektroda odstupa za više od vrednosti faktora 2 računa se k_c = 1.
Utvrdite vrednost koeficijenta k_m	k_m zavisi od materijala električne izolacije: ▪ Materijal vazduh: k_m = 1 ▪ Materijal beton, cigla: k_m = 0,5 ▪ GFK izolacione šipke: k_m = 0,7 Kada se koristi više izolacionih materijala, obično se u praksi za k_m koristi najmanja vrednost.
Utvrdite vrednost L	L je dužina provodnika izmereno od tačke na kojoj treba da se utvrdi rastojanje razdvajanja s do najbliže tačke izjednačavanja potencijala.

Na visoki napon izolovani odvodnik **isCon®** je moderno rešenje za sigurno pridržavanje potrebnih rastojanja razdvajanja!

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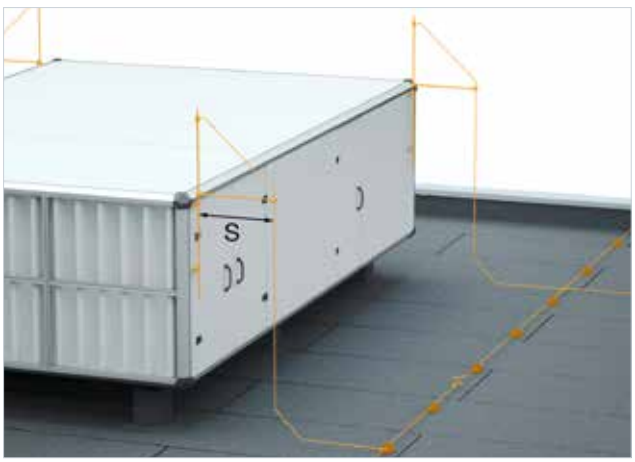
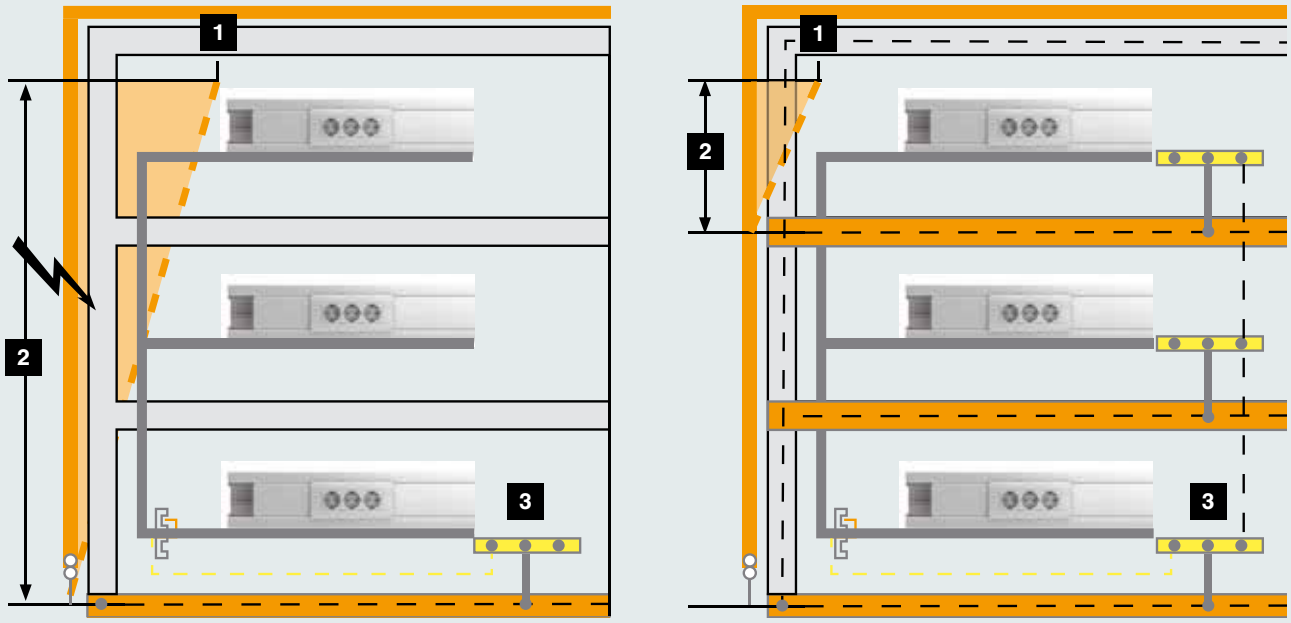
$$s = k_i \frac{k_c}{k_m} L(m)$$

s = rastojanje razdvajanja





1 Rastojanje razdvajanja (s)

3 HES

2 Dužina L

Ekvipotencijalne površine kao referentni nivo za izračunavanje rastojanja razdvajanja kod visokih zgrada

U slučaju visokih zgrada, prilikom konvencionalnih izračunavanja rastojanja razdvajanja može da dođe do rastojanja razdvajanja koji više ne mogu da se realizuju jer je dužina do najbližeg referentnog nivoa (npr. sistema za uzemljenje ili najbliže tačke izjednačavanja potencijala) pri kalkulaciji veoma dugačka u odnosu na zgradu.

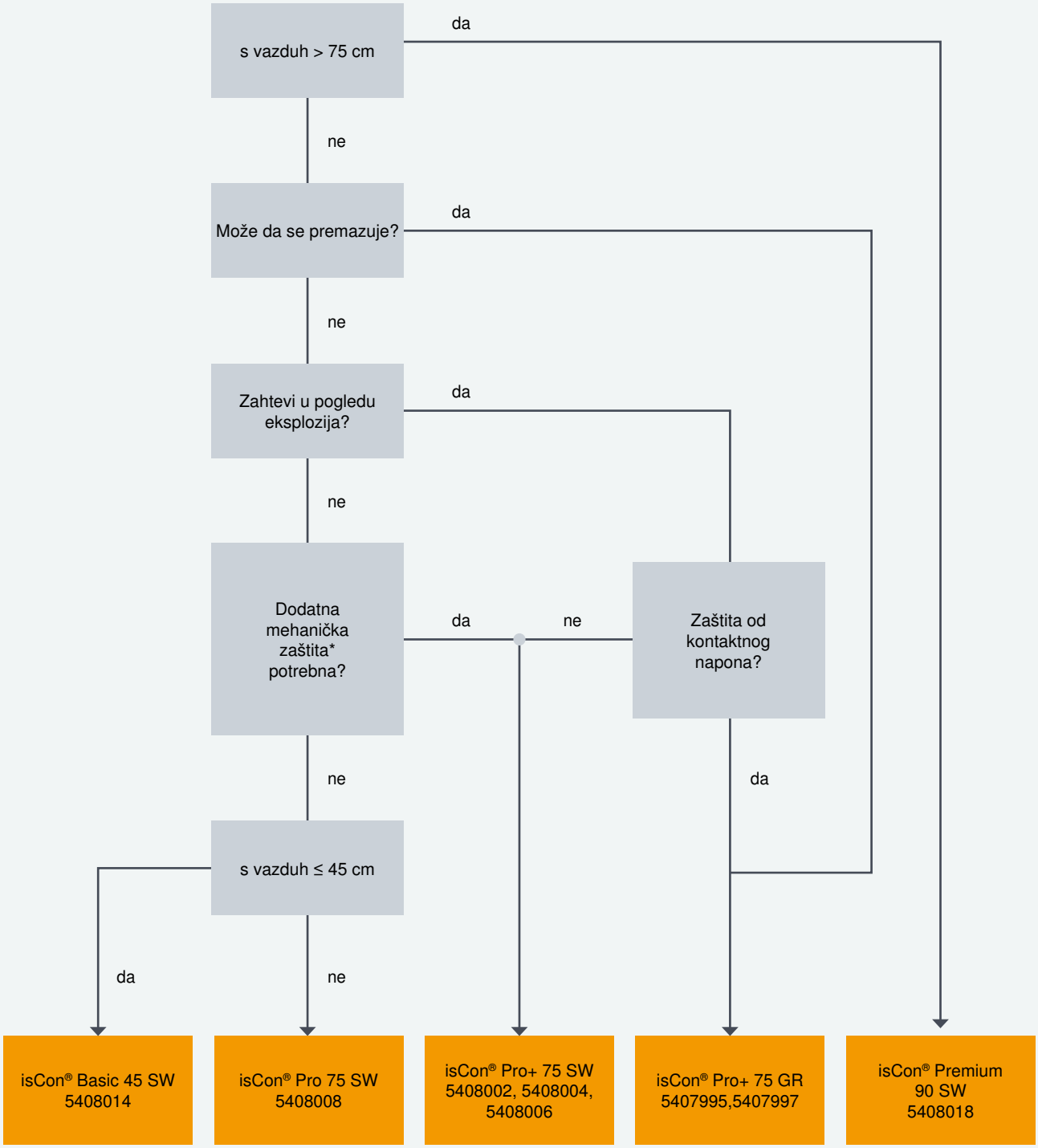
Da bi sistem gromobranske zaštite ipak mogao da se projektuje i instalira prema VDE 0185-305-3 (IEC/EN 62305-3), trebalo bi prilikom planiranja na vreme uzeti u obzir izradu ekvipotencijalnih površina u projektu.

Obezbeđivanje ekvipotencijalnih površina, npr. na svaka 2-3 sprata, pomoću:

- Gromobransko izjednačavanje potencijala i uređaji za zaštitu od prenapona za energetske i komunikacione sisteme
- Mrežasti sistem uzemljenja prema DIN 1804
- Mrežasta armatura krova (više puta u zgradi) 5 x 5 m prema DIN EN 62305-4 (VDE 0185-304-4)
- Povezivanje sa armirnom konstrukcijom na svaka 2 m
- Gromobransko izjednačavanje potencijala svih metalnih ili električnih provodnikaa koji vode u ekvipotencijalni nivo (npr. spoljne kamere, svetilljke, provodnici za snabdevanje, PV sistemi itd.)

isCon® odvodnici

Pomoć za izbor



**Dodatna mehanička zaštita: površinska oštećenja spoljnog zaštitnog omotača ne utiču na, na visoki napon otpornu, izolujuću funkciju crnog isCon Pro+ odvodnika! Omotač mora da bude održan min. 0,2 mm na celom obimu odvodnika.*

Materijali i zaštita od korozije

Zahtevi za dugotrajnu zaštitu

U spoljnoj gromobranskoj zaštiti prednost se daje uglavnom sledećim materijalima: toplo pocinkovanom čeliku, nerđajućem čeliku (VA), bakru i aluminijumu.

Korozija

Opasnost od korozije je najveća kod spojeva različitih materijala. Iz tog razloga iznad pocinkovanih površina ili iznad aluminijumskih delova ne smeju da se ugrađuju delovi od bakra jer bi usled kiše ili drugih uticaja otkinute površine bakra mogle doći u dodir sa pocinkovanim površinama. Osim toga nastaje i galvanski element usled kog kontaktna površine brže korodira.

KOmbinacije materijala bez povećane opasnosti od korozije

	Čelik, pocinkovan	Aluminijum	Bakar	Nerđajući čelik	Titan	Kalaj
Čelik, pocinkovan	da	da	ne	da	da	da
Aluminijum	da	da	ne	da	da	da
Bakar	ne	ne	da	da	ne	da
Nerđajući čelik	da	da	da	da	da	da
Titan	da	da	ne	da	da	da
Kalaj	da	da	da	da	da	da

Materijal	Oblik	Minimalne dimenzije
Bakar **kalajisani bakar**	Trakasto masivno okruglo masivno (b) uže (b) Okruglo masivno	20 x 2,5 mm ø 8 mm 50 mm² ø 15 mm
Aluminijum	Okruglo masivno uže	ø 8 mm 50 mm²
Bakrom presvučena legura aluminijuma	Okruglo masivno (c)	ø 8 mm
Legura aluminijuma	Trakasto masivno okruglo masivno uže (b) Okruglo masivno	20 x 2,5 mm ø 8 mm 50 mm² ø 15 mm
Toplo pocinkovani čelik	Trakasto masivno okruglo masivno uže (b) Okruglo masivno	20 x 2,5 mm ø 8 mm 50 mm² ø 15 mm
Čelik presvučen bakrom (c)	Okruglo masivno trakasto masivno	ø 8 mm 20 x 2,5 mm
Nerđajući čelik (a)	Trakasto masivno okruglo masivno uže (b) Okruglo masivno (d)	20 x 2,5 mm ø 8 mm 50 mm² ø 15 mm

Materijal, oblik i minimalne dimenzije provodnika, štapnih hvataljki, šipki za uvođenje uzemljenja i odvodnika

(a) hrom ≥ 16 %; nikl ≥ 8 %; ugljenik ≤ 0,08 %
(b) prečnik 8 mm sme u određenim primenama da se smanji na 28 mm² (prečnik 6 mm) kada je mehanička čvrstoća važan uslov.
(c) Najmanje 70 µm sloja bakra sa 99,9 % sadržajem bakra
(d) primanjivo na štapnim hvataljkama i osnovi

Materijal	Oblik	Minimalne dimenzije		
		Vertikalni uzemljivač	Provodnik za uzemljenje	Pločasti uzemljivač
Bakar **kalajisani bakar**	Uže			
	Okruglo masivno			
	Trakasto masivno		50 mm²	
	Okruglo masivno	ø 15 mm	ø 8 mm	
	Mrežasta ploča	ø 20 mm	20 x 2,5 mm	
	Cev			500 x 500 mm
	Ploča masivna			600 x 600 mm
Toplo pocinkovani čelik	Okruglo masivno			
	Okruglo masivno	ø 14 mm		
	Cev	ø 25 mm	ø 10 mm	
	Trakasto masivno			
	Ploča masivna			
	Mrežasta ploča		30 x 3 mm	500 x 500 mm
	Profil (a)	290 mm²		600 x 600 mm
Sjajni čelik (b)	Uže		70 mm²	
	Okruglo masivno	ø 8 mm	ø 10 mm	
	Trakasto masivno		25 x 3 mm	
Čelik presvučen bakrom (c)	Okruglo masivno		ø 8 mm	
	Okruglo masivno	ø 14 mm	ø 10 mm	
	Trakasto masivno		30 x 3 mm	
Nerđajući čelik (d)	Okruglo masivno		ø 10 mm	
	Okruglo masivno			
	Trakasto masivno	ø 15 mm	30 x 3,5 mm	

Materijal, oblik i prečnik uzemljivača prema VDE 0185-561-2 (IEC 62561-2)

(a) Dozvoljeni su različiti profili prečnika 290 mm² i minimalne debljine od 3 mm, npr. ukrsni profili.
(b) Mora da se postavi na dubini od najmanje 50 m u betonu.
(c) Pri minimalno 250 µm sloja bakra sa 99,99 % sadržaja bakra.
(d) Hrom ≥ 16 %; nikl ≥ 5 %; molibden ≥ 2 %; ugljenik ≤ 0,08 %.

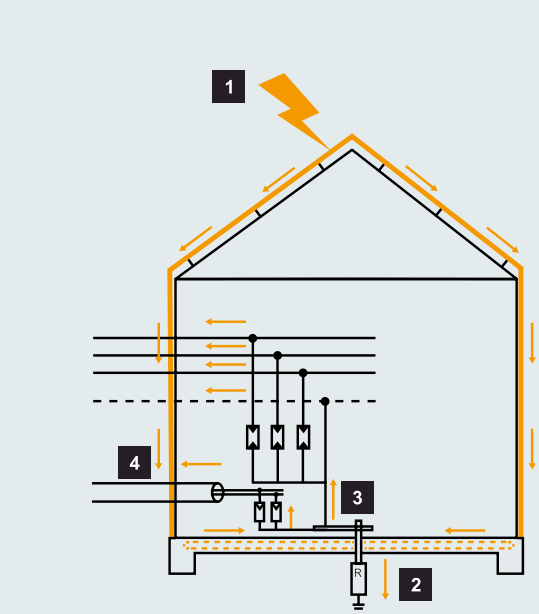
Sistemi gromobranske i prenaponske zaštite

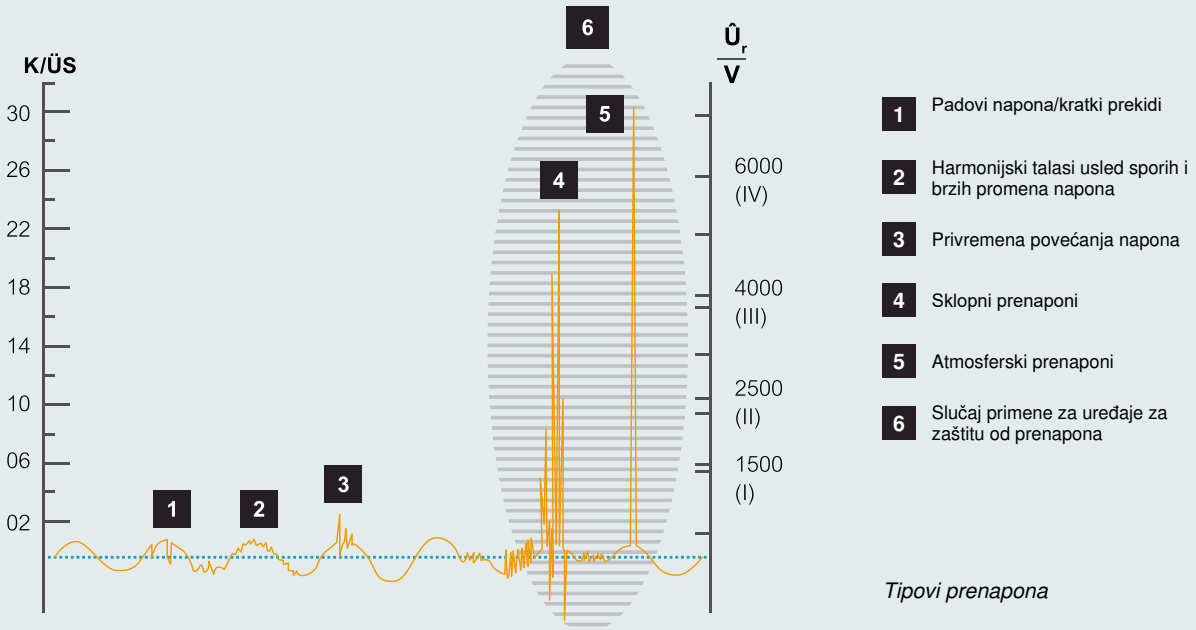
U slučaju atmosferskog pražnjenja, preko sistema za uzemljenje odvodi se samo 50 % energije munje. Druga polovina odlazi u električne instalacije građevinskog objekta. Drugi razlozi za prenapone su atmosfersko pražnjenje ili sklopne operacije u daljini. OBO odvodnici struje munje i prenapona sigurno štite osetljive električne uređaje u sistemu od oštećenja usled prenapona.

Najveći prenaponi nastaju usled atmosferskih pražnjenja. Prema IEC/EN 62305 simuliraju se atmosferska pražnjenja sa udarnim strujama munje do 200 kA (10/350 µs).

1	Udar	100 %	limp = max 200 kA (IEC/EN 62305)
2	Sistem za uzemljenje	~ 50 %	I = 100 kA
3	Električna instalacija	~ 50 %	I = 100 kA
4	Provodnik za računarsku tehniku	~ 5 %	I = 5 kA

Tipična podela struje munje

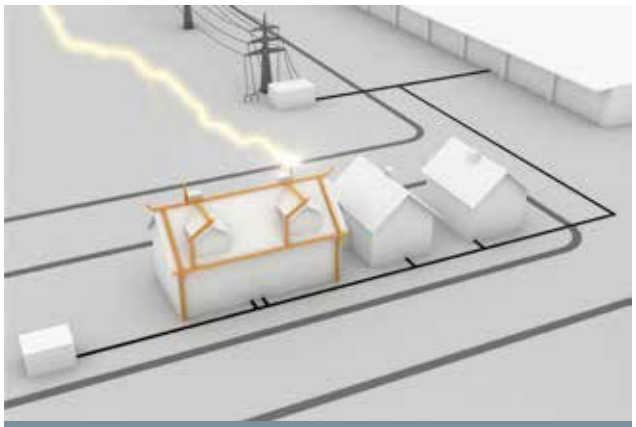




Tipovi prenapona

Uzroci oštećenja

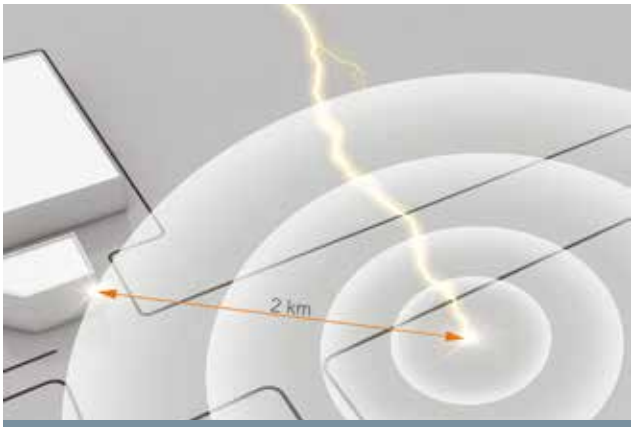
Uređaji i sistemi mogu da se zaštite OBO-odvodnicima prenapona od svih prikazanih uzroka štete.



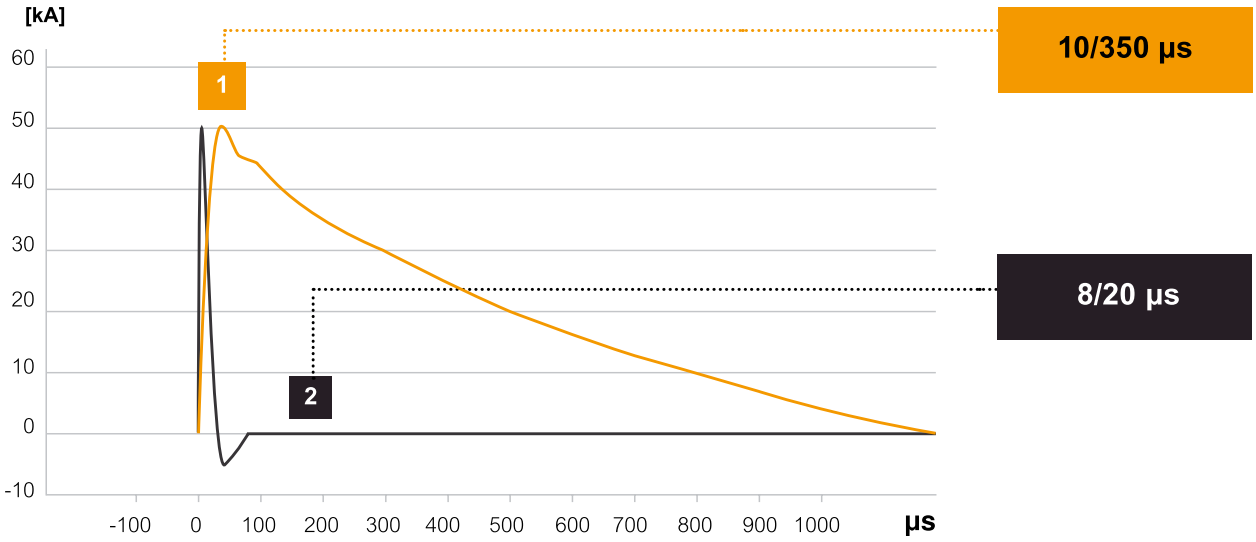
Direktno atmosfersko pražnjenje

Atmosfersko pražnjenje u provodnik za snabdevanje

Atmosfersko pražnjenje pored provodnika za snabdevanje i sklopne operacije



Atmosferska pražnjenja u okruženju



Vrste impulsa i njihove karakteristike:

1 Oblik impulsa 1, direktno atmosfersko pražnjenje, 10/350 µs simulirani impuls munje

2 Oblik impulsa 2, udaljeno atmosfersko pražnjenje ili električna operacija, 8/20 µs simulirani strujni impuls (prenapon)

Sistemi prenaponske zaštite za energetsku tehnologiju

Oprema za zaštitu od prenapona obezbeđuje ispravno izjednačenje potencijala na vodovima pod naponom. Ona deluje pre nego što se izolacija na električnim i elektronskim aparatima nepopravljevo ošteti zbog prenapona.

Odvodnik prenapona tipa 1/klasa I
Kombinovani odvodnik tipa 1+2/klasa I+II

TN-C sistem: Odvodnik prenapona tipa 1/klasa I i kombinovani odvodnik tipa 1+2/klasa I+II postavljaju se 3-polno (npr. tri puta MCD 50-B).

TN-S i TT sistem: Gromobranski i kombinovani odvodnici primenjuju se u 3+1 varijanti (npr. tri puta MC 50-B i jednom MC 125-B NPE). Kod 3+1 varijante spoljni provodnici (L1, L2, L3) se preko odvodnika priključuju na neutralni provodnik (N). Neutralni provodnik (N) se preko zbirnog rastavnog iskrišta povezuje sa zaštitnim provodnikom (PE). Nakon usklađivanja sa lokalnim distributerom energije moguća je i primena sistema glavnog brojača.

Odvodnik prenapona tipa 2/klasa II

Odvodnici prenapona tipa 2/klasa II primenjuju se u 3+1 sklopnoj operaciji (npr. V20-C 3+NPE). Kod 3+1 varijante spoljni provodnici (L1, L2, L3) se preko odvodnika priključuju na neutralni provodnik (N). Neutralni provodnik (N) se preko zbirnog rastavnog iskrišta povezuje sa zaštitnim provodnikom (PE). Svi odvodnici prenapona moraju da se postave ispred zaštite od pogrešne struje (RCD), jer će on u suprotnom odvedenu udarnu struju interpretirati kao pogrešnu struju i prekinuti strujno kolo.

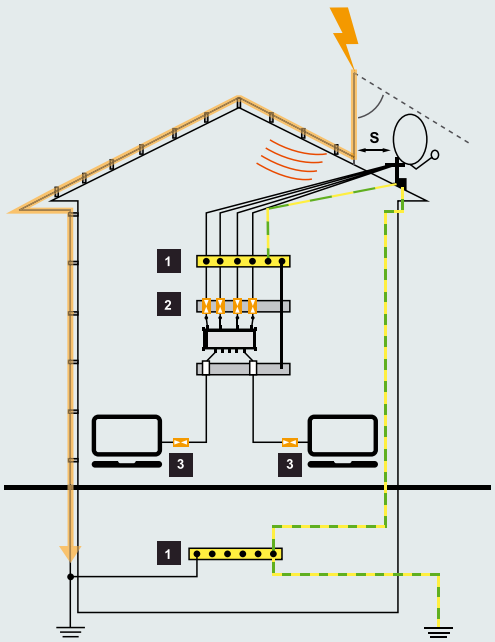
Gromobranska i prenaponska zaštita za satelitske sisteme prema IEC/EN 60728-11

SAT sistemi ili antene pripadaju objektima koji su često instalirani na krovovima i izvedeni kao eksponirani objekti pored štapnih hvataljki. Iz tog razloga ovi sistemi moraju da se zaštite od atmosferskih pražnjenja pomoću štapnih hvataljki kako i samio ne bi poslužili kao uređaj za hvatanje pražnjenja. Idealno je da nakon ugradnje sistema gromobranske zaštite SAT antena nalazi unutar zaštitnog ugla štapne hvataljke. U tom slučaju se skoro isključuje opasnost od direktnog atmosferskog pražnjenja i SAT provodnike.

Ali, prilikom udara u štapnu hvataljku stvaraju se prenaponi.

Ovi prenaponi mogu uz pomoć uređaja za zaštitu od prenapona kao što je OBO TV 4+1 (za zaštitu od npr. Multiswitches) ili FC-SAT-D (za zaštitu TV uređaja) da se ograniče na nivo koji nije opasan za uređaj koji se štiti.

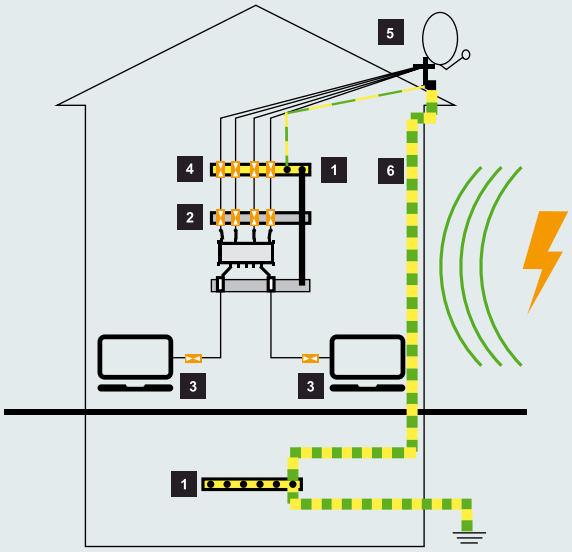
Kao važan preduslov važi da mora da se održi rastojanje razdvajanja (s) između štapne hvataljke i antene. Gromobranska i prenaponska zaštita SAT sistema prikazana je na narednim slikama:



Protok struje pri direktnom atmosferskom pražnjenju u blizini SAT antene

	Proizvod	Br. art.
1	Šina za izjednačavanje potencijala npr. OBO 1801 VDE	5015650
2	Koaksijalni uređaj za zaštitnu od prenapona npr. TV 4+1	5083400
3	Fini zaštitni uređaj za SAT i 230 V dovode npr. OBO FC-SAT-D	5092816

Koordinacijom gromobranskih i prenaponskih zaštitnih komponenti mogu sigurno da se odvedu struje atmosferskih pražnjenja i prenaponi. Ukoliko zgrada nema spoljnu gromobranskuu zaštitu, usled eksponiranih instalacija SAT sistema postoji opasnost od direktnog atmosferskog pražnjenja, kao kod štapne hvataljke. Iz tog razloga prenaponska zaštita mora da se dopuni odvodnicima prenapona klase D1. Pored uobičajenog uzemljenja sa 4 mm² Cu, antenski sistem mora dodatno da bude povezan sa glavnom šinom uzemljenja preko najmanje 16 mm² Cu provodnikom. Ukoliko analiza rizika prema VDE 0185-305-2 (IEC/



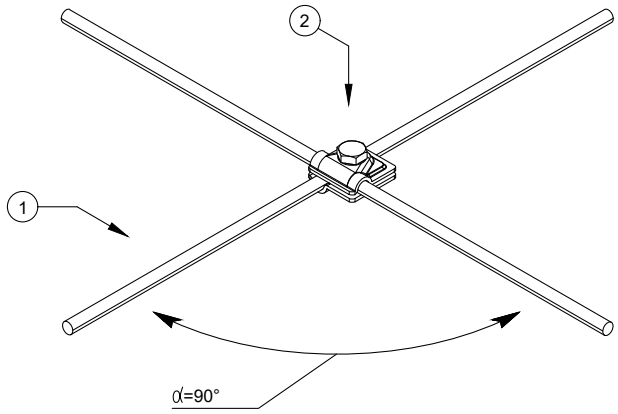
Indukcija prenapona u SAT sistem

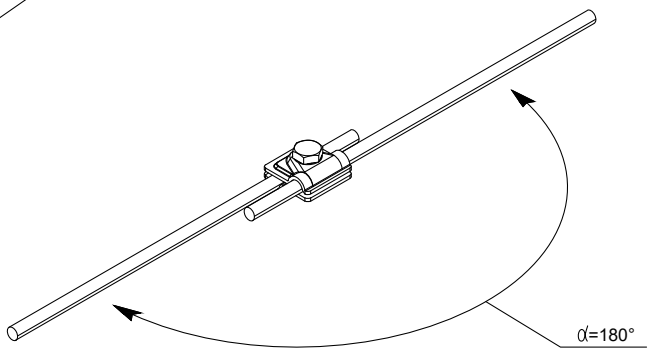
EN 62305-2) nije moguća ili zvanično nije potrebna, pri statičkim atmosferskim prenaponima (npr. munje) može da dođe do prebacivanja sa 16-mm² provodnika uzemljenja na električne instalacije ili antenski sistem zgrade. Zbog toga se preporučuje da se provodnik za uzemljenje izvede izolujuće, kaoo i da se klizna pražnjenja spreče odgovarajućim merama.

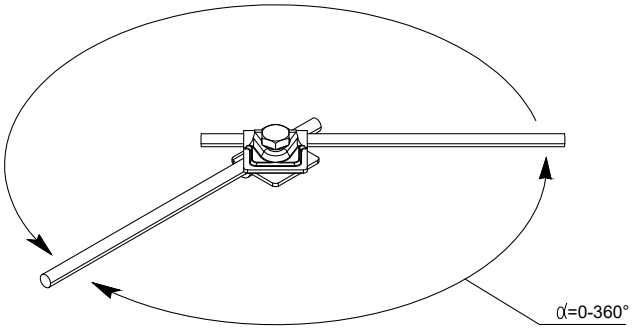
	Proizvod	Br. art.
1	Šina za izjednačavanje potencijala npr. OBO 1801 VDE	5015650
2	Koaksijalni uređaj za zaštitnu od prenapona npr. TV 4+1	5083400
3	Fini zaštitni uređaj za SAT i 230 V dovode npr. OBO FC-SAT-D	5092816
4	Odvodnik prenapona OBO DS-F	5093275/5093272
5	Uzemljenje antene 4 mm² Cu	-
6	Provodnik za uzemljenje min. 16 mm² Cu	-

Beleška

OBO Typicals - detaljni crtež montaže sistema prenaponske zaštite, uzemljenja i izjednačavanja potencijala







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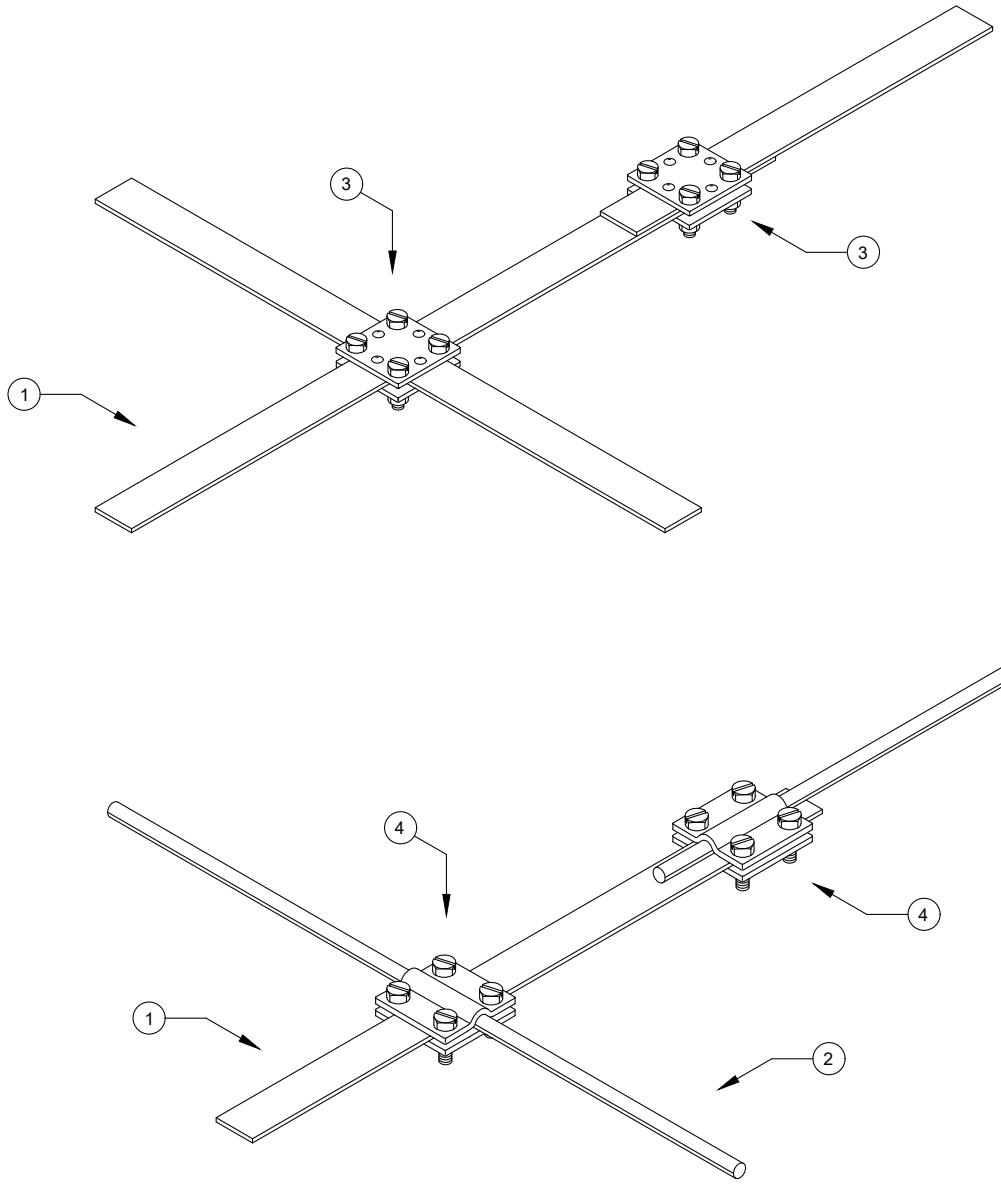
— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:		



	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	

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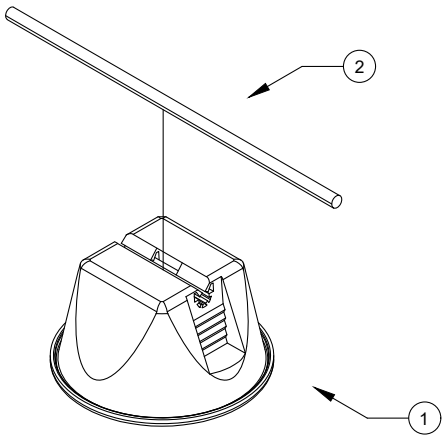
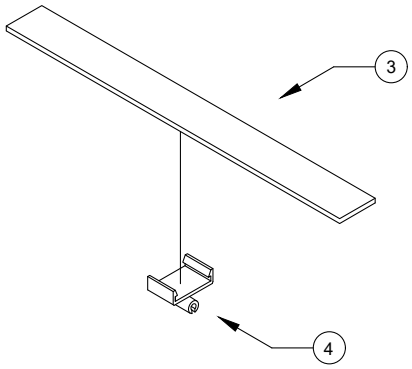
Ind.	Amendment typical		Date:	Name:		

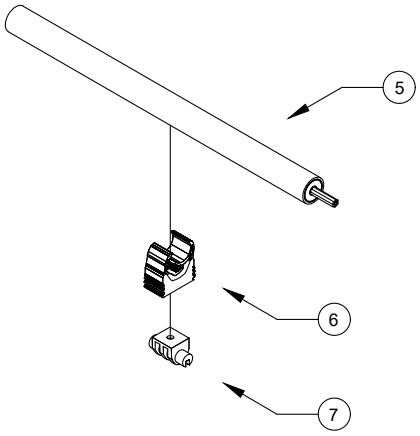
1 Fixing the round conductor



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.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Methods of mounting various conductors on a flat roof surface			

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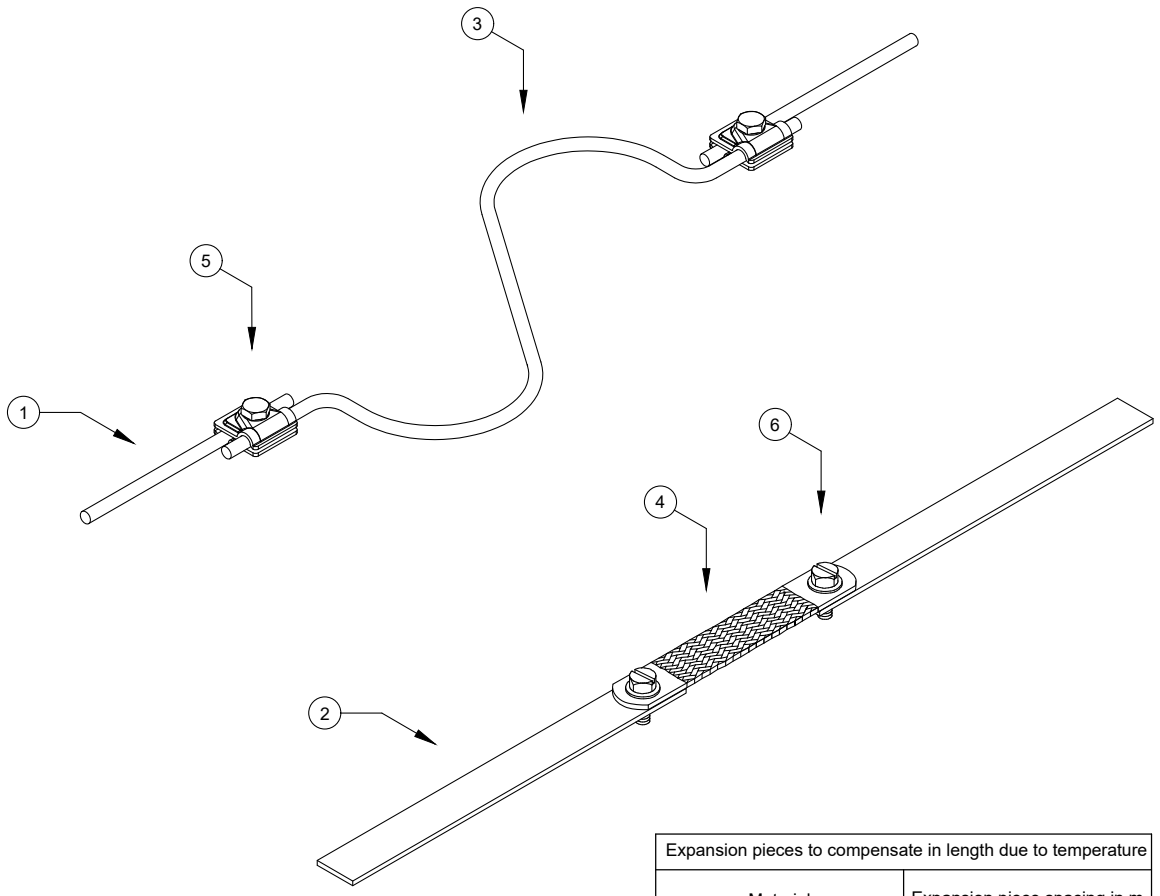
Ind.	Amendment typical	Date:	Name:		

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.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Installation of thermal expansion compensators for conductors			

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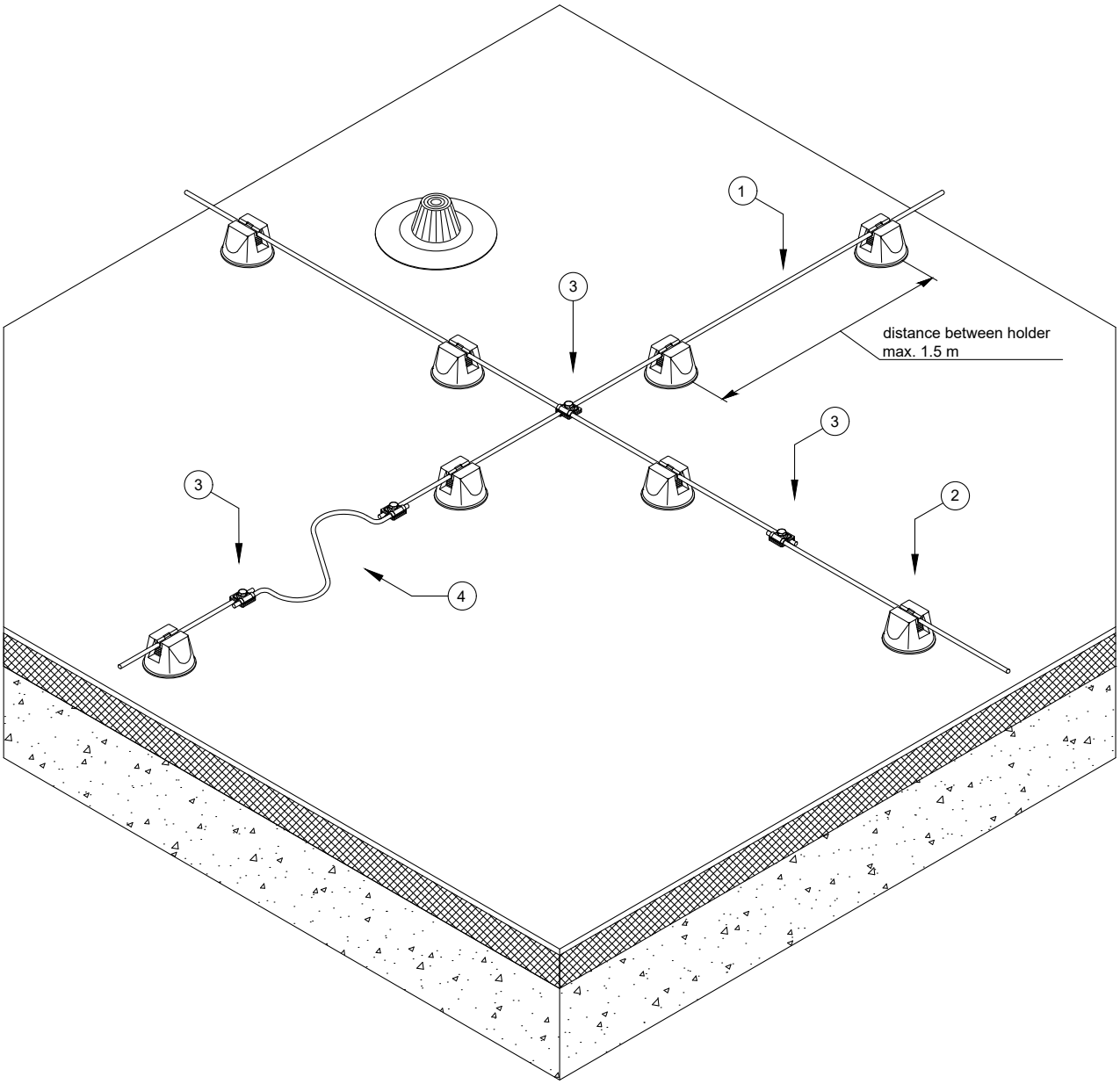
Ind.	Amendment typical	Date:	Name:			

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	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.:	
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Installation of a lightning protection grid with round conductor on the roof surface			
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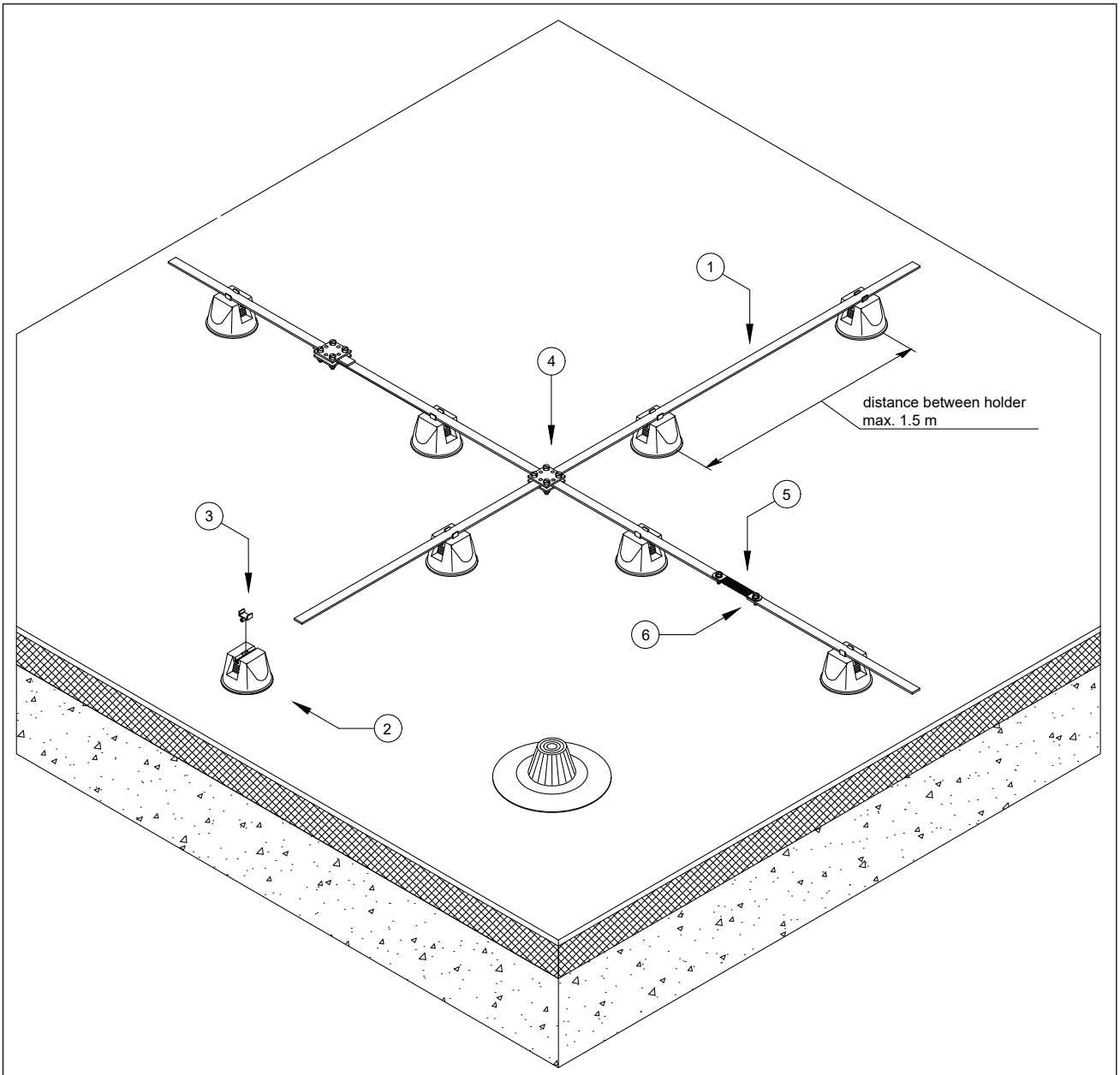
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	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.:
	Date:	Name:	Description: The external lightning protection system for flat roofs			
Creator:						
Editor:						
Status:			Comment: Installation of a lightning protection grid with flat conductor on the roof surface			

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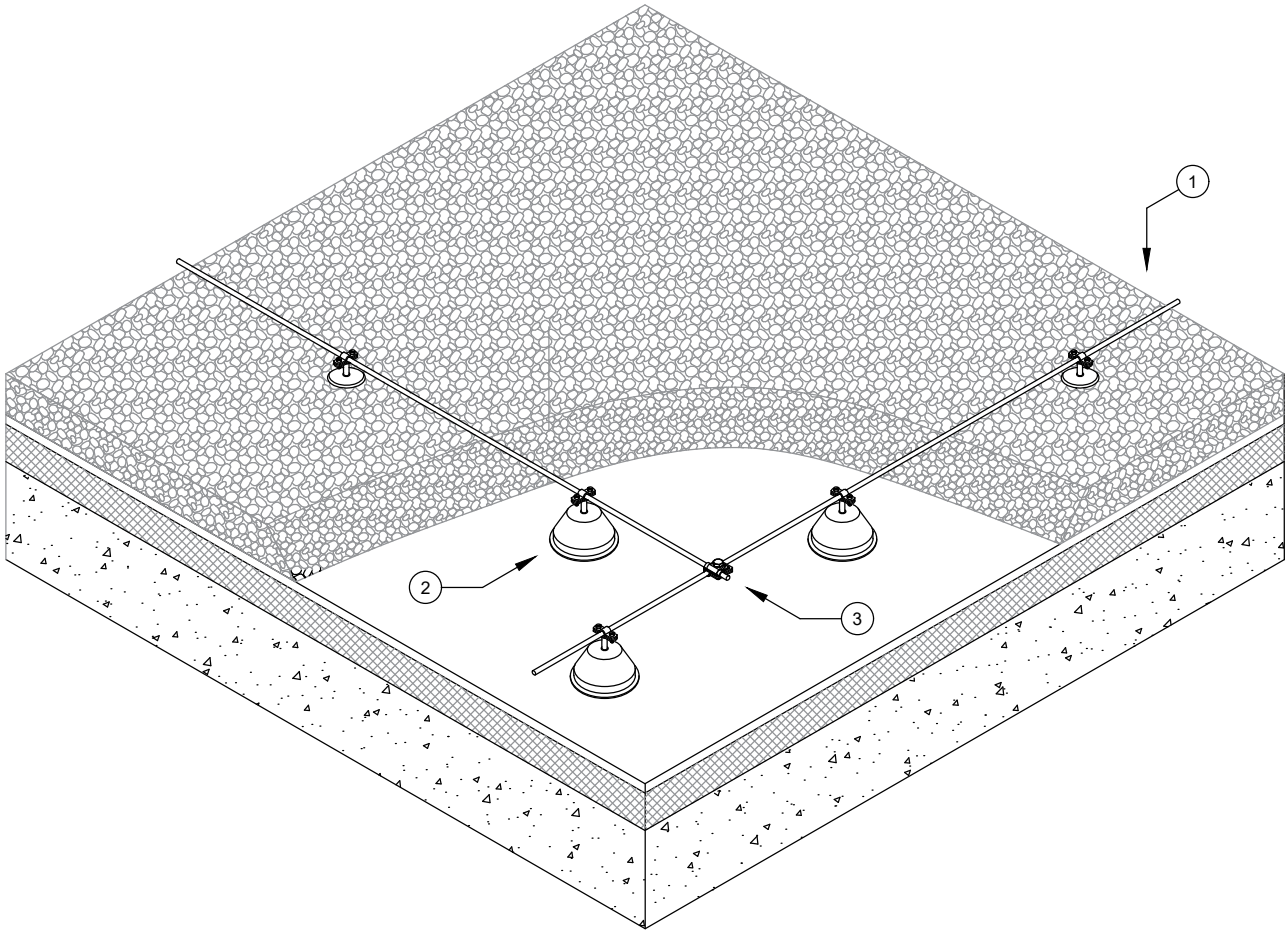
Ind.	Amendment typical	Date:	Name:			

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.:	
	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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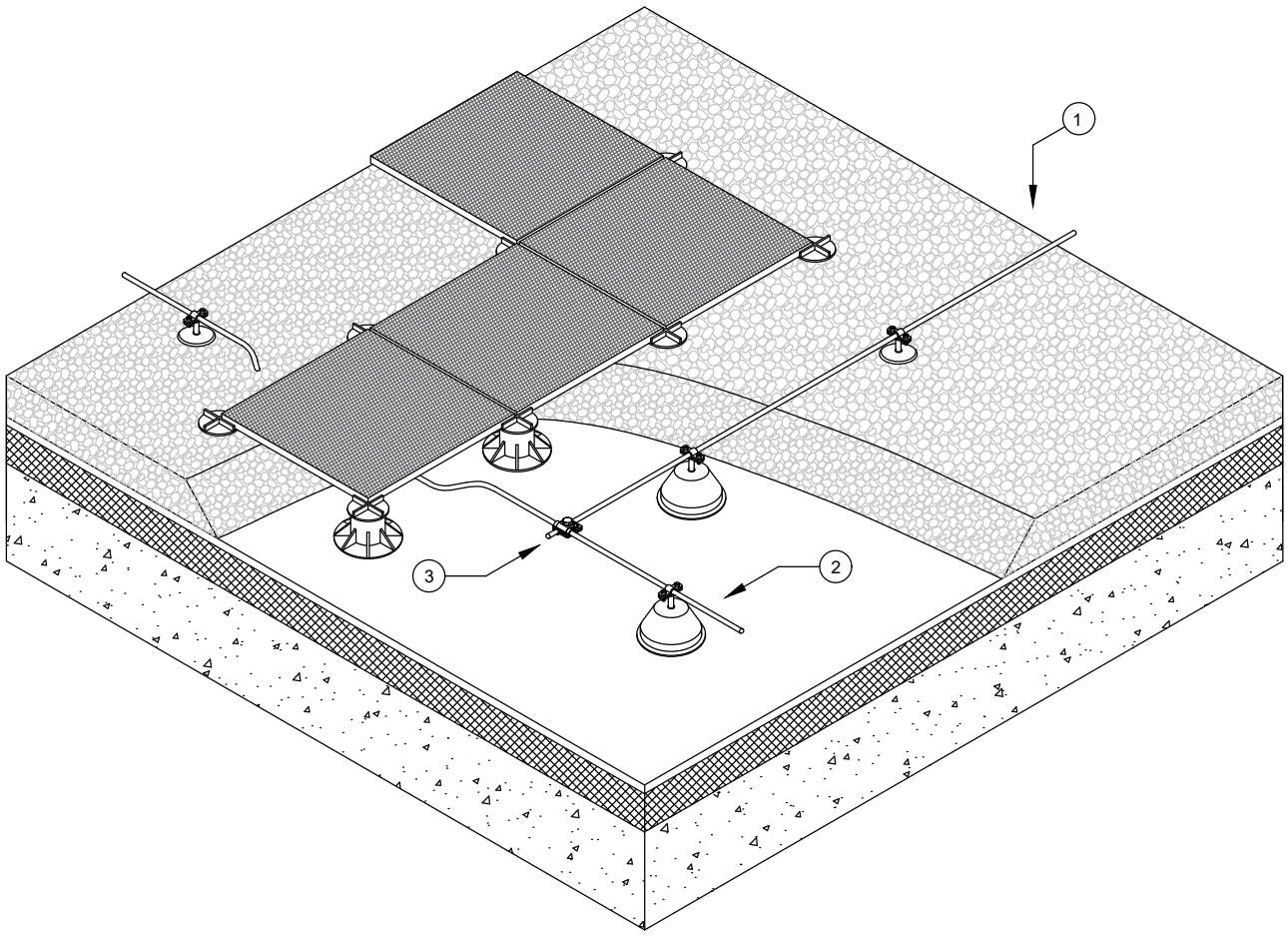
Ind.	Amendment typical	Date:	Name:			

1 External lightning protection systems for flat roofs



	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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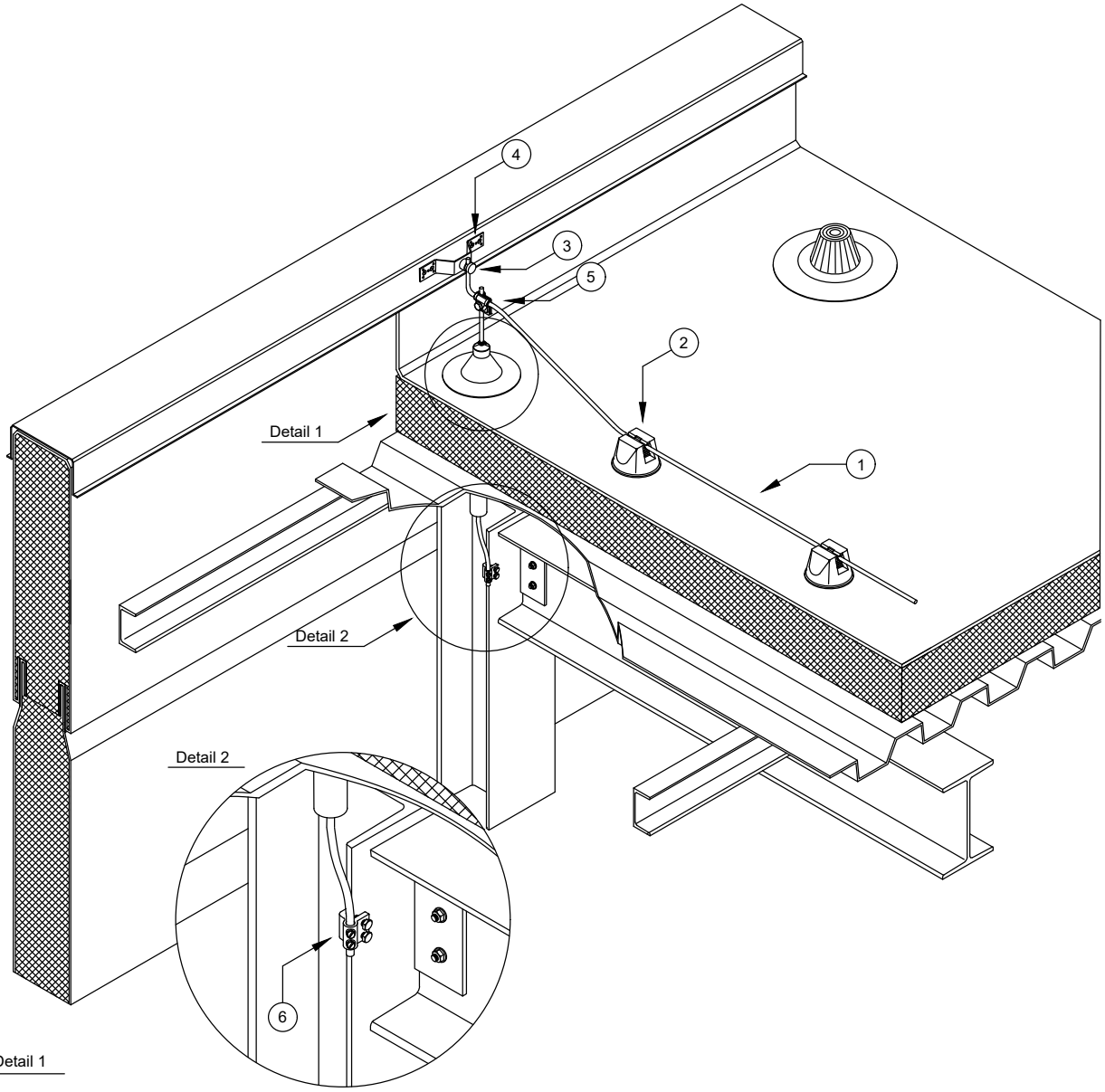
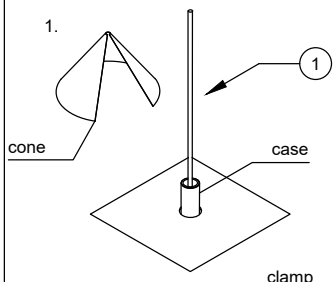
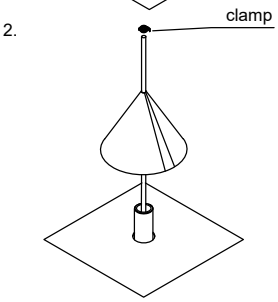
Ind.	Amendment typical	Date:	Name:			

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:						
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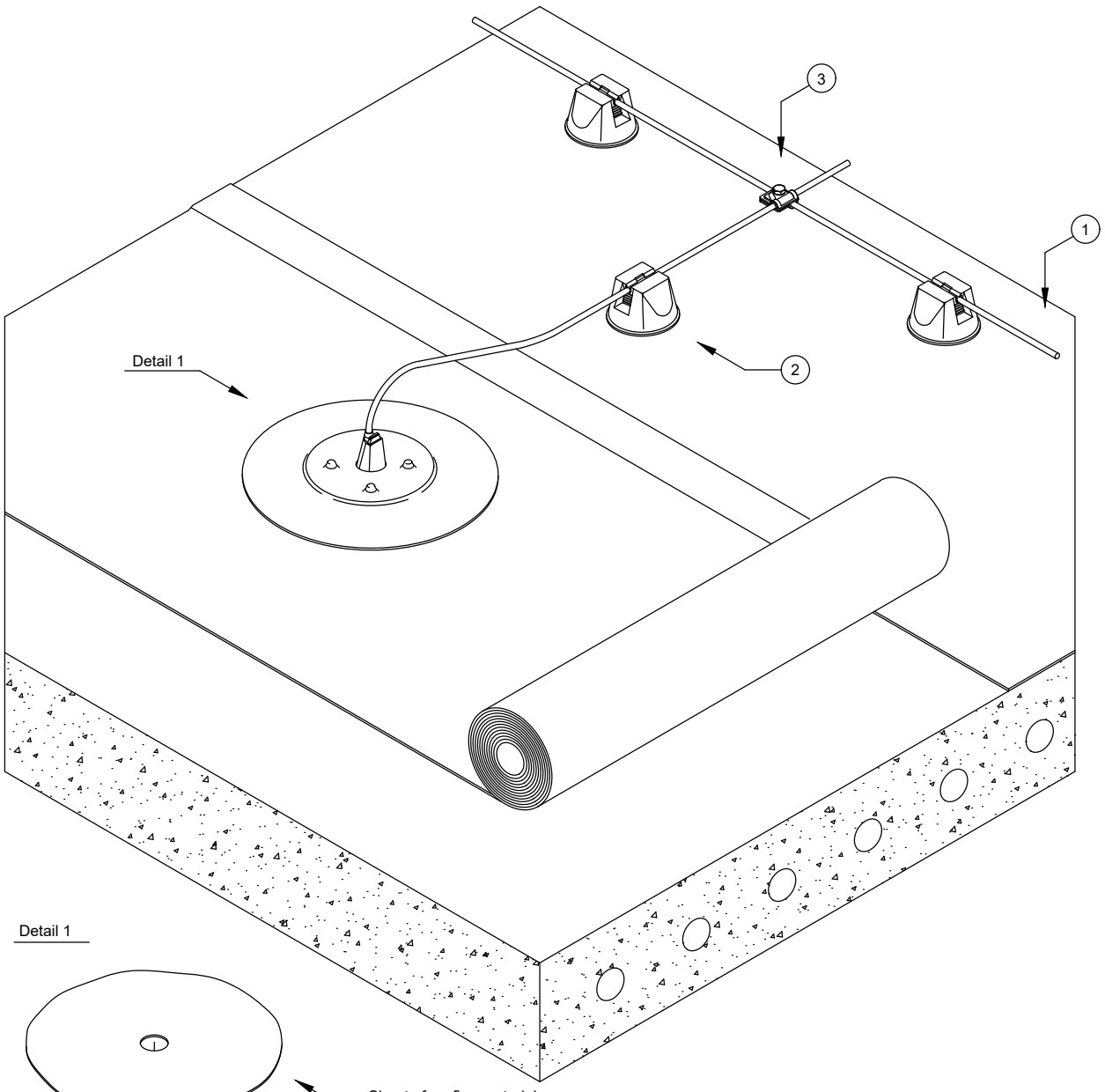
Ind.	Amendment typical		Date:	Name:		

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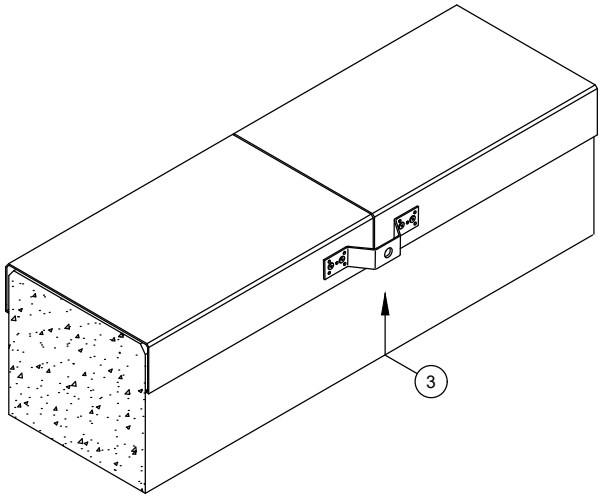
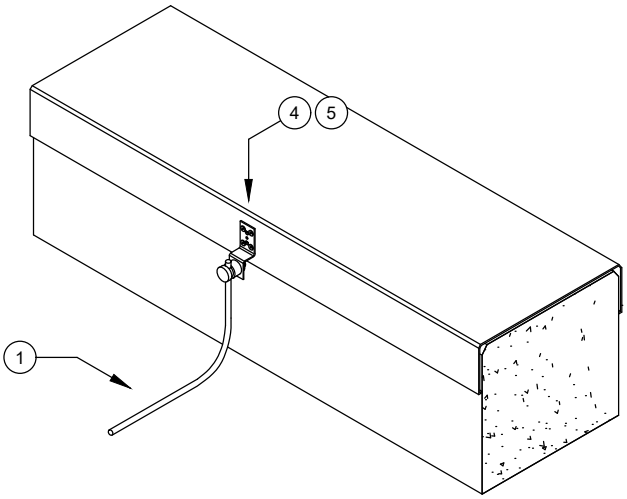
	— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:			

1 External lightning protection systems for flat roofs

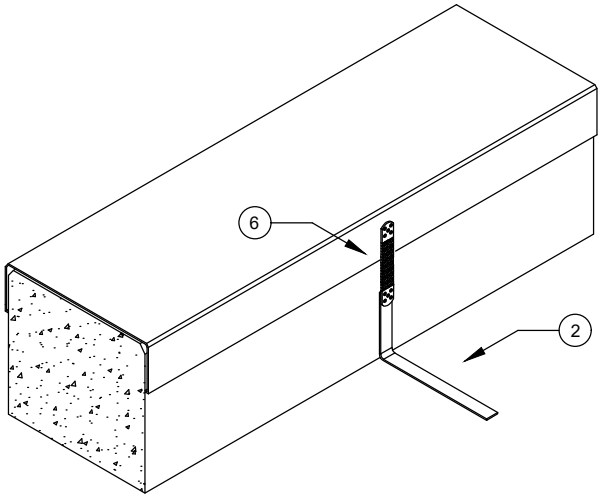
(1) Mounting on 2 blind rivets d = 6 mm



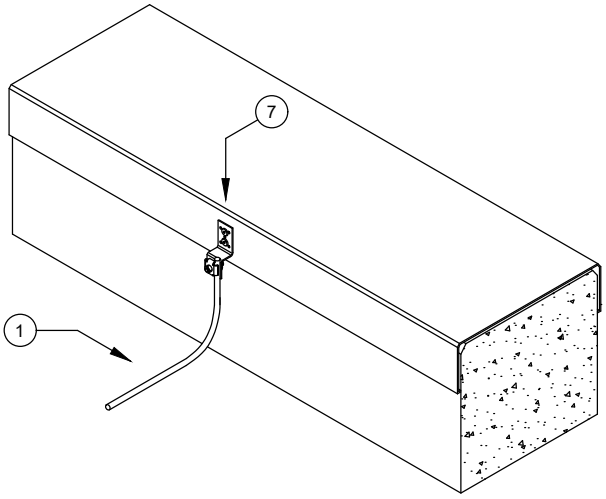
(2) Mounting on 4 blind rivets d = 5 mm



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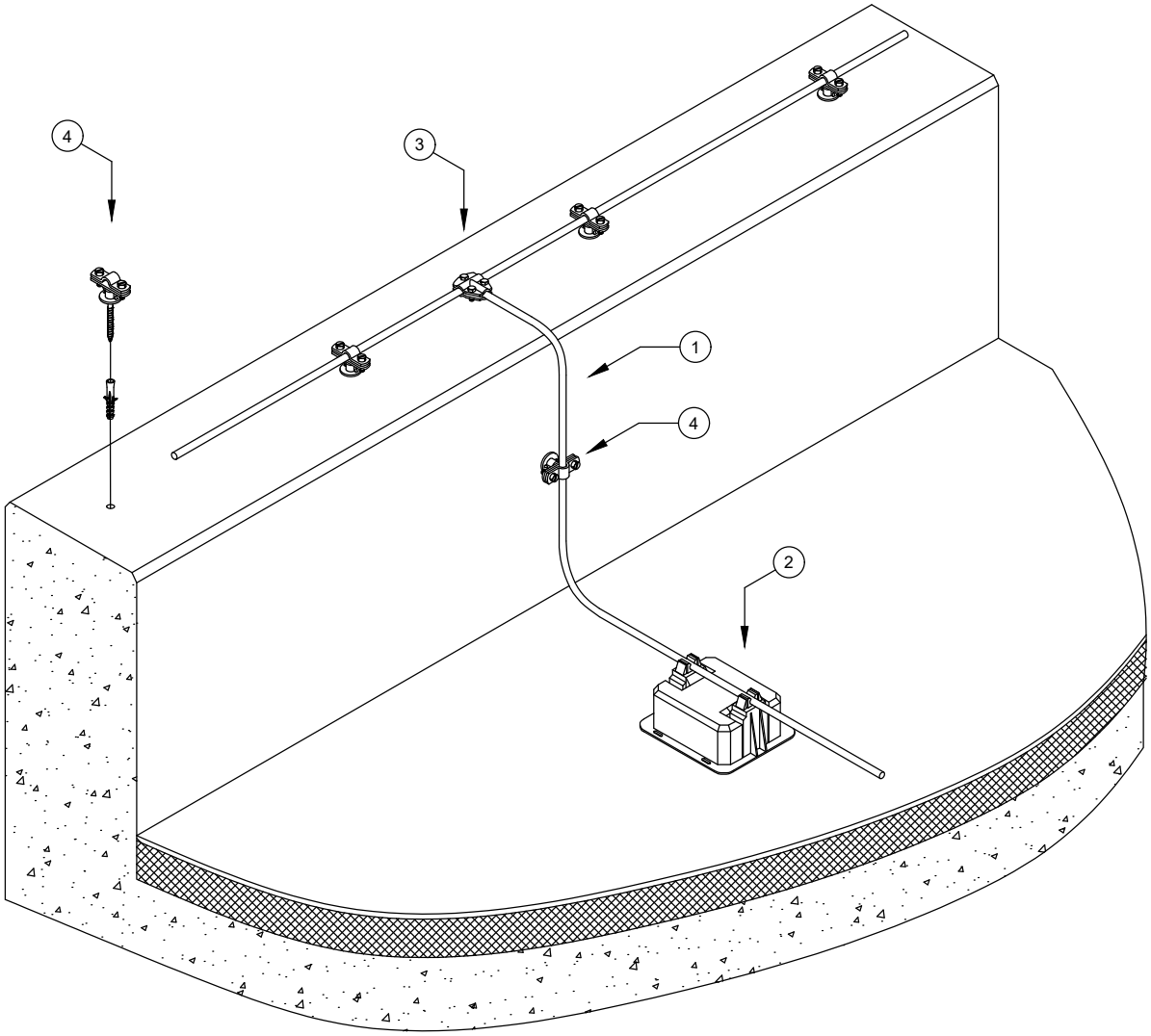
	— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:			

1 External lightning protection systems for flat roofs



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	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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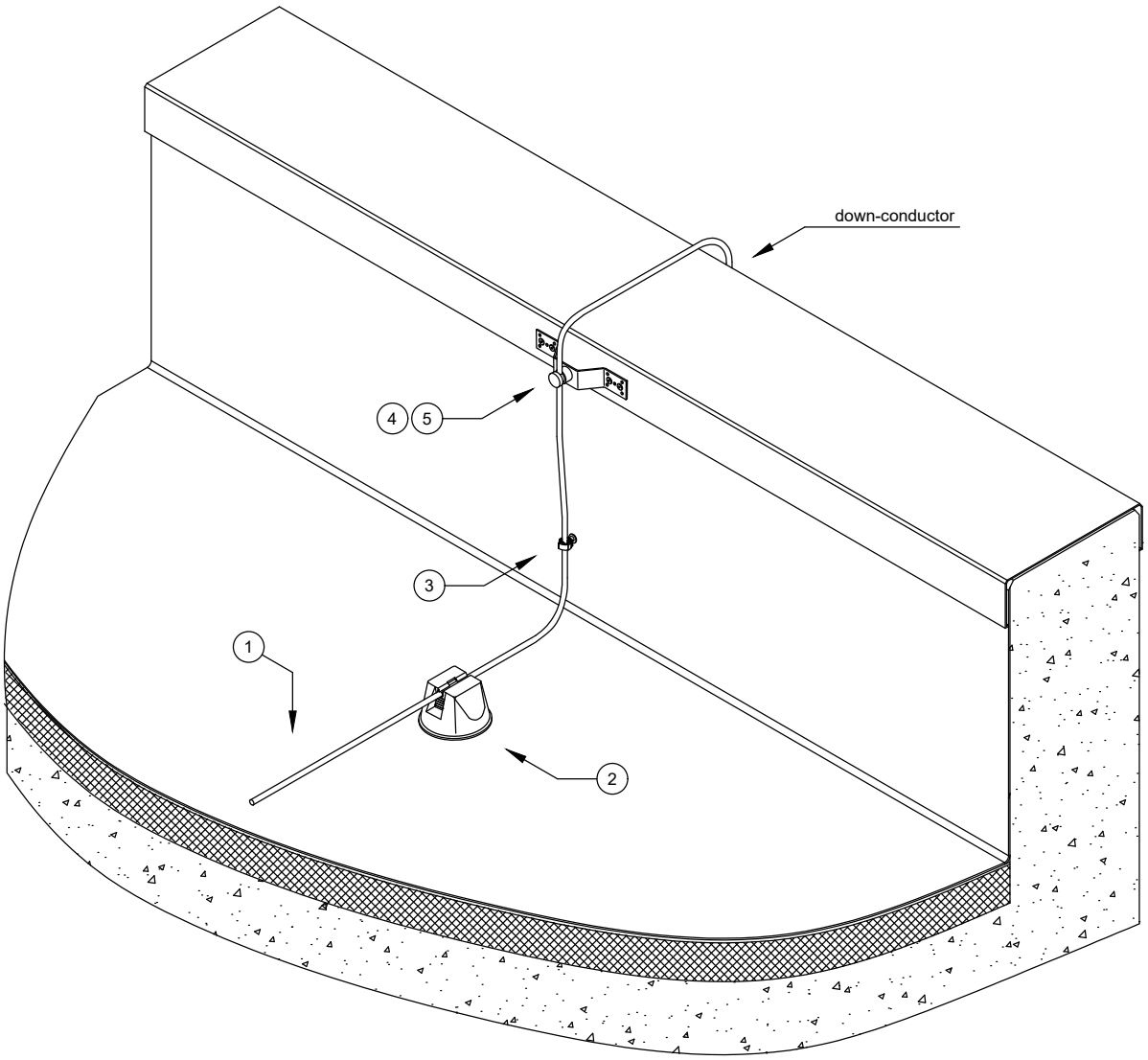
Ind.	Amendment typical		Date:	Name:		

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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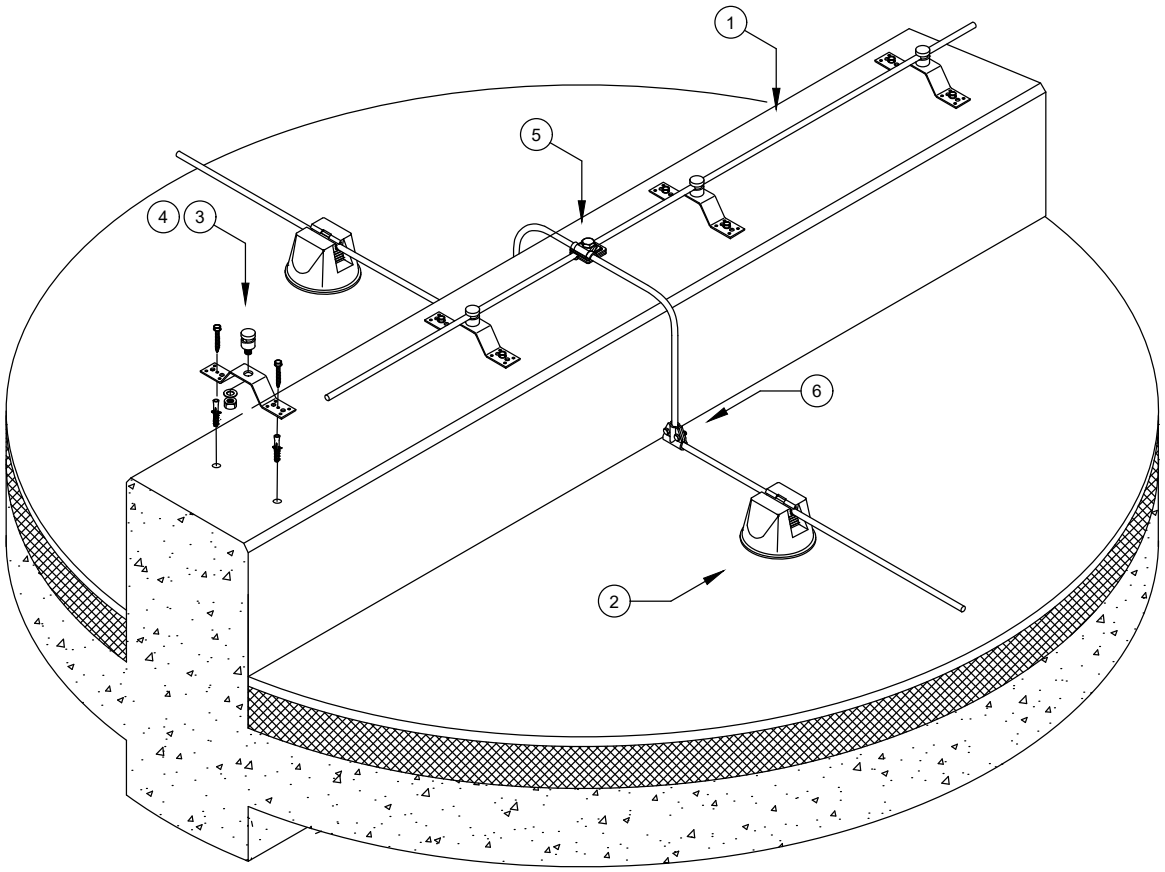
Ind.	Amendment typical		Date:	Name:		



	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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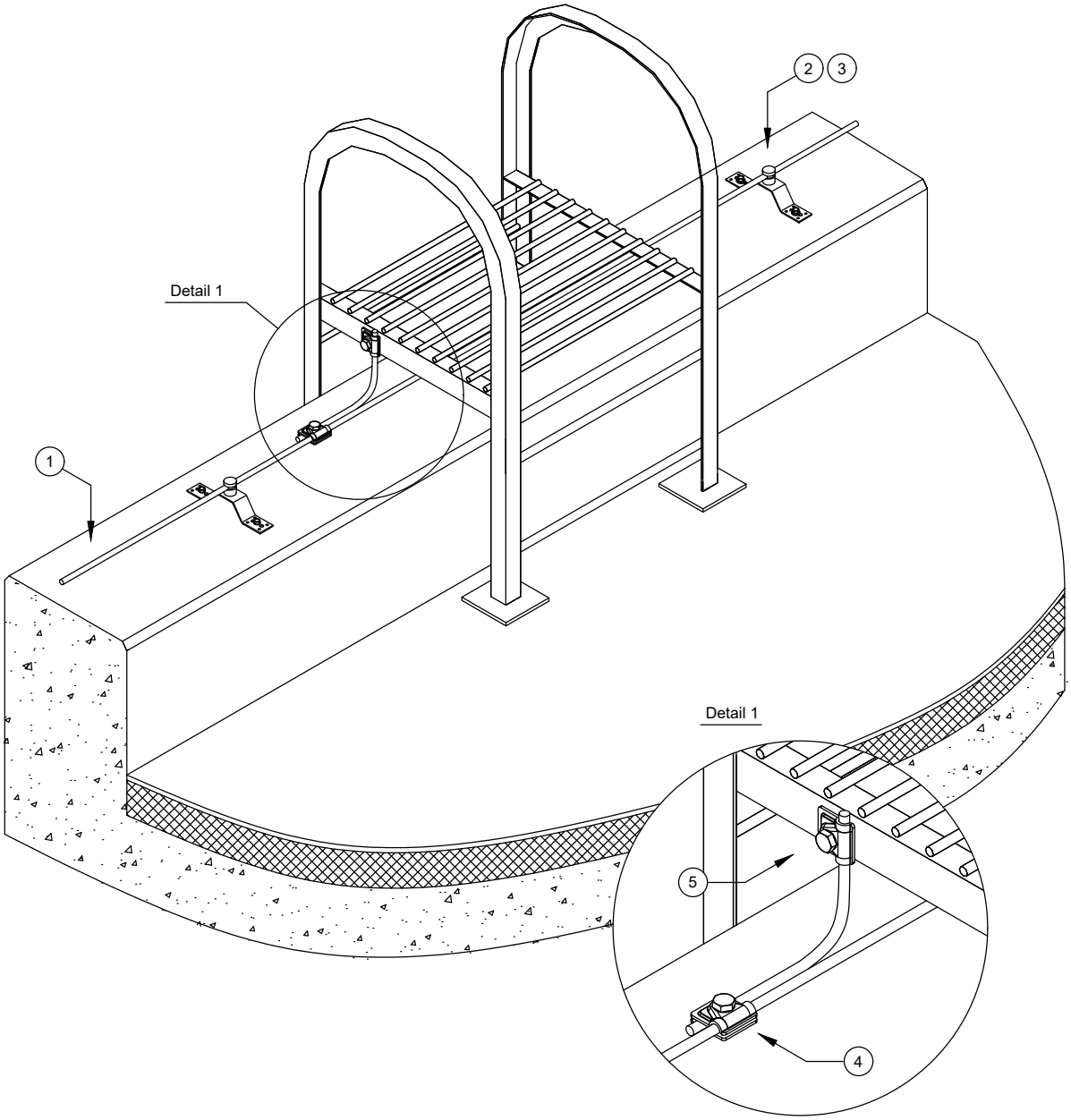
Ind.	Amendment typical	Date:	Name:			

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	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.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
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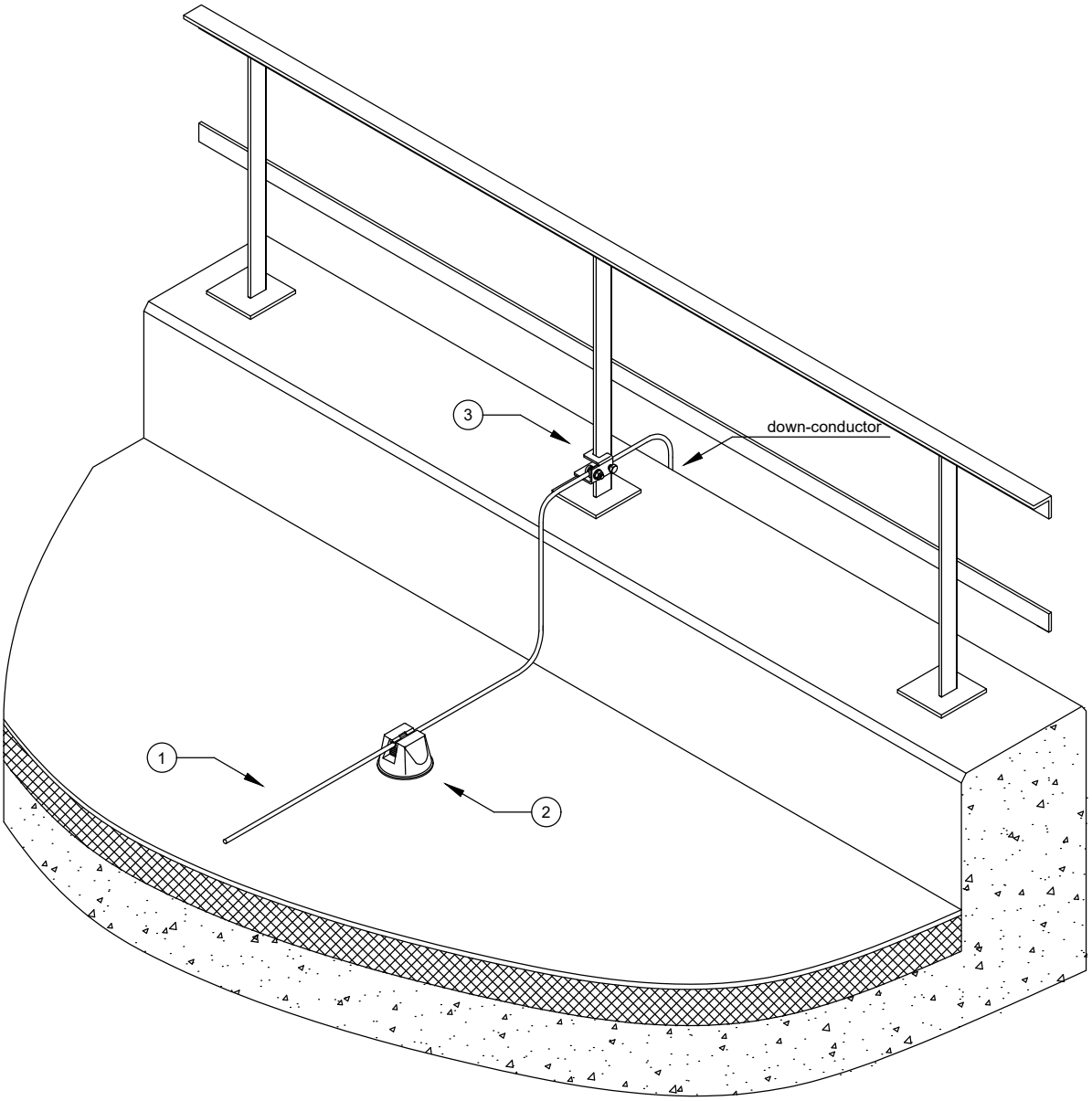
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	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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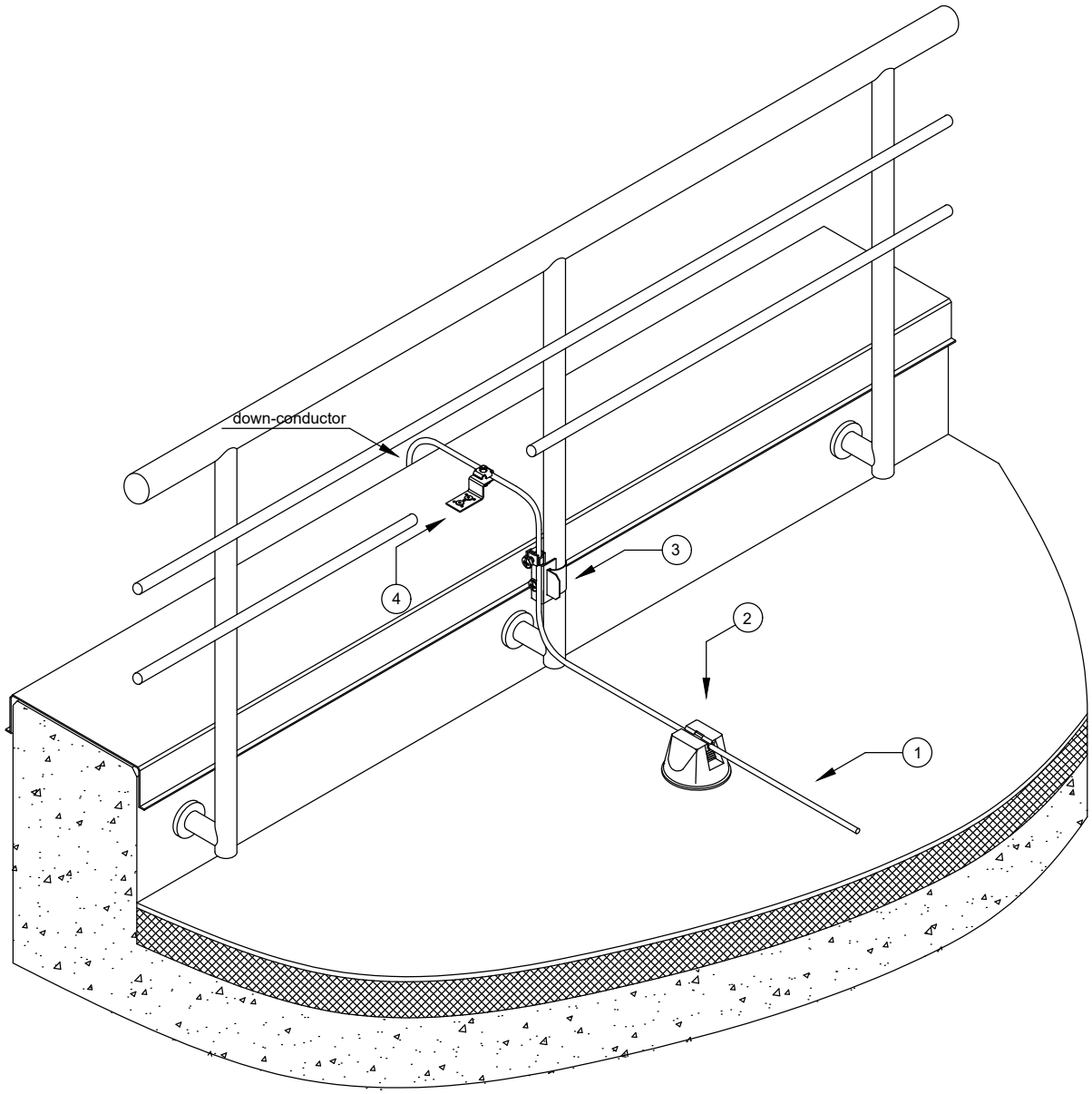
Ind.	Amendment typical		Date:	Name:		

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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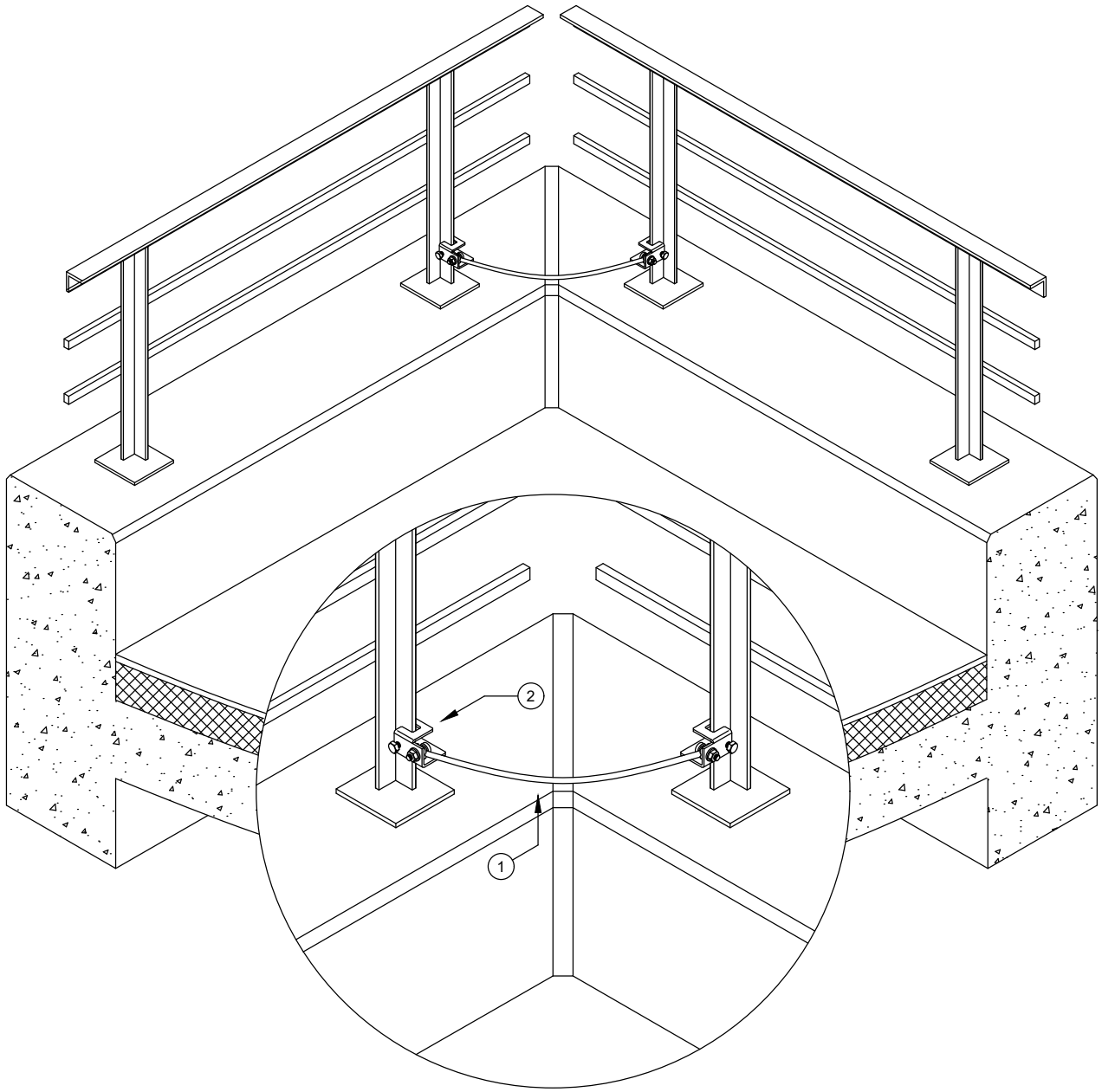
Ind.	Amendment typical	Date:	Name:			

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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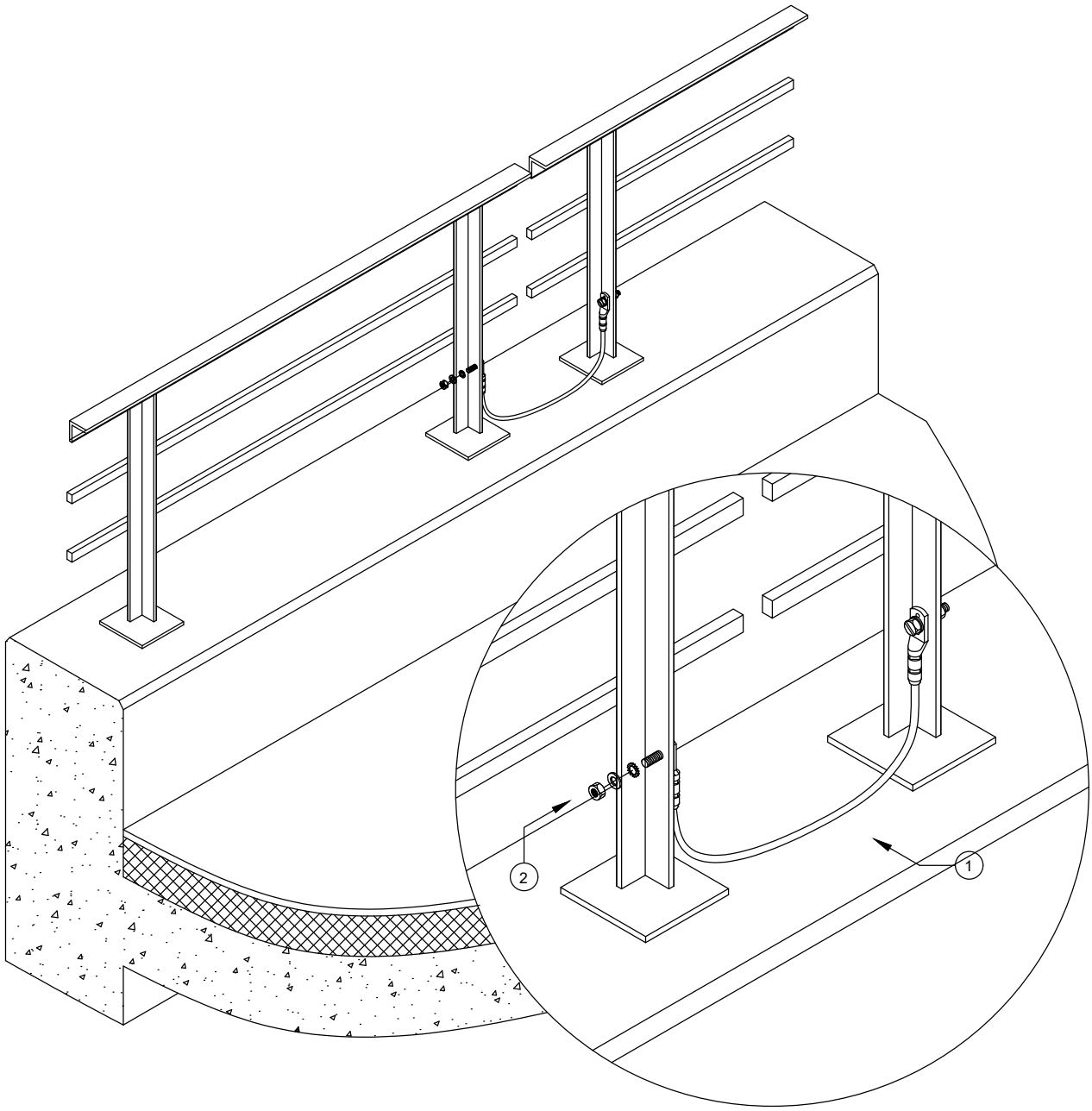
Ind.	Amendment typical		Date:	Name:		

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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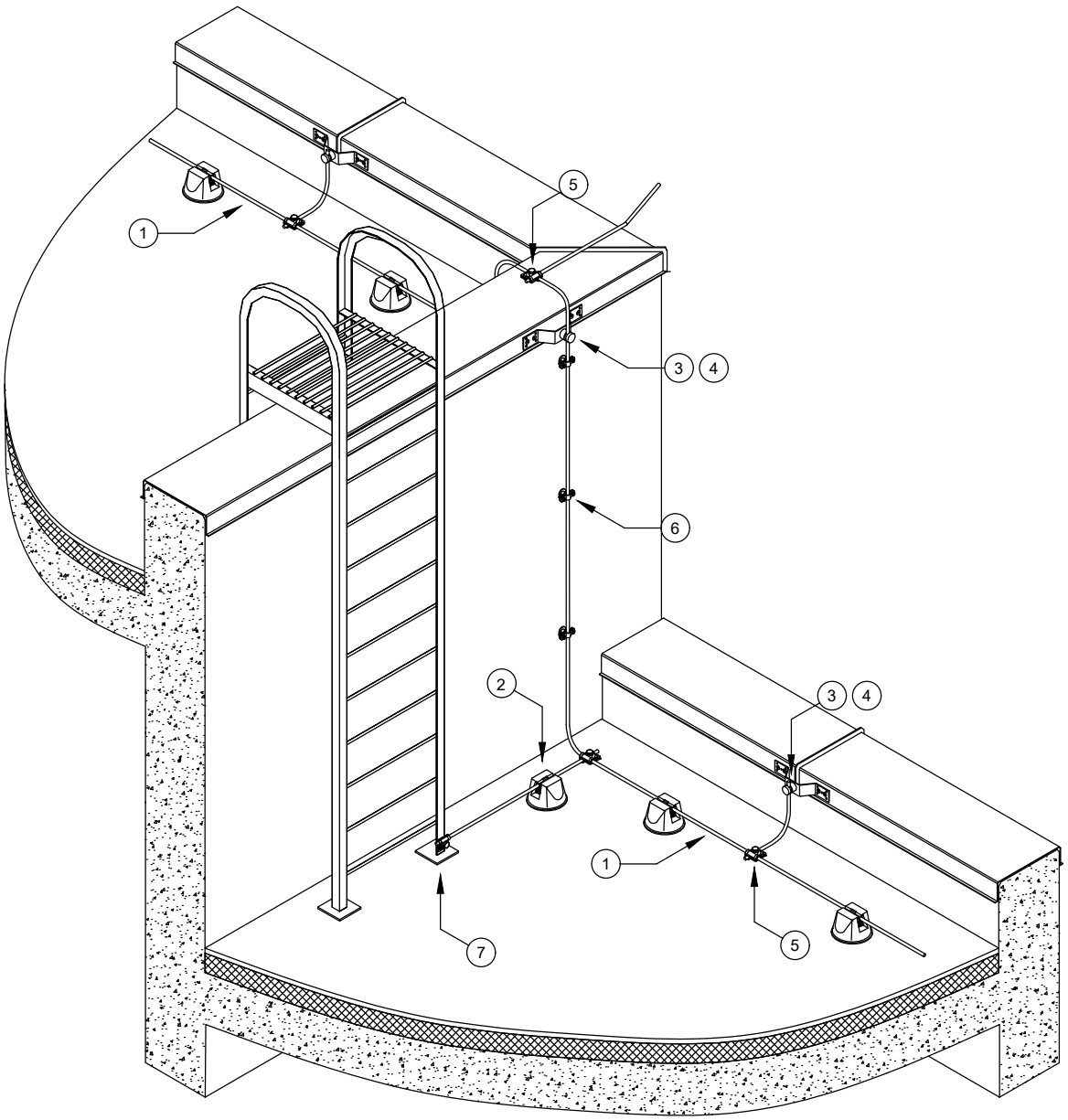
Ind.	Amendment typical	Date:	Name:			

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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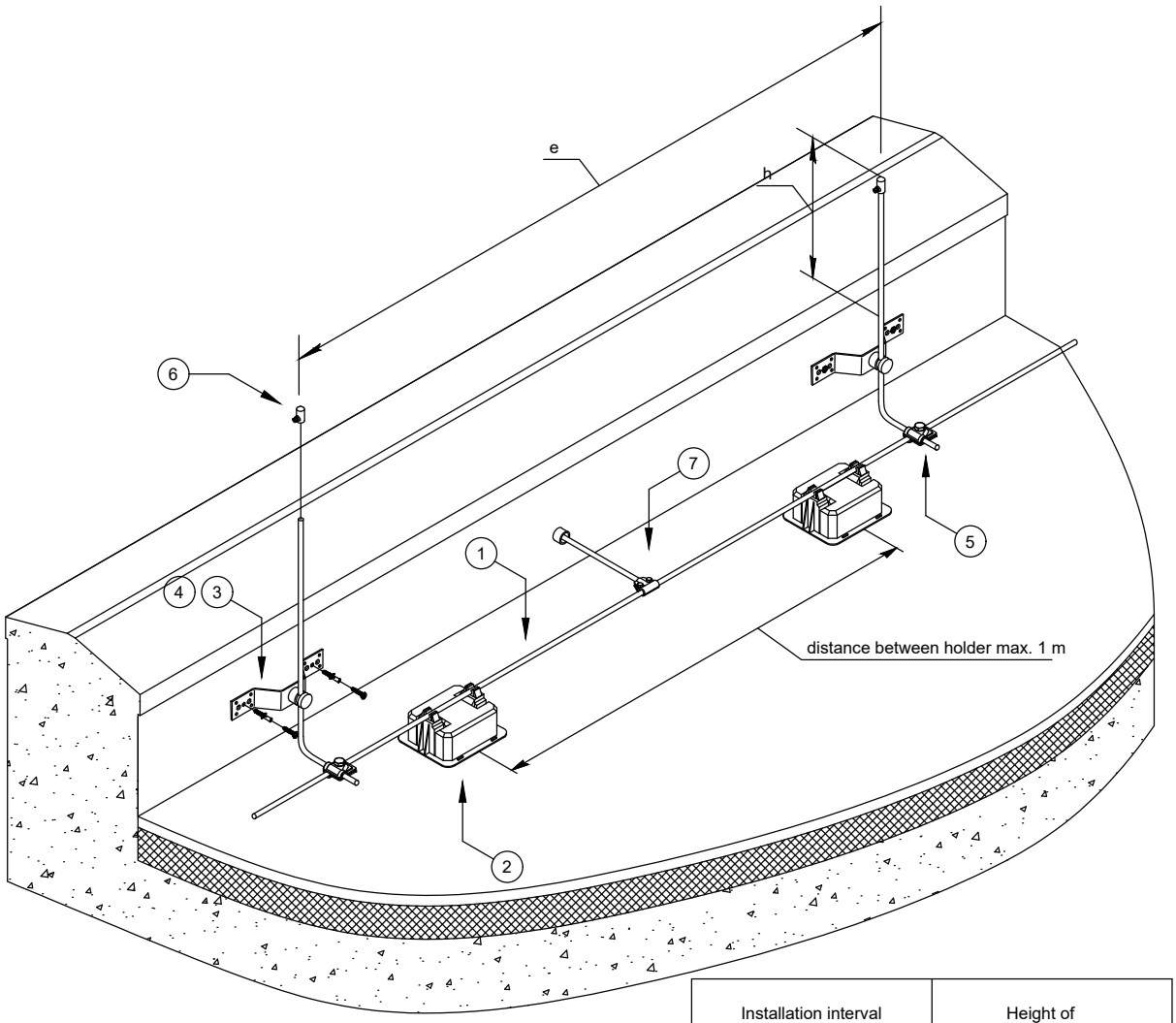
Ind.	Amendment typical	Date:	Name:			

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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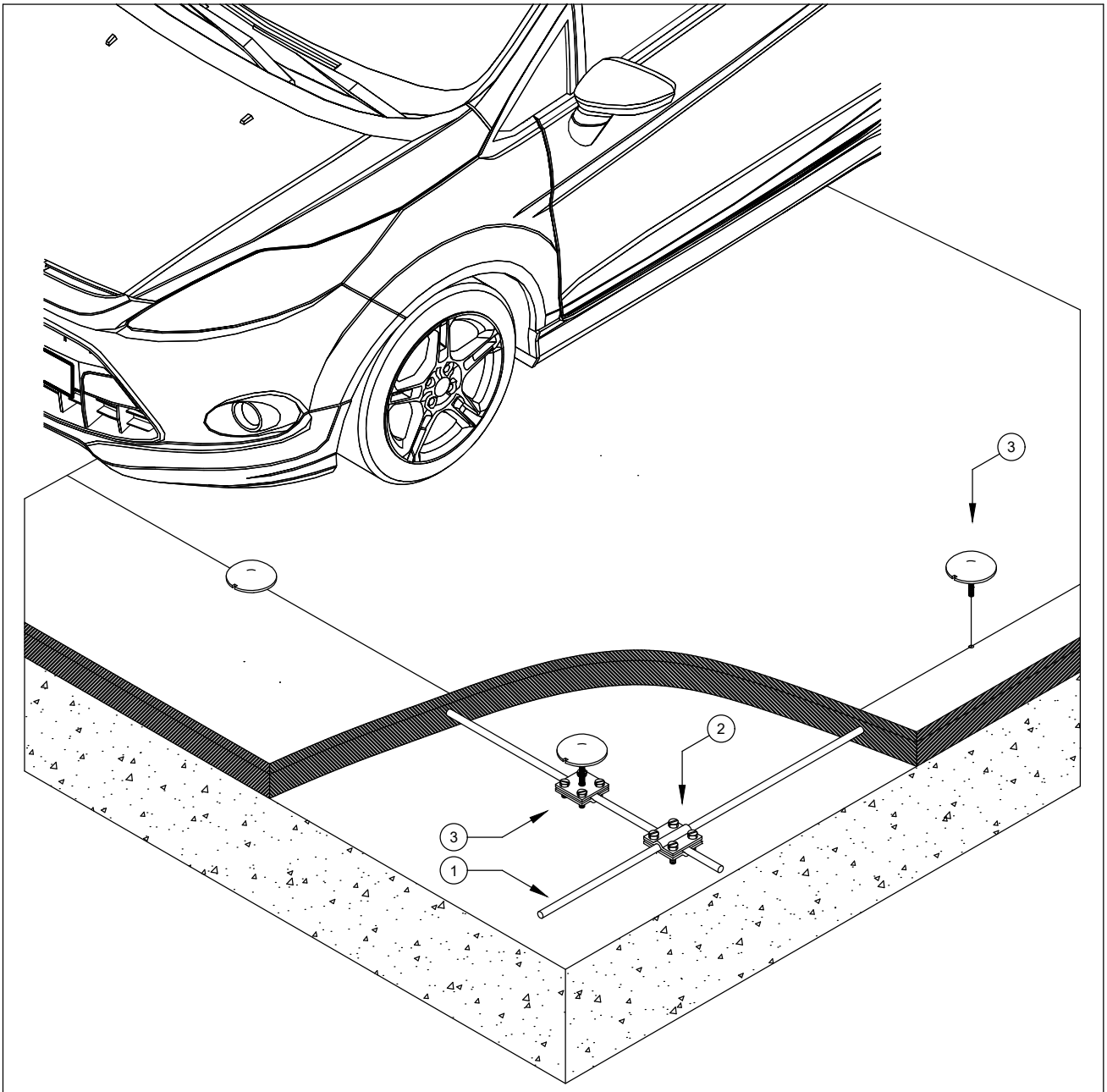
Ind.	Amendment typical	Date:	Name:			

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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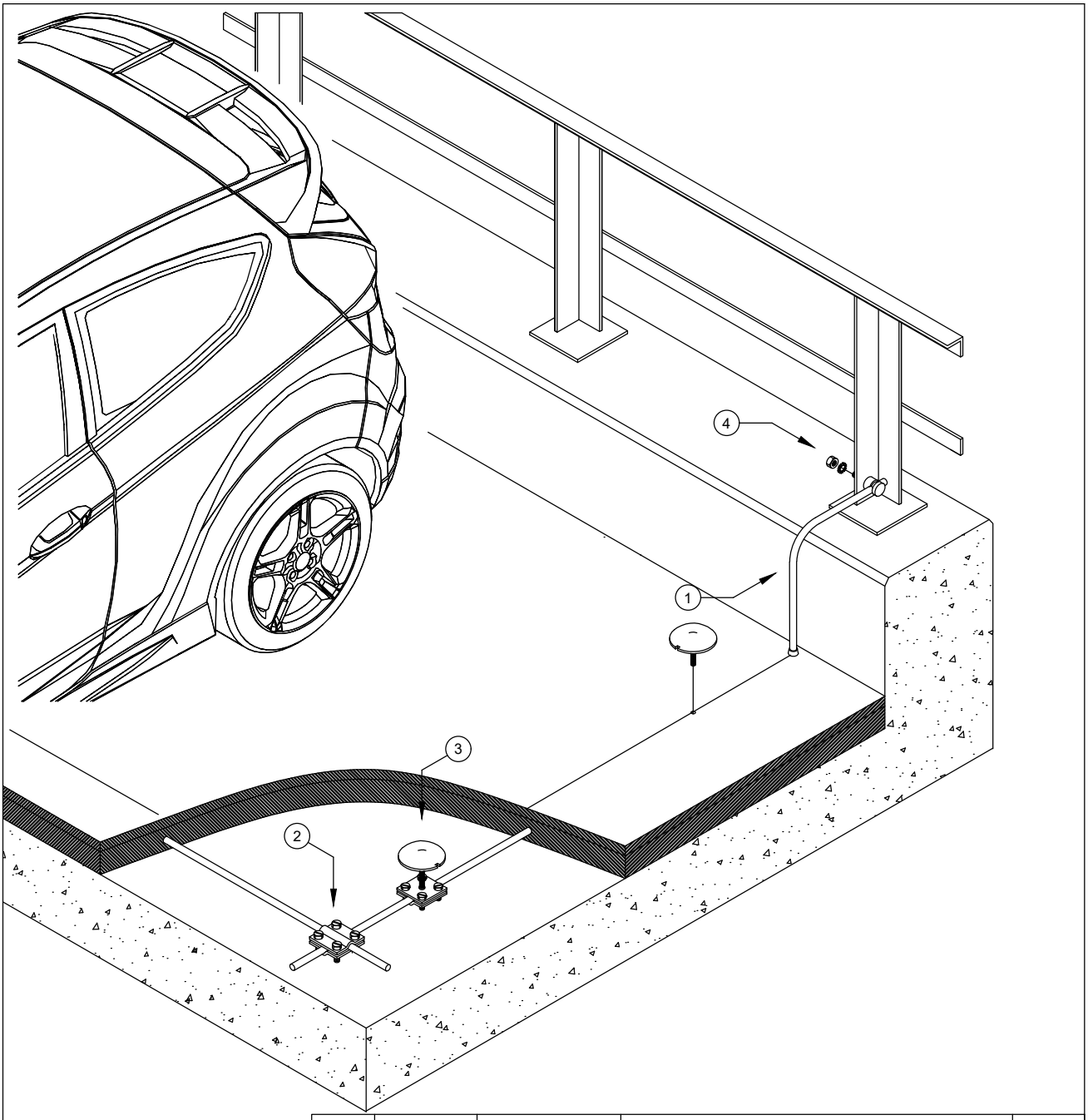
Ind.	Amendment typical	Date:	Name:			

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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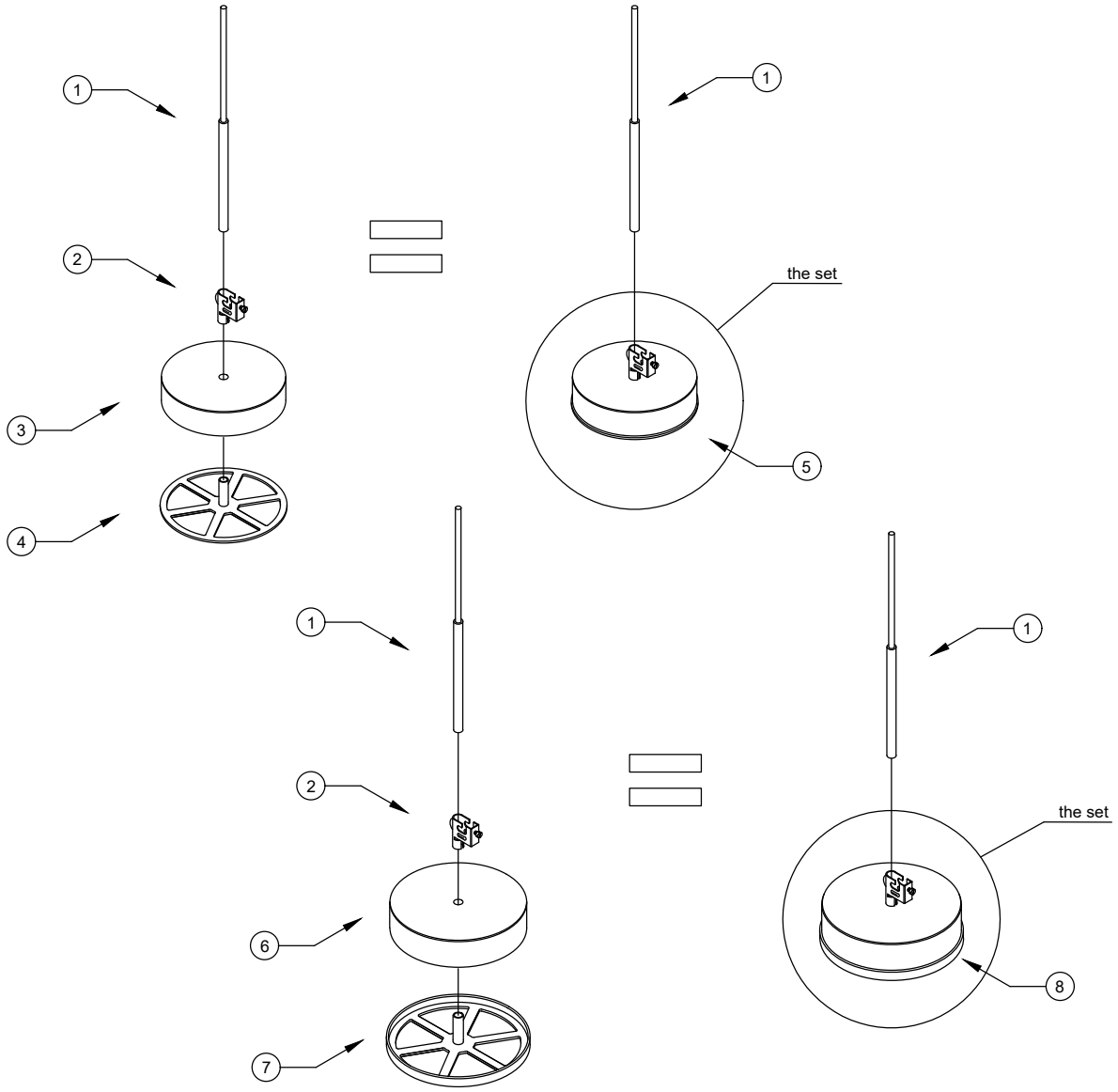
Ind.	Amendment typical	Date:	Name:			

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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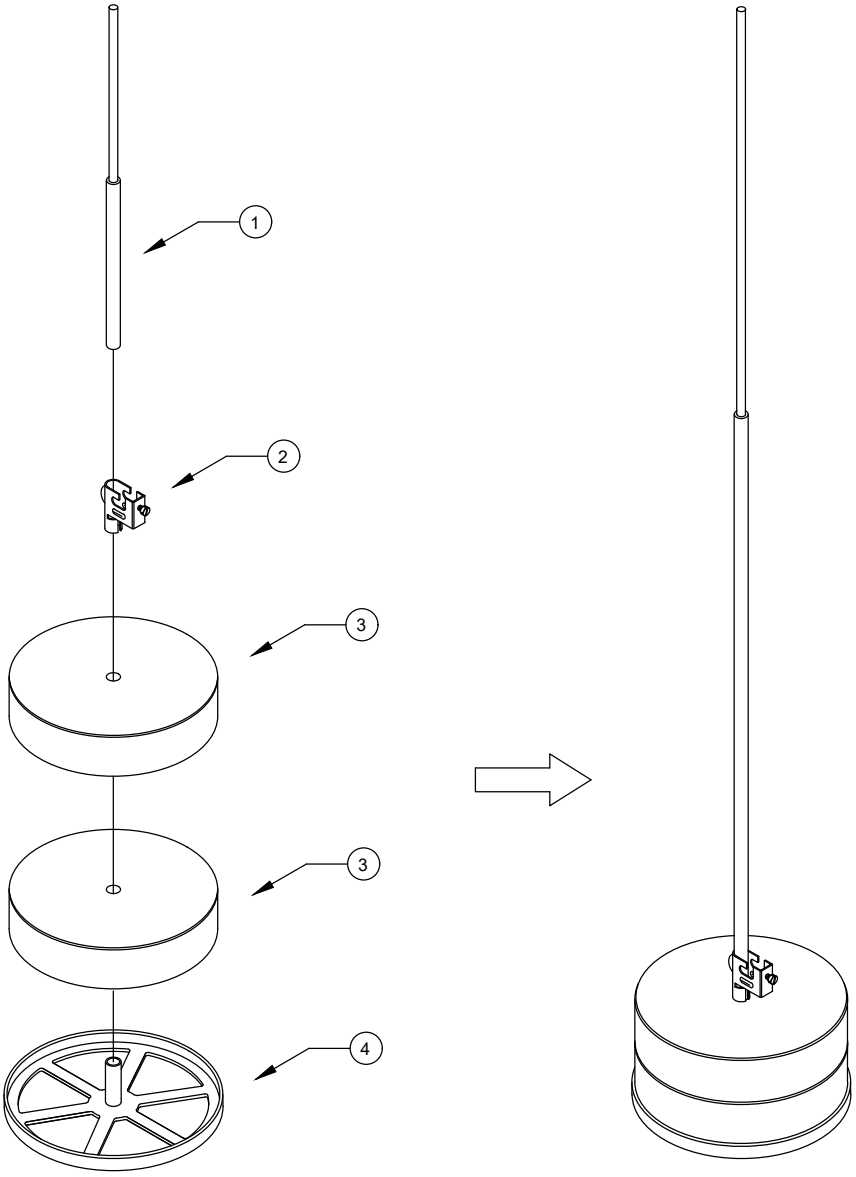
Ind.	Amendment typical	Date:	Name:			



	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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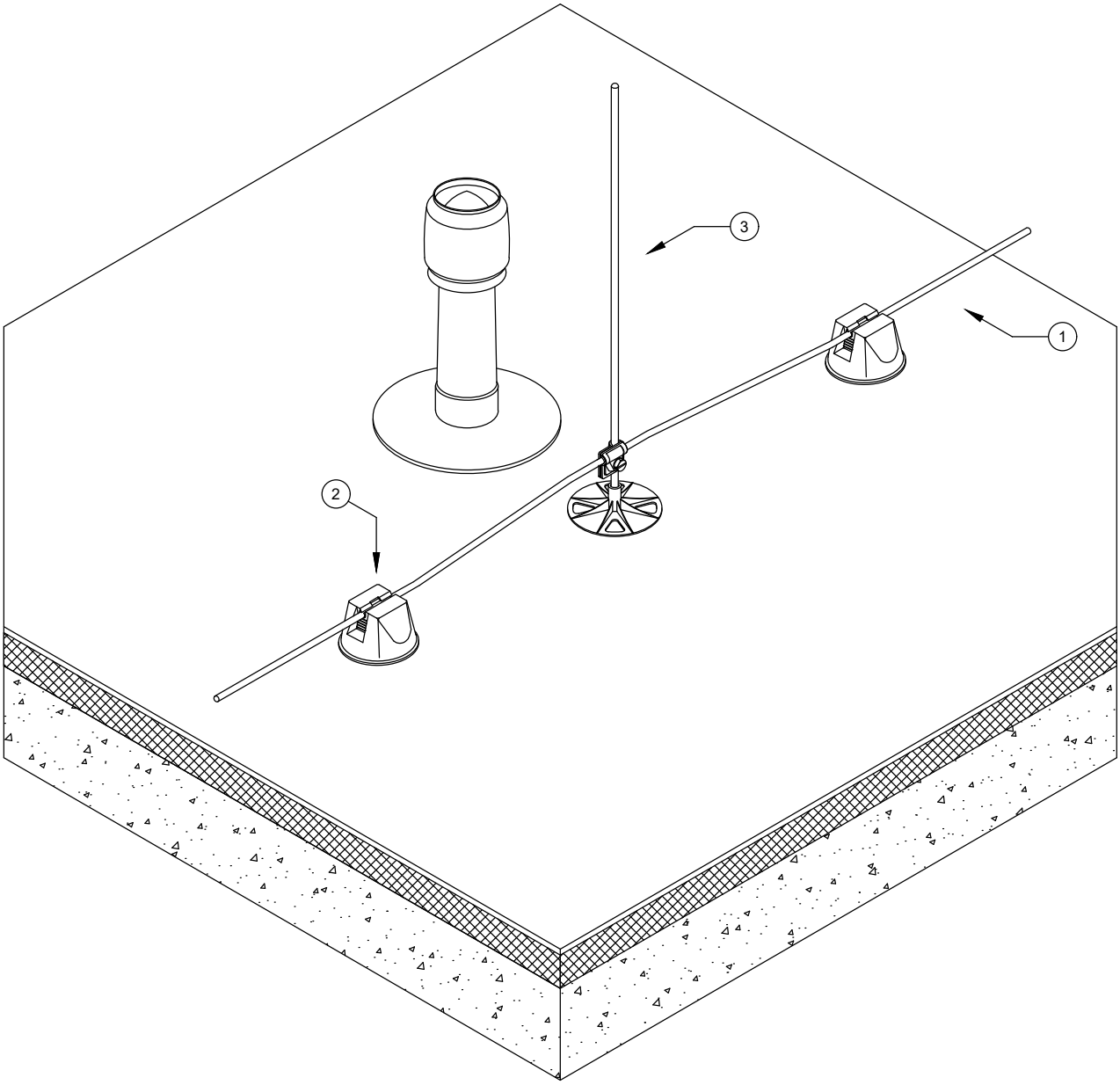
Ind.	Amendment typical	Date:	Name:			



	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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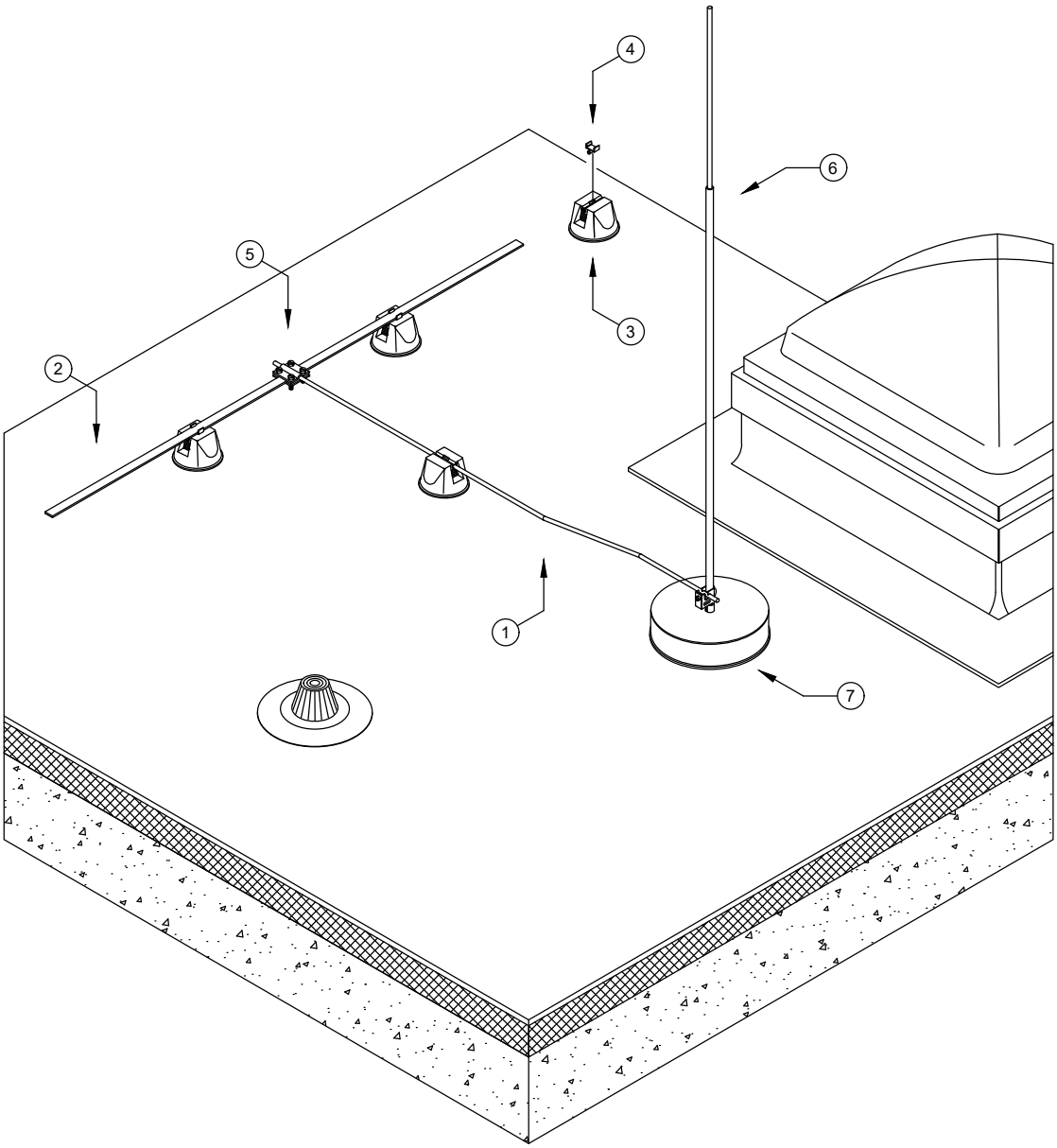

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
3	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
4	5218885	165 MBG HFL	Flat conductor adapter for roof conductor holder	
5	5312655	252 8-10xFL30FT	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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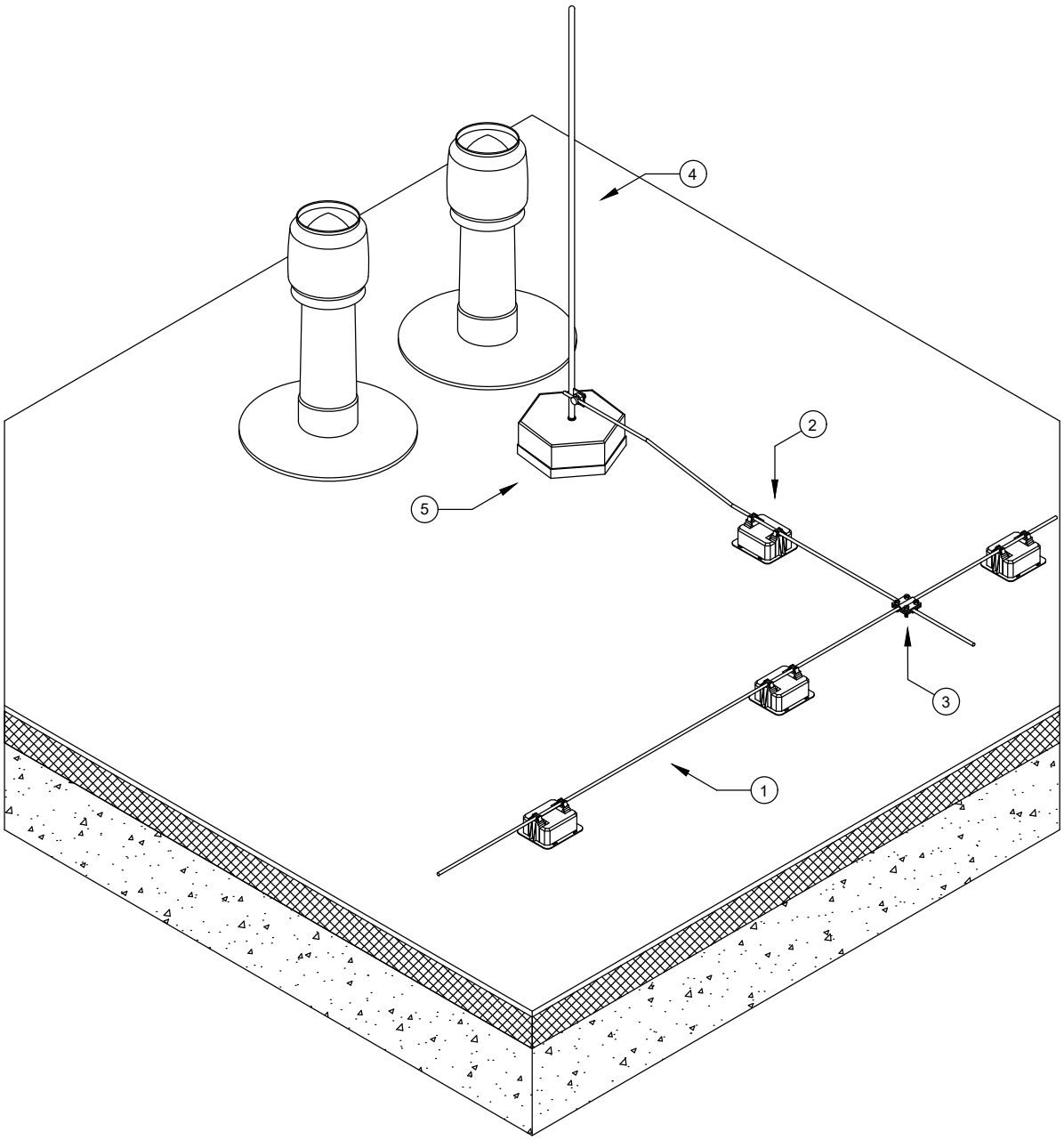
Ind.	Amendment typical		Date:	Name:		

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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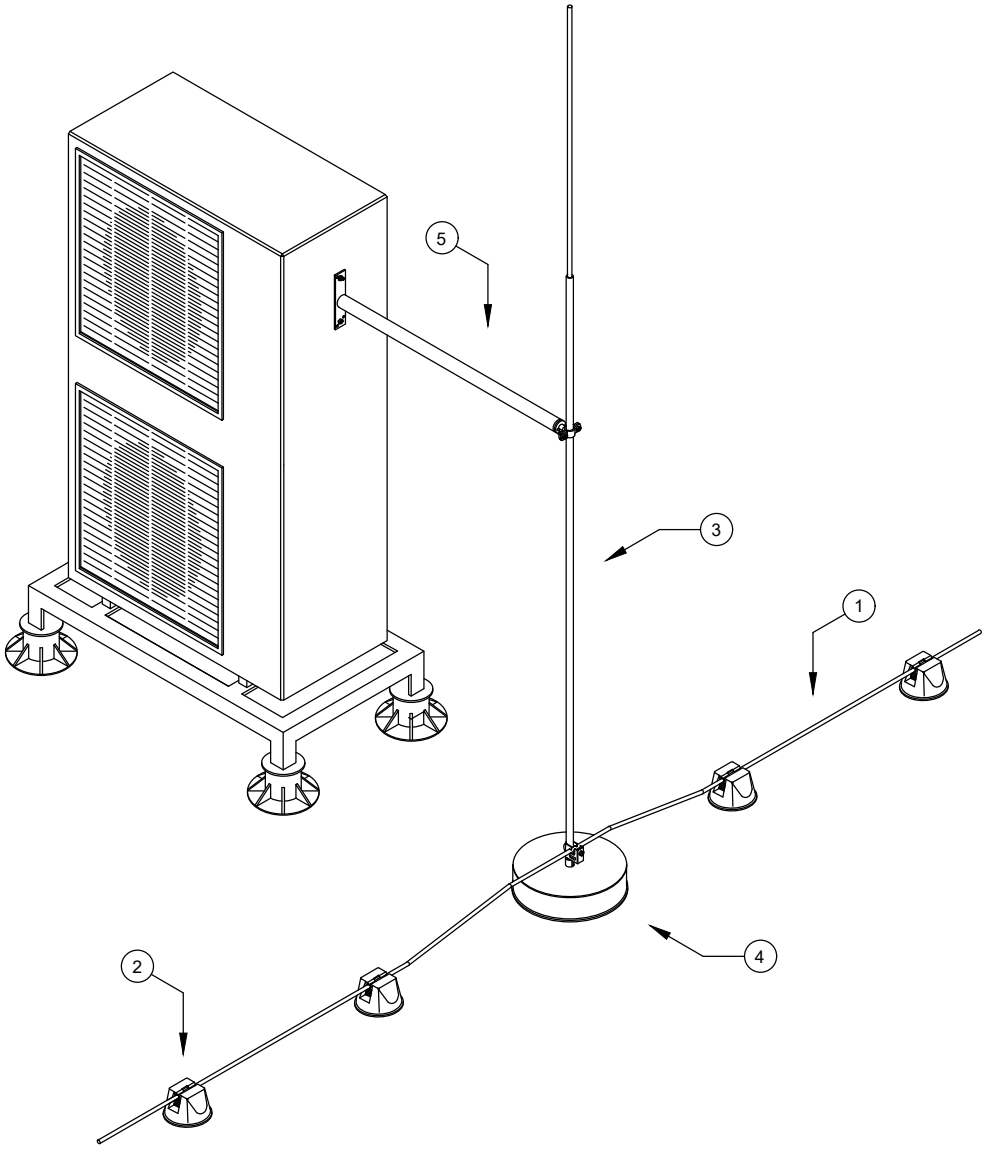

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5401989	101 VL3000	Tapered pipe air-termination rod	
4	5403200	F-FIX-16	Stand for FangFix system 16 kg	
5	5408806	ISO-A-500	Insulated spacer	

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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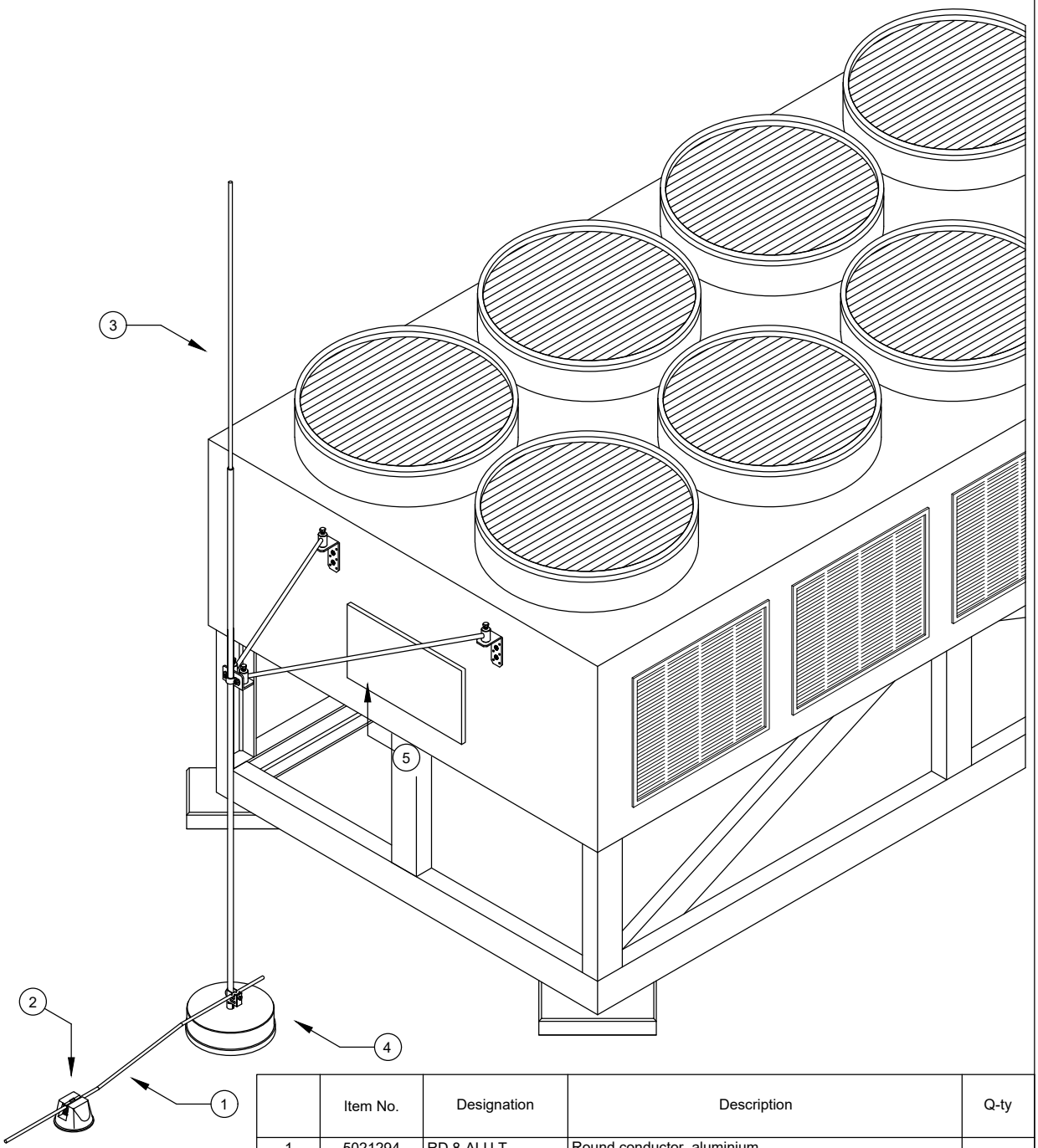
Ind.	Amendment typical	Date:	Name:			



	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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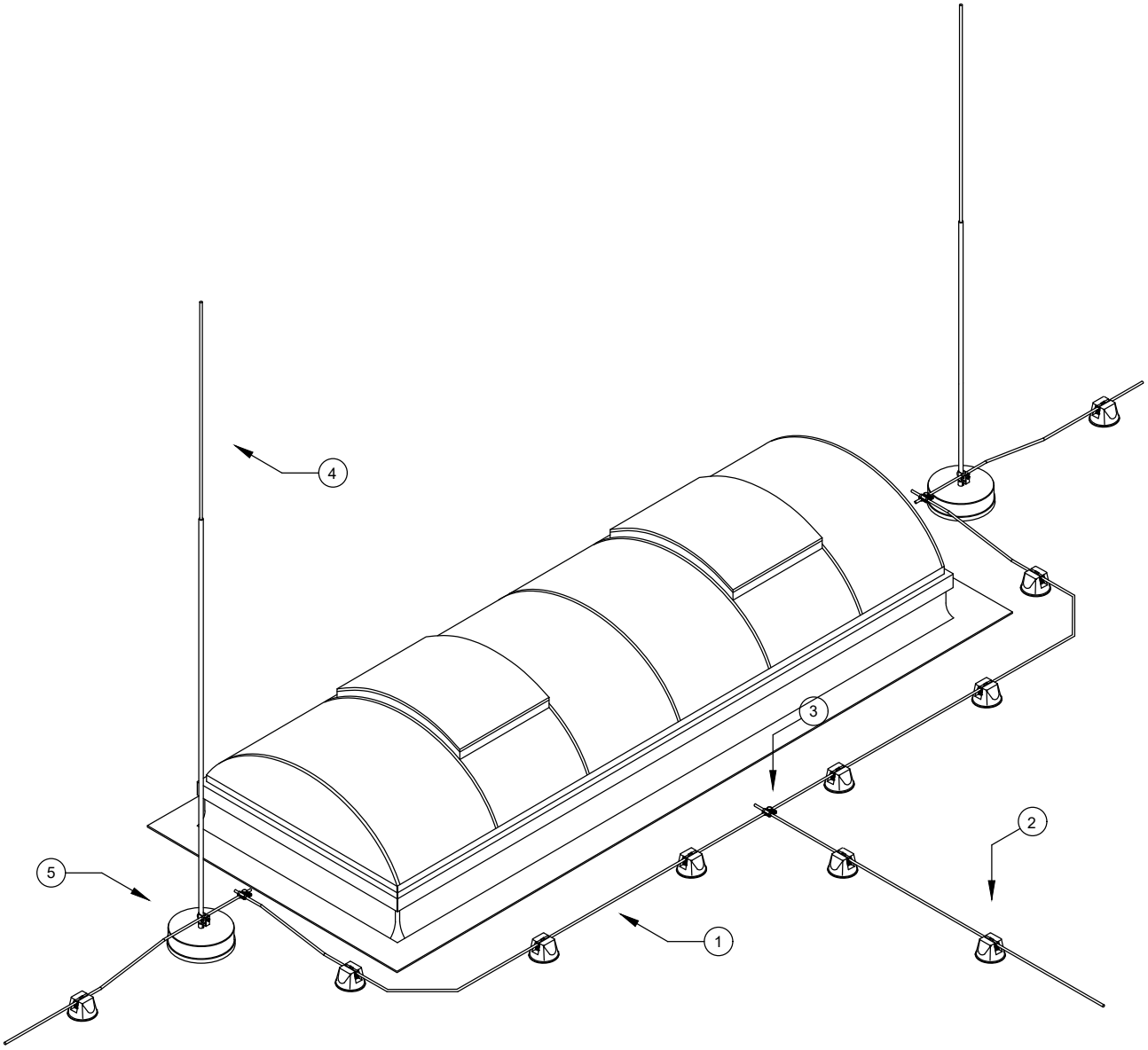

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU T	Round conductor, aluminium	
2	5218700	165 MBG-8-10	Roof conductor holder for flat roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4	5401983	101 VL2000	Tapered pipe air-termination rod	
5	5403200	F-FIX-16	Stand for FangFix system 16 kg	

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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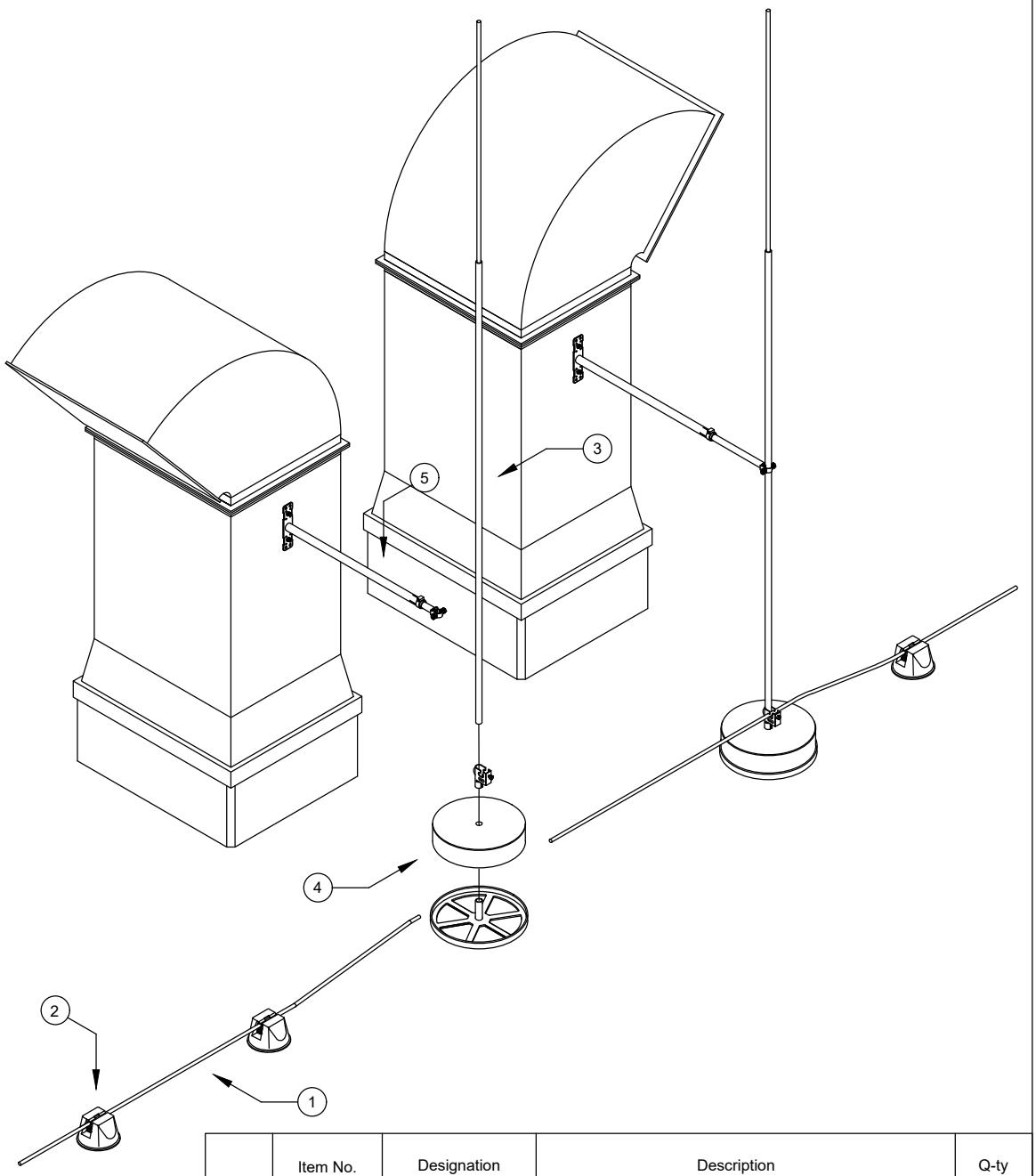
Ind.	Amendment typical	Date:	Name:			



	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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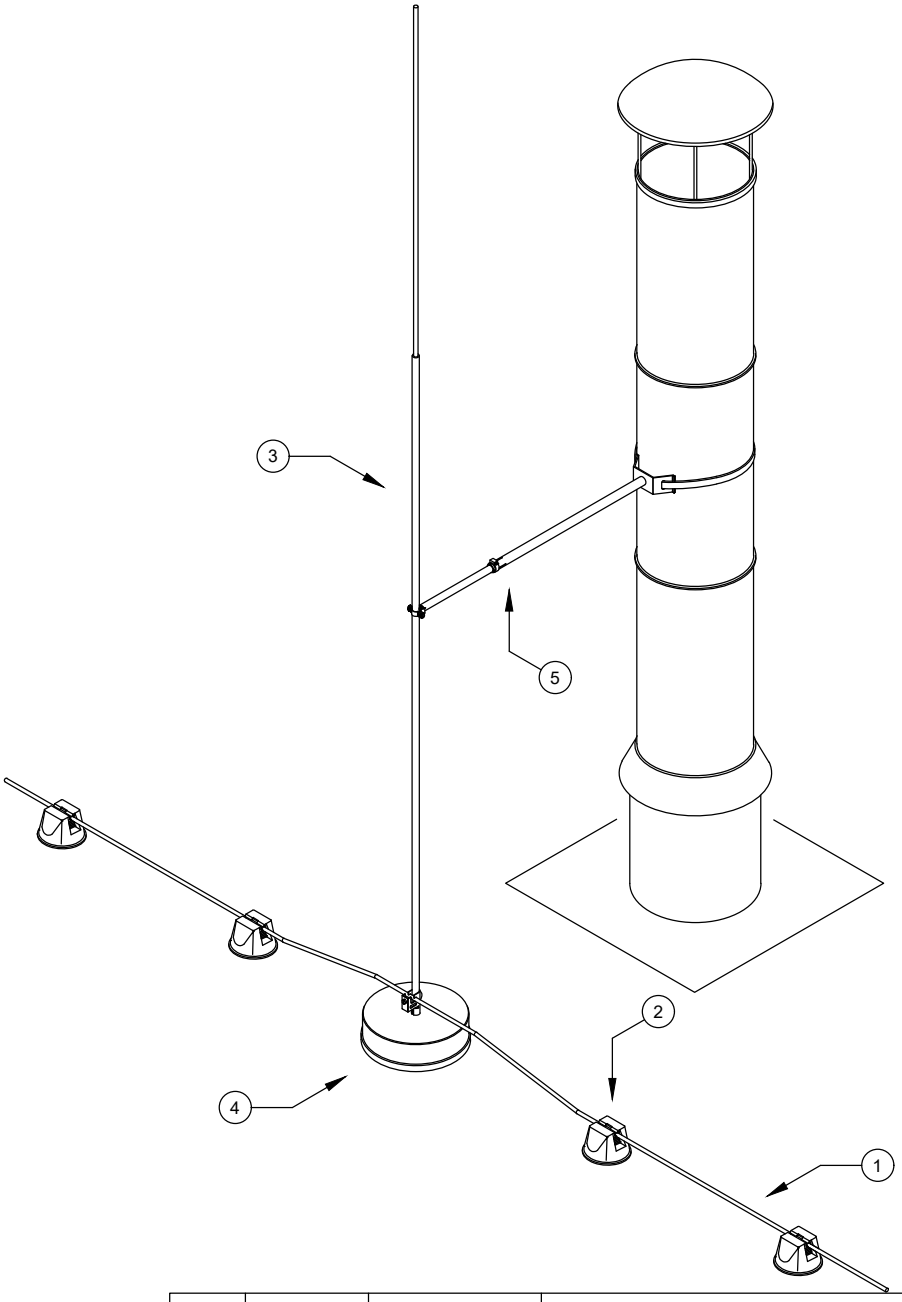
Ind.	Amendment typical	Date:	Name:			

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	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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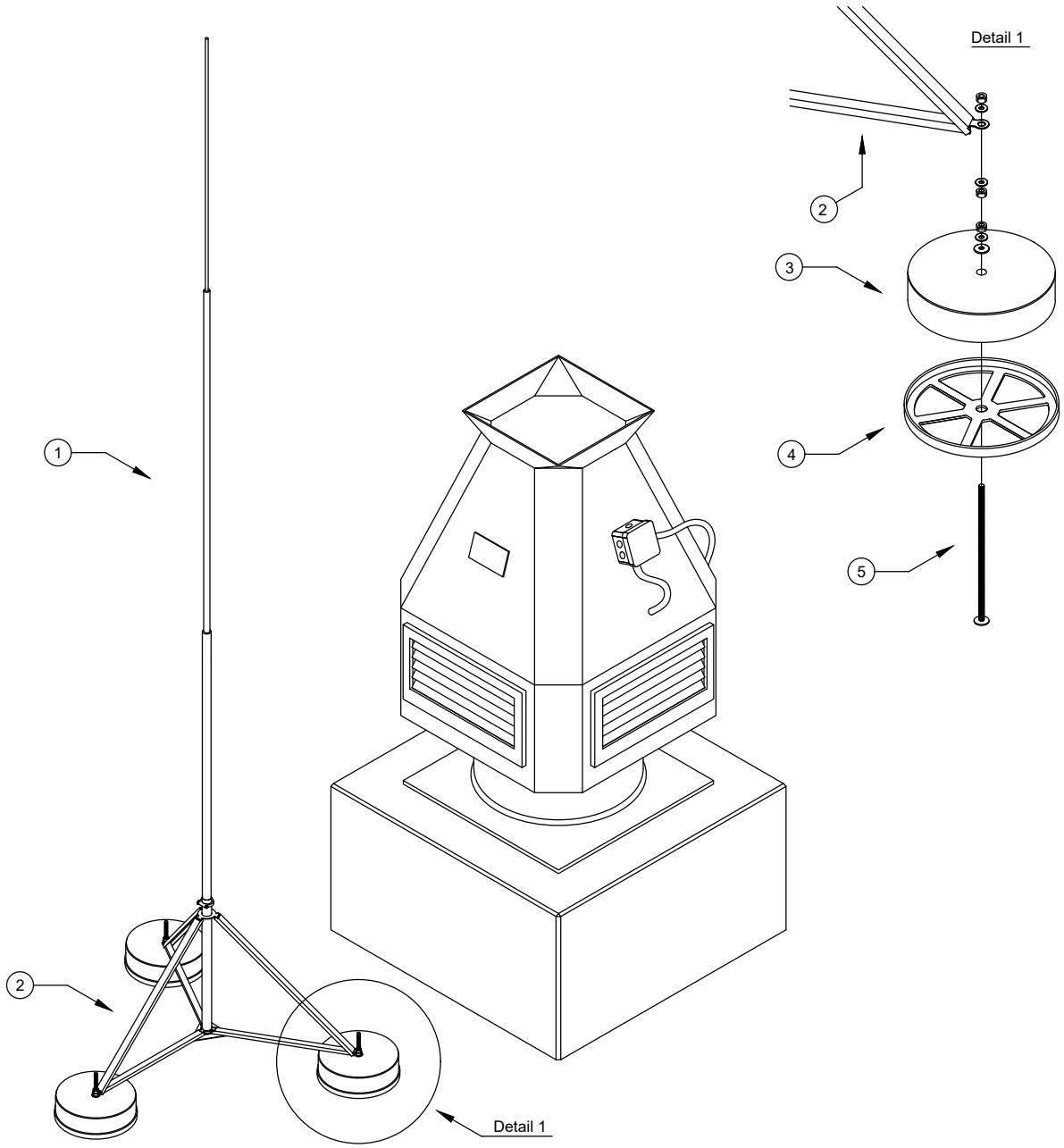
Ind.	Amendment typical	Date:	Name:			



	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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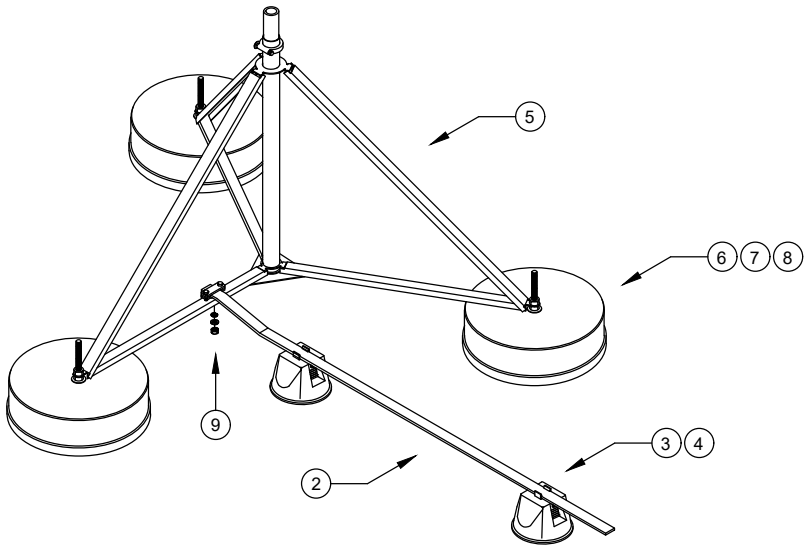
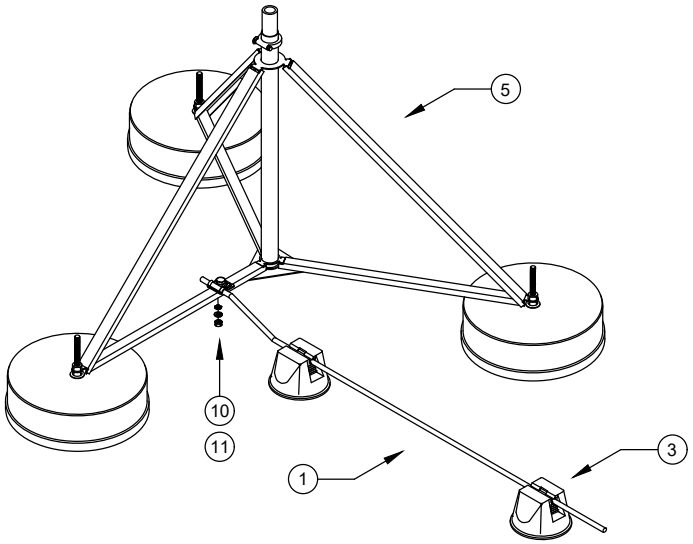
Ind.	Amendment typical	Date:	Name:			





	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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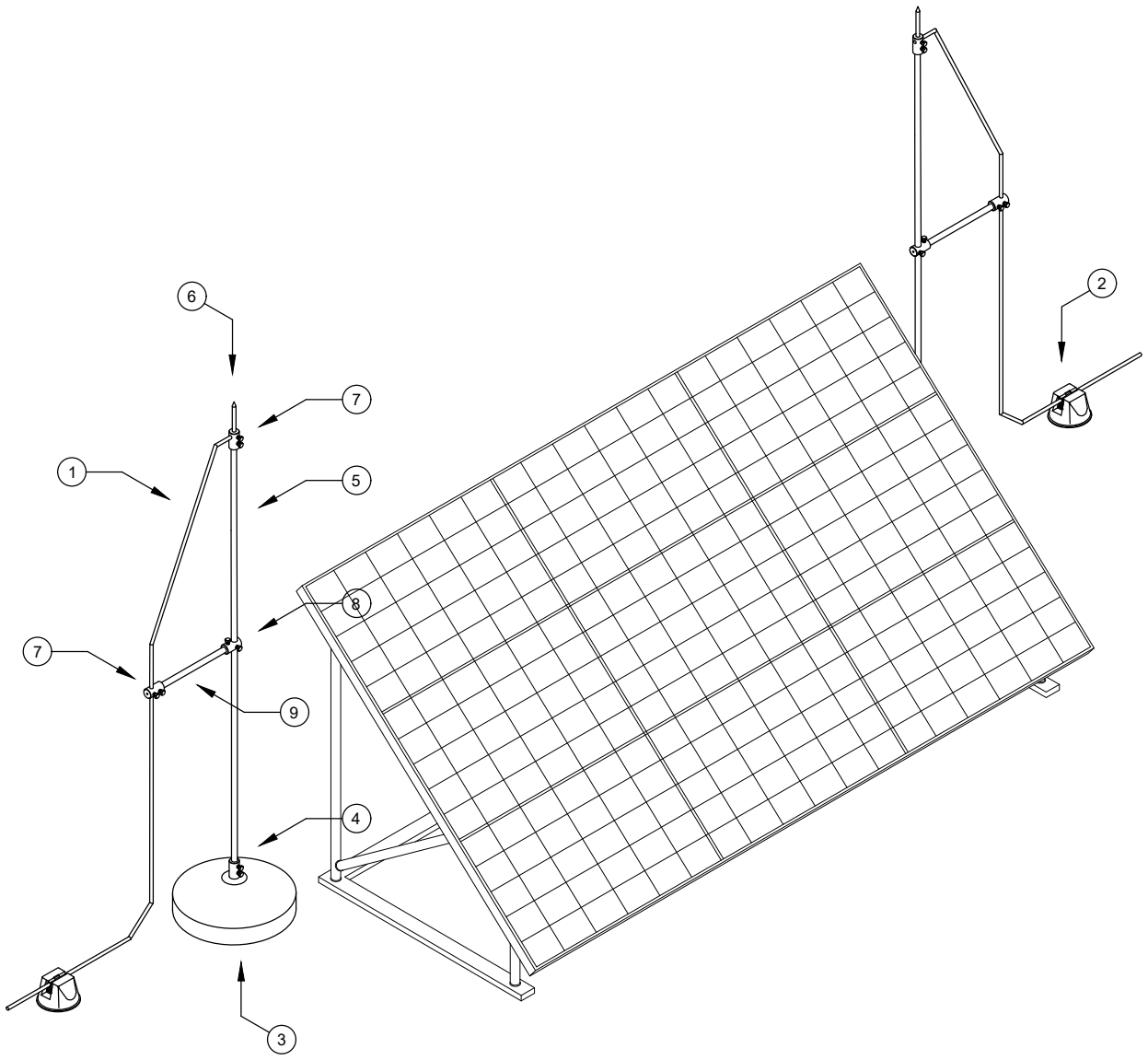
Ind.	Amendment typical		Date:	Name:			

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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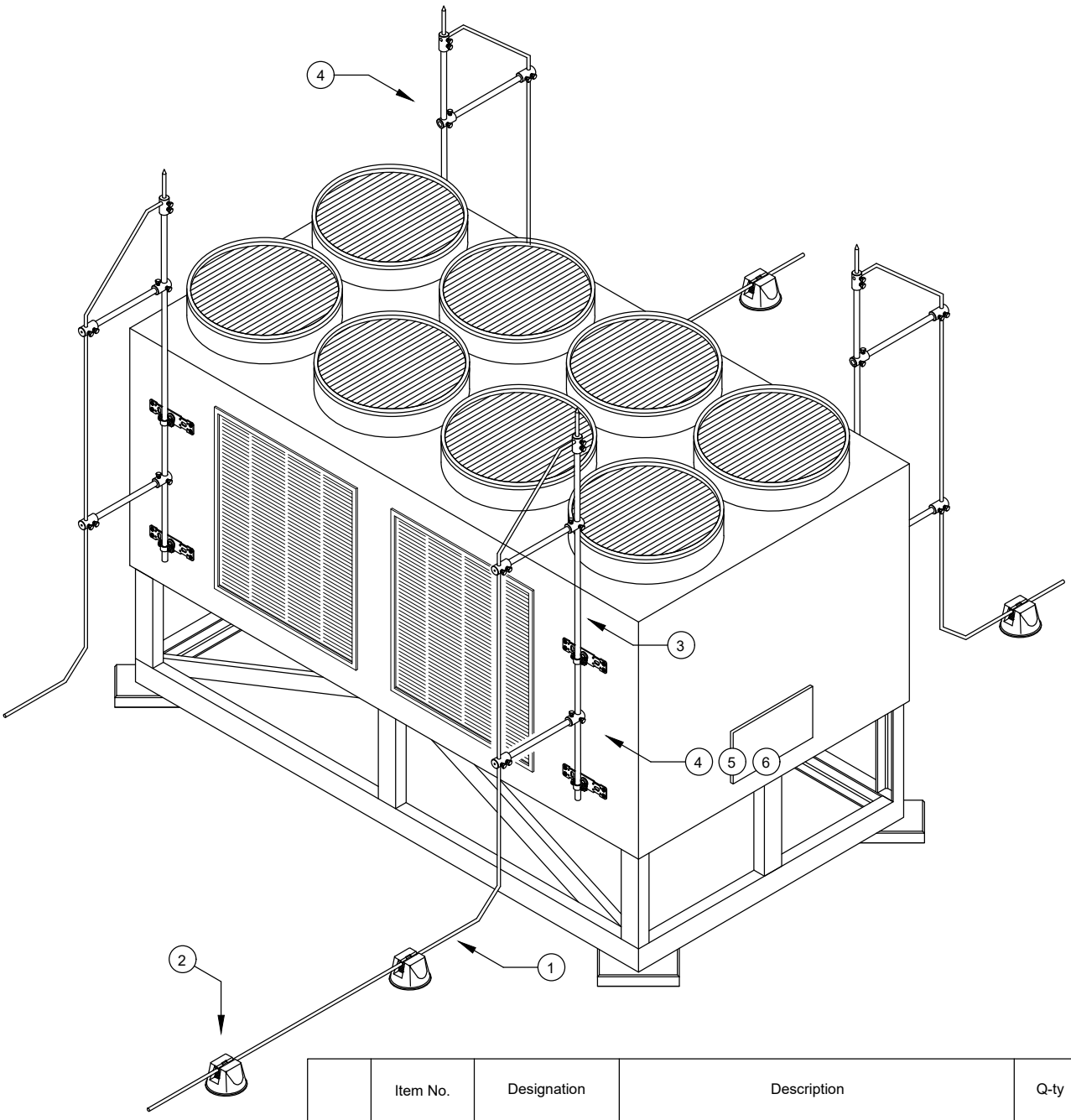
Ind.	Amendment typical	Date:	Name:		



	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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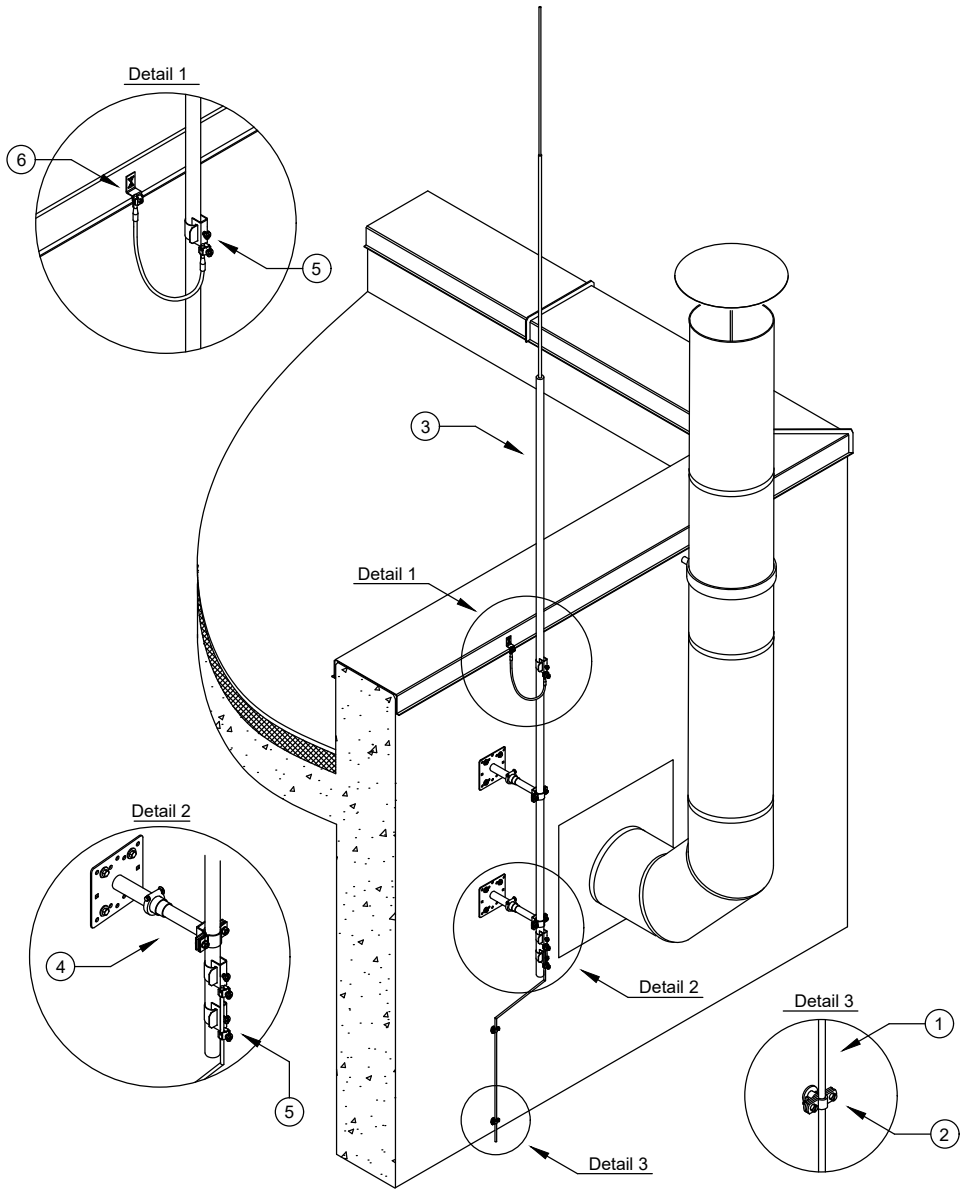
Ind.	Amendment typical	Date:	Name:			



	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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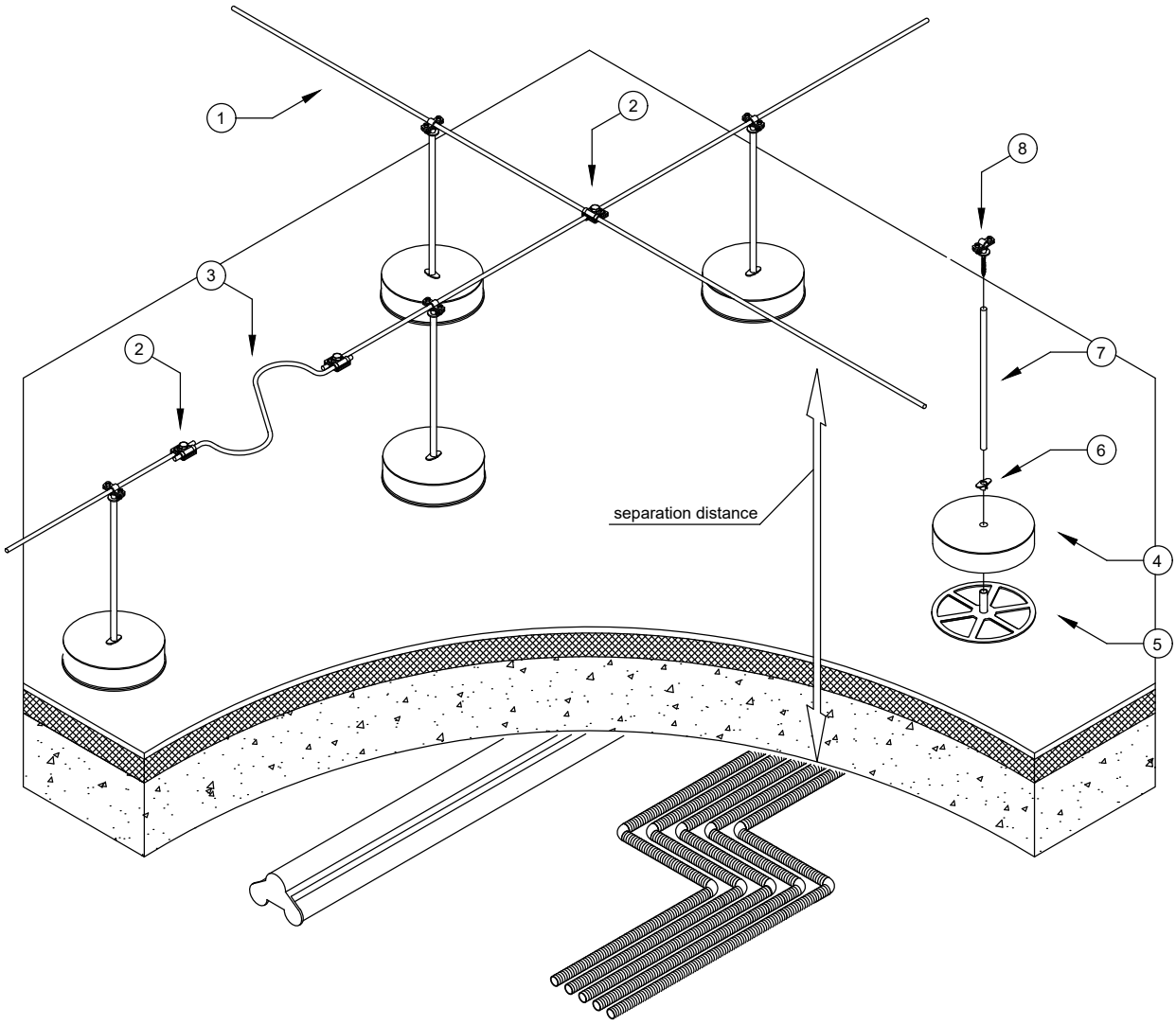
Ind.	Amendment typical		Date:	Name:			



	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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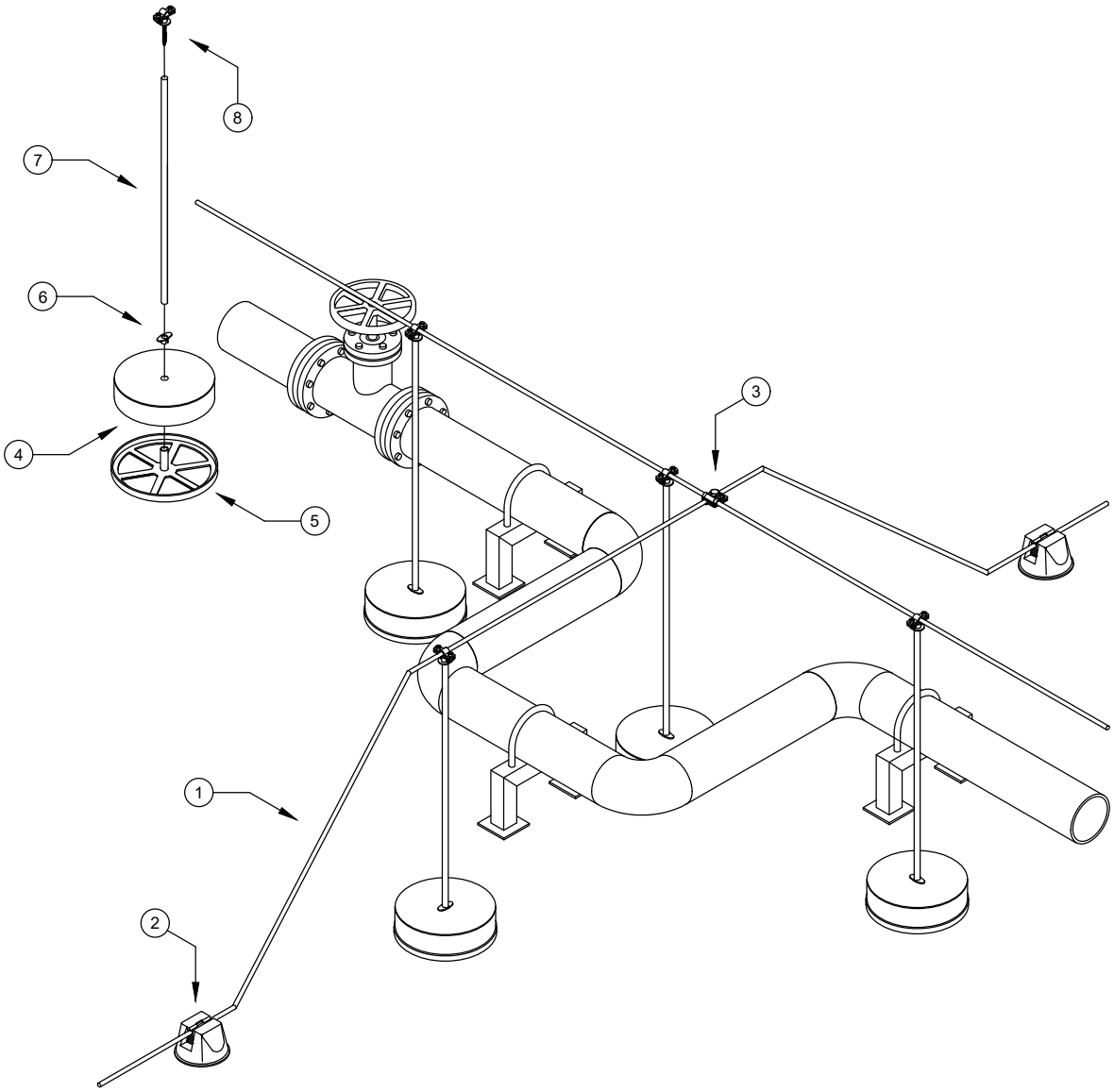
Ind.	Amendment typical	Date:	Name:			

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	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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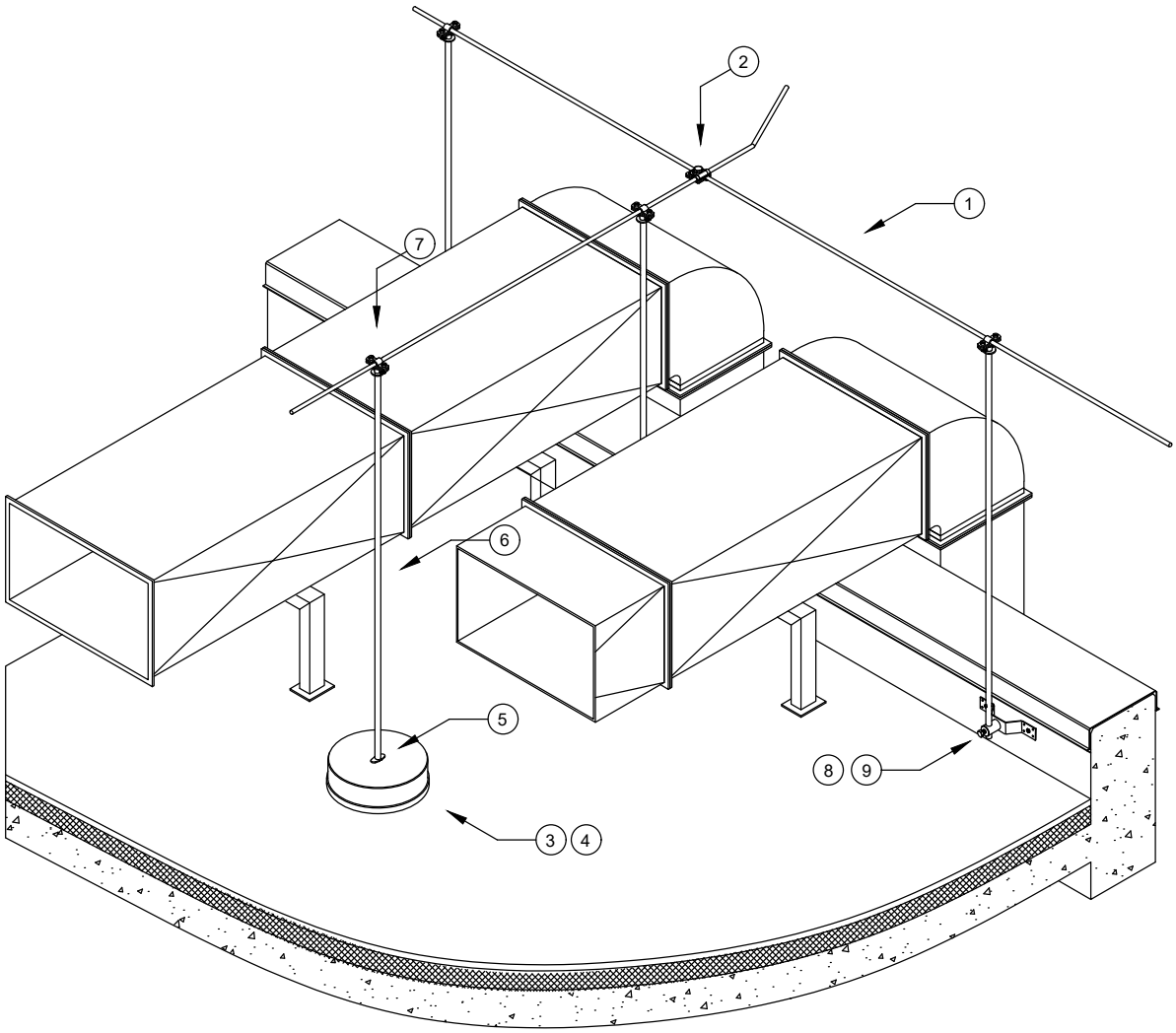
Ind.	Amendment typical	Date:	Name:			



	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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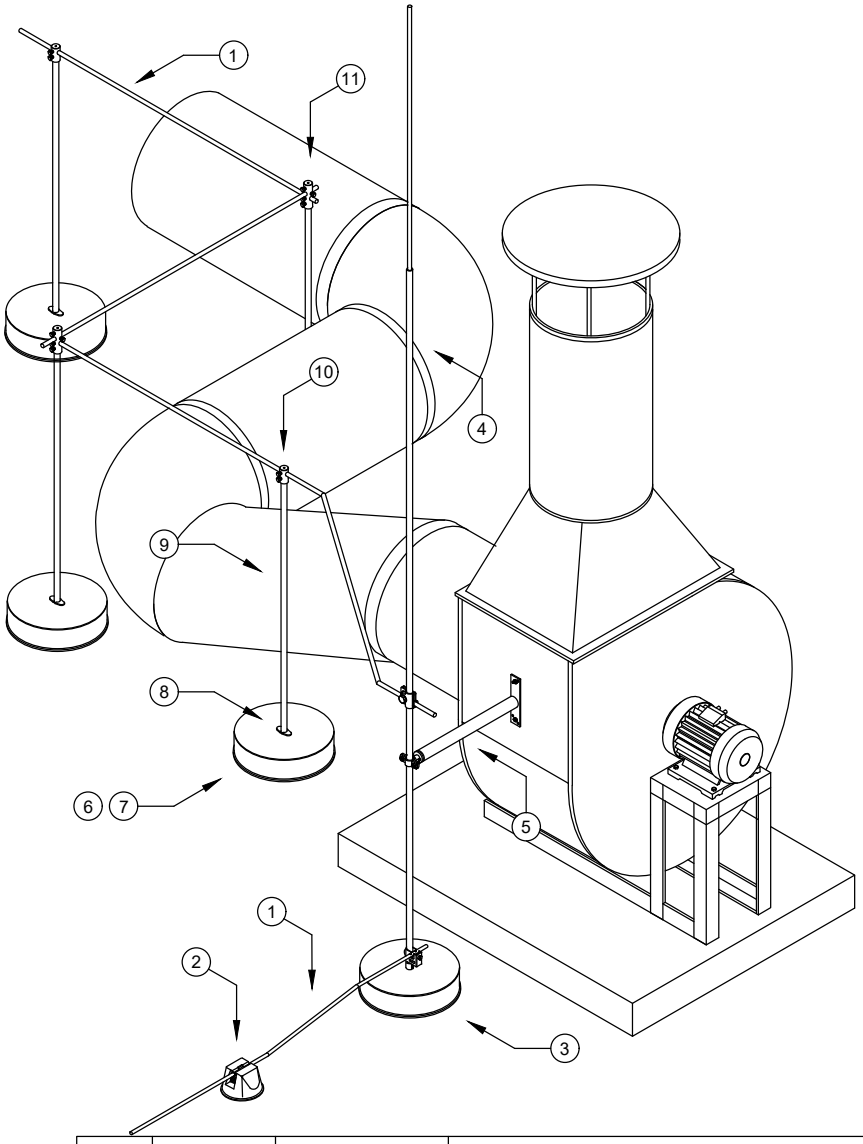
Ind.	Amendment typical	Date:	Name:			

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	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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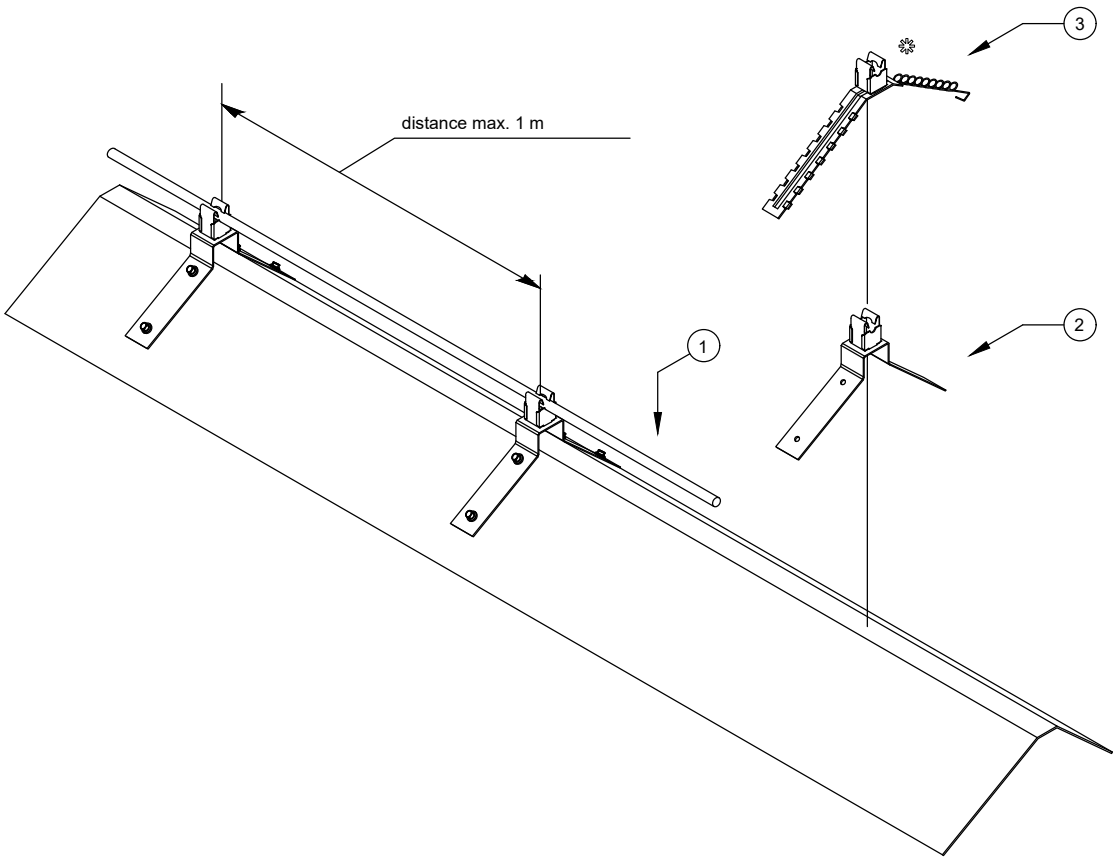
Ind.	Amendment typical		Date:	Name:		

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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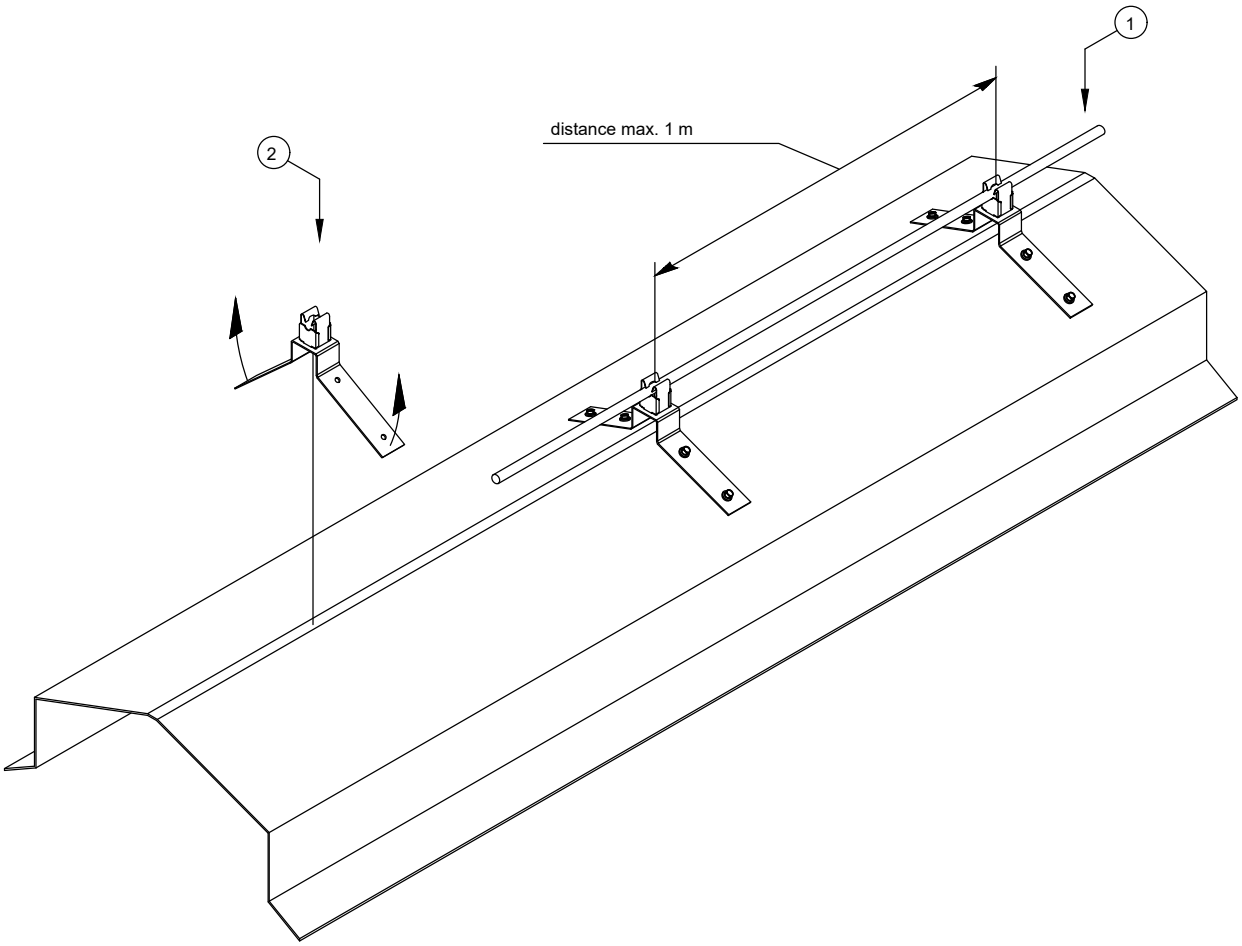
Ind.	Amendment typical		Date:	Name:		



	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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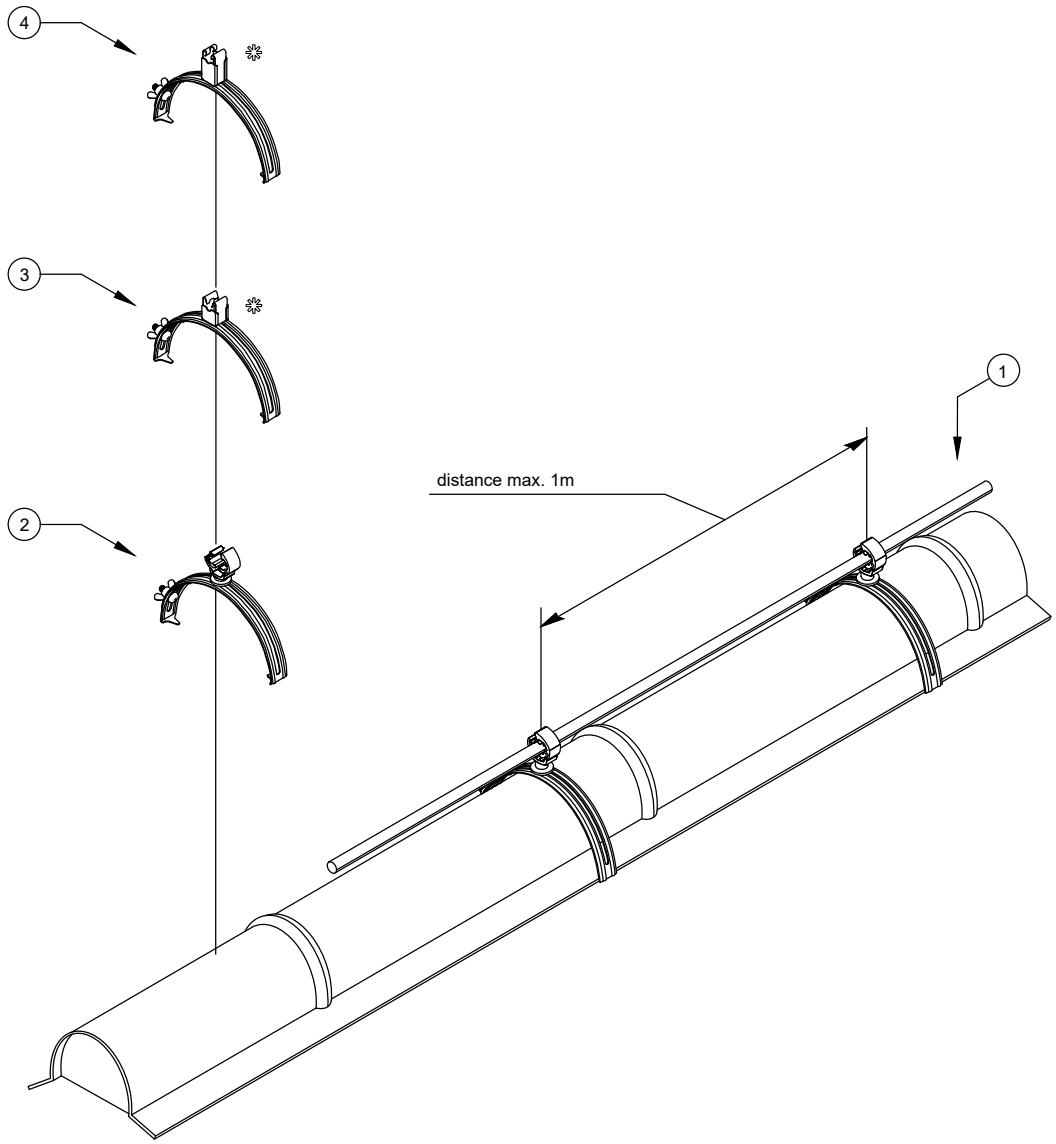
Ind.	Amendment typical	Date:	Name:			



	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-T3.03	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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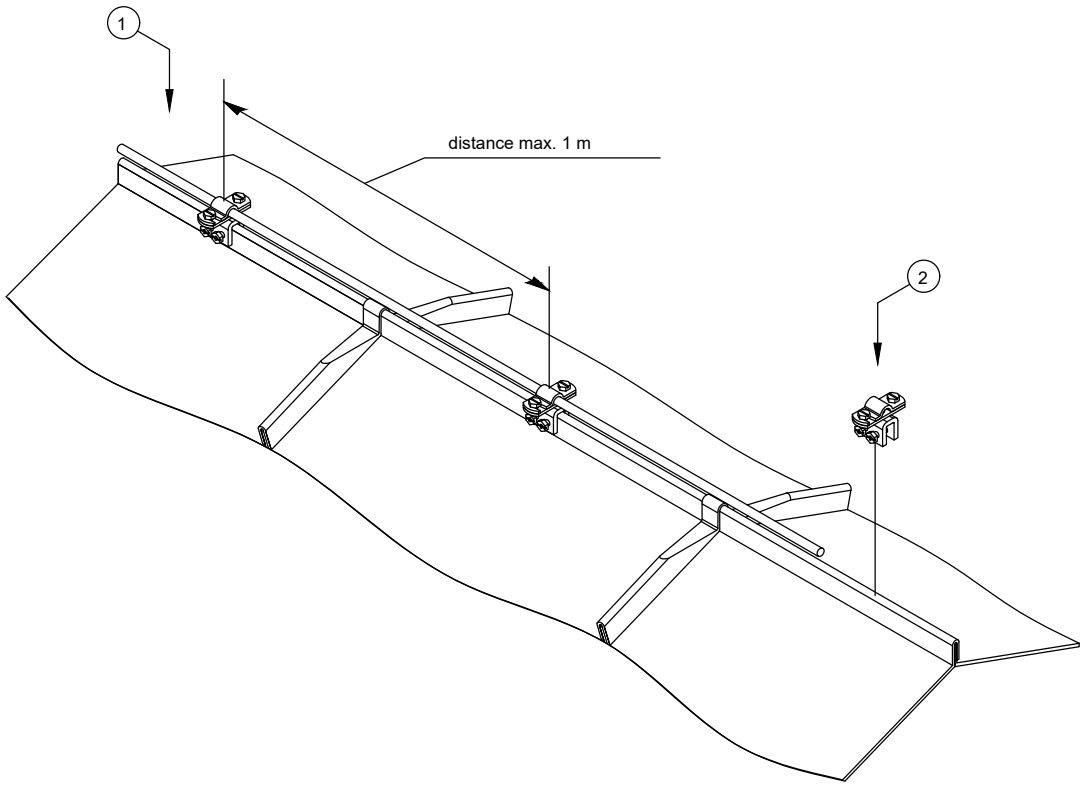
Ind.	Amendment typical		Date:	Name:		



	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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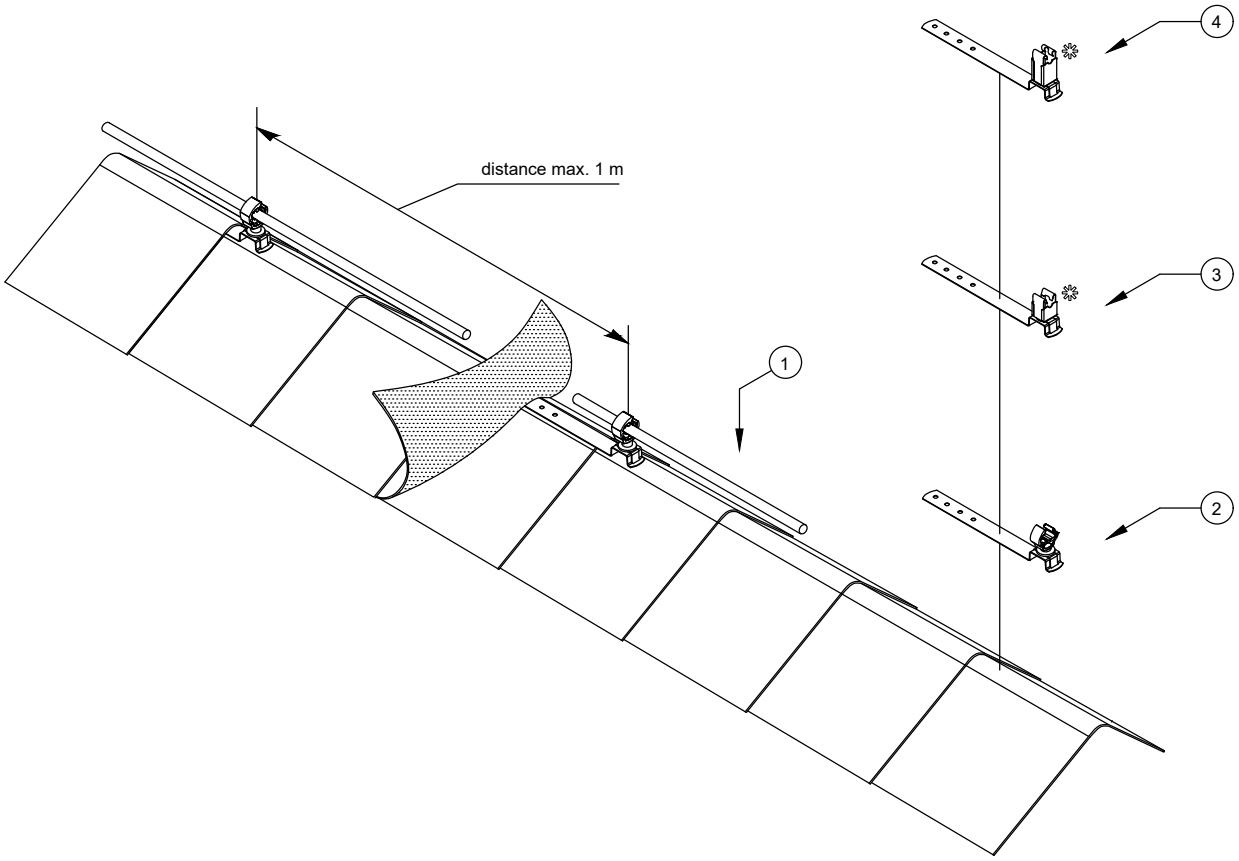
Ind.	Amendment typical	Date:	Name:			



	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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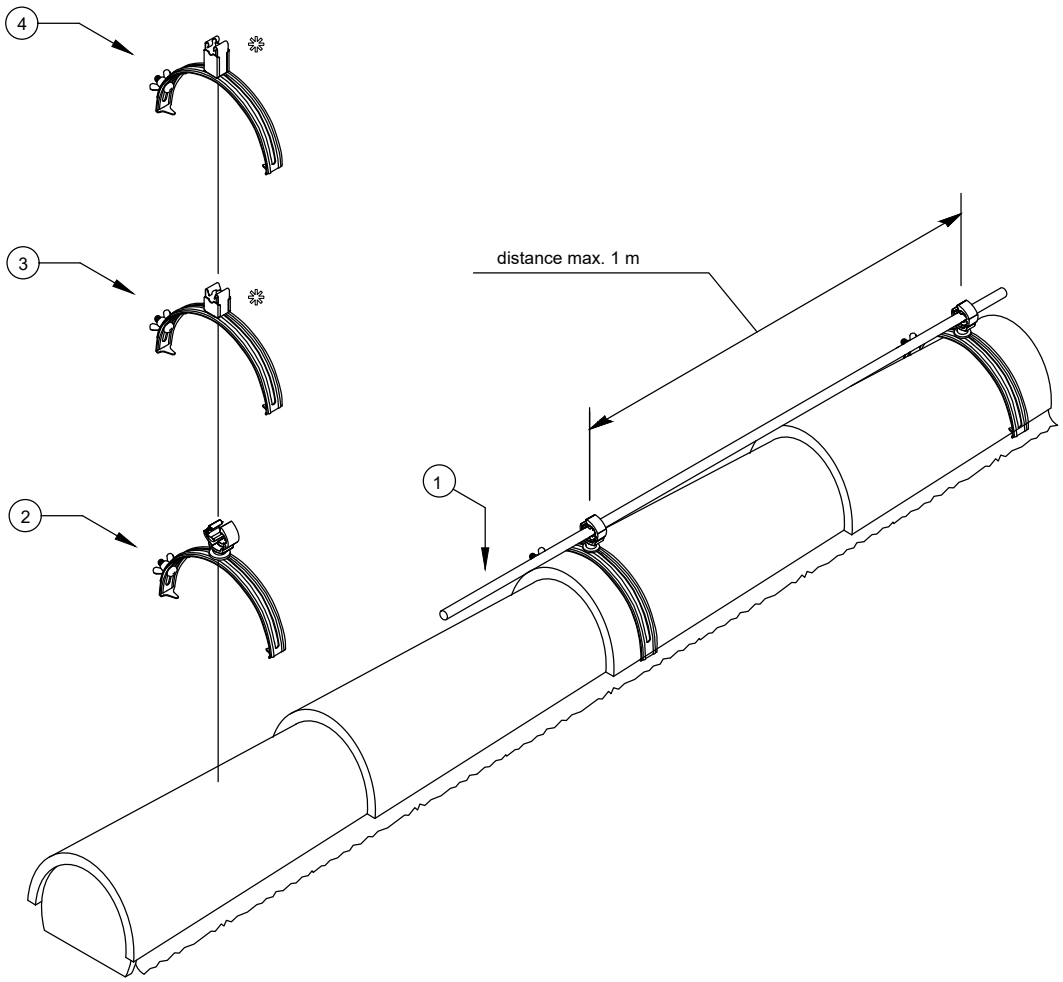
Ind.	Amendment typical		Date:	Name:		



	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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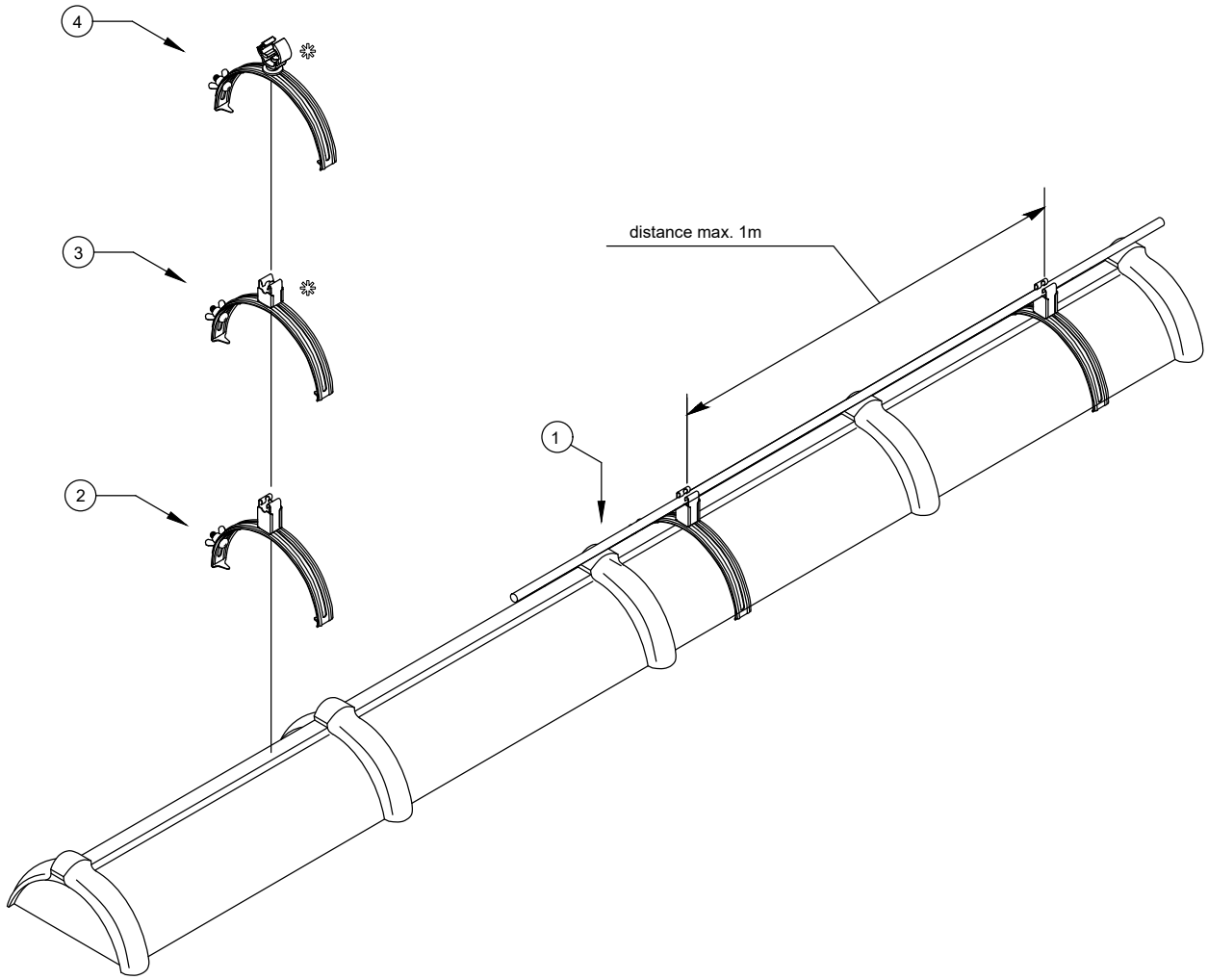
Ind.	Amendment typical		Date:	Name:		



	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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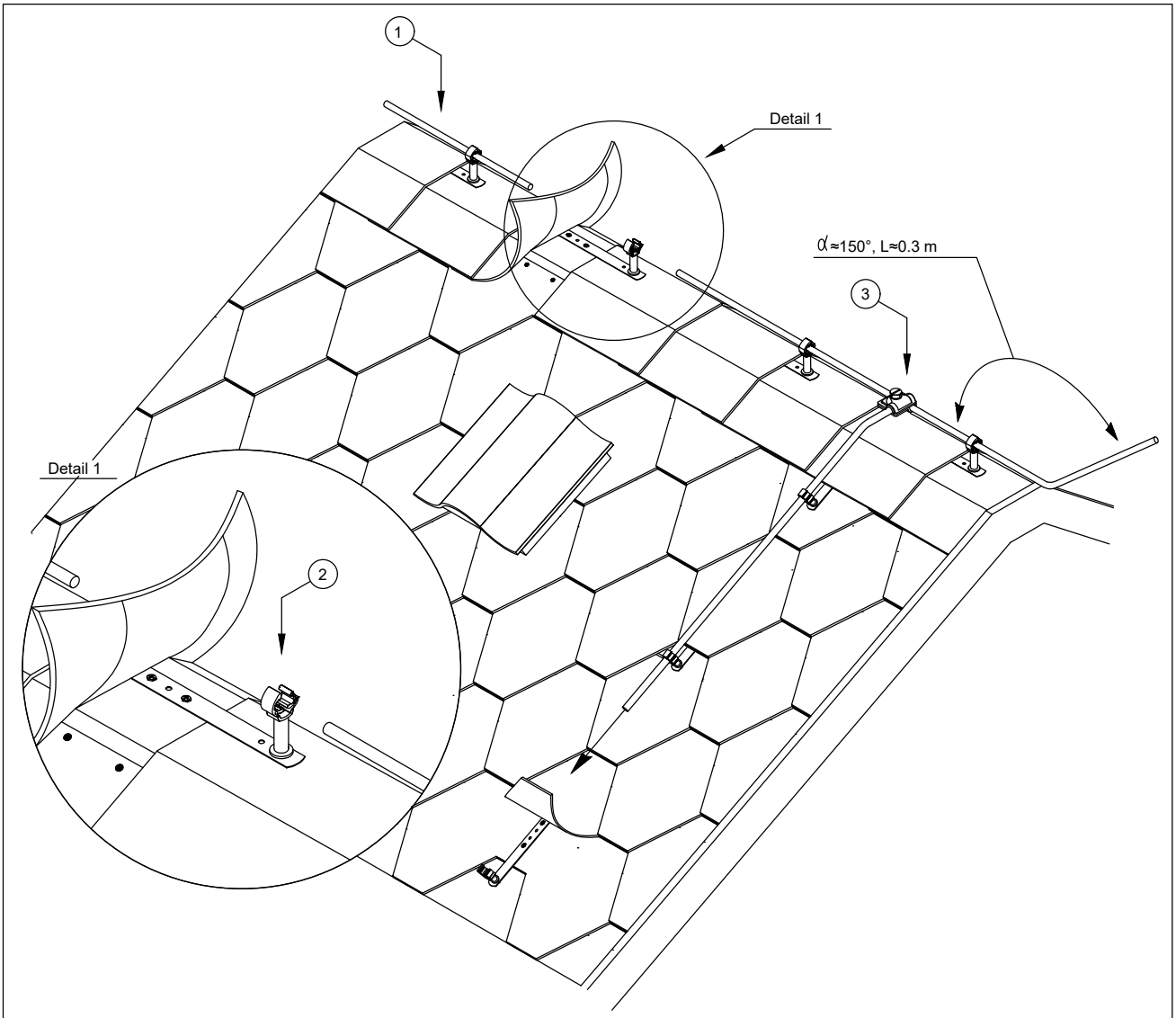
Ind.	Amendment typical	Date:	Name:			



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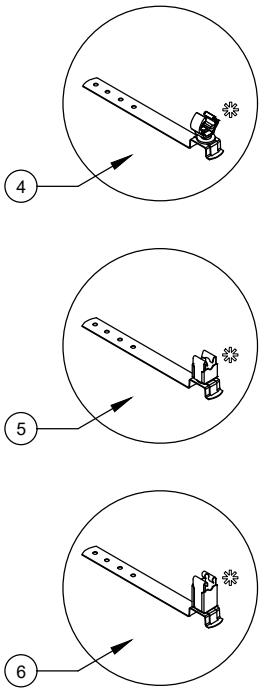

	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	5215307	157 ND-VA	Roof conductor holder for tiled and stated roofs	
3	5311519	249 8-10 ALU	Vario quick connector	
4*	5215544	157 FK-VA 230	Roof conductor holder for tiled roofs	
5*	5215552	157 F-VA 230	Roof conductor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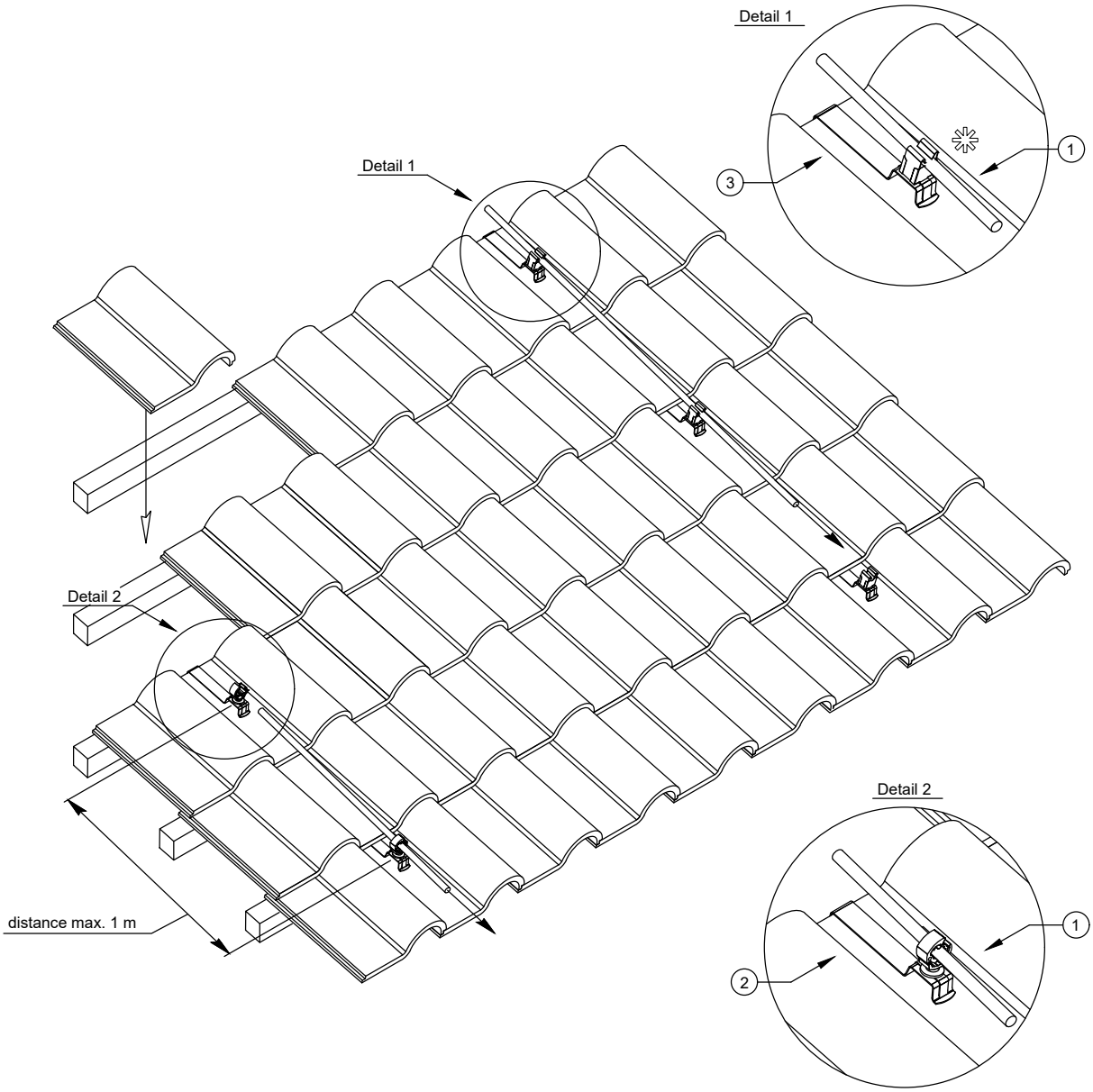
Ind.	Amendment typical	Date:	Name:			



	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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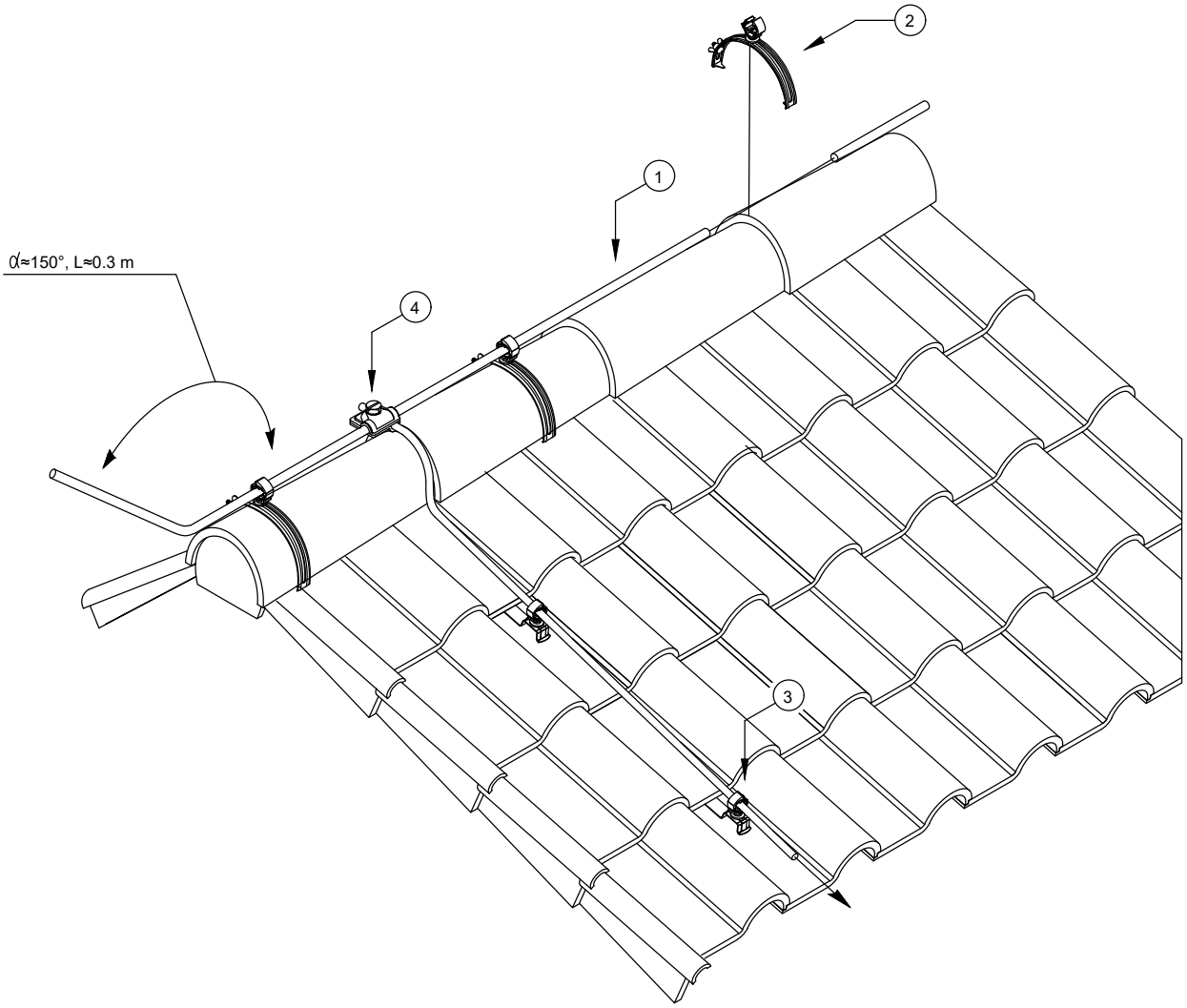
Ind.	Amendment typical	Date:	Name:			



	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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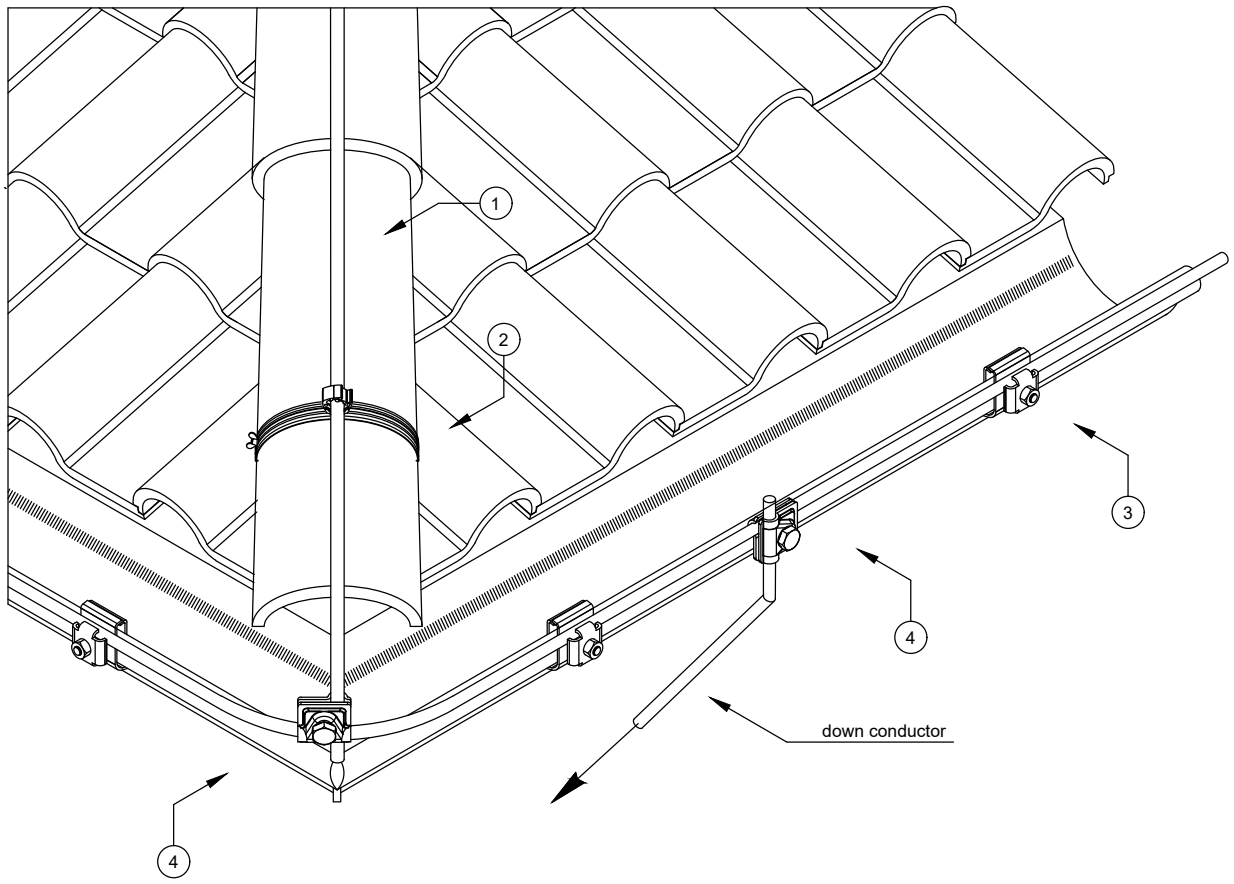
Ind.	Amendment typical		Date:	Name:		



	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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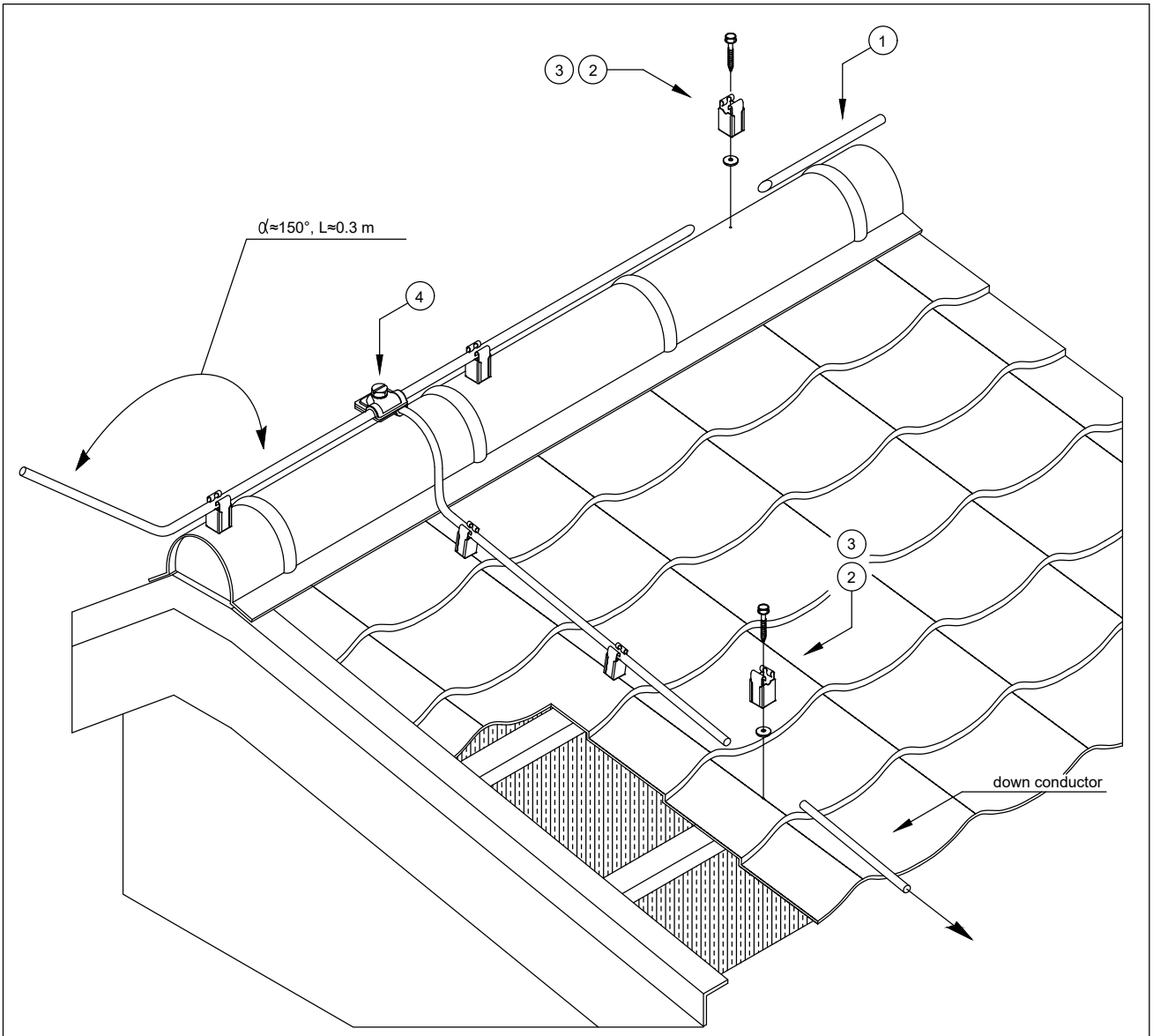
Ind.	Amendment typical	Date:	Name:			



	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.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
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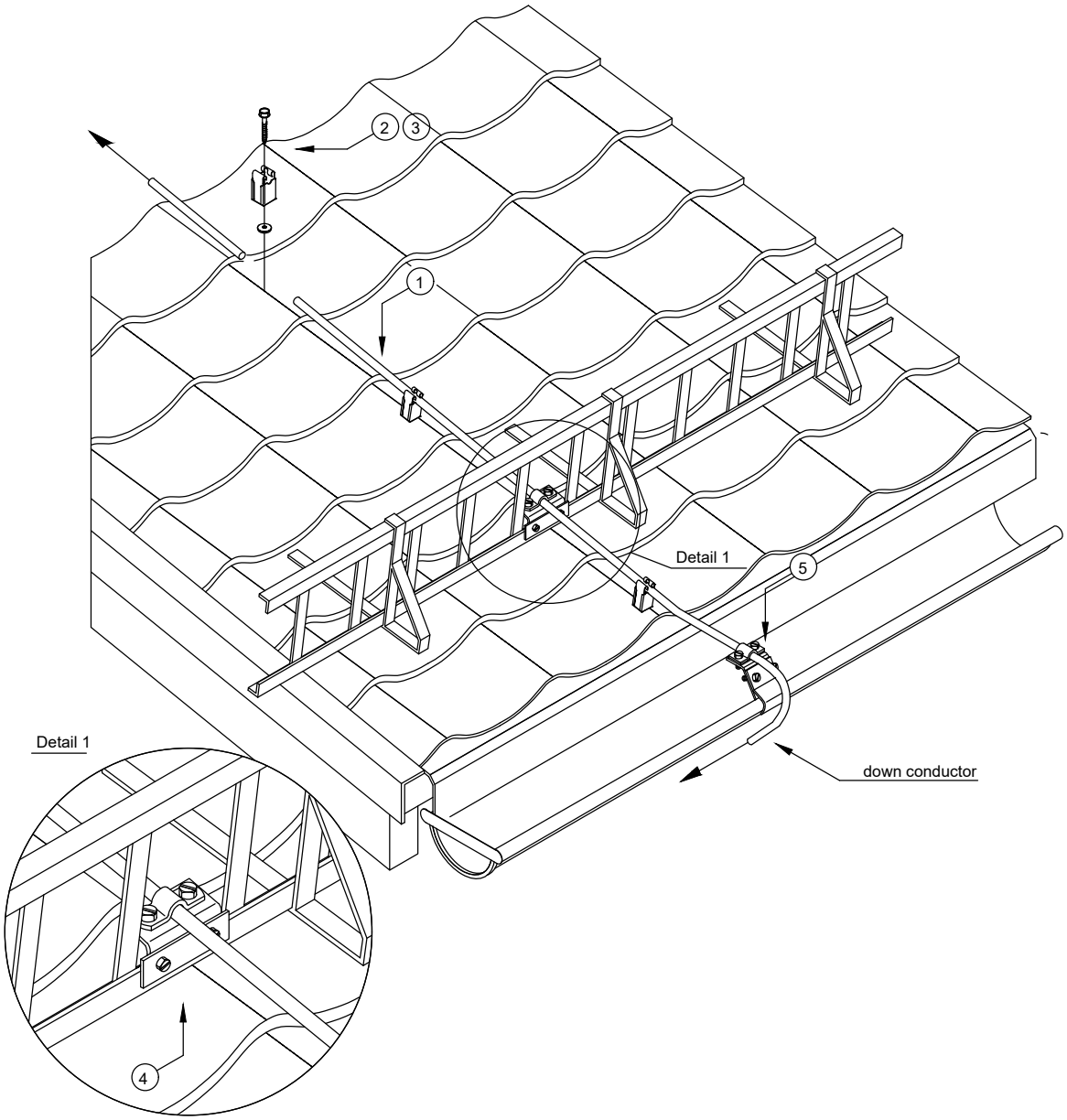
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	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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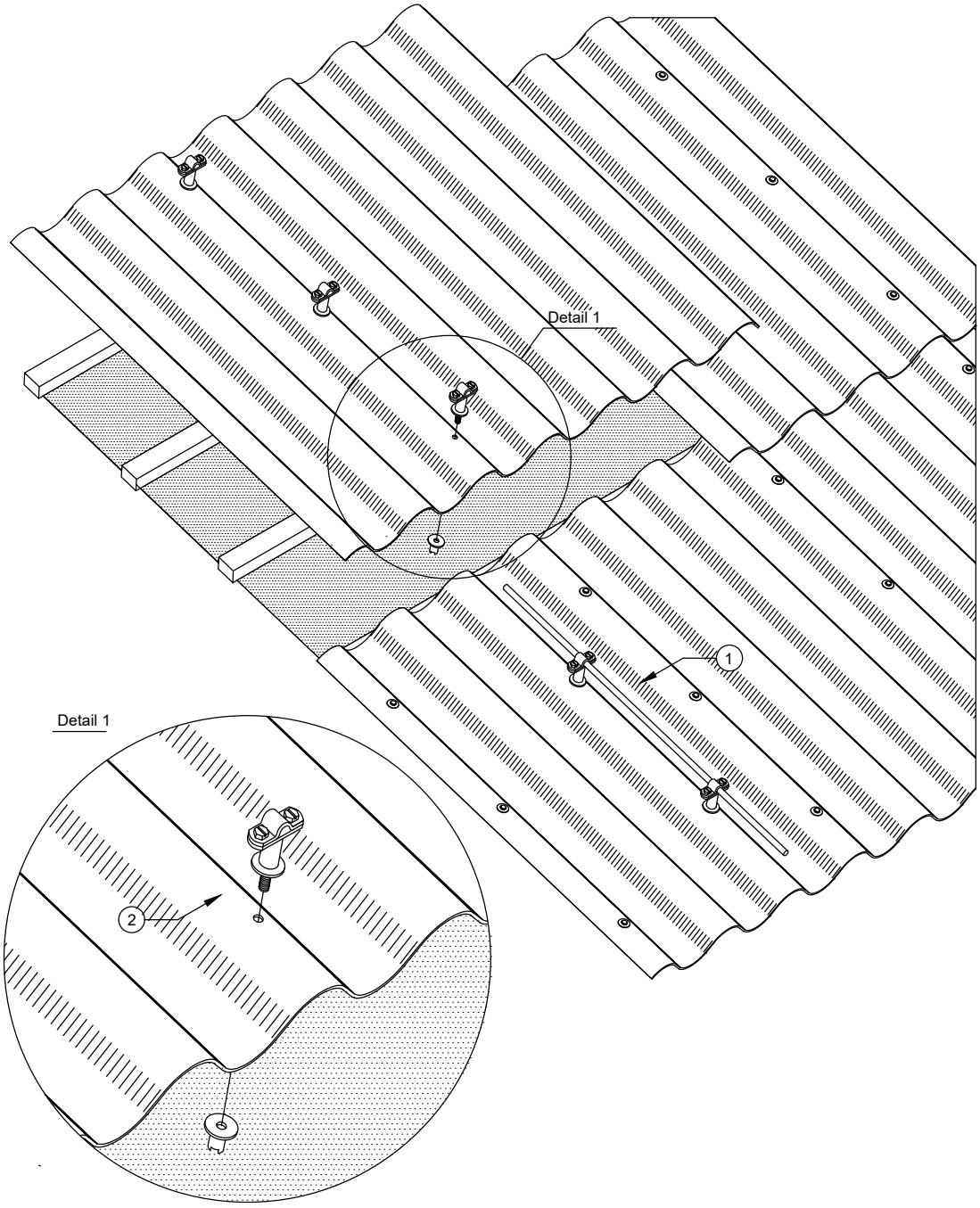
Ind.	Amendment typical	Date:	Name:			



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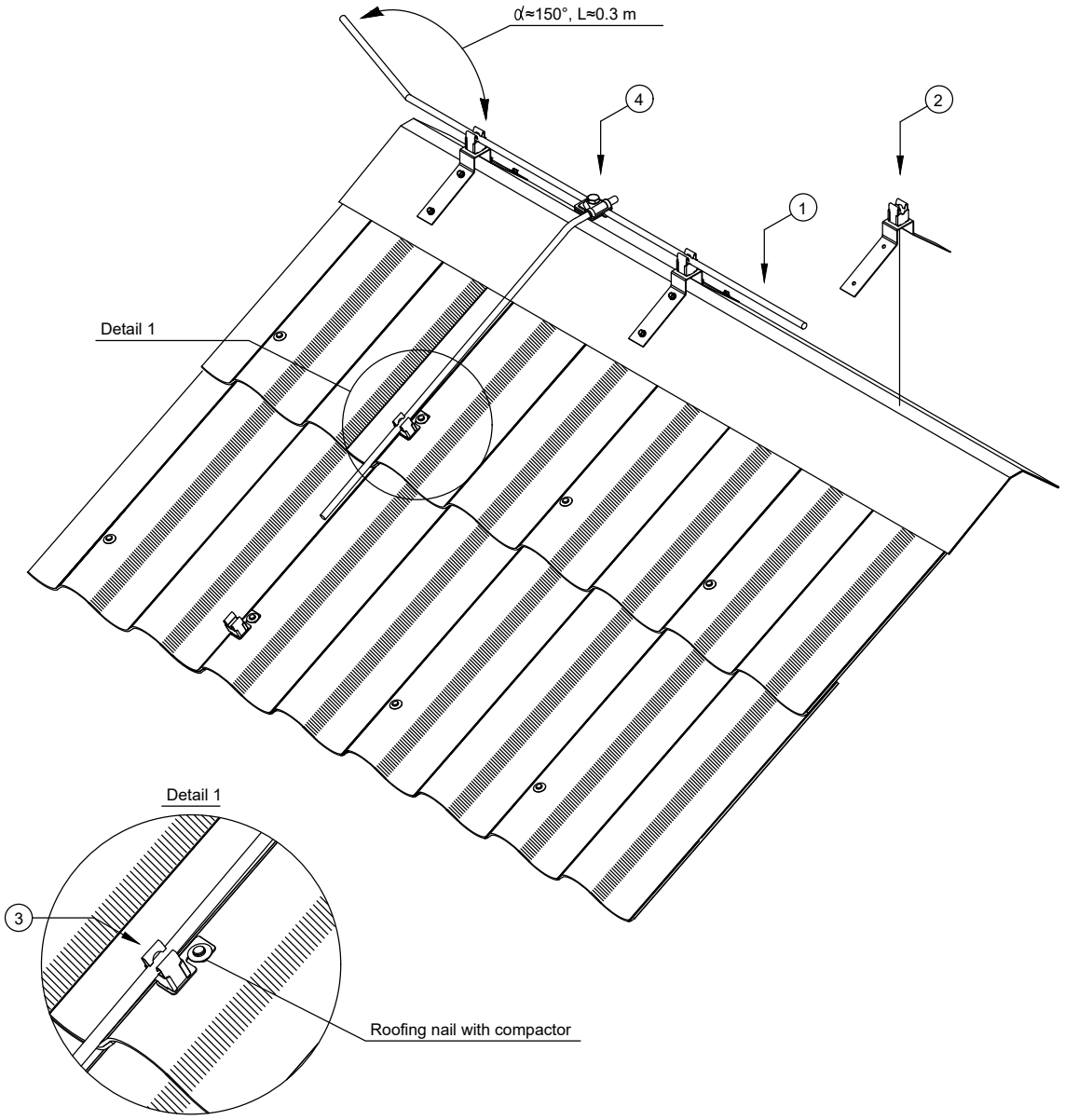
— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:		



	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.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
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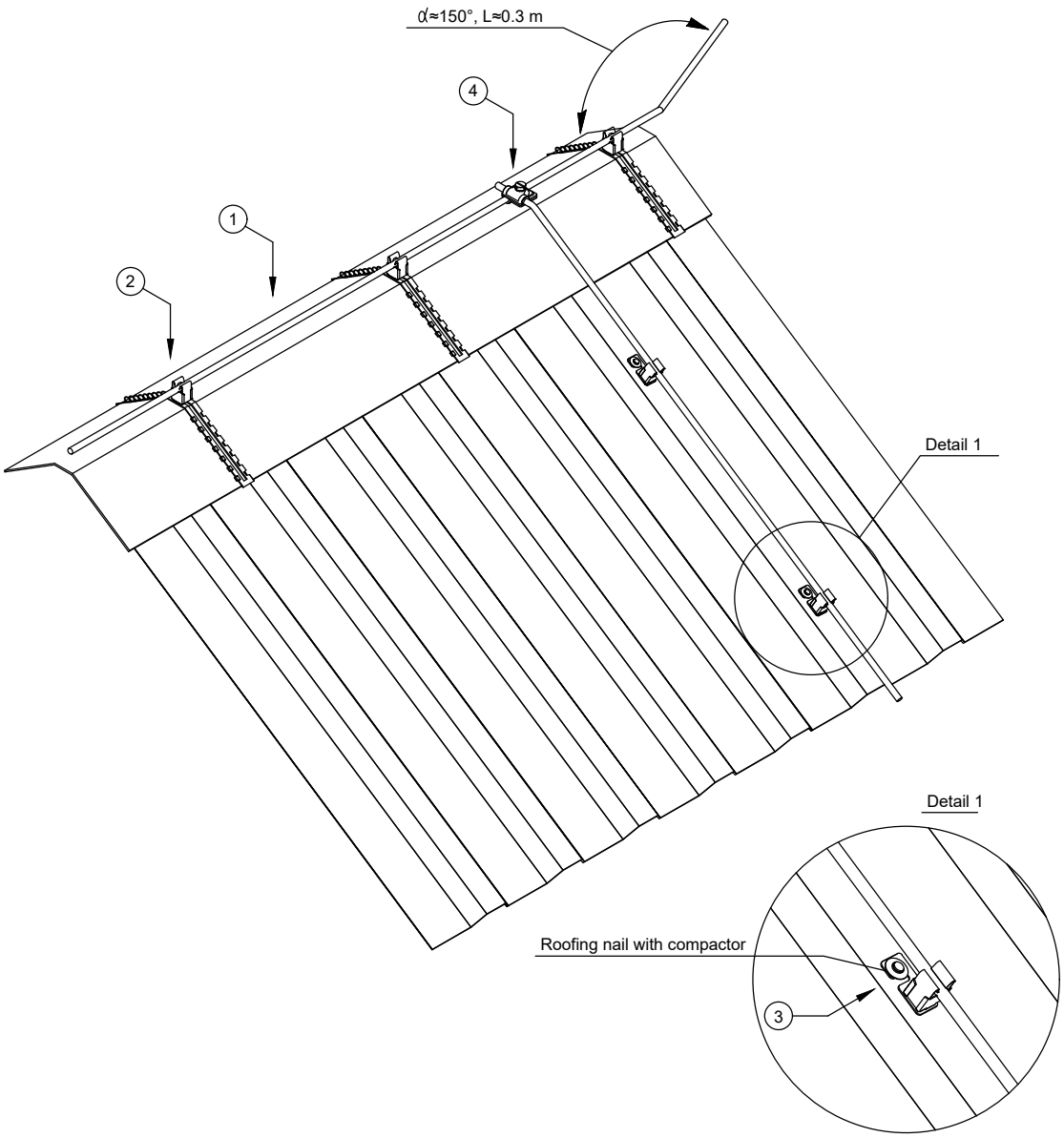
Ind.	Amendment typical		Date:	Name:		



	Item No.	Designation	Description	Q-ty
1	5021294	RD 8-ALU-T	Round conductor, aluminium	
2	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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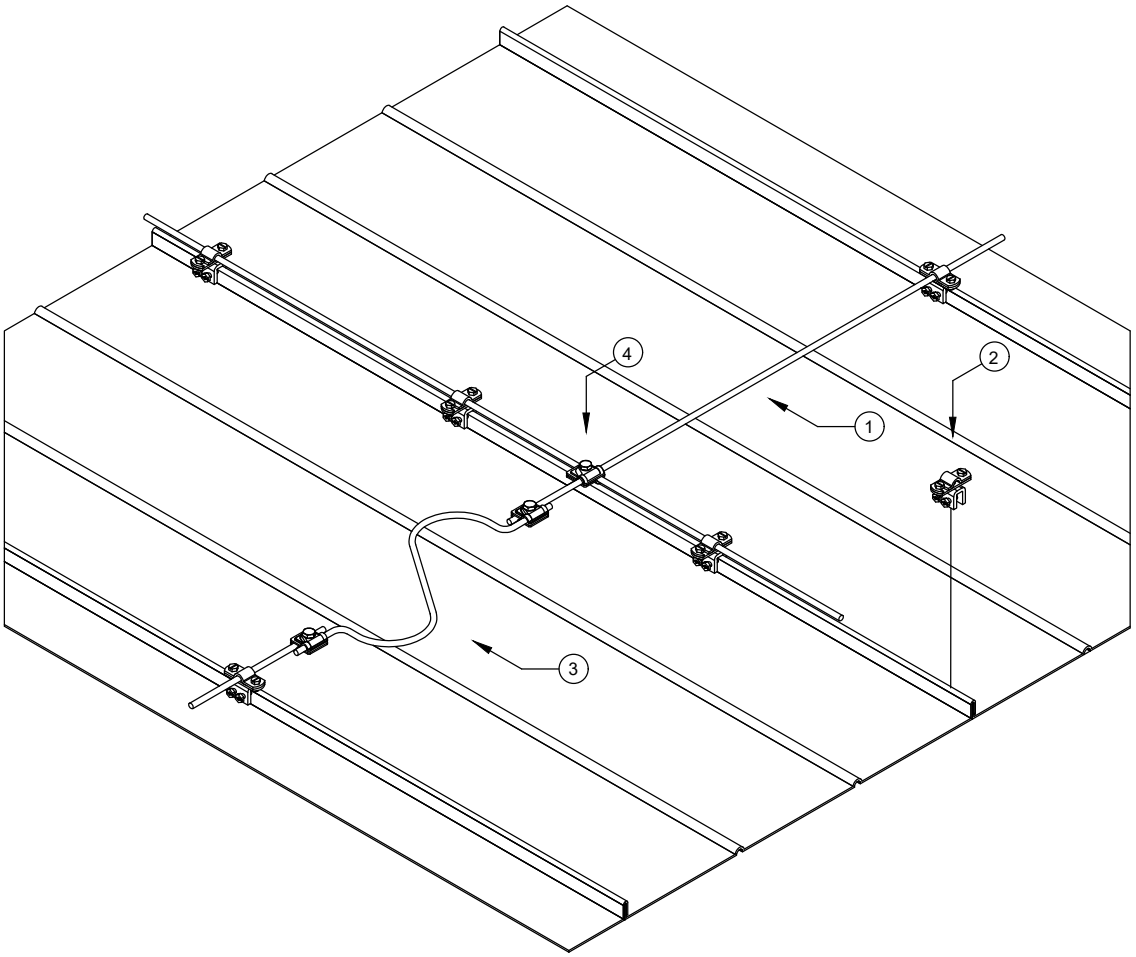
Ind.	Amendment typical	Date:	Name:			



	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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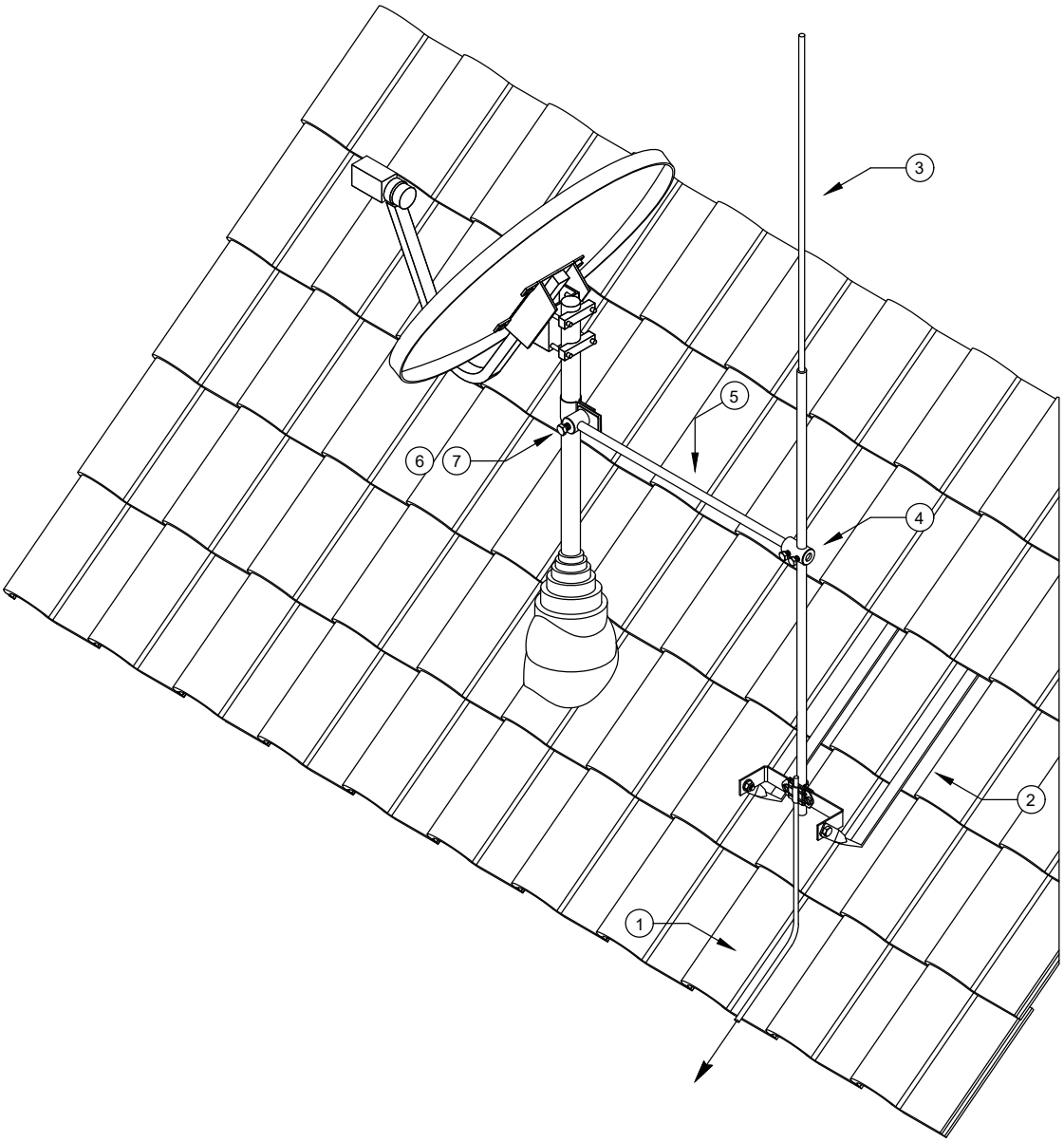
Ind.	Amendment typical		Date:	Name:		



	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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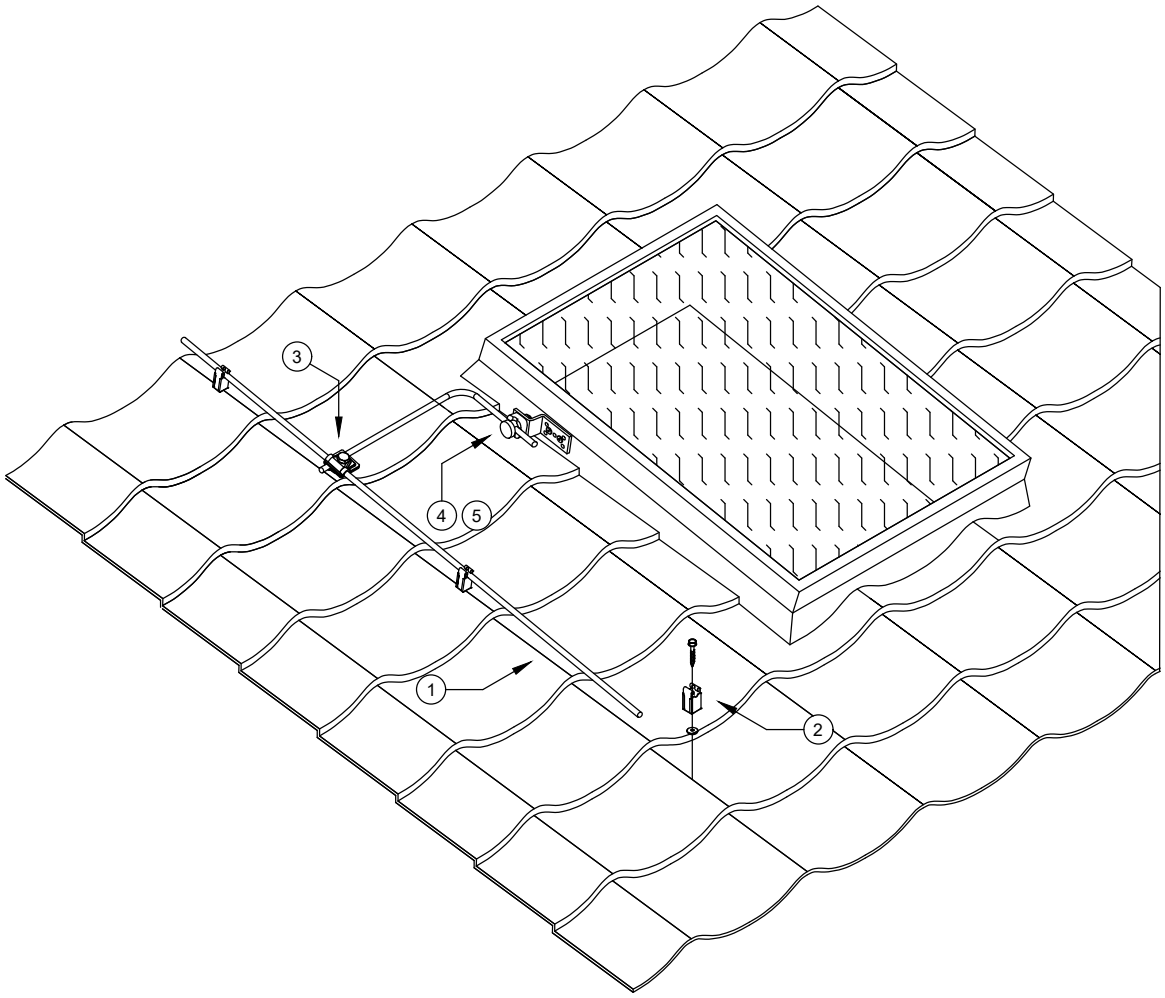
Ind.	Amendment typical		Date:	Name:		



	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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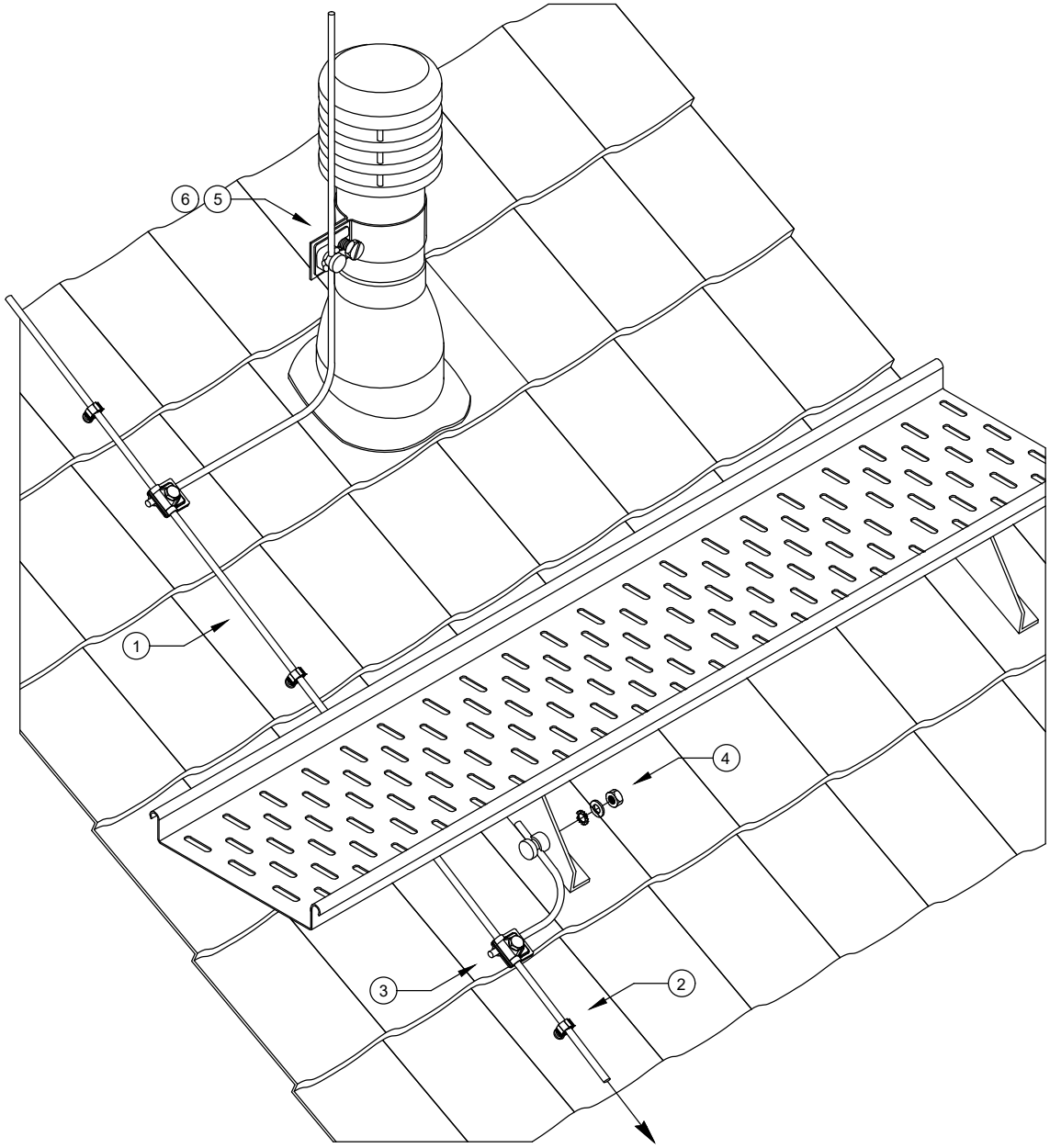
Ind.	Amendment typical		Date:	Name:		



	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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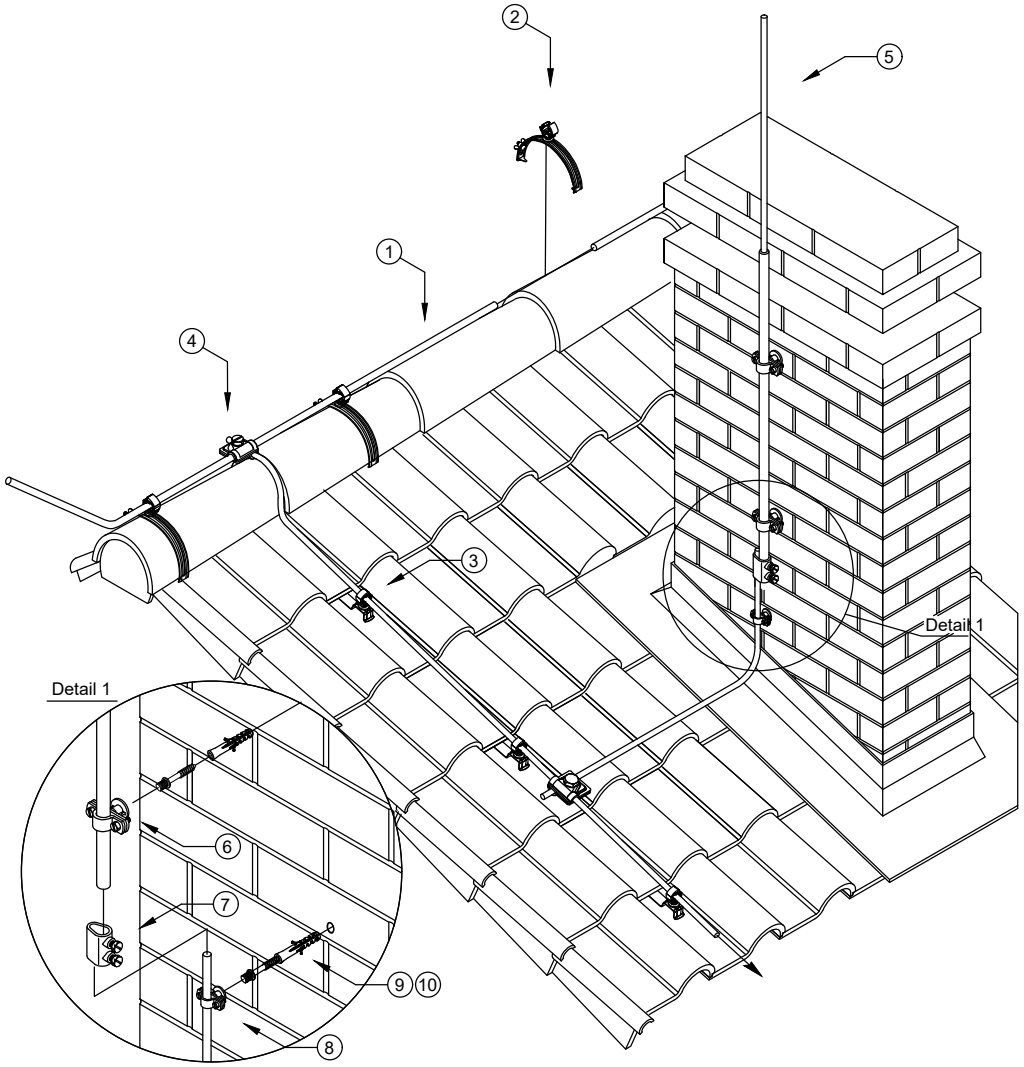
Ind.	Amendment typical	Date:	Name:			



	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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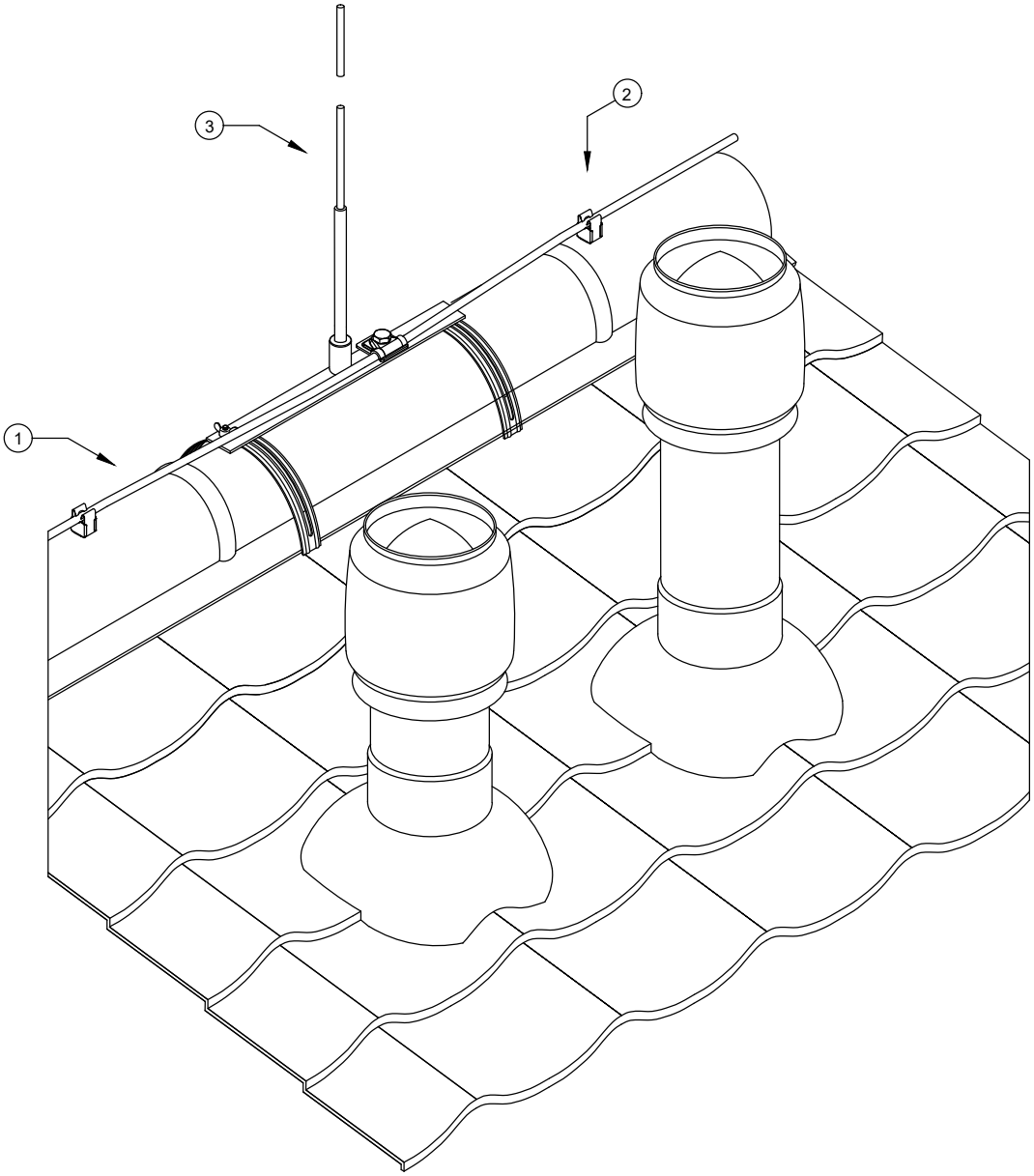
Ind.	Amendment typical	Date:	Name:			



	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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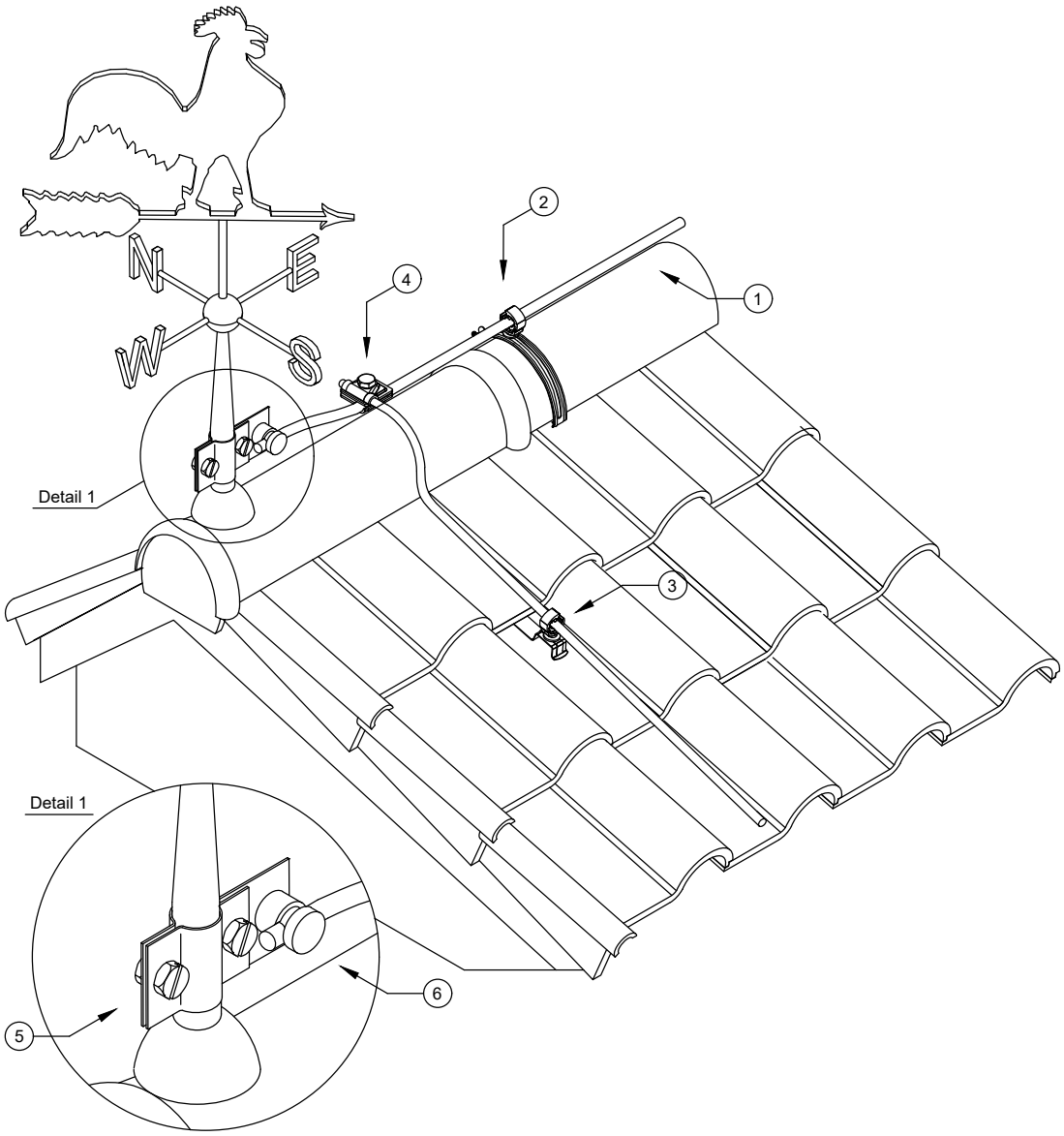
Ind.	Amendment typical	Date:	Name:			



	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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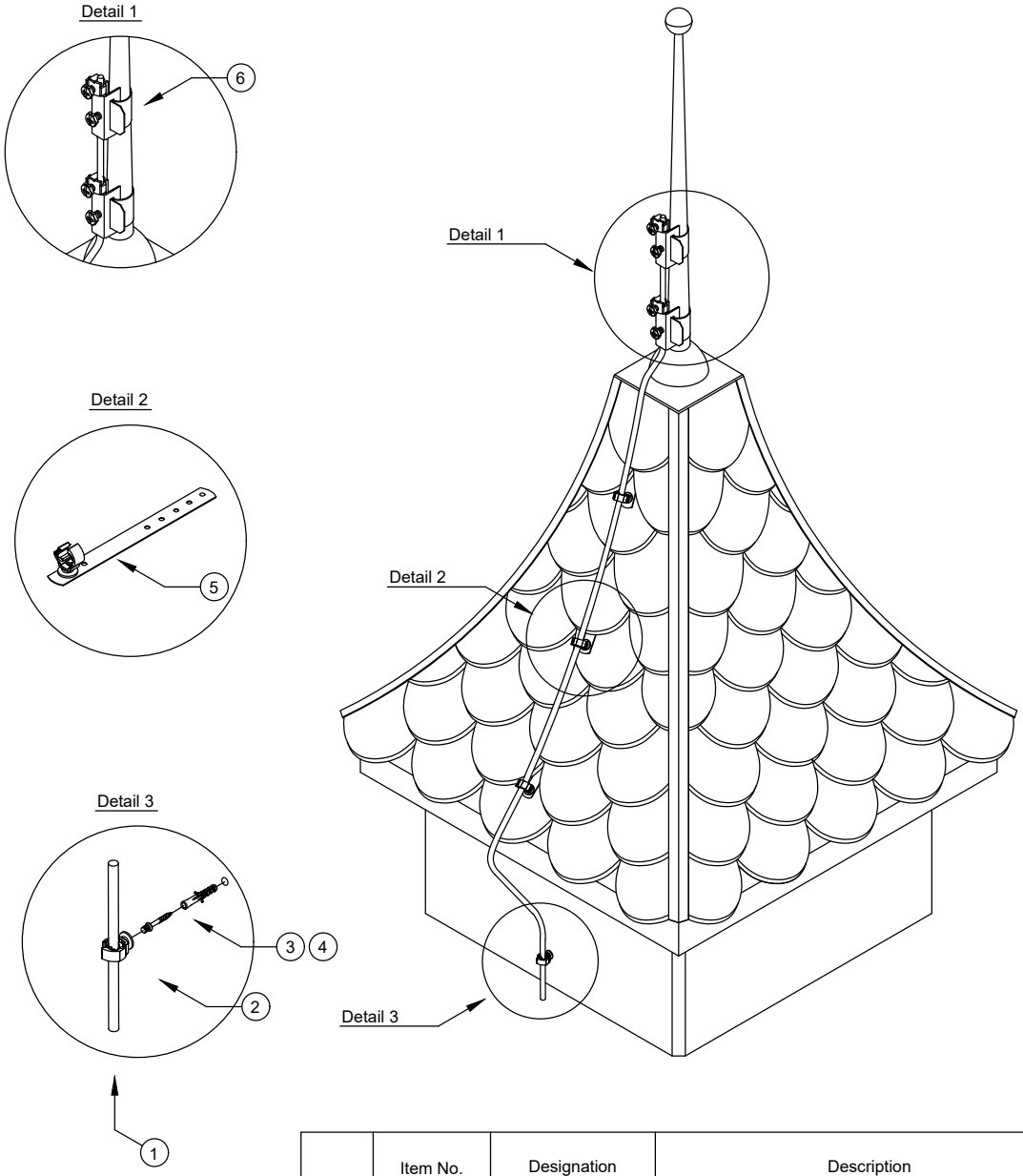
Ind.	Amendment typical	Date:	Name:			



	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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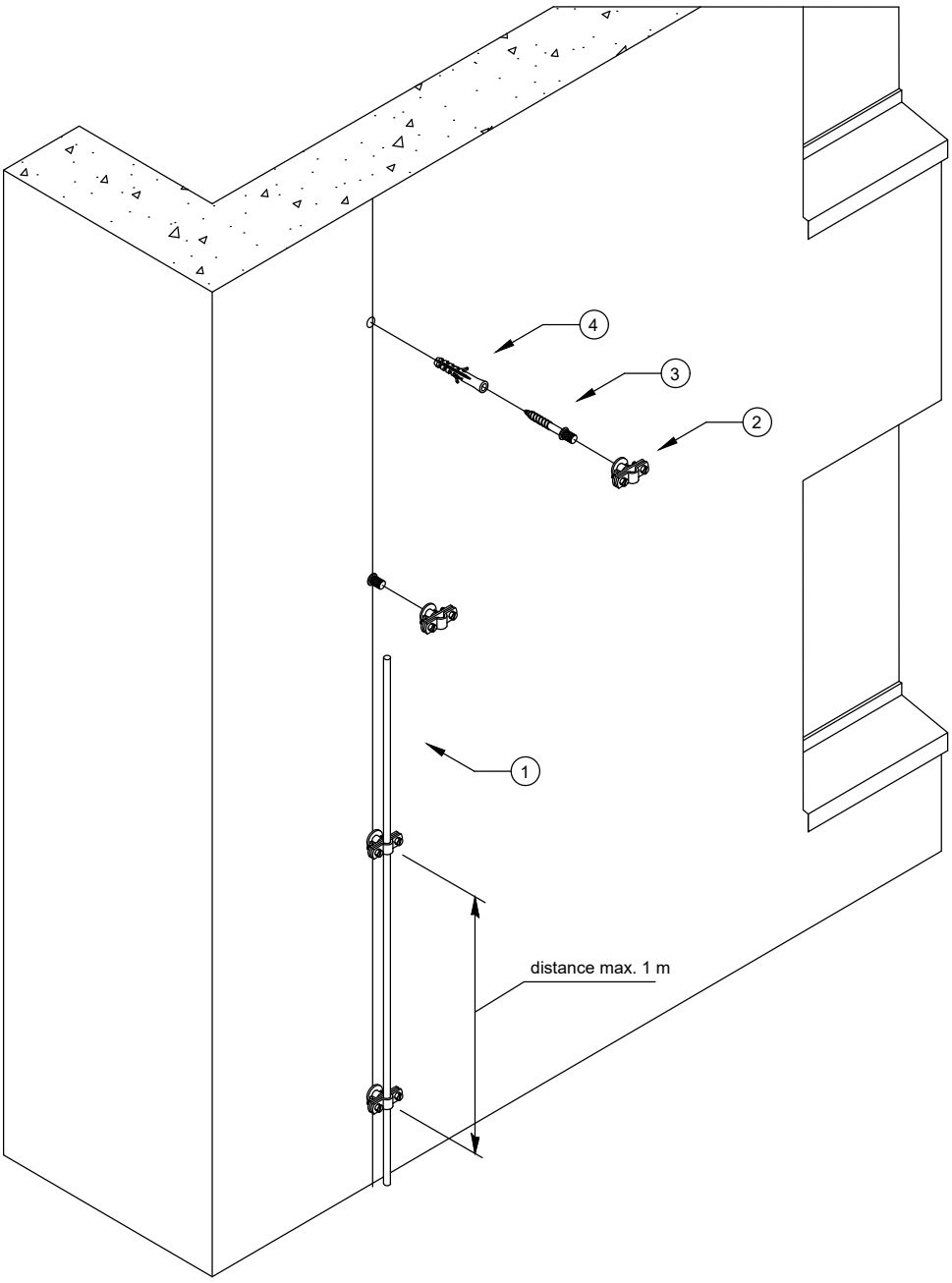
Ind.	Amendment typical	Date:	Name:			



	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			
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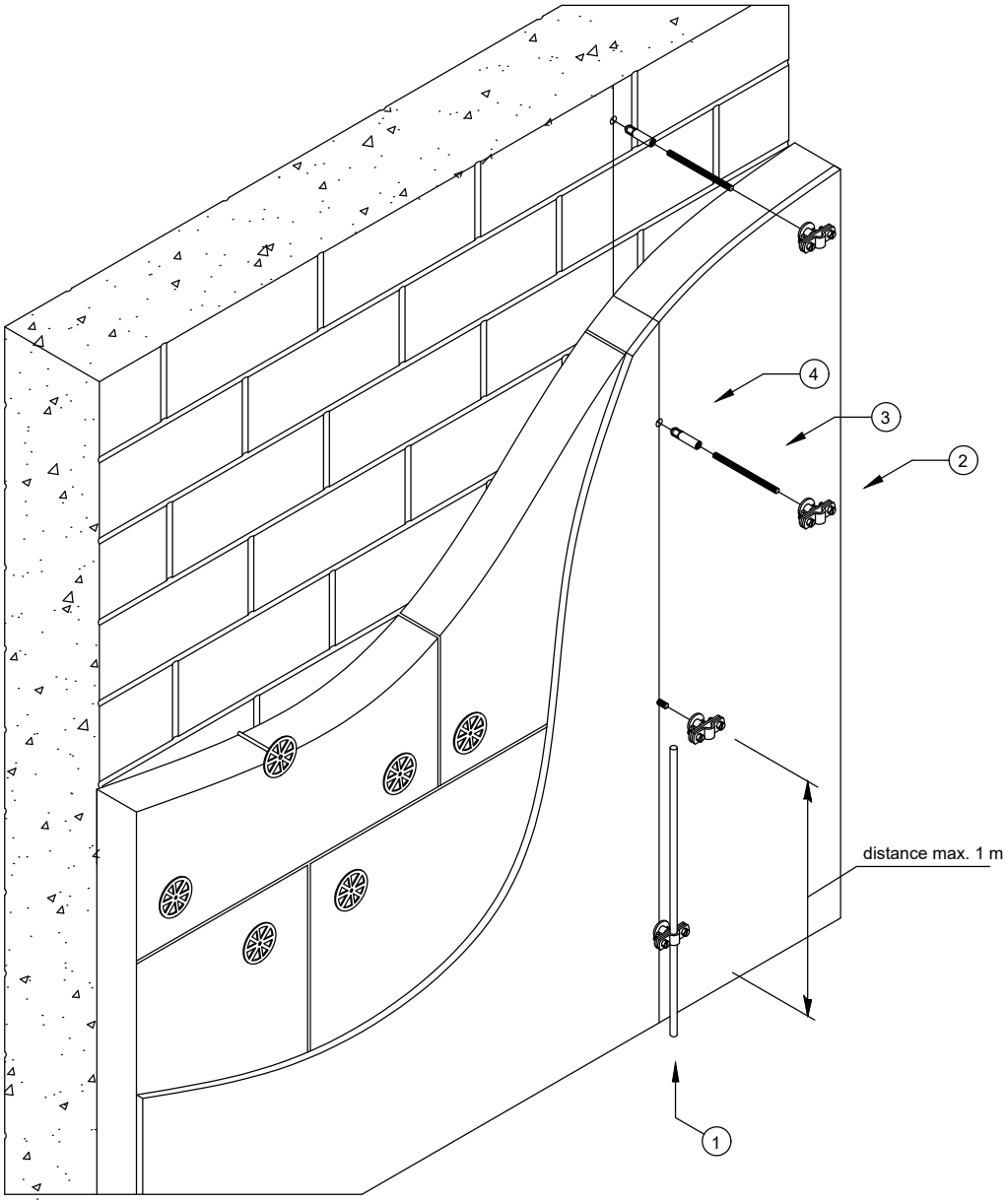
Ind.	Amendment typical		Date:	Name:		



	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: The external lightning protection system Down-conductors			
Creator:						
Editor:						
Status:			Comment: Laying a round conductor over an insulated wall surface.			
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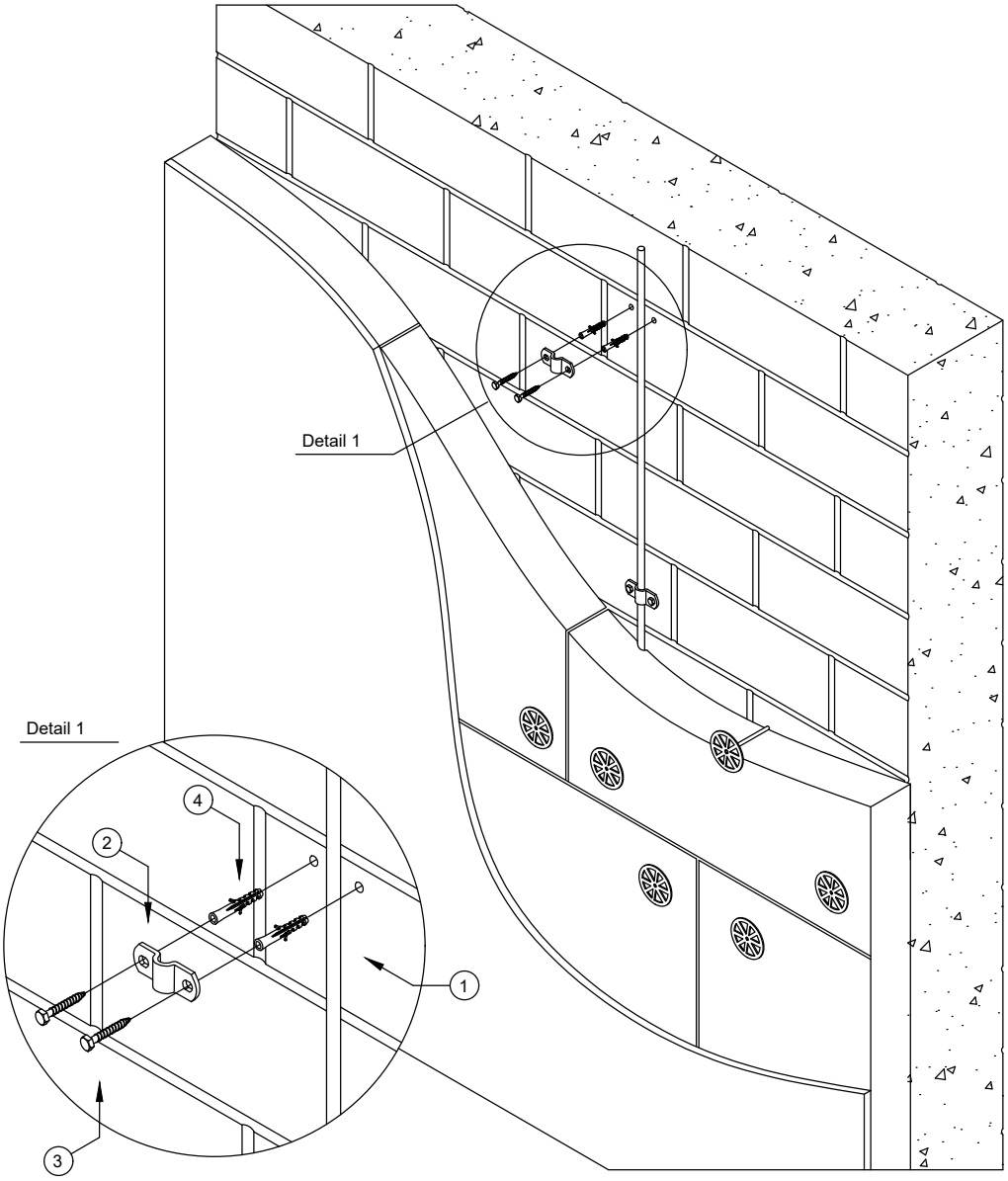
Ind.	Amendment typical	Date:	Name:			



	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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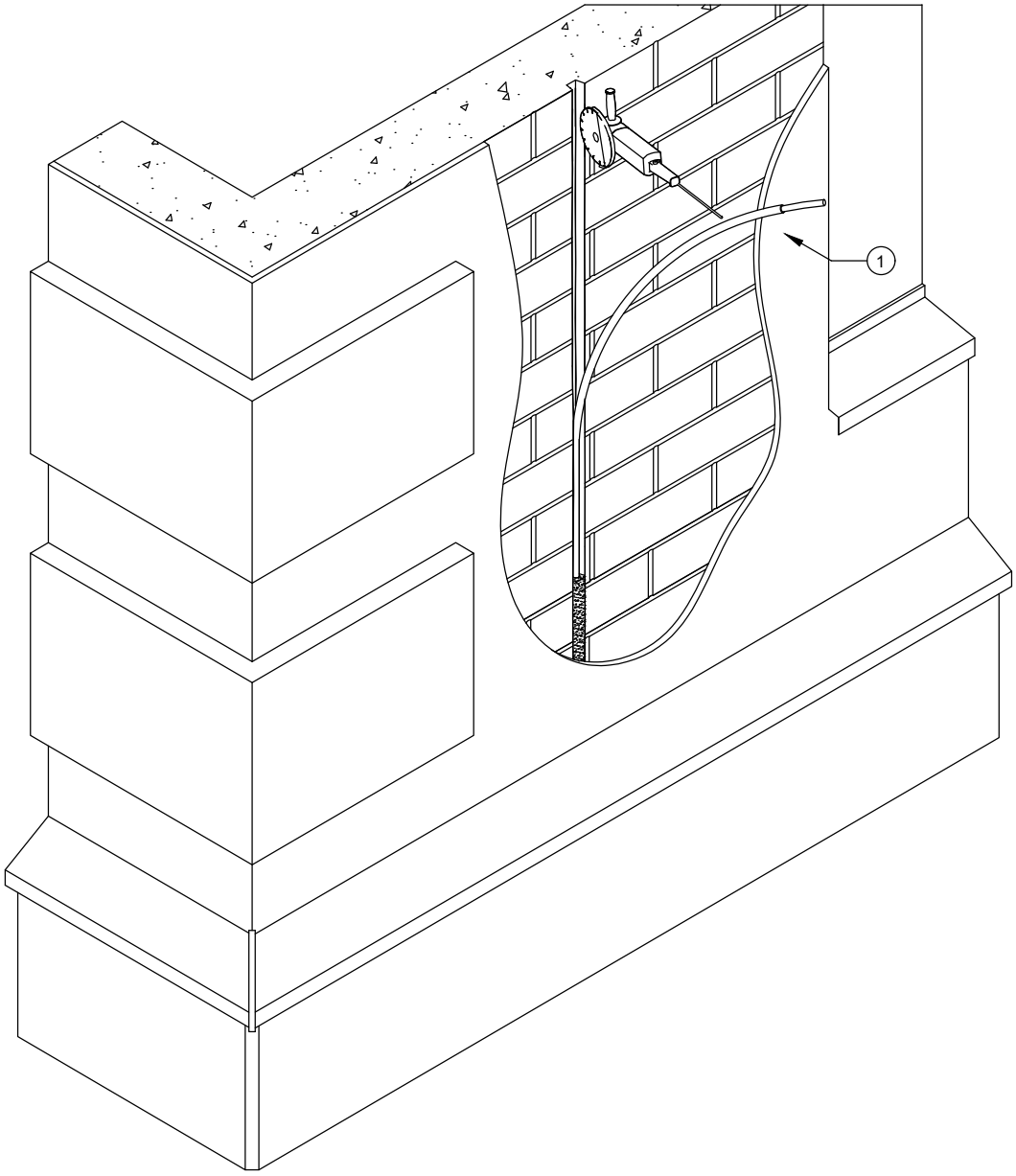
Ind.	Amendment typical		Date:	Name:		



	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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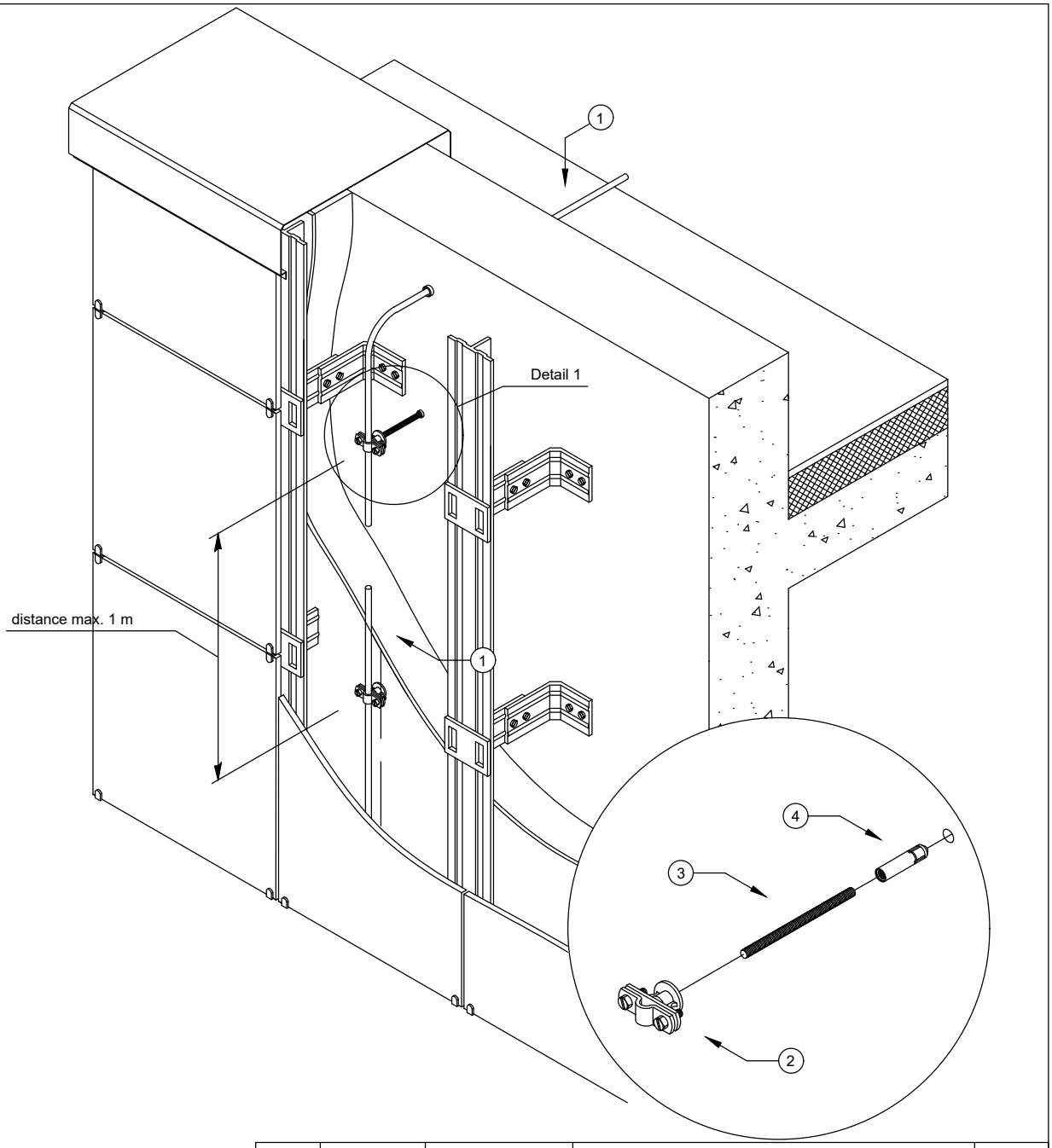
Ind.	Amendment typical		Date:	Name:		



	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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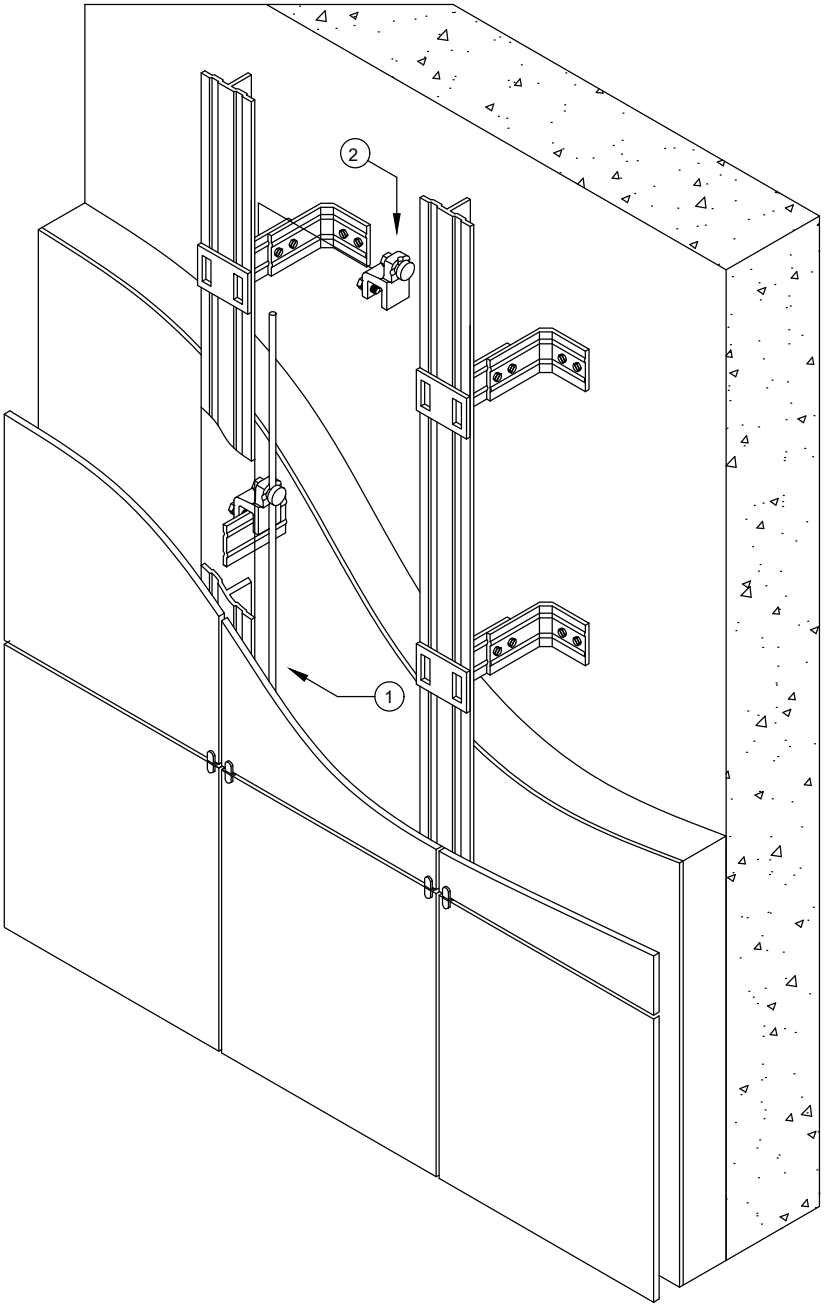
Ind.	Amendment typical	Date:	Name:			



	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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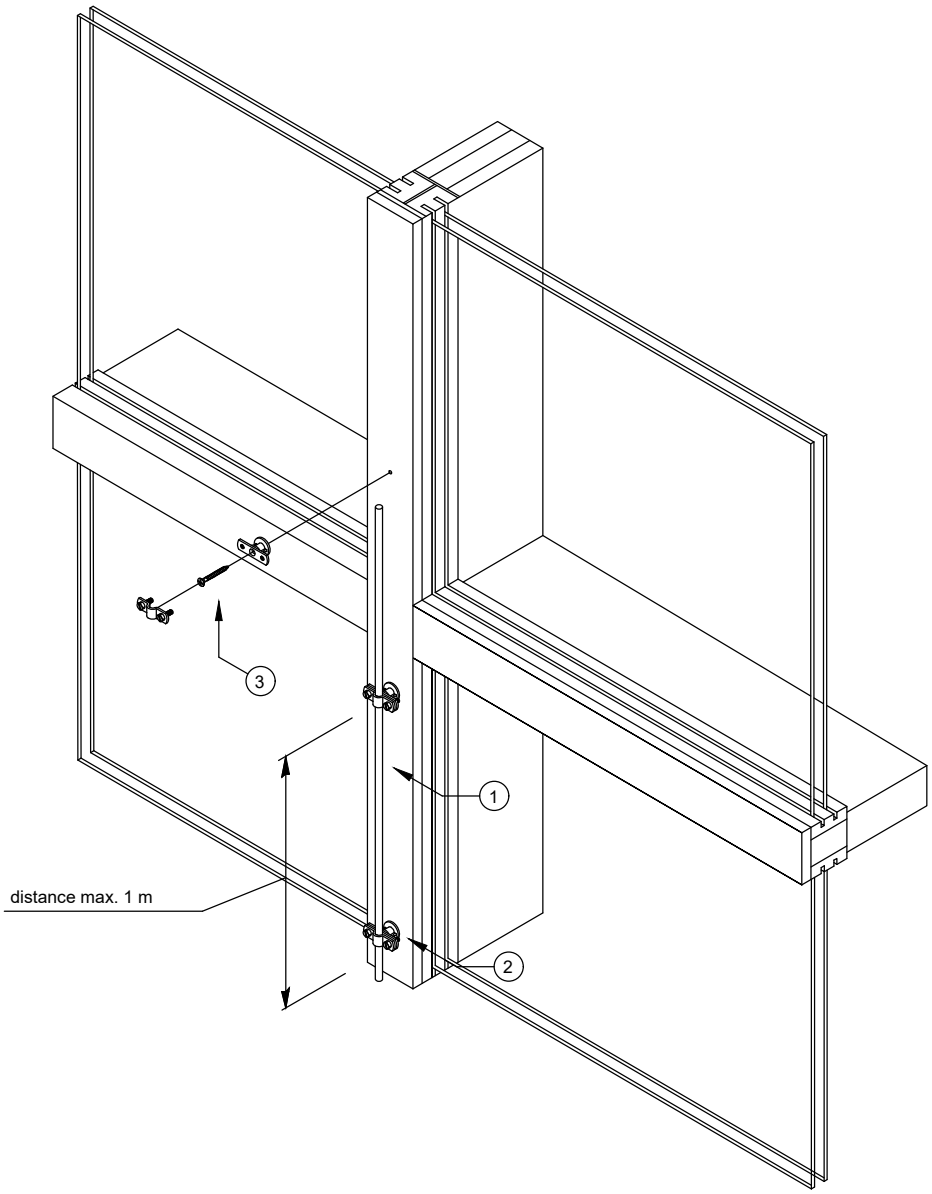
Ind.	Amendment typical		Date:	Name:		



	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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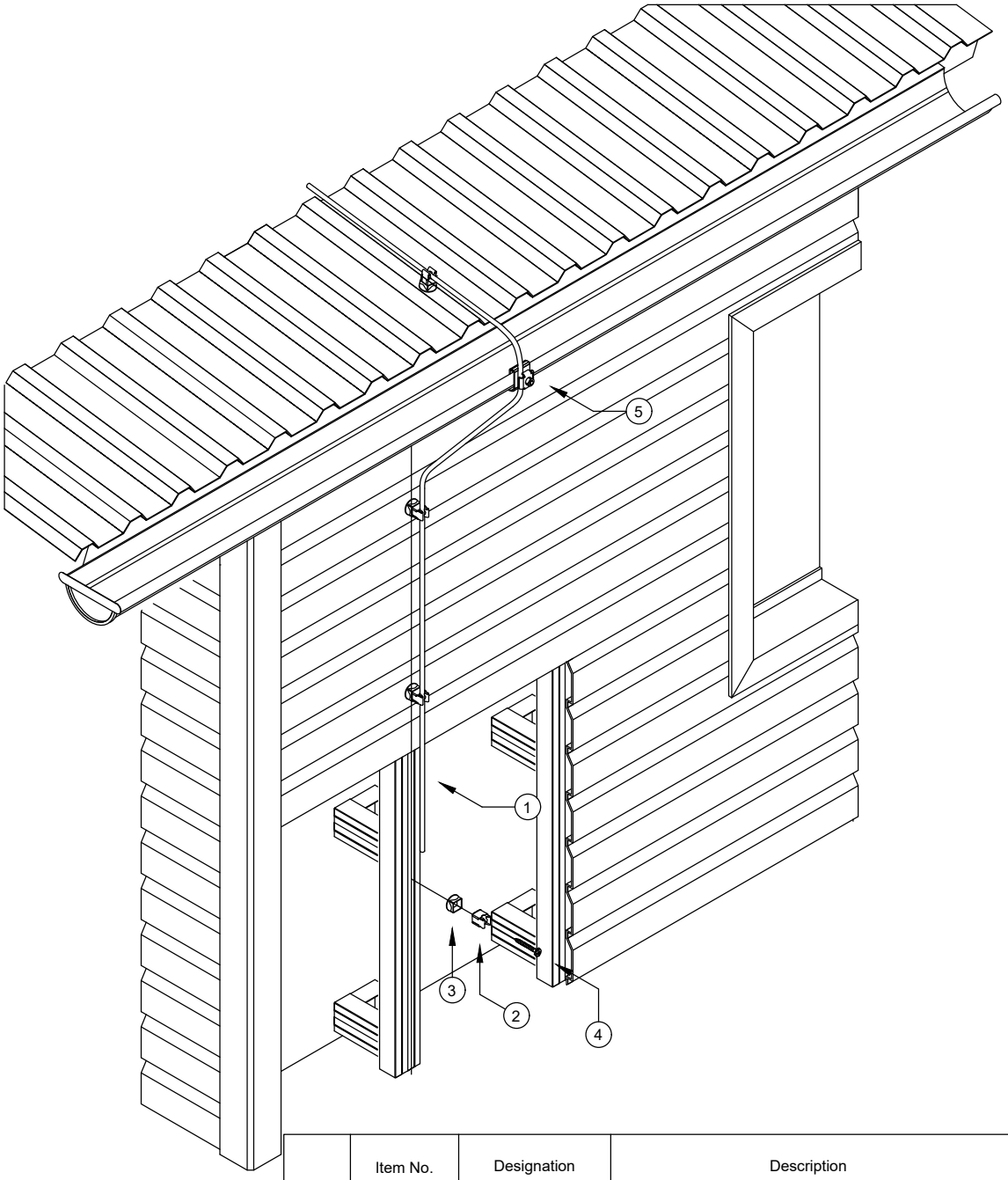
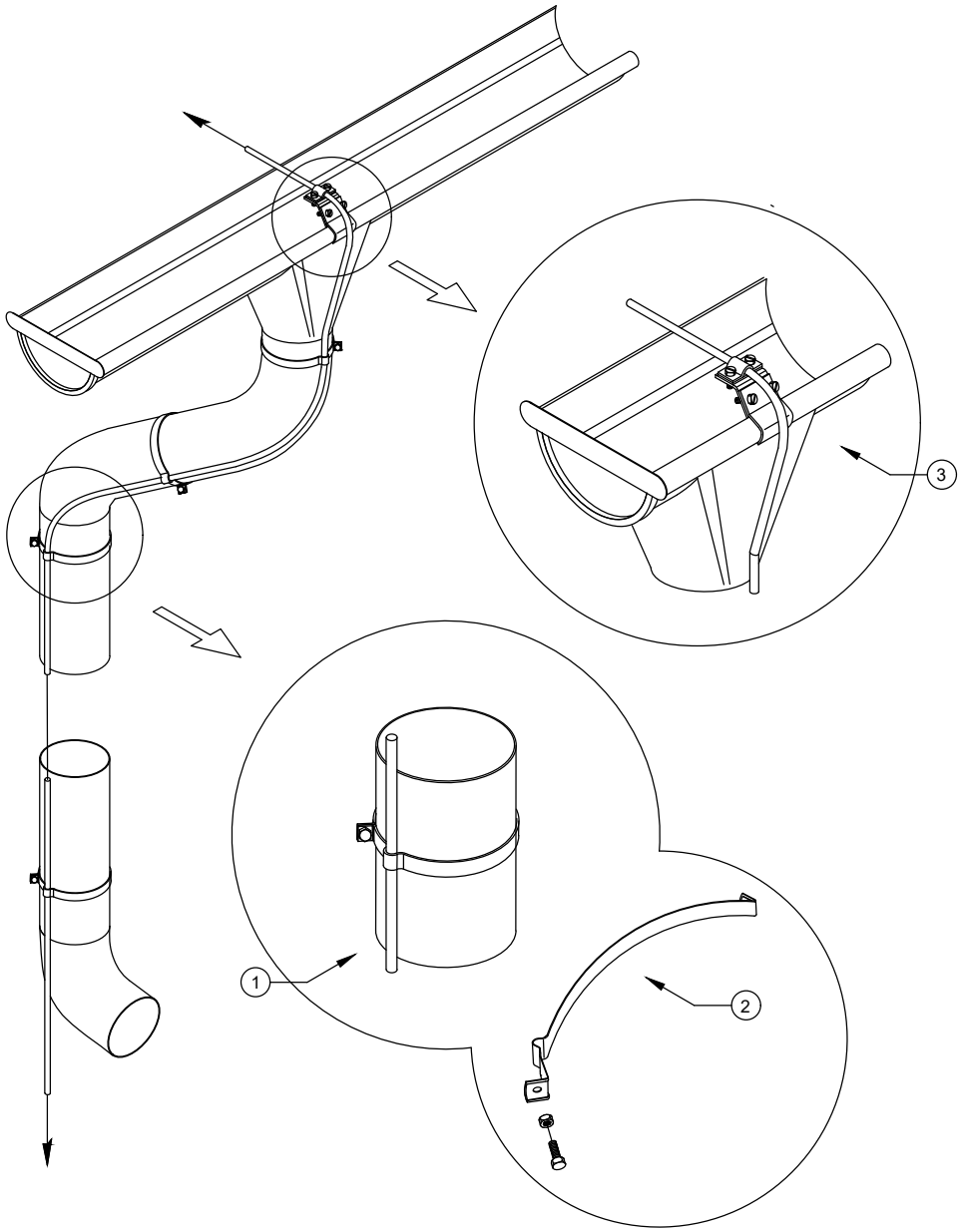
Ind.	Amendment typical		Date:	Name:		



	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.			
— — —					OBO BETTERMANN	Scale: / Sheet size:
— — —						Sheet: / of:
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.			
— — —					Scale:	Sheet size:
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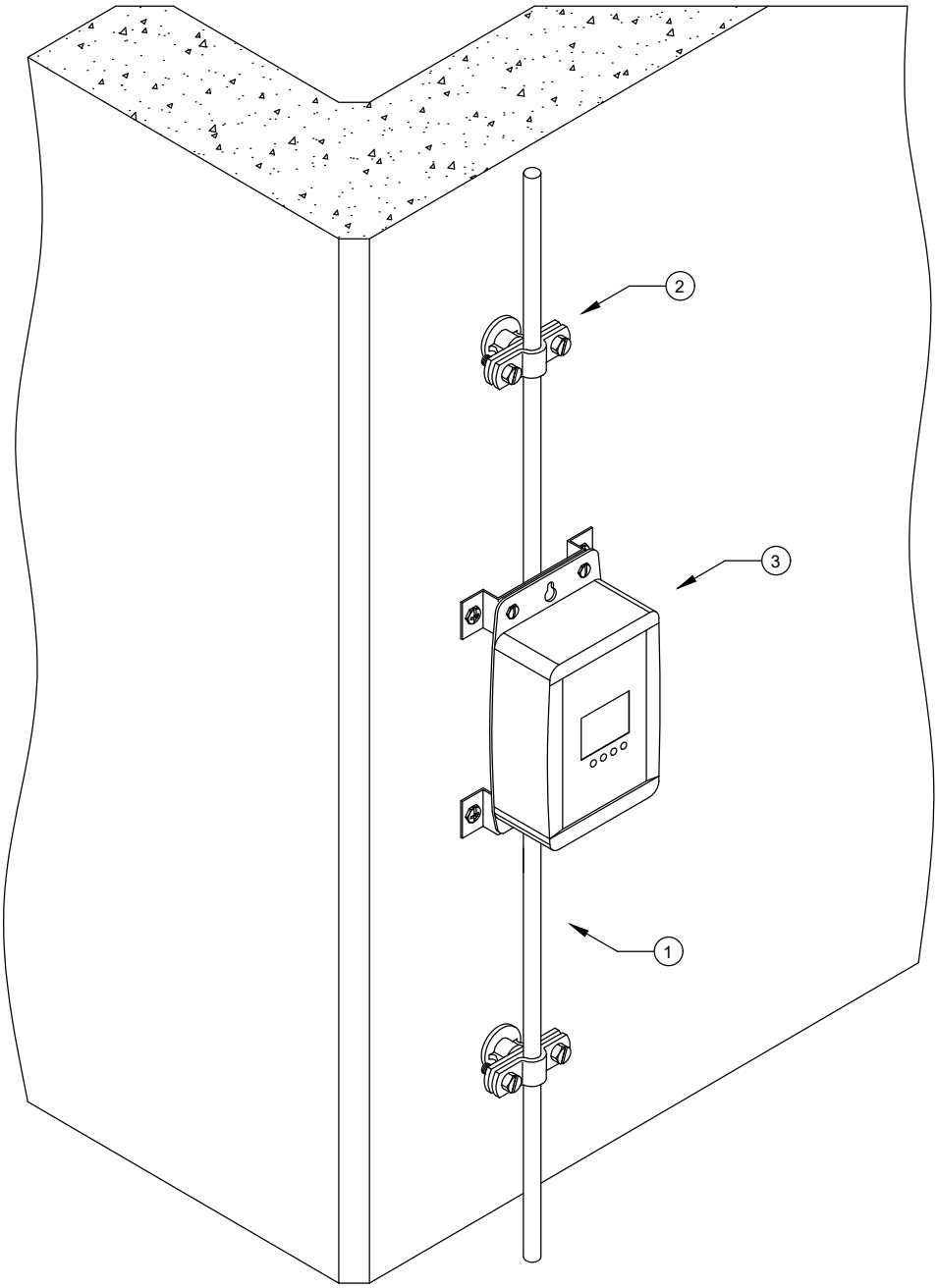
Ind.	Amendment typical		Date:	Name:		

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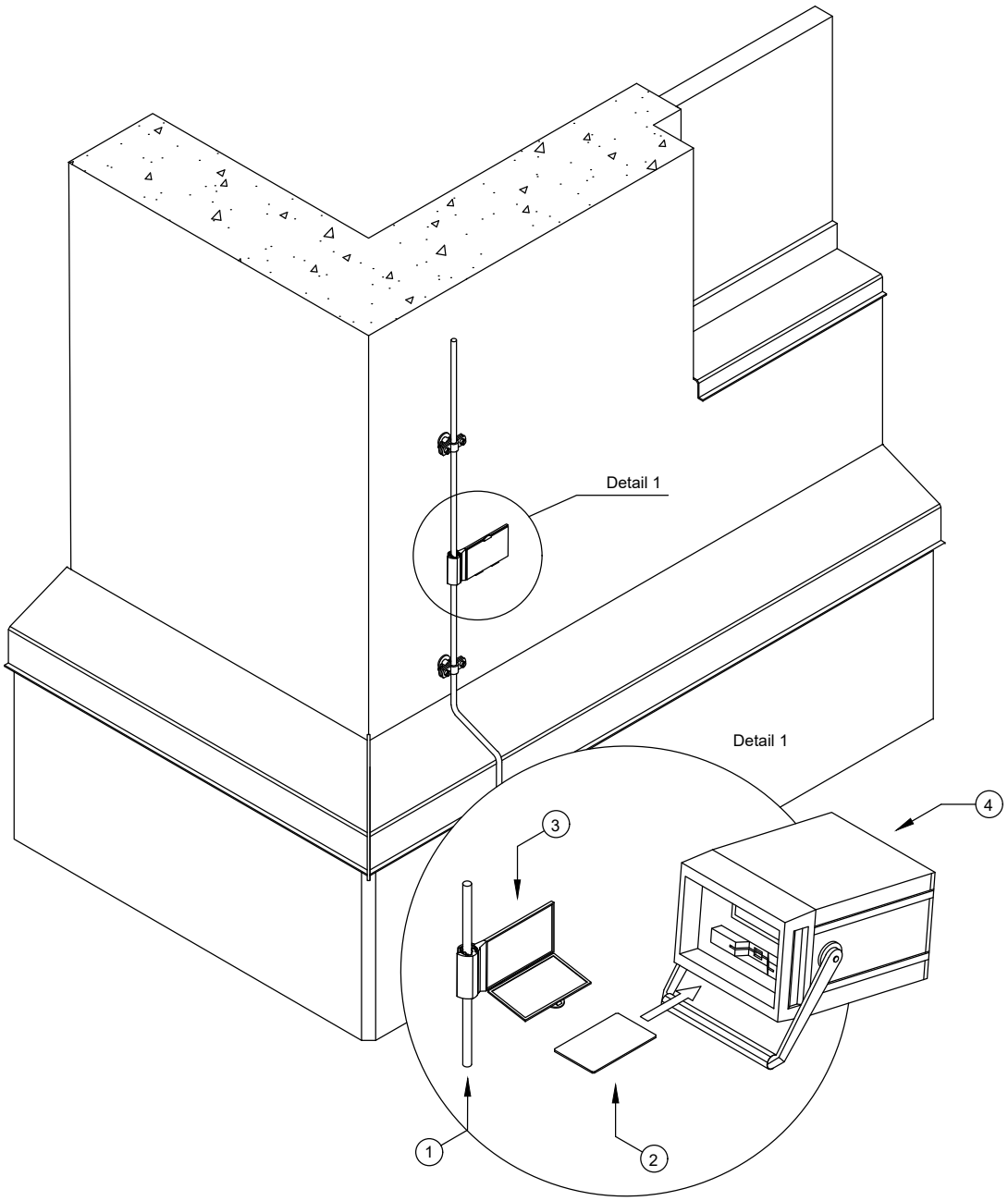
— — —					Sheet:	of:
Ind.	Amendment typical		Date:	Name:		

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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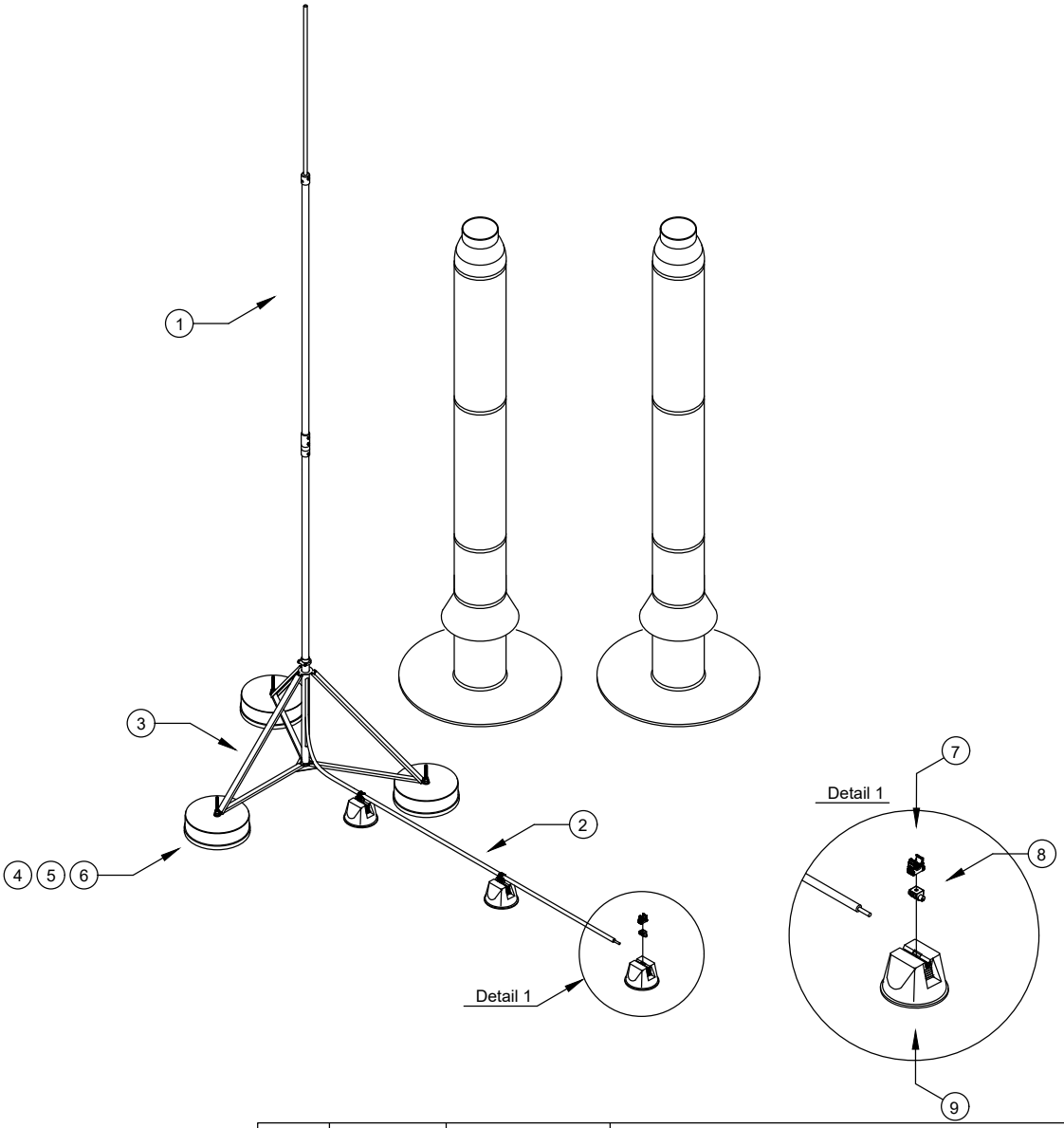
Ind.	Amendment typical	Date:	Name:			



	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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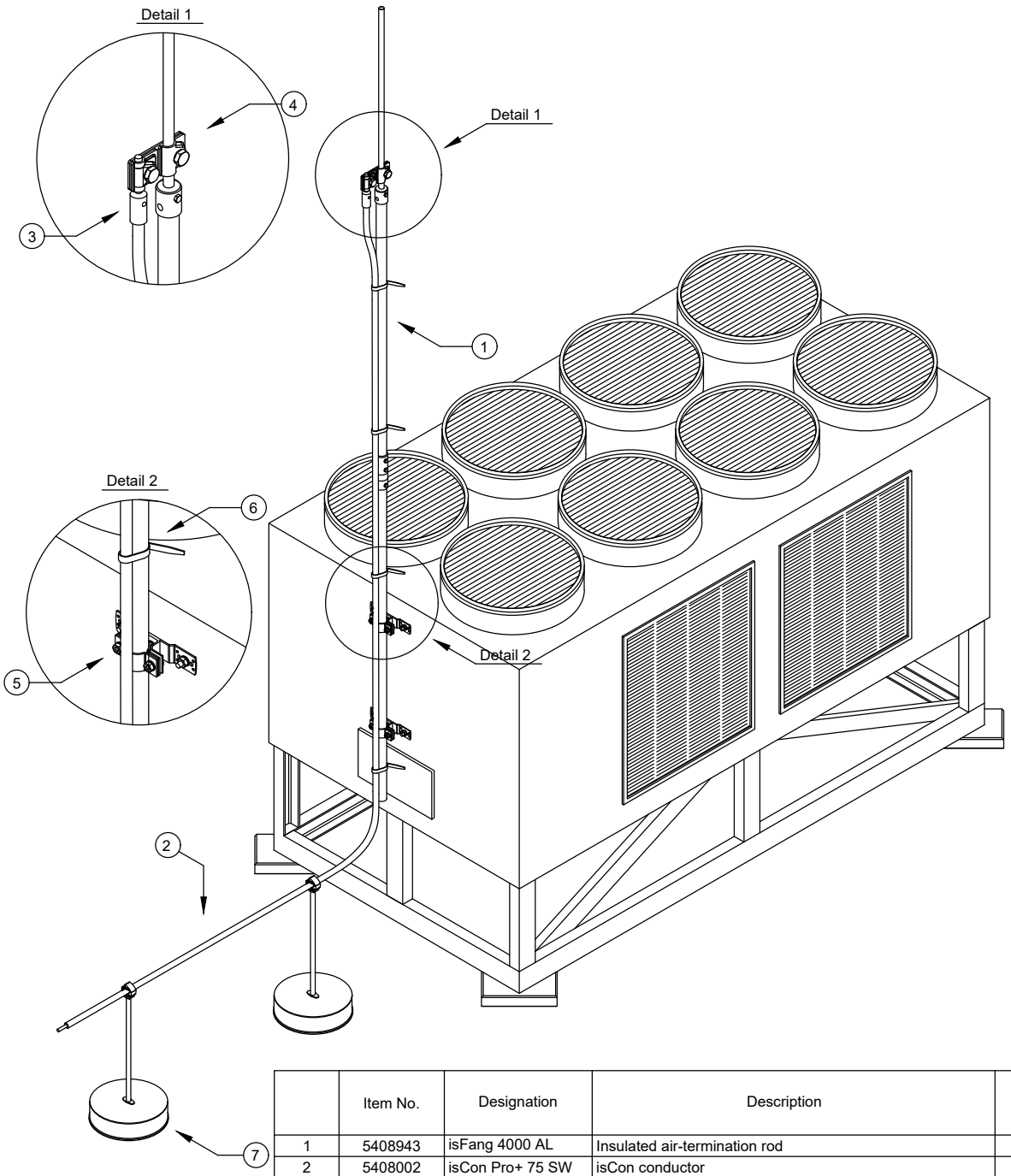
Ind.	Amendment typical		Date:	Name:			



	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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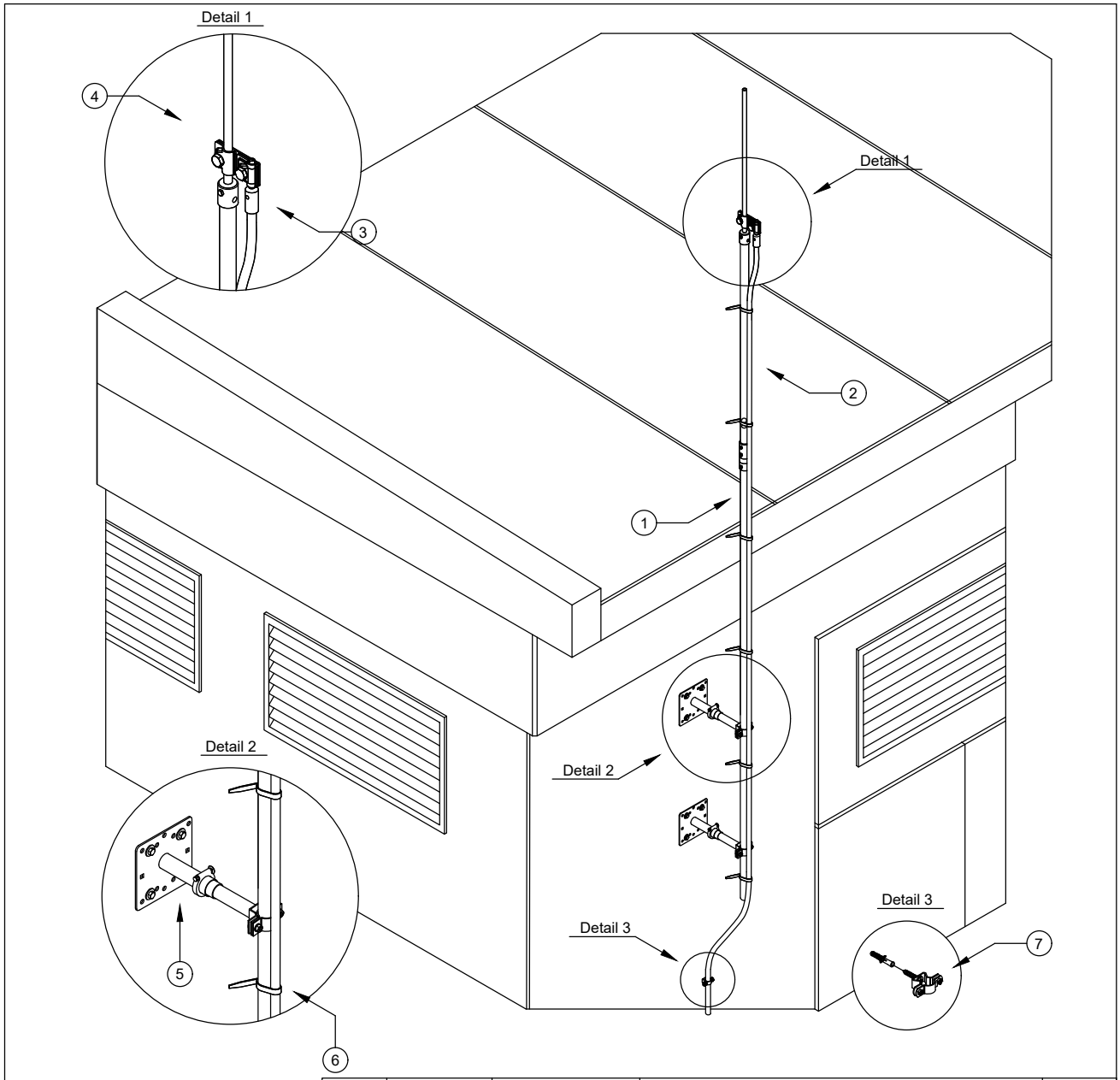
Ind.	Amendment typical	Date:	Name:			



	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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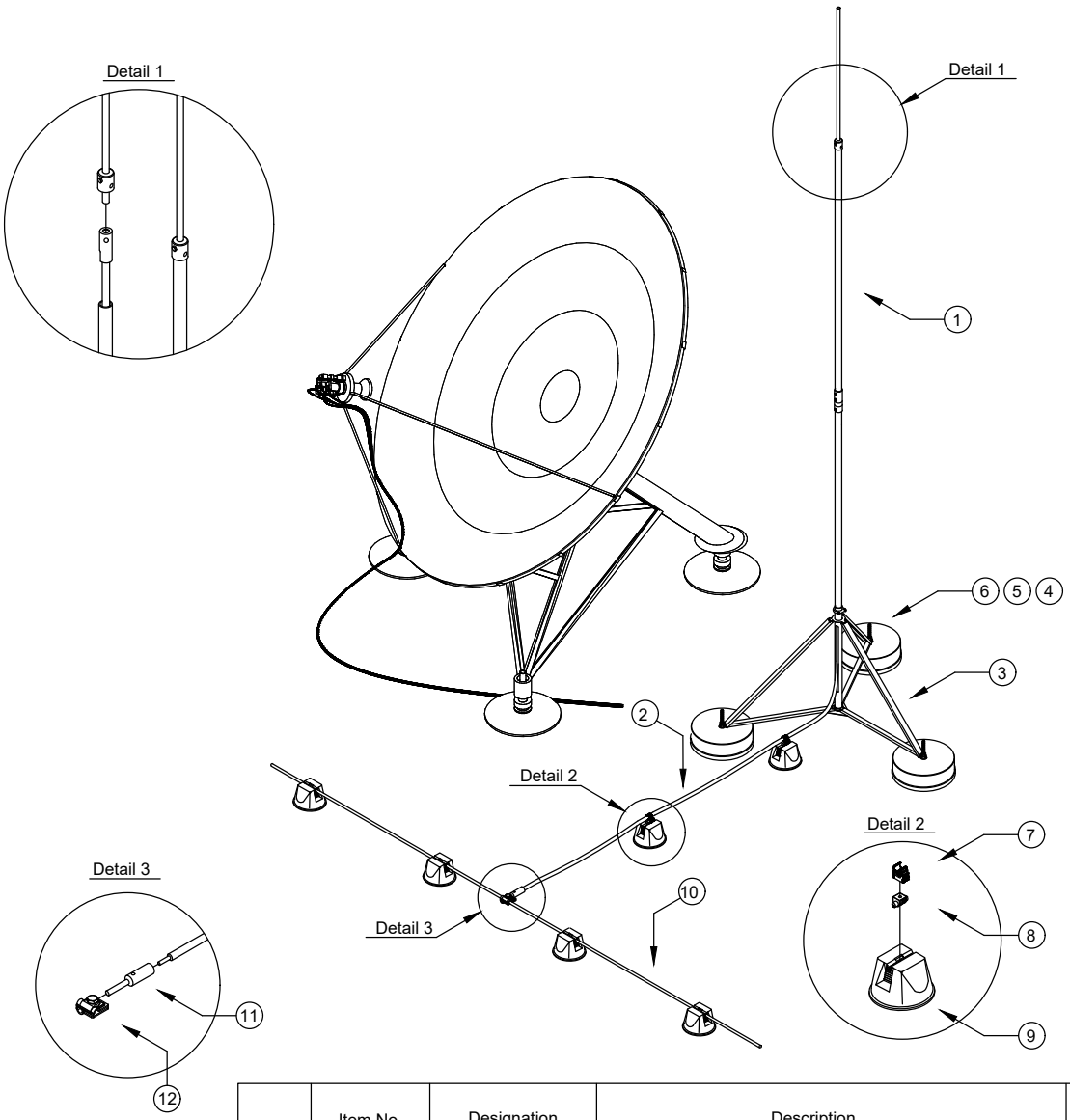
Ind.	Amendment typical		Date:	Name:		



	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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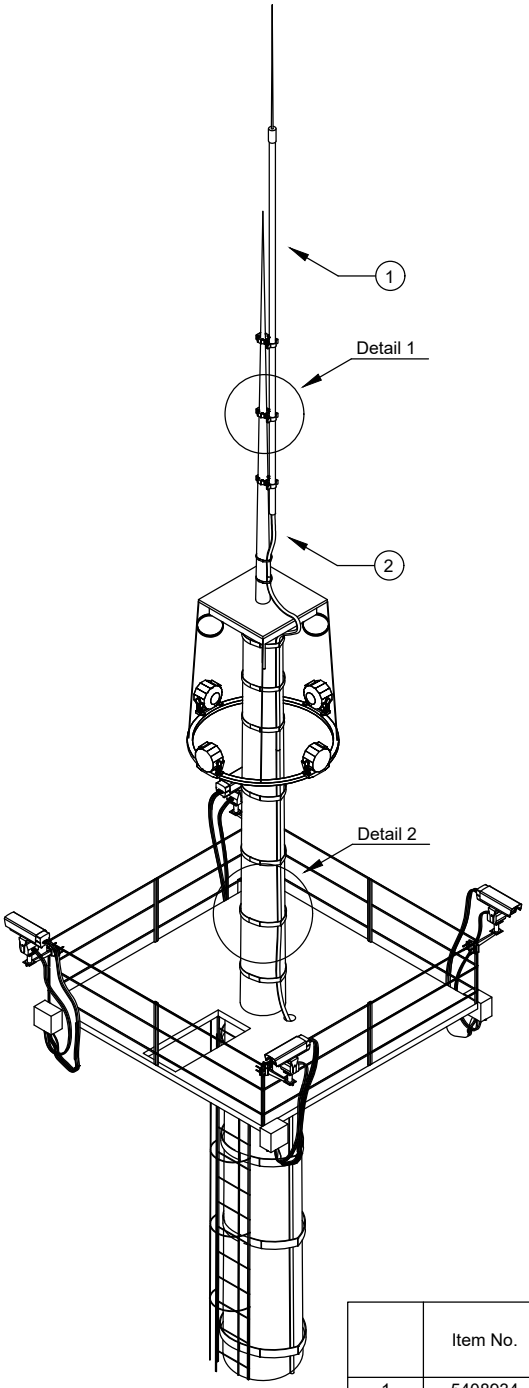
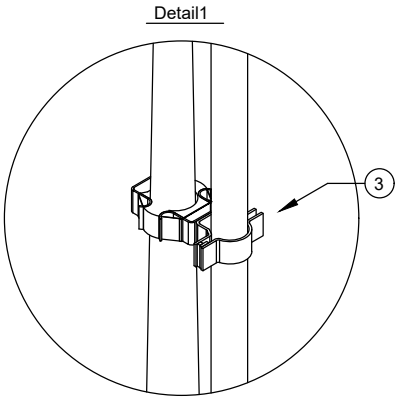
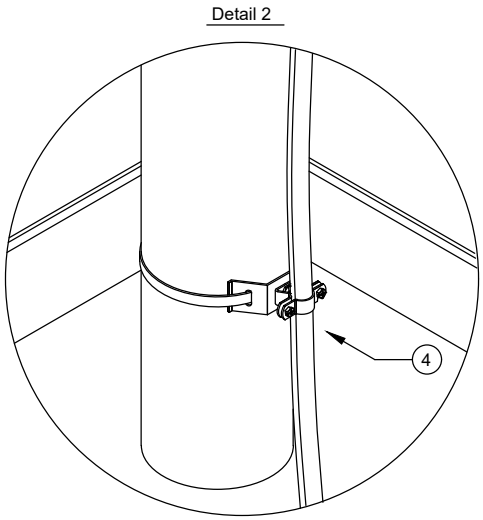
Ind.	Amendment typical	Date:	Name:			







	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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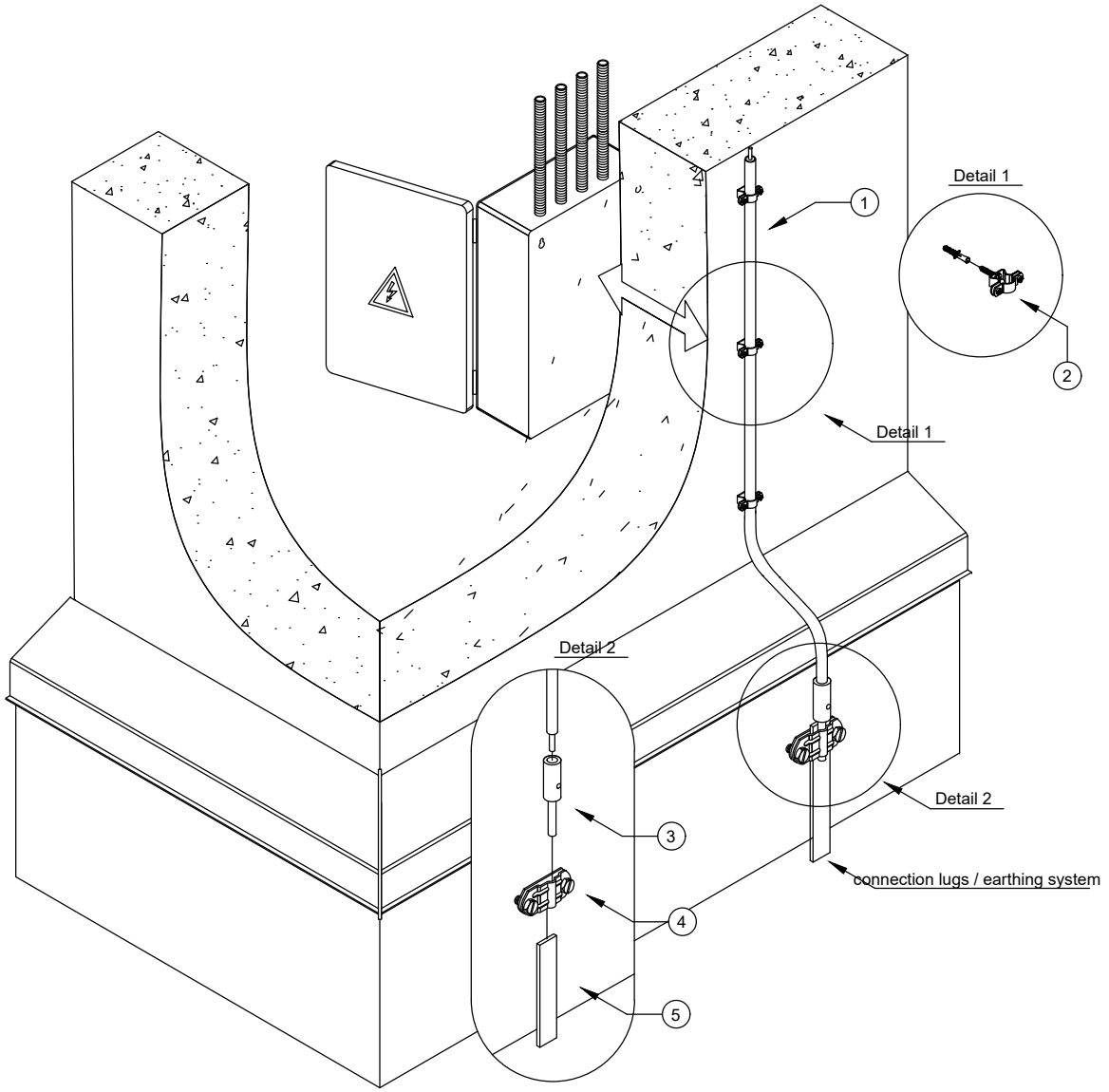
Ind.	Amendment typical		Date:	Name:			



	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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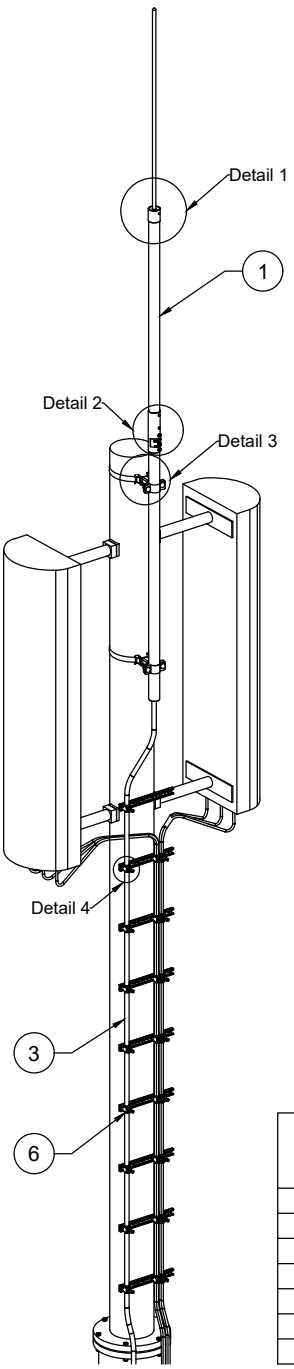
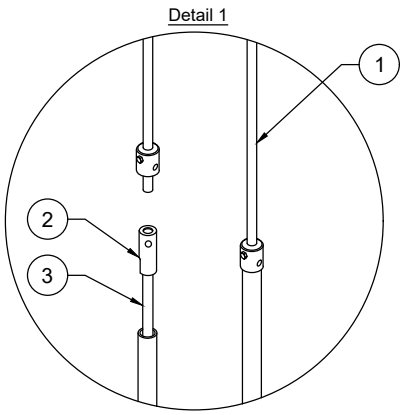
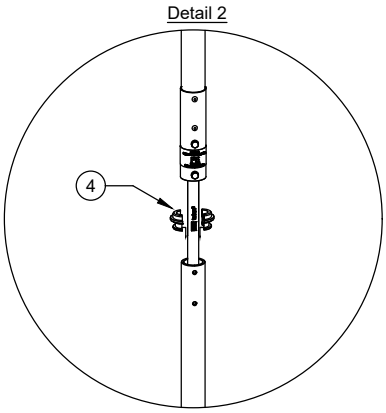
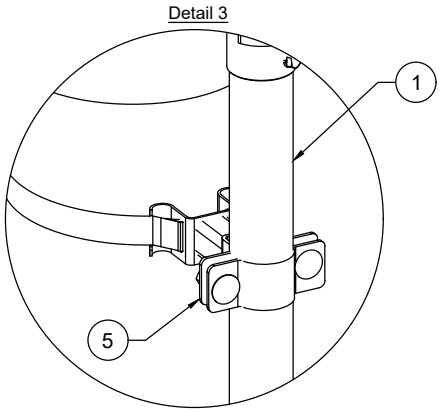
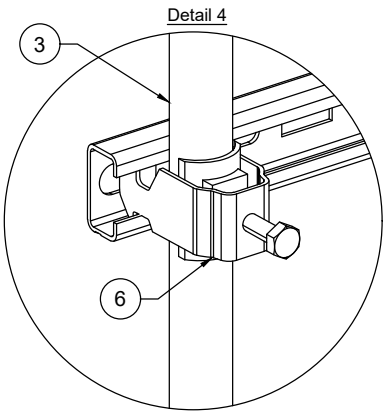
Ind.	Amendment typical	Date:	Name:			











	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:						
Status:			Comment: Lightning protection of mobile phone antenna			
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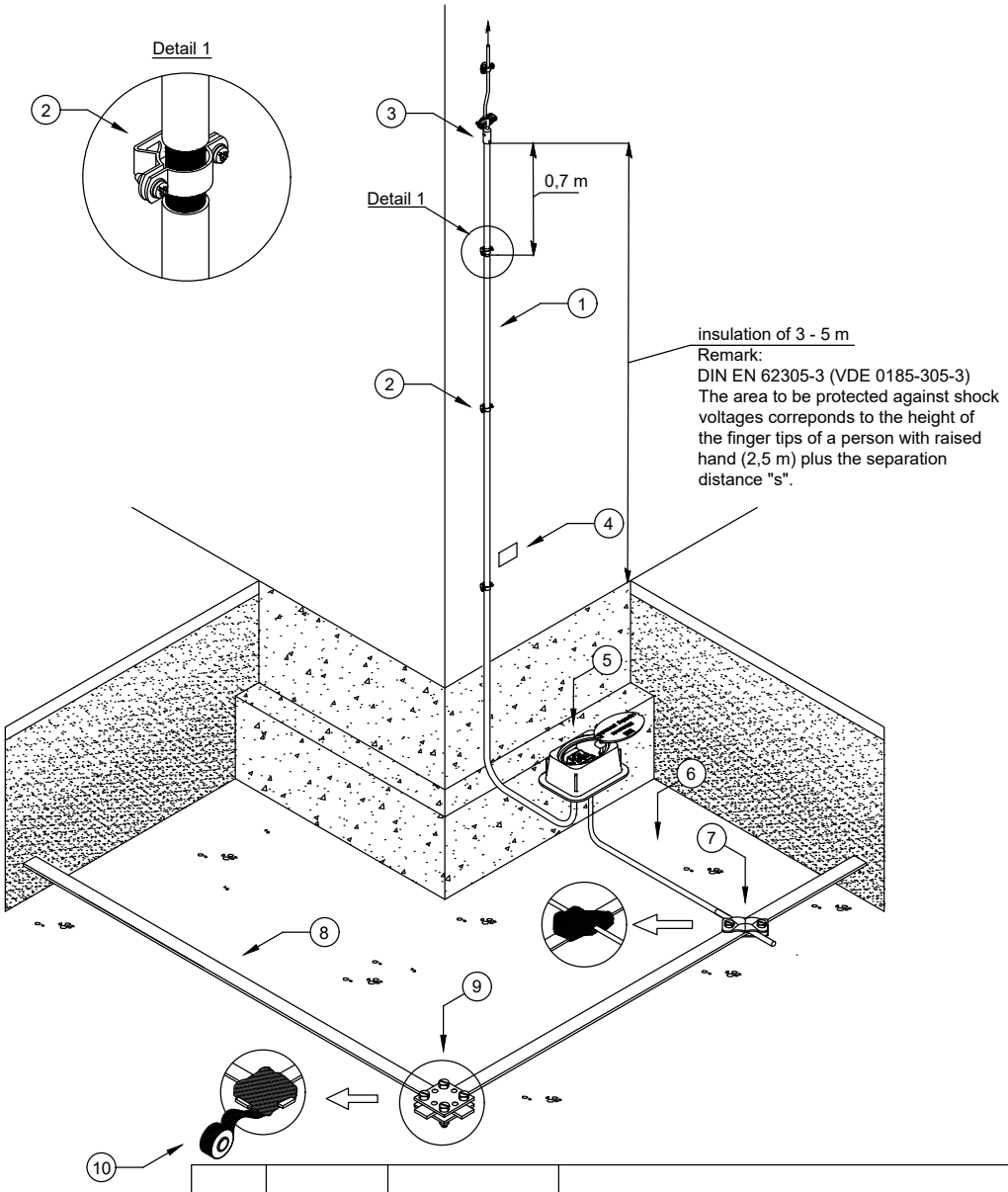
Ind.	Amendment typical		Date:	Name:		



	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.			

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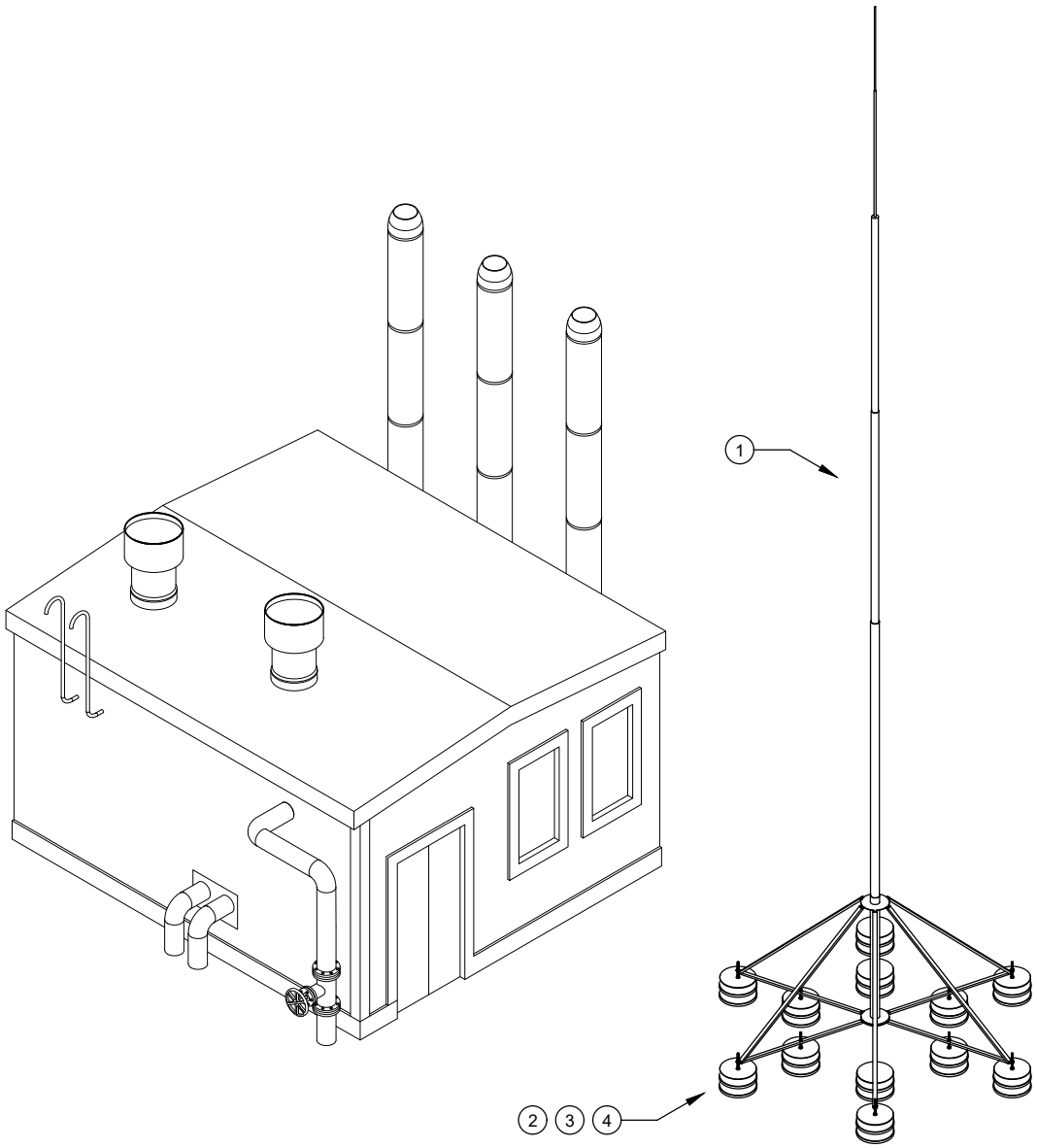
Ind.	Amendment typical	Date:	Name:			



	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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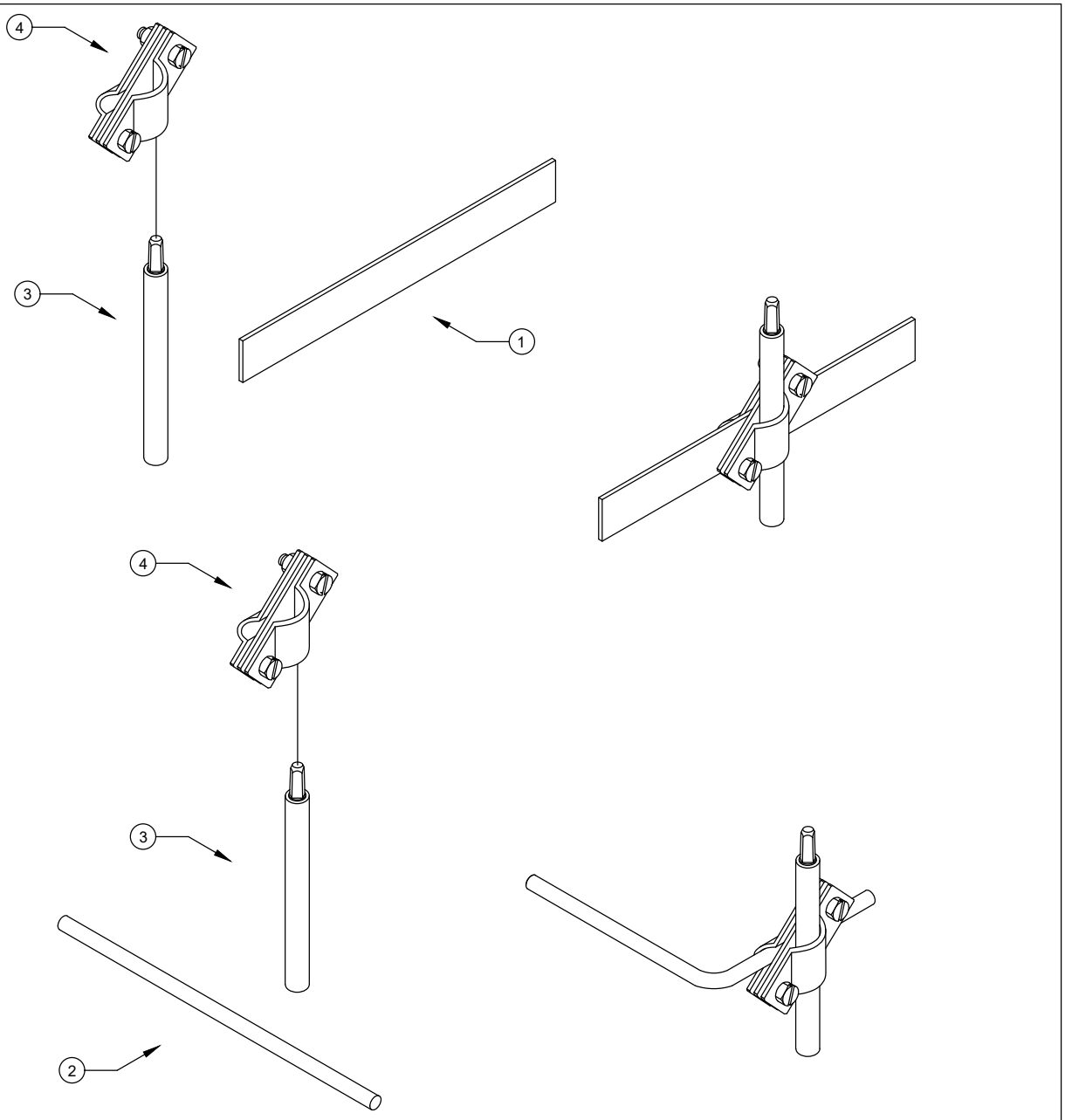
Ind.	Amendment typical	Date:	Name:			

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.			
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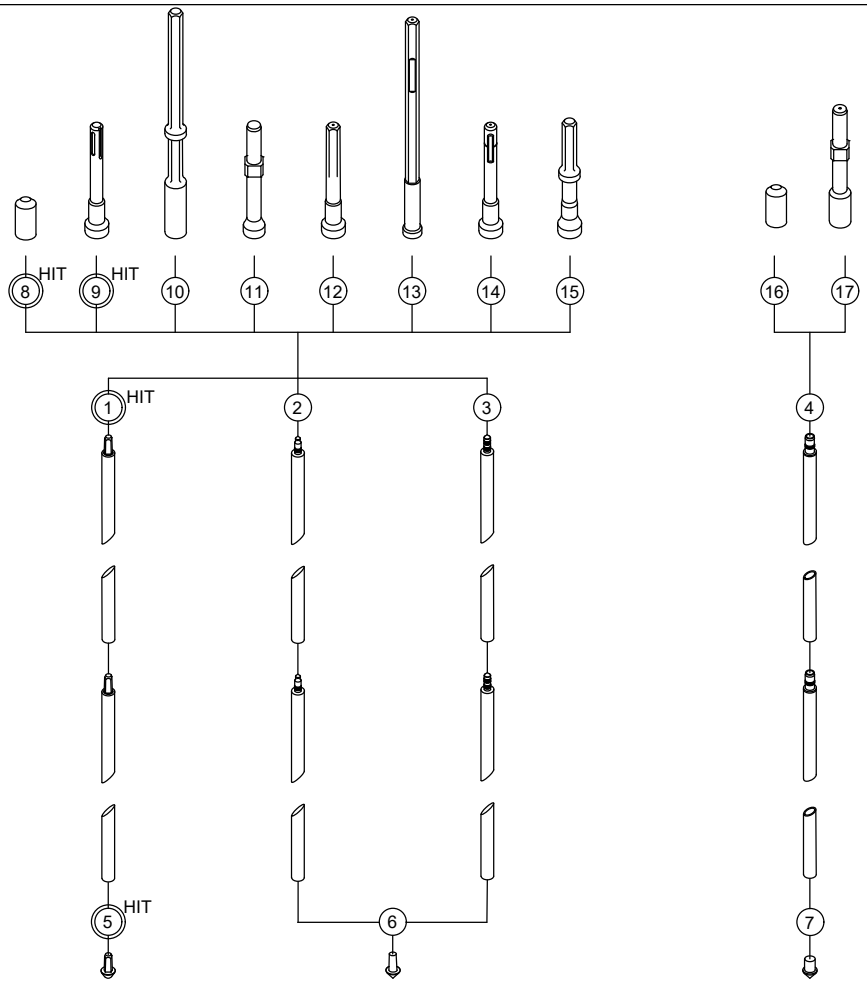
Ind.	Amendment typical		Date:	Name:		



	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:						
Status:			Comment: Types of earthing rods and accessories for their mounting			

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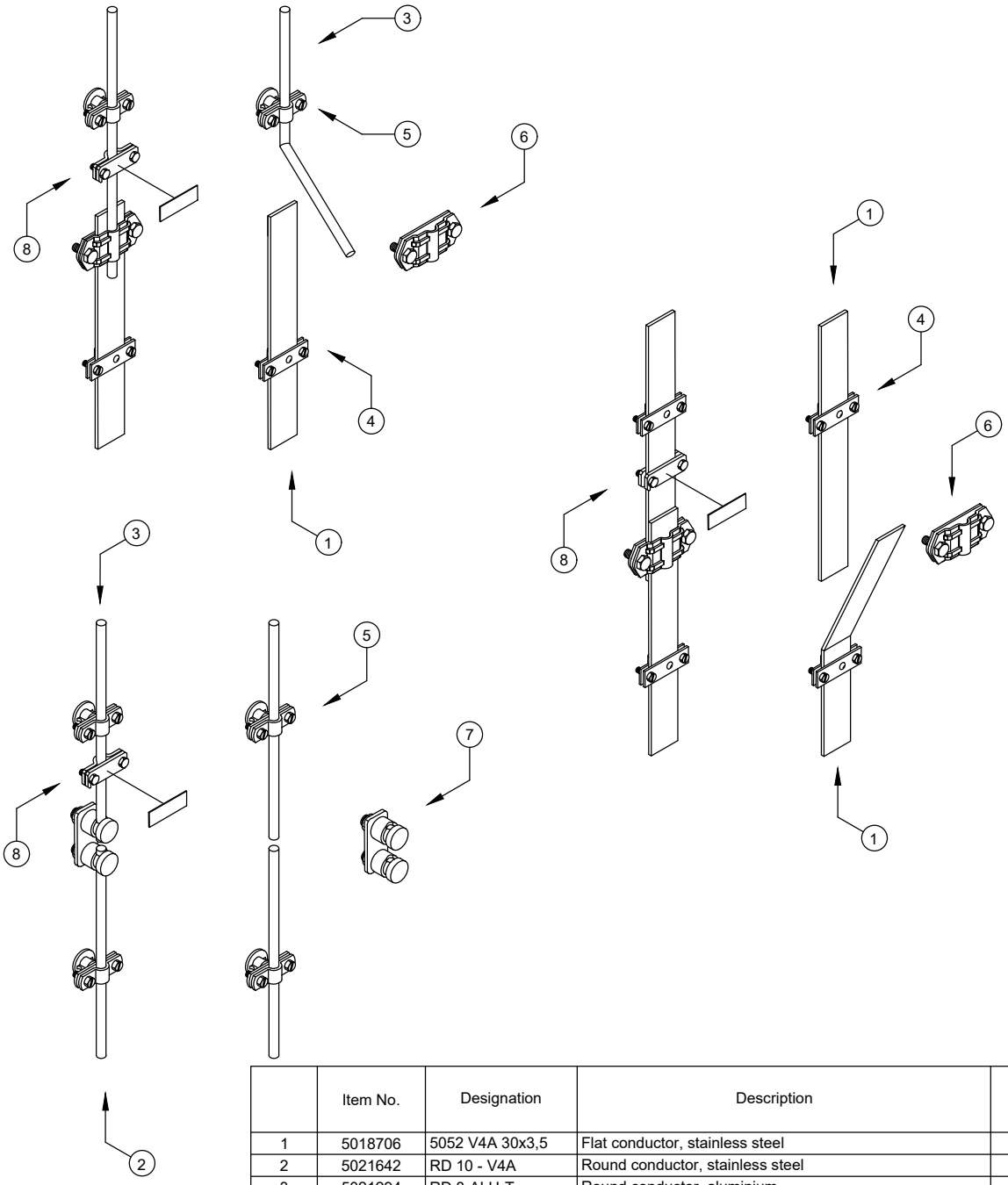
Ind.	Amendment typical	Date:	Name:			



	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.			
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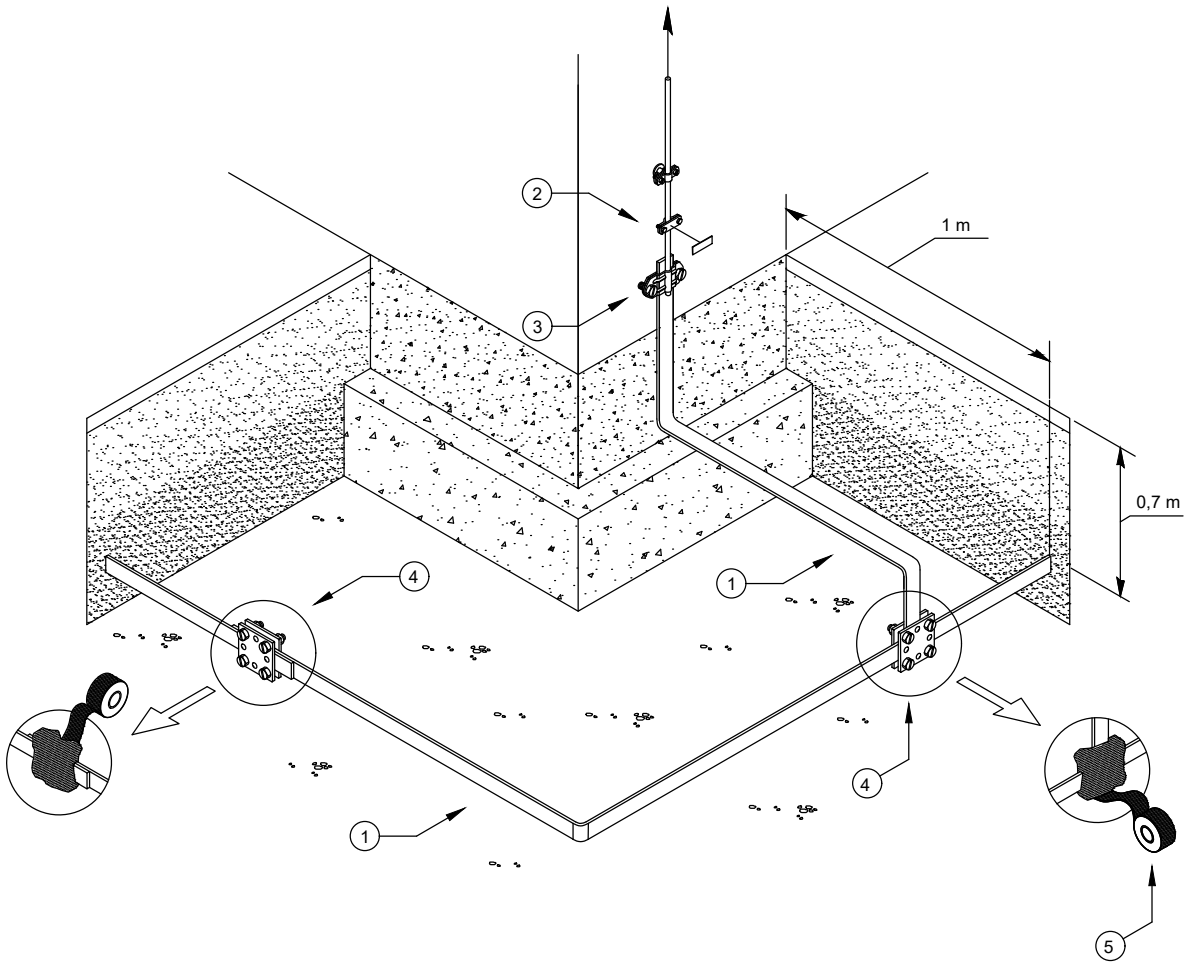
Ind.	Amendment typical		Date:	Name:		



	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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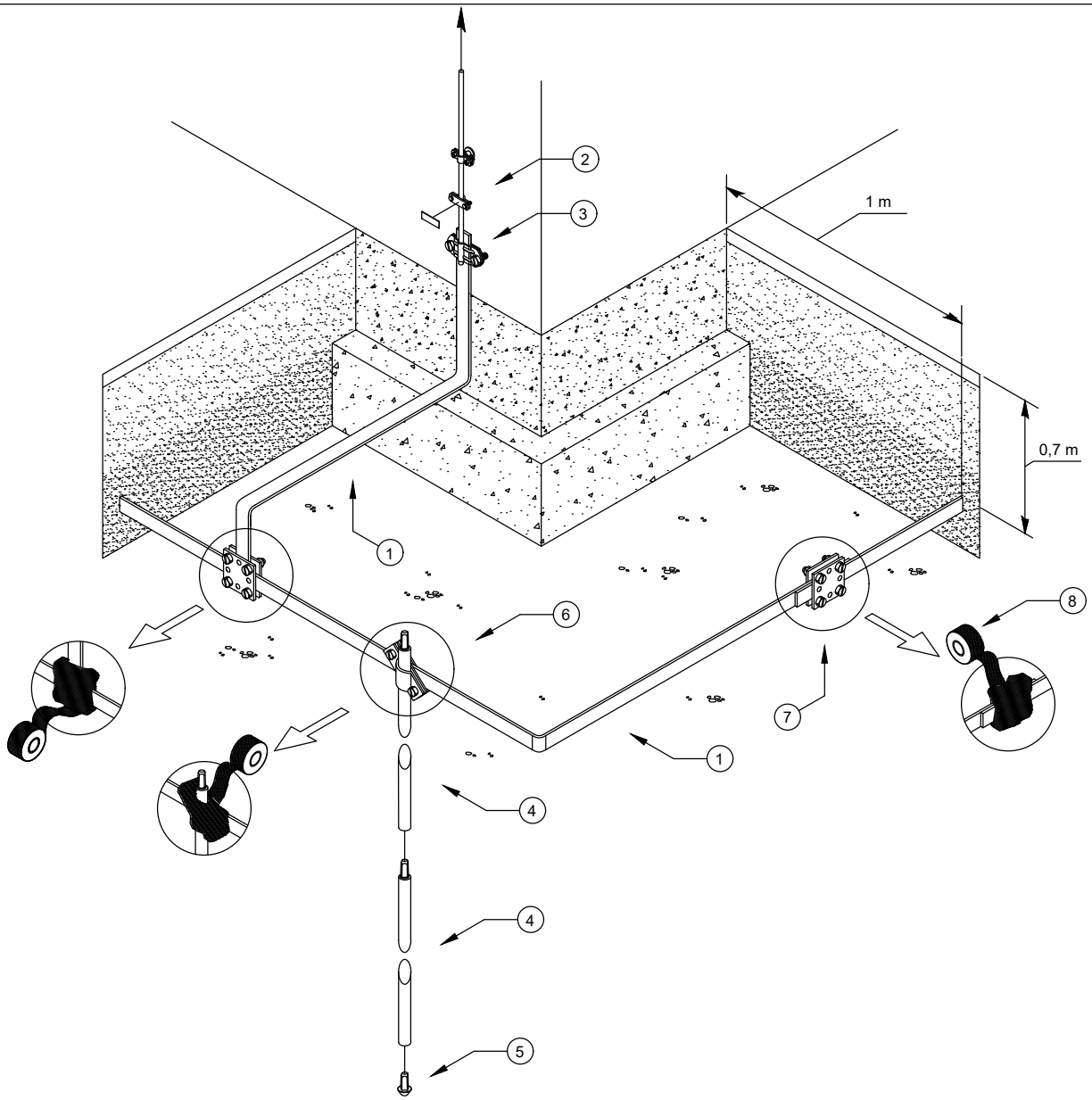
Ind.	Amendment typical		Date:	Name:		



	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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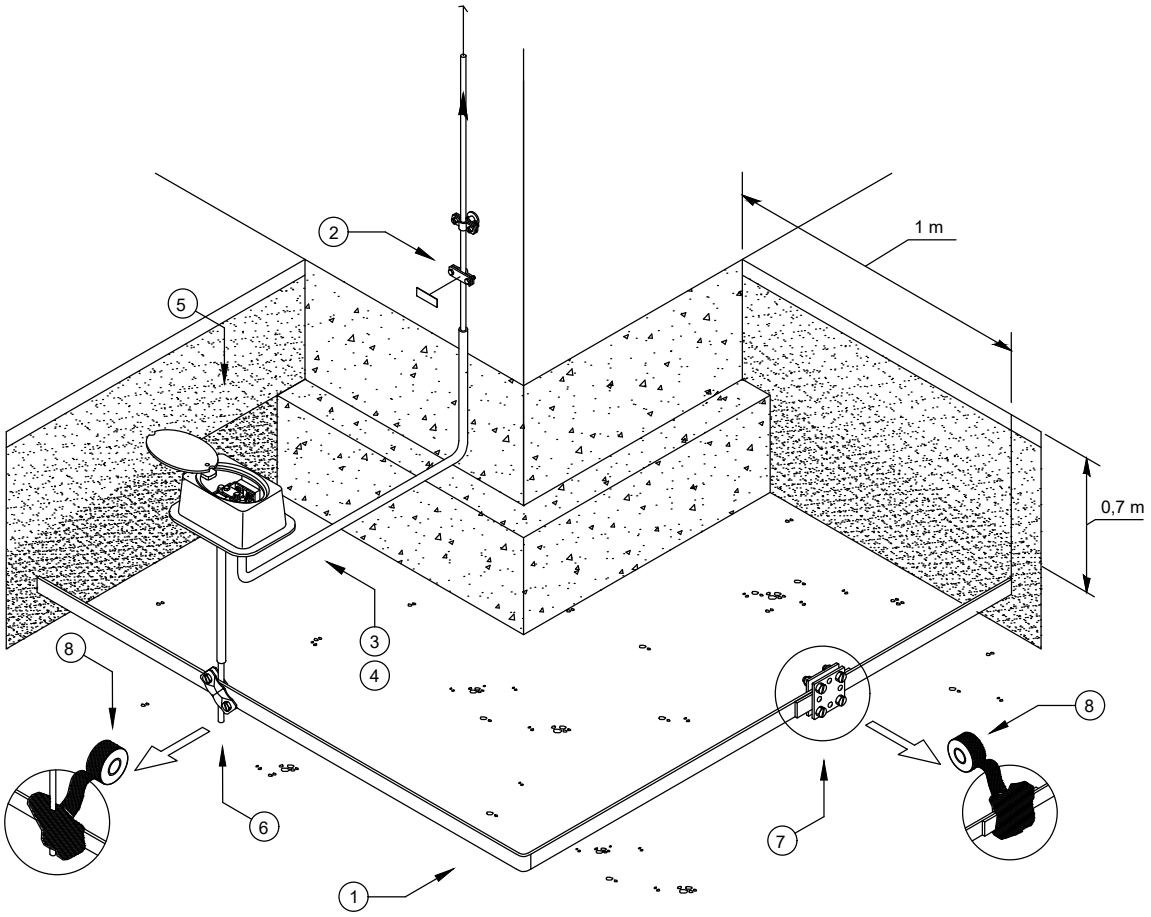
Ind.	Amendment typical	Date:	Name:			



	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.			
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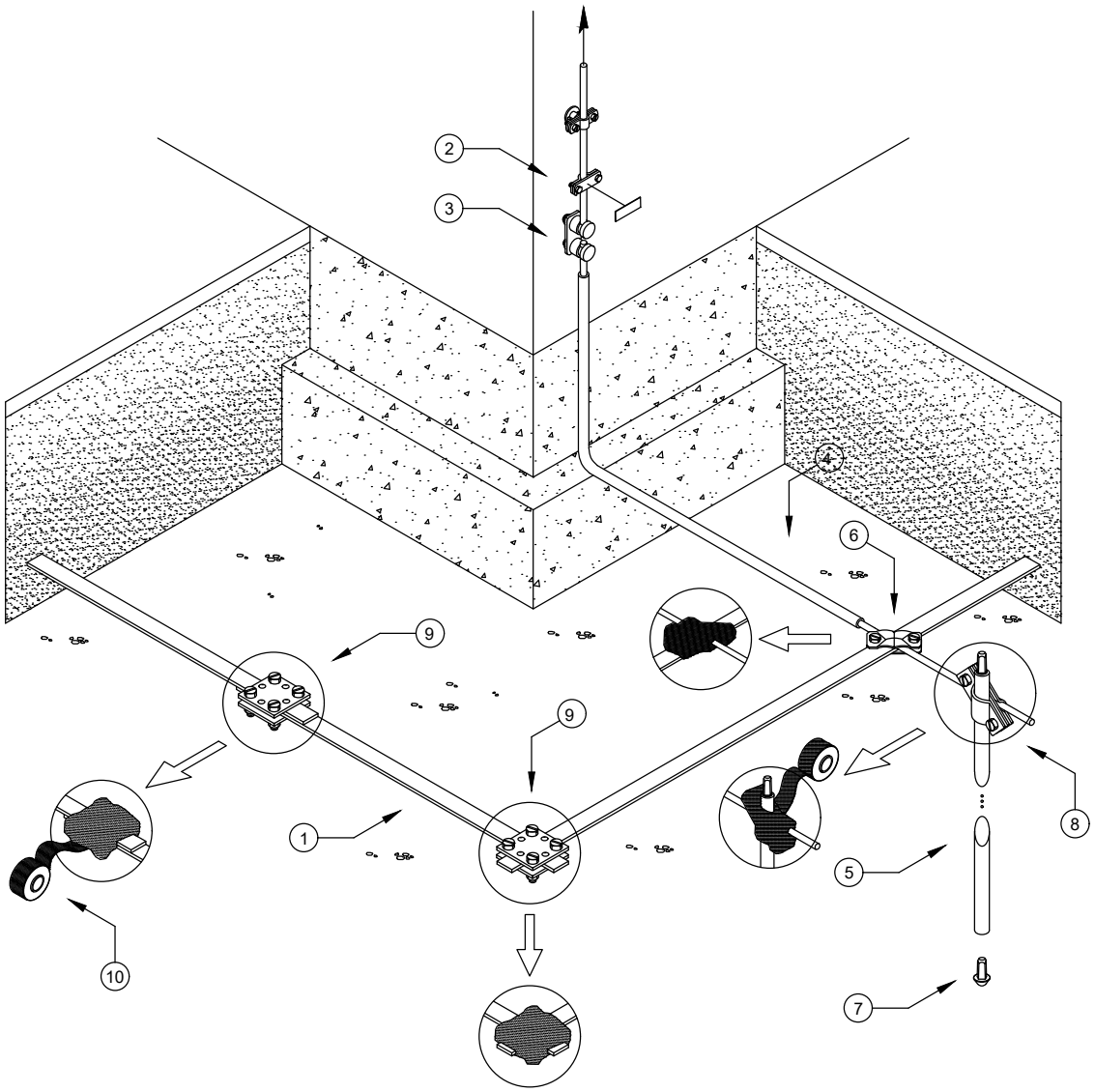
Ind.	Amendment typical		Date:	Name:		



	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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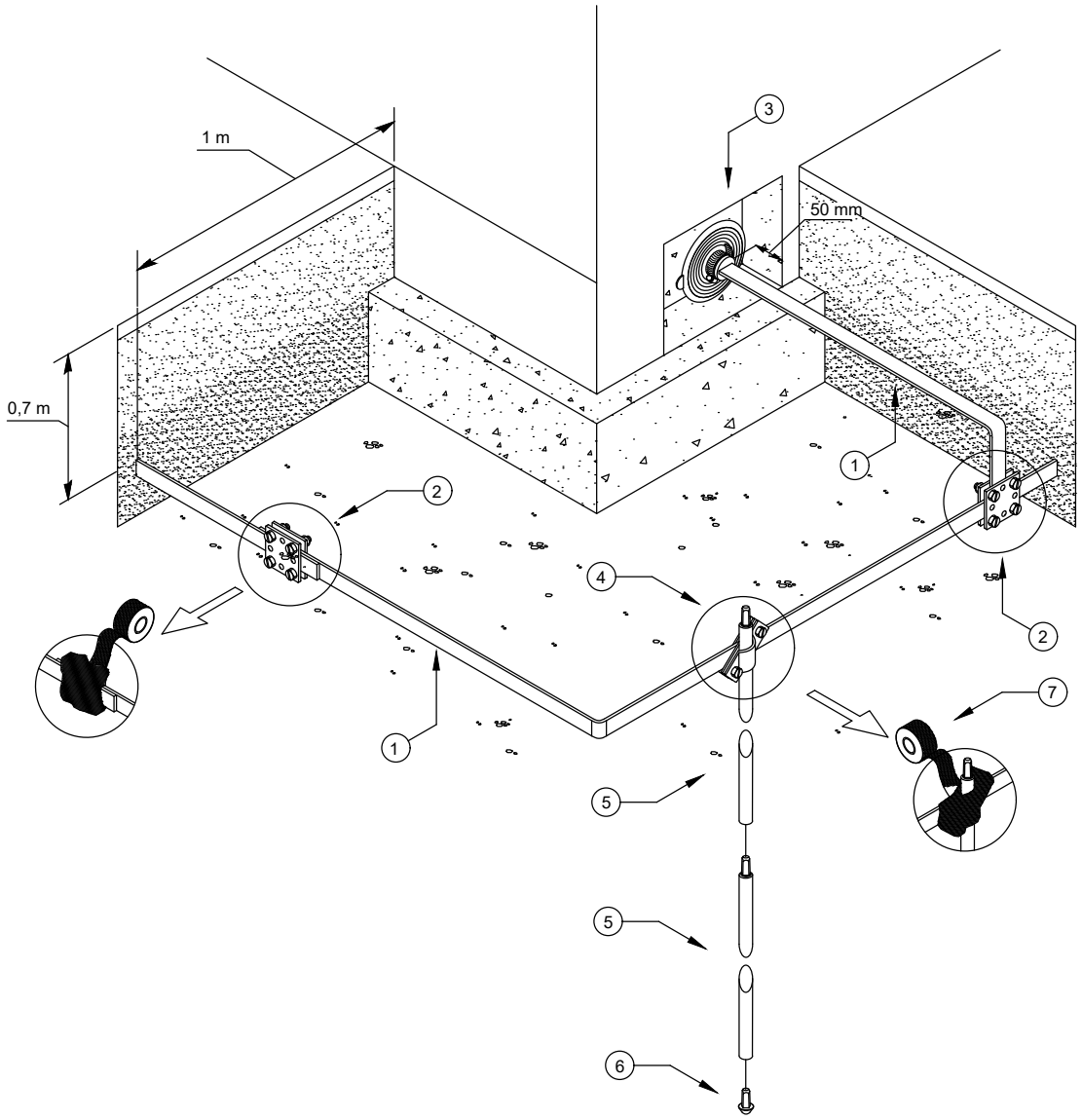
Ind.	Amendment typical	Date:	Name:			



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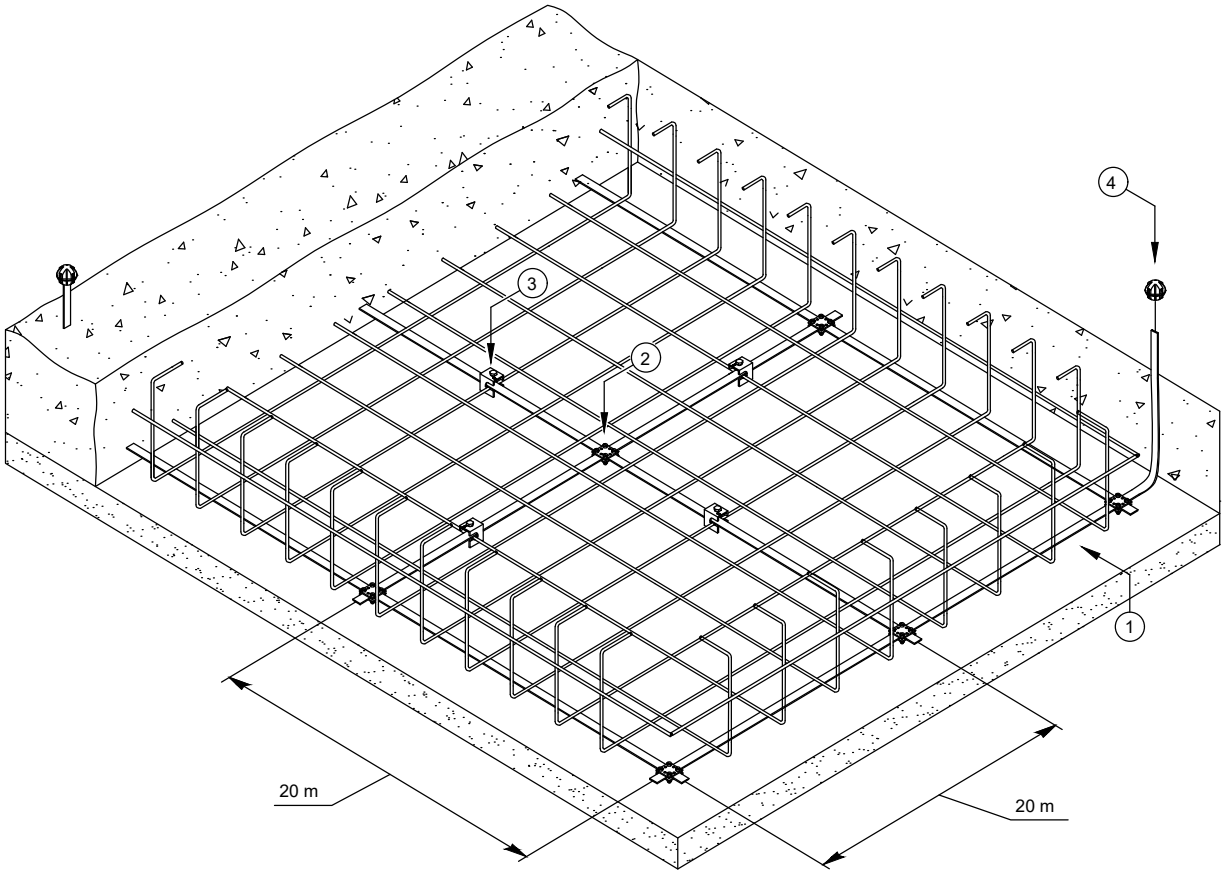
Ind.	Amendment typical		Date:	Name:		



	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:
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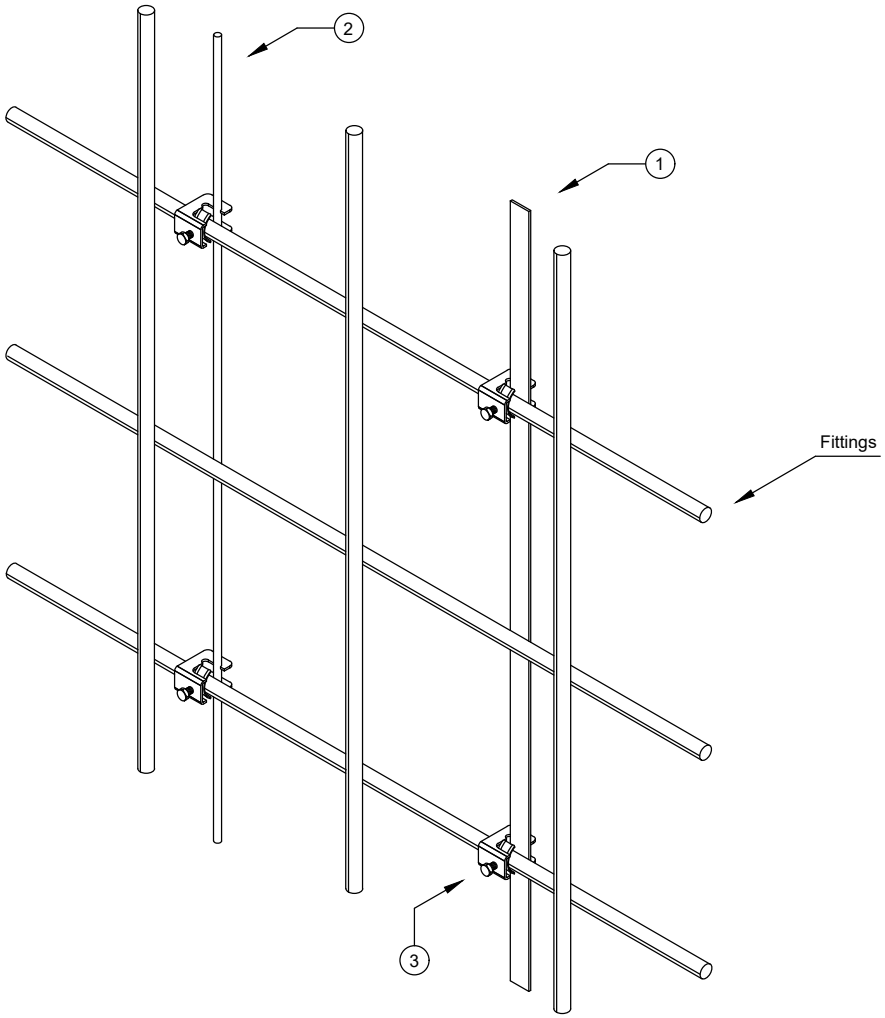

	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5021103	RD 10	Round conductor, galvanised steel	
3	5014469	1814 FT D37	Connection terminal for large reinforced steels	

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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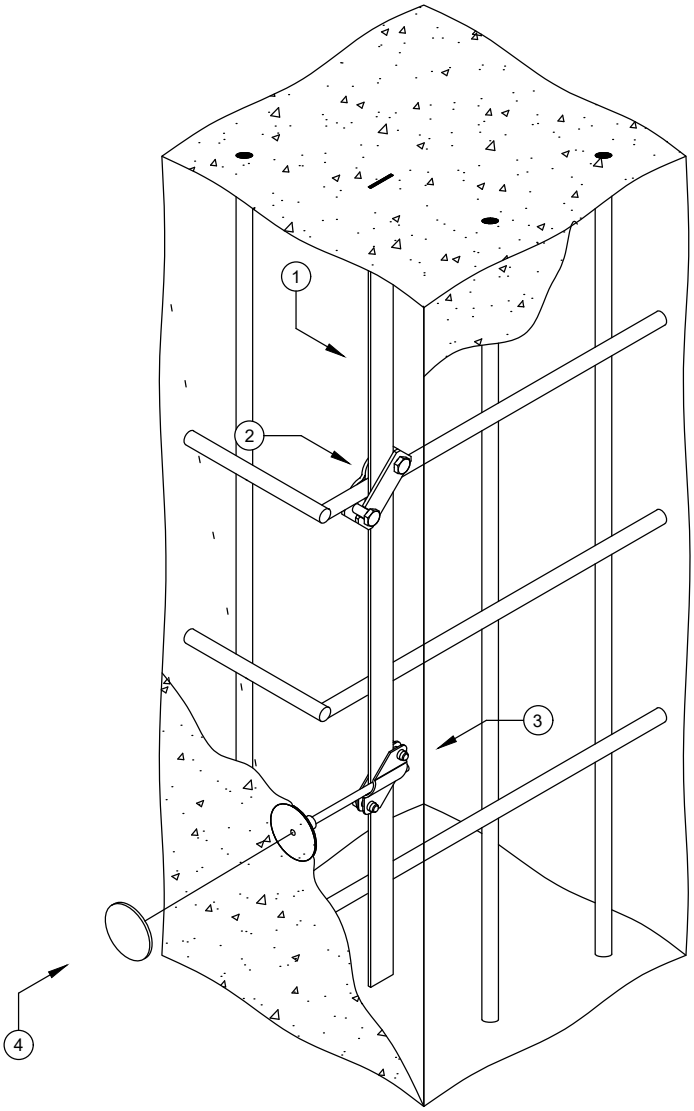
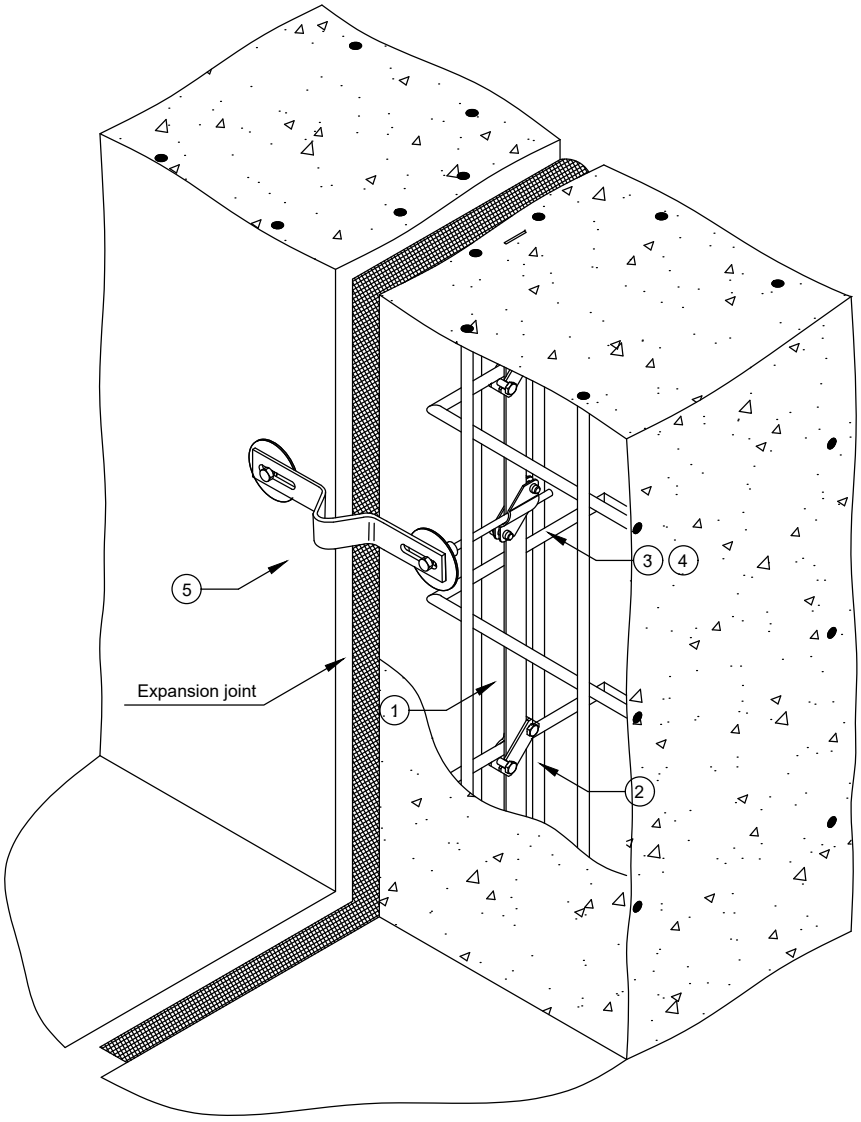
Ind.	Amendment typical		Date:	Name:		



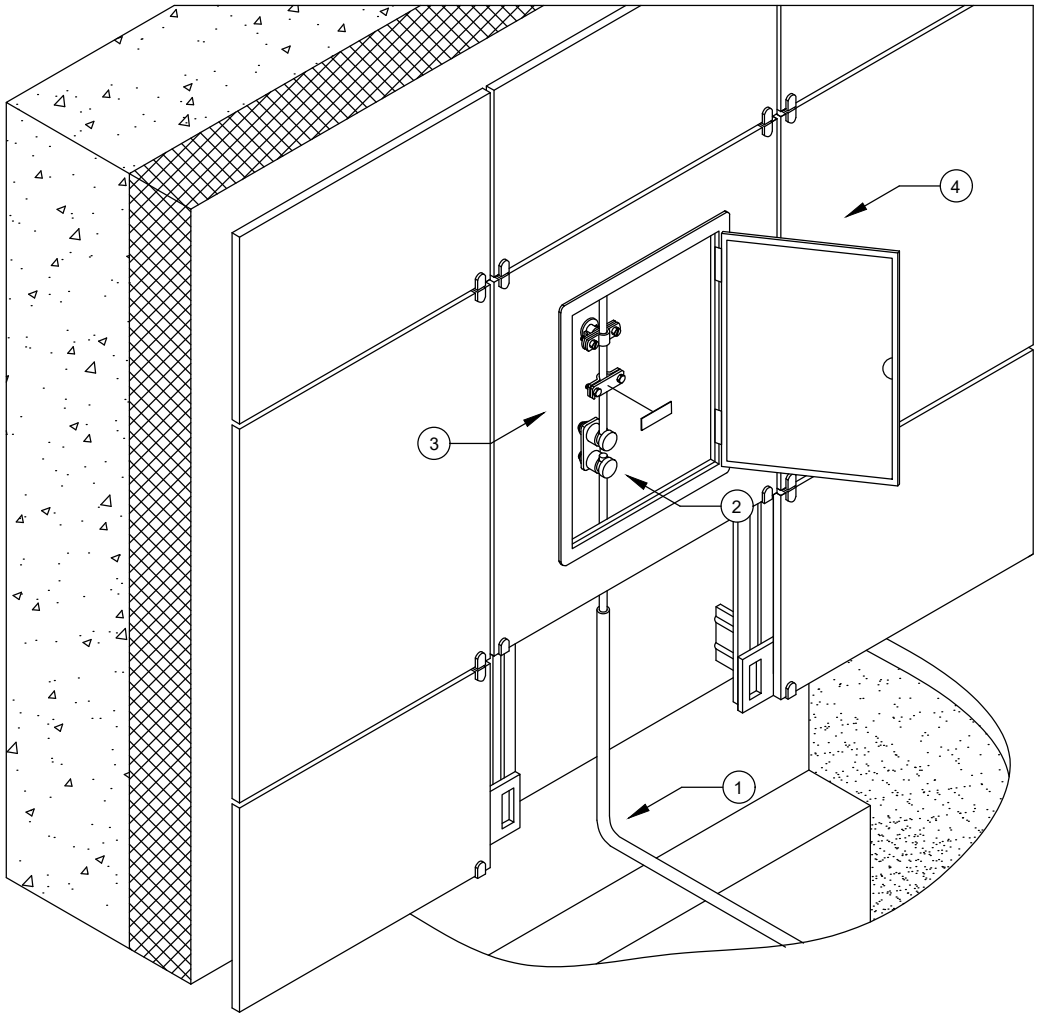
	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	5313031	250 AS-FT	Diagonal clamp for flat conductors and round conductors	
3	5312925	250 V4A	Cross-connector for flat conductors and round conductors	
4	5420022	205 DG L180 V4A	Fixed earthing point	

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.			
— — —					Scale:	Sheet size:
— — —					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.			
— — —				OBO BETTERMANN	Scale:	Sheet size:
— — —					Sheet:	of:
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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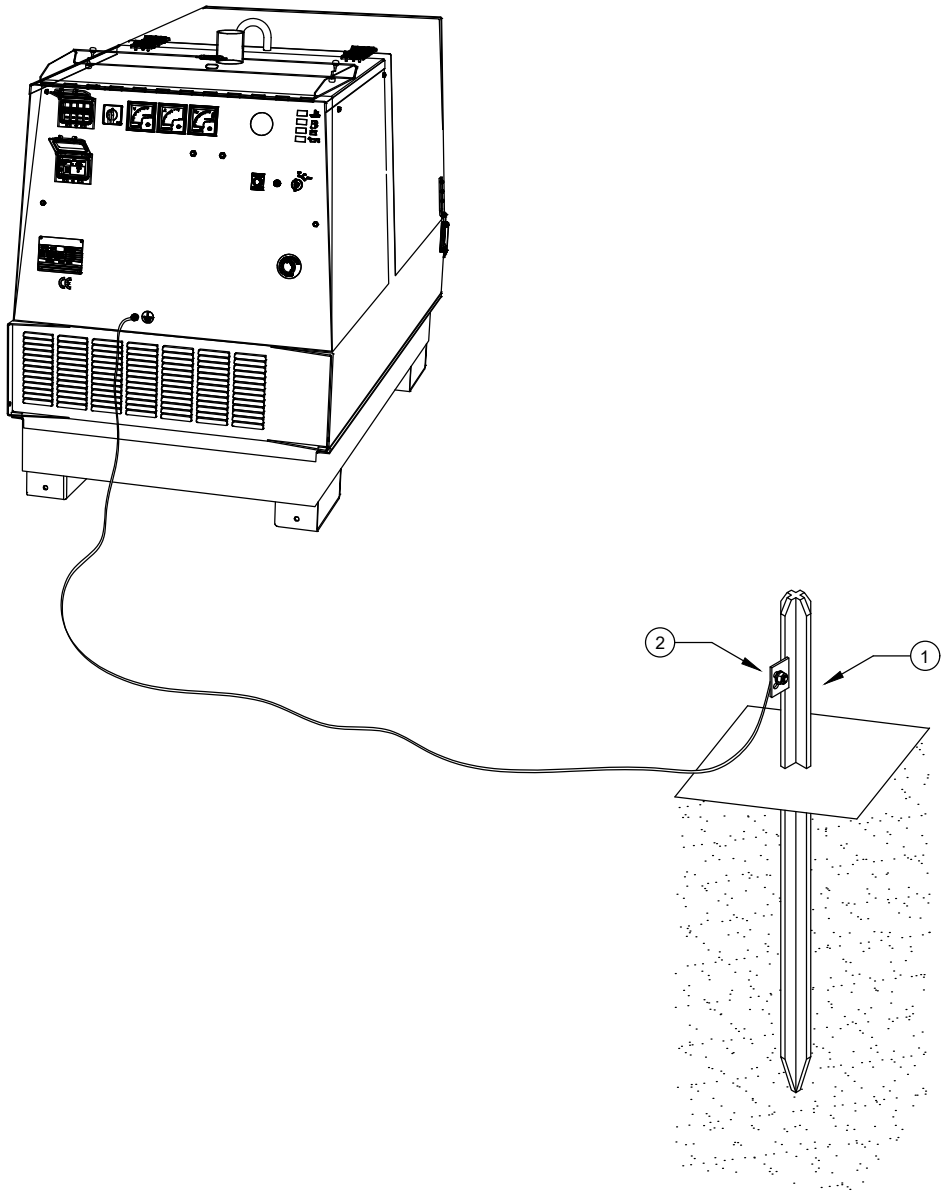
Ind.	Amendment typical	Date:	Name:			



	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.			
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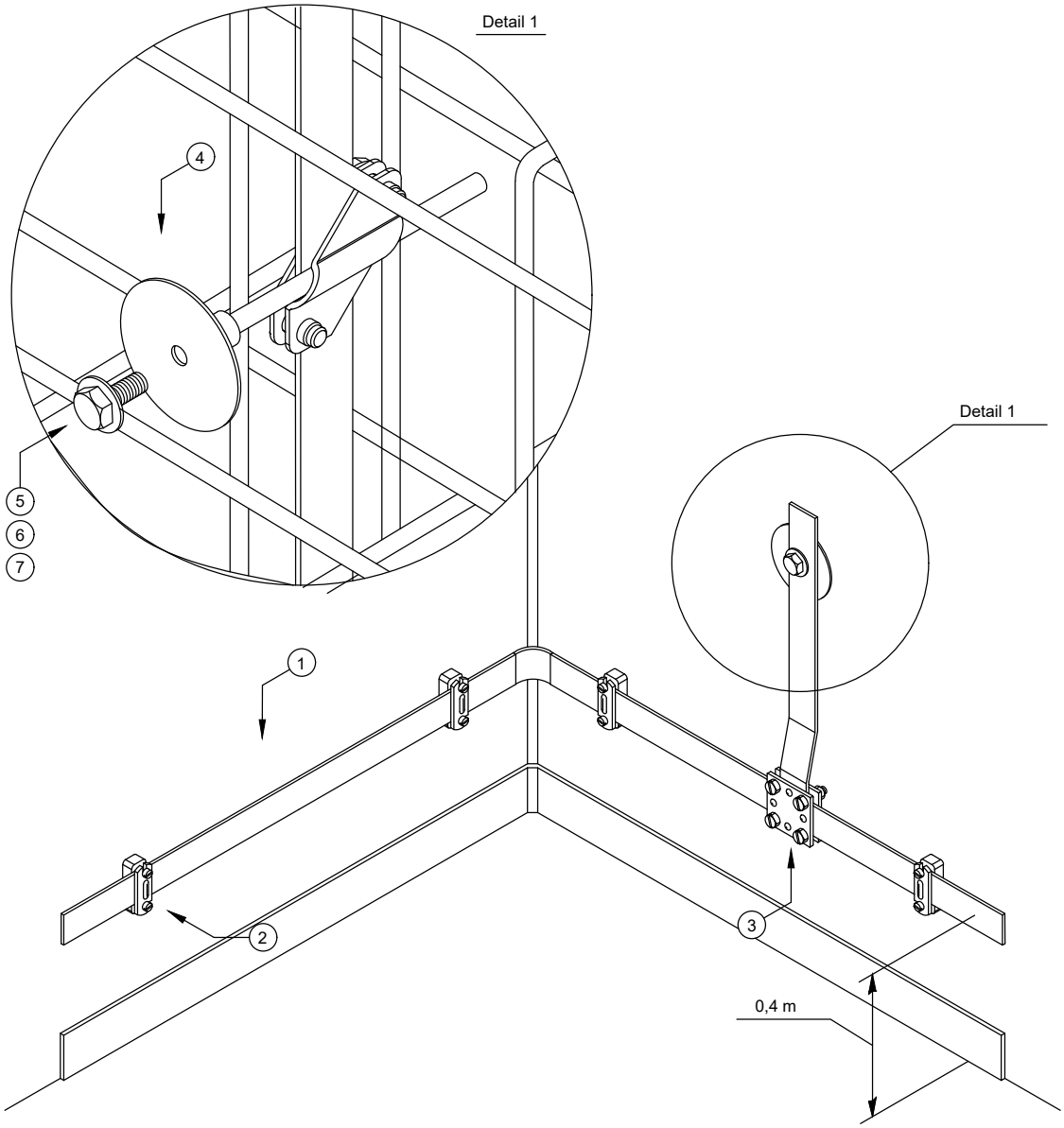
Ind.	Amendment typical	Date:	Name:			



	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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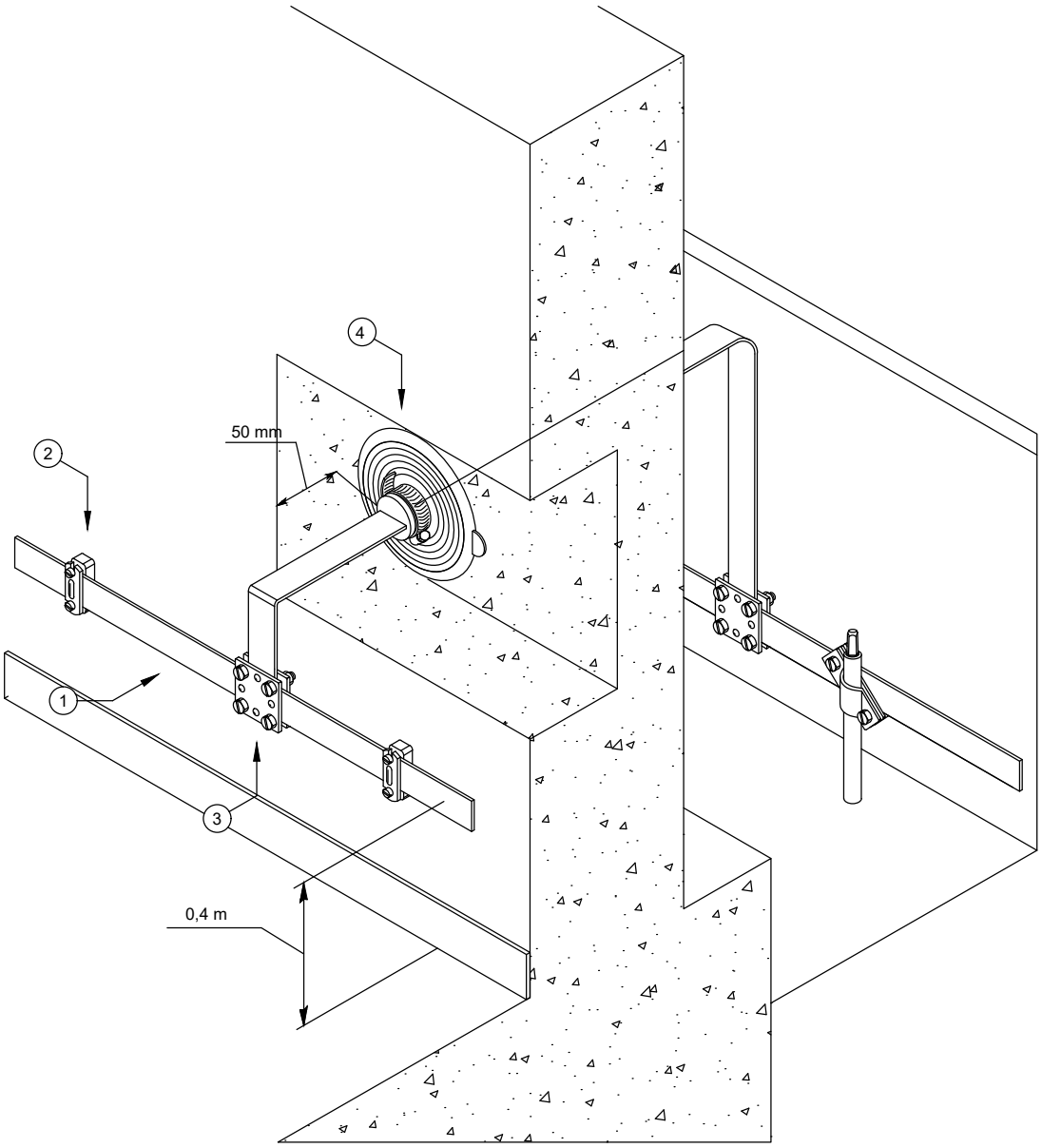
Ind.	Amendment typical		Date:	Name:		



	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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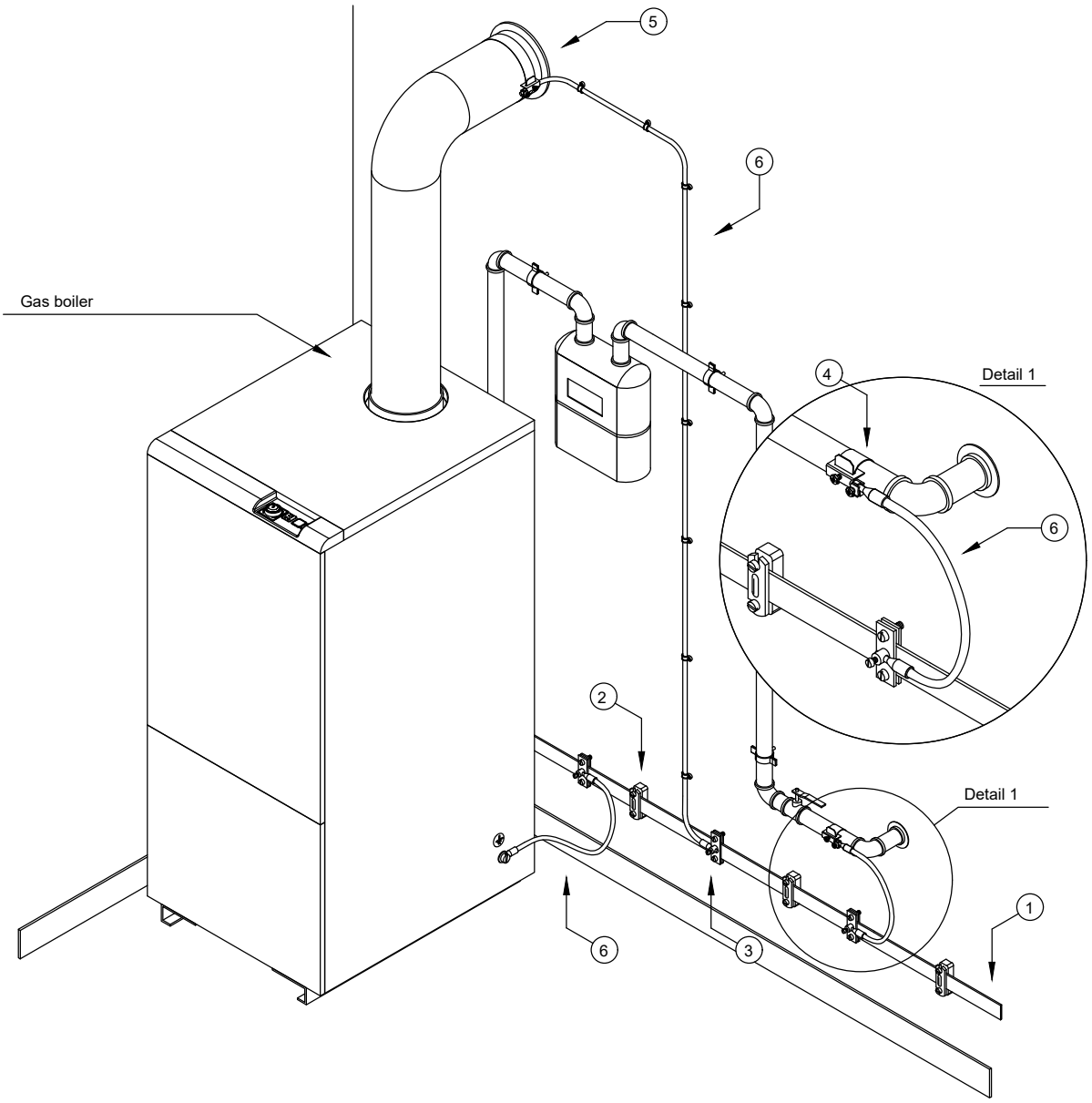
Ind.	Amendment typical	Date:	Name:			



	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:			
Creator:			Equipotential bonding system			
Editor:						
Status:			Comment: Connection of the gas boiler to the equipotential bonding bus.			

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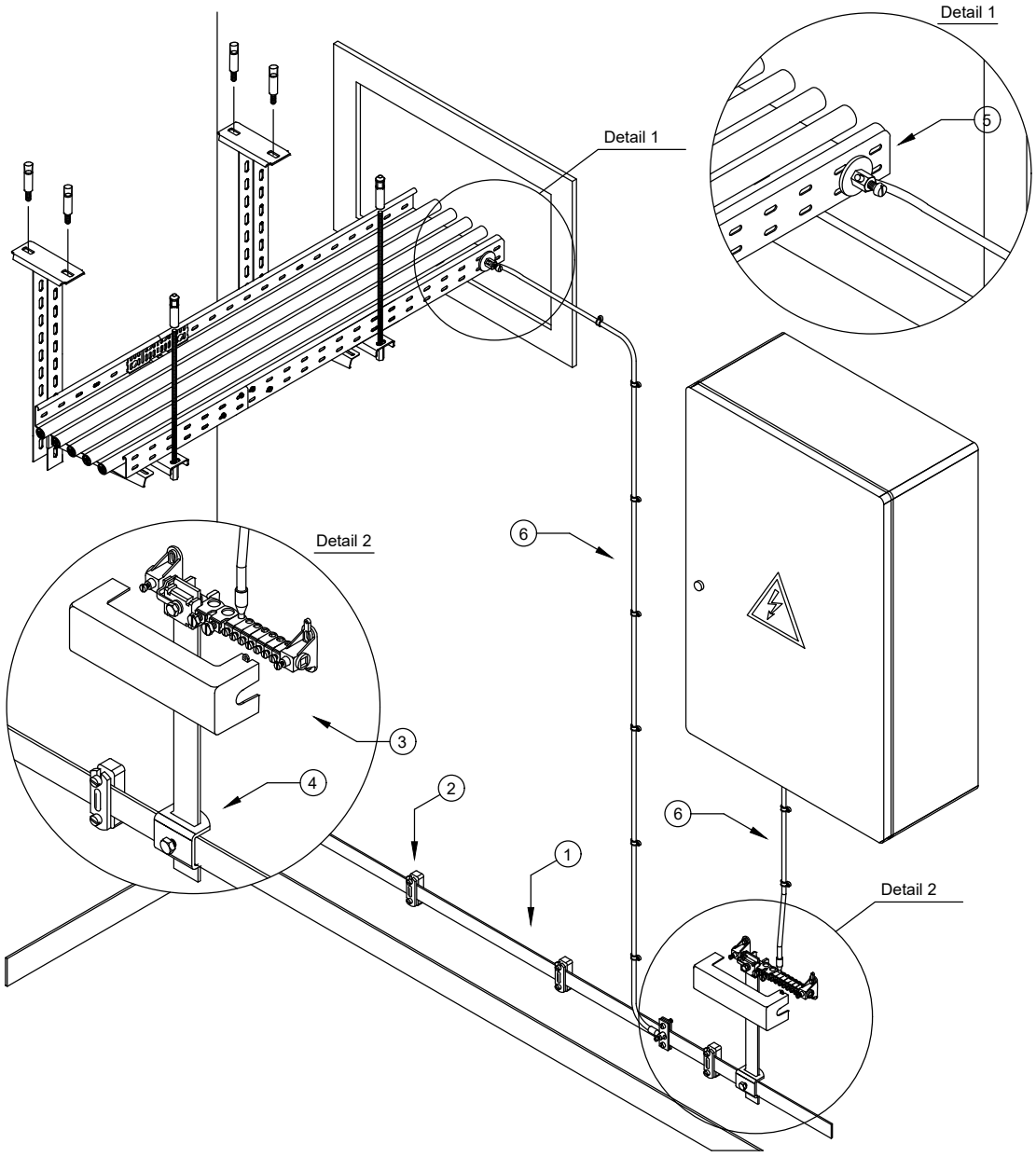
	— — —				Sheet:	of:
Ind.	Amendment typical	Date:	Name:			



	Item No.	Designation	Description	Q-ty
1	5019347	5052 DIN 30x3,5	Flat conductor, galvanised steel	
2	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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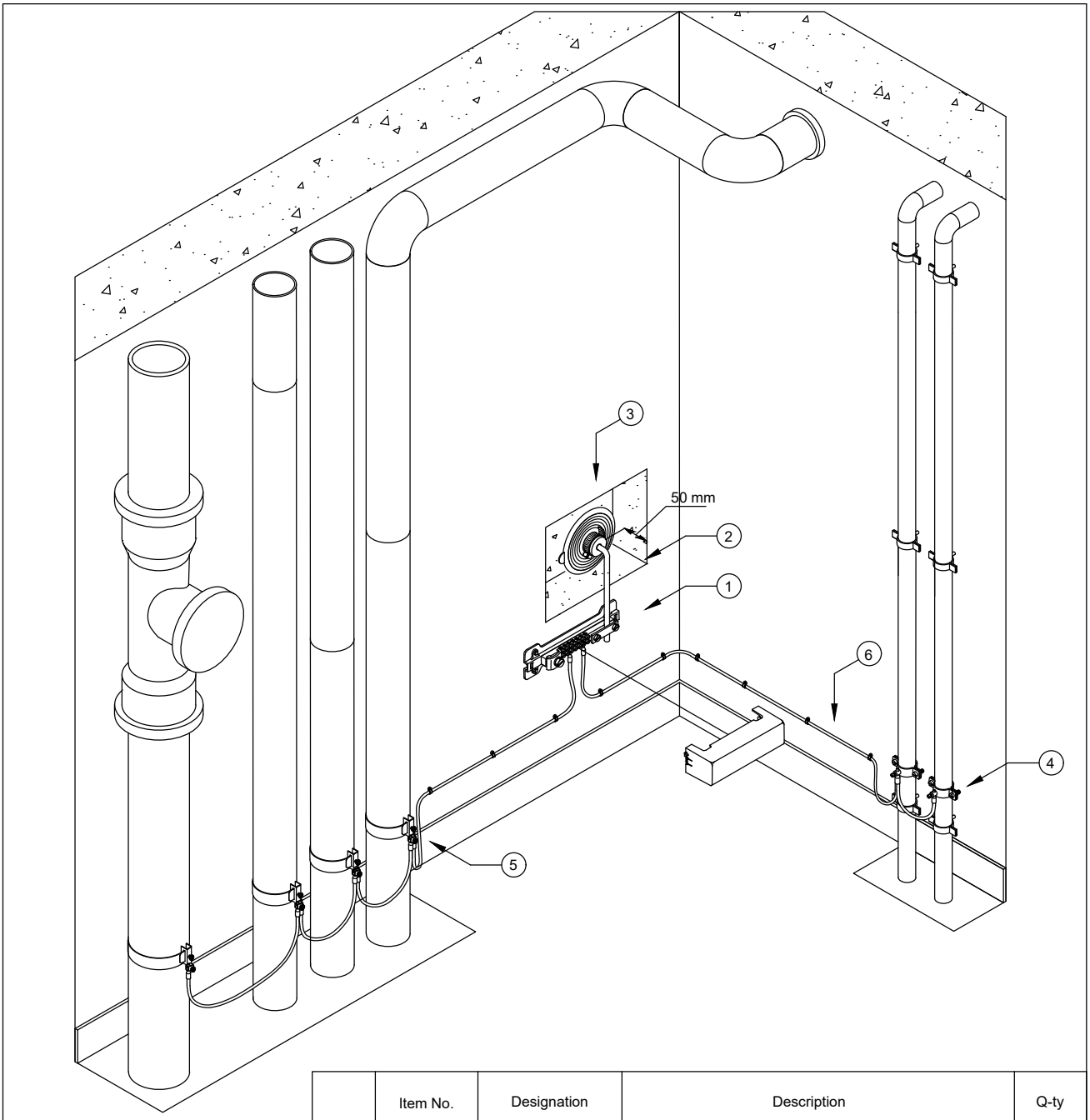
	— — —				Sheet:	of:
Ind.	Amendment typical	Date:	Name:			



	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.			
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Ind.	Amendment typical	Date:	Name:			

Notes

Notes

Notes

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Building Connections

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