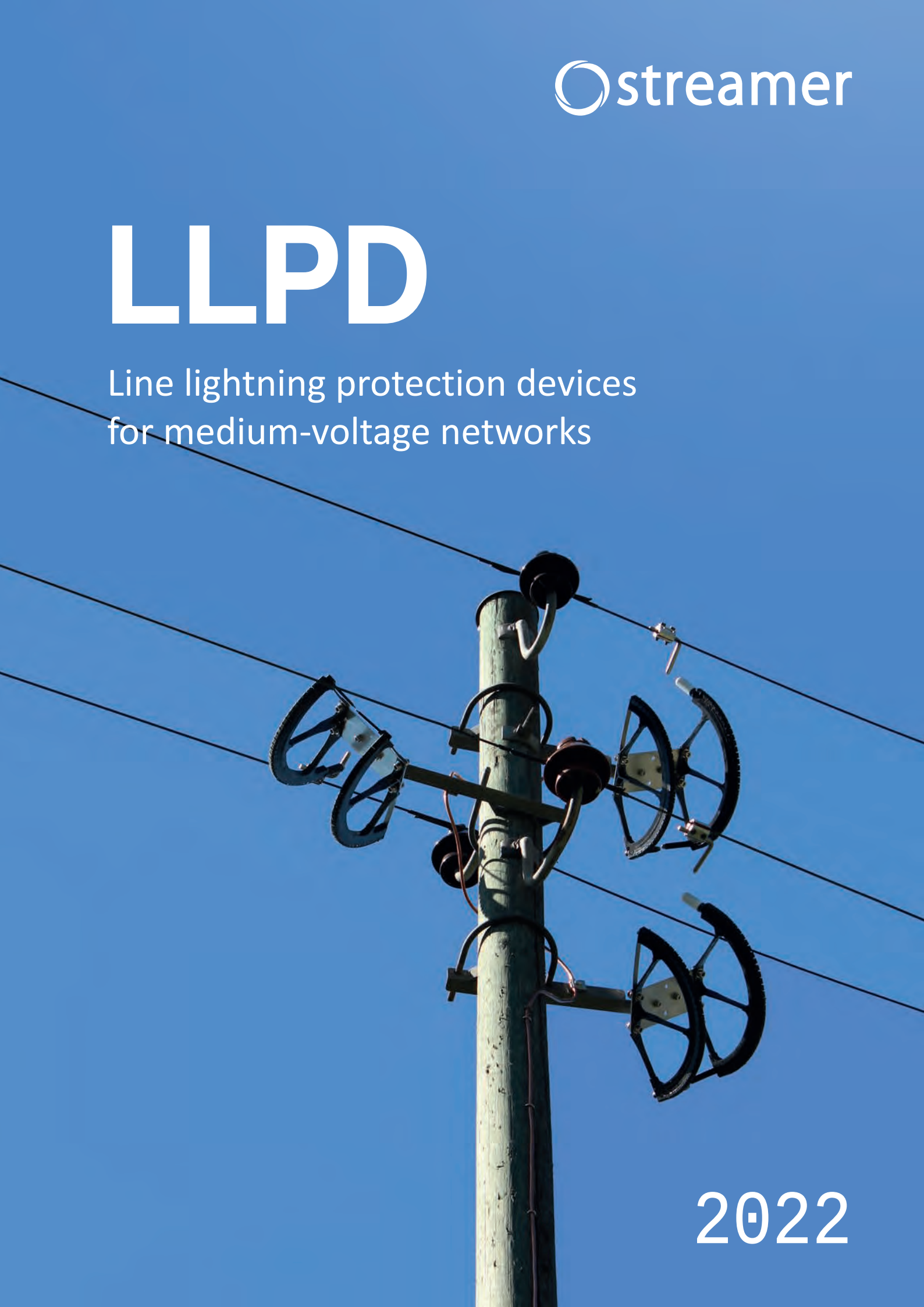
streamer

LLPD

Line lightning protection devices for medium-voltage networks



2022

Table of Contents

INTRODUCTION

PRODUCTS

ACCESSORIES

LLPD SERVICES

Glossary

BIL — Basic Insulation Level

BFO — Back Flashover
A flashover of phase-to-earth insulation resulting from a lightning strike to that part of the system which is normally at earth potential

CFO — Critical Flashover Voltage
The voltage amplitude of a given waveshape that, under specified conditions, causes flashover through the surrounding medium on 50% of the voltage applications

DLS — Direct Lightning Strike
Lightning striking a component of the network such as the conductor, tower or substation equipment

FTR — Footing Resistance
The resistance offered by the metal parts of a tower and the ground resistance

IEC — International Electrotechnical Commission
The world's leading organization that prepares and publishes international standards for all electrical, electronic and related technologies

IOV — Induced Overvoltage
An overvoltage in the network that is induced by a lightning strike that does not strike directly at any part of the network

LLPD — Line Lightning Protection Device

MOA/SA/TLA — Metal-Oxide Arrester
A surge arrester utilizing varistor elements fabricated from nonlinear resistance metal-oxide materials

MPFC — Maximum Prospective Fault Current
The highest electric current which can exist in a particular electrical system under short-circuit conditions without any protective or current-limiting devices. It is determined by power, voltage and impedance of the supply system

PMT — Pole-Mounted Transformer
A distribution transformer that provides the final voltage transformation in the electric power distribution system, stepping down the voltage used in the distribution lines to the level used by the customer, and is located on the pole of an overhead line

UV — Ultraviolet

Icon legends:

IOV

DLS

BFO

Streamer Electric AG

A Swiss company based in Chur

About us:

Founded in 1996

Cooperation with 5 universities & R&D centers; 7 offices 90 distributors in 30+ countries

200+ employees of 9 nationalities in 7 different countries

In 2012 the HQ was moved to Switzerland, Chur

25+ years of experience

2'000'000+ LLPDs installed

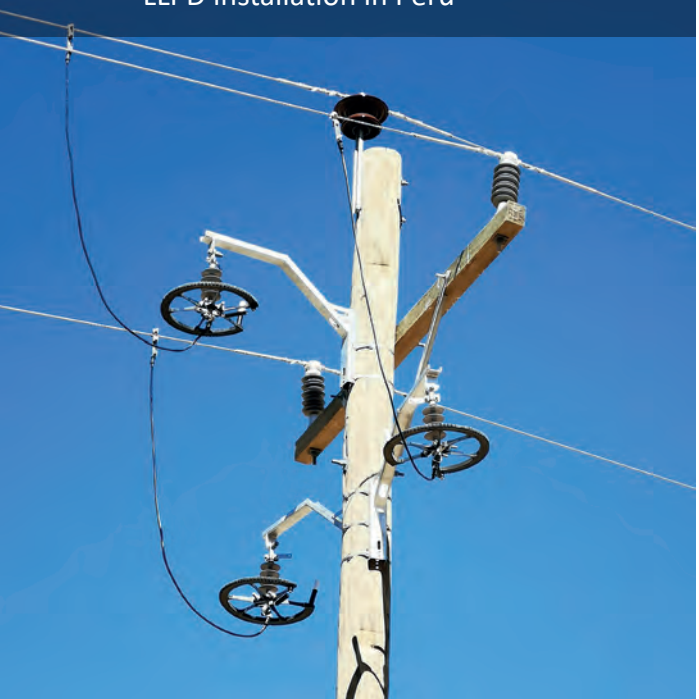
30+ countries of presence

126 registered patents

Streamer team on Piz Grevasalvas summit (Switzerland)

LLPD testing

LLPD installation in Peru



LLPD installation in Switzerland

Product Range

LLPD

Lightning protection up to 69 kV

A unique lightning protection solution for overhead lines: Line Lightning Protection Devices (LLPDs) with EasyQuench (EQ) technology have been invented and patented by Streamer. More than 2 million LLPDs have been installed worldwide (Russia, China, Indonesia, Malaysia, Brazil, UAE, Iran, Vietnam, Switzerland, Germany and elsewhere).

TRANSEC

Moisture monitoring and extraction for power transformers

Moisture is one of the primary causes of failures for power transformers and one of the main degradation factors for insulation paper. Therefore, it increases the risks of operation failures and shortens the life expectancy of the asset.

After several year of service operations, moisture can appear in a transformer from several sources which are external or internal and it has a complex dynamic between the oil and paper within the transformer. Also it is difficult to evaluate the moisture situation of a transformer without thorough monitoring.

TRANSEC offers an efficient solution for both moisture monitoring and extraction which is online and does not require any operator.

FIPRES

Electrical Fire Prevention & Overheating Control system

FIPRES detects abnormal overheating of electrical equipment, thus avoiding material damage from fire, loss of profit and life threat to life.

In a nutshell, the system consists of thermolabels (rFPT), a special gas sensor (FPA), and a concentrator unit (FPC).

rFPT is a sticker made of composite material with encapsulated gas inside. These stickers are glued at the contact connections (CB inputs/outputs, bus-bars, cable terminations, etc.). Since the contact is heated up to the activation temperature of the sticker, rFPT releases a safe and non-toxic signal gas. This gas is detected by FPA, which in turn sends an ALARM signal to maintenance personnel through Modbus, dry contact relay, or via SMS in case of use with FPC.

FIPRES offers a new and unique solution at an affordable price that takes utility and industrial companies to a new level of safety and maintenance efficiency.

Type Tests

Products are tested in the leading and most recognized high voltage laboratories worldwide:

CESI (Italy)

STRI (Sweden)

CPRI (India)

CEPRI (China)

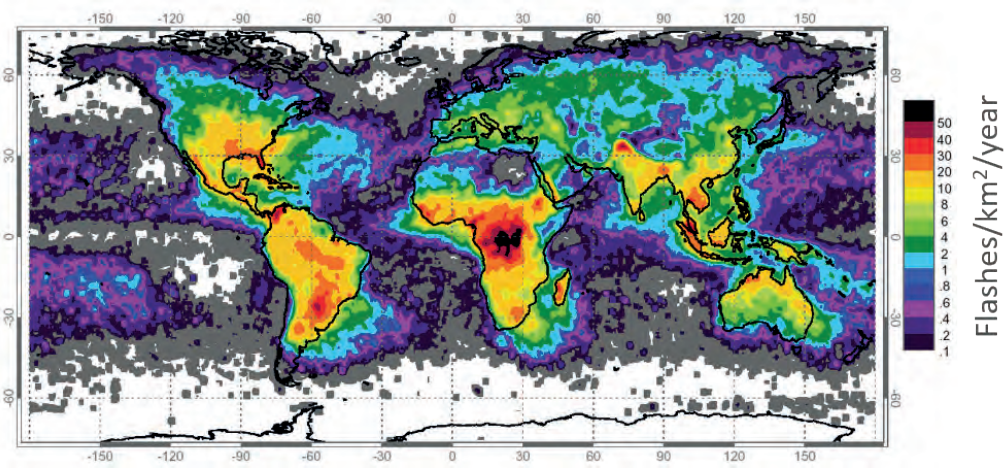
Customer list

Perusahaan Listrik Negara (Indonesia)
VietNam Electricity (Vietnam)
Tenaga Nasional Berhad (Malaysia)
Dagupan Electric (Philippines)
China Railway First Group co (China)
China Southern Power Grid (China)
State Grid Corporation of China (China)
GAZPROM (Russia)
LUKOIL (Russia)
PJSC ROSSETI (Russia)
Celesc (Brazil)
CPFL Energia (Brazil)
Rio Grande Energia (Brazil)
EPM (Colombia)
Mineros (Colombia)
Electrosur (Peru)
JPSCo (Jamaica)
Botswana Power Corporation (Botswana)
AngloAmerican (South Africa)
Saudi Aramco (Saudi Arabia)
BKW (Switzerland)
Groupe E (Switzerland)
Repower (Switzerland)
LAPP Insulators (Germany)
Westnetz (Germany)
Electronet (New Zealand)
Covanta (USA)
EOLO (Nicaragua)
EOLO (Costa Rica)
ERCO (Chile)
EERSA (Ecuador)
EEQ (Ecuador)
CNEL (Ecuador)
Salto Grande (Argentina)
Albanesi (Argentina)
Vasile (Argentina)
NGCP (Philippines)
EDL (Laos)
VALE (Indonesia)
Pertamina (Indonesia)
Medco Energy (Indonesia)
Seriti (South Africa)
ENEL (Italy)
HEP (Croatia)

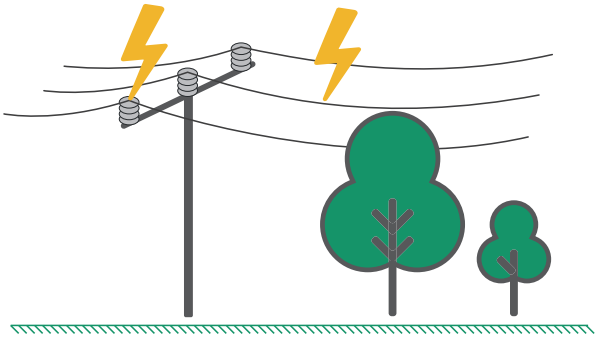
Lightning

and its interaction with overhead lines

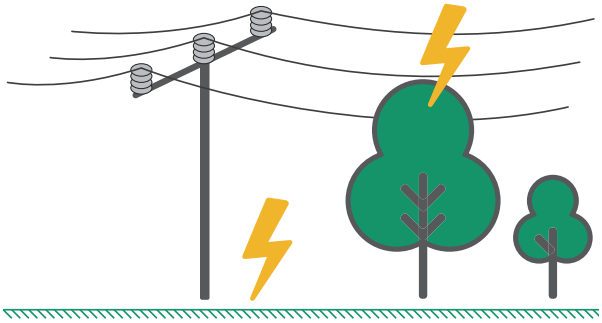
Lightning is a very common natural phenomenon. About 6 lightning strikes hit the Earth's surface each second. Below is a map of the ground flash density developed by NASA. You can estimate the situation in your region: if ground flash density (GFD) is greater than 10, then you should not ignore it.



Lightning overvoltage origins on overhead lines



Direct Lightning Strike (DLS)



Induced Overvoltage (IOV)

Strike location:

- Poles/towers
- Phase conductors
- Overhead shielding wire

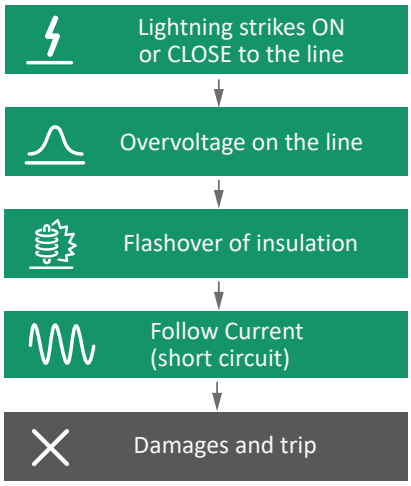
- Trees
- Buildings
- Telecom towers
- Adjacent overhead lines

Parameters:

- Average voltage 6 MV
- Average current 30 kA

- Voltage up to 300 kV

Issues caused by lightning on overhead lines



Direct strike creates a lightning impulse splitting and propagating along the line making insulators flashover on its way.

Indirect strike generates induced overvoltages up to 300kV on a power line due to electromagnetic effect.

After insulators flashover, the current powered by a transformer at the nearest substation deviates from the normal circuit: fault current establishes along the insulators affected by lightning overvoltage.

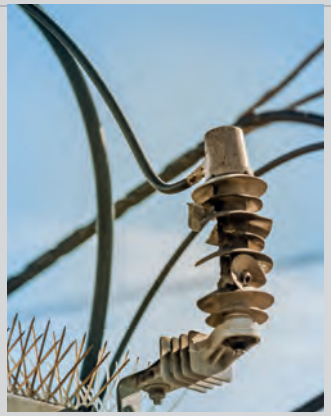
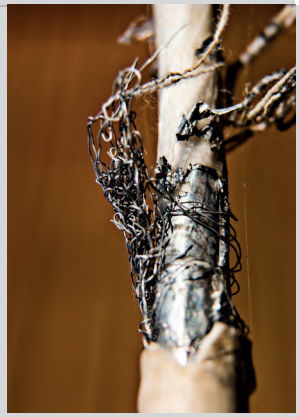
Possible consequences

of follow current

- Failure of the transformer by mechanical stress and temperature rise
- Outages and trips
- Conductor breakage (in particular covered conductors)
- Insulator breakage

of lightning overvoltage propagation

- Metal Oxide Arrester breakage
- Failure of the transformer due to insulation failure

EasyQuench

A unique & efficient technology for Line Lightning Protection

EasyQuench is a unique technology, developed and being improved since 1996 by Streamer. Products featuring the **EasyQuench** technology protect overhead lines against direct and indirect lightning strikes, thus helping to prevent breakage of conductors, insulators and power outages. Due to their operating principle, line lightning protection devices (LLPDs) do not require any special grounding (e.g. a ground lead). Therefore, these devices are especially efficient in areas with high soil resistivity.

The Operating principle of LLPDs with the **EasyQuench system** is based on the following concepts:

1. Insulation coordination. Coordination of lightning protection devices with line insulation is necessary to ensure proper operation and is achieved by adjusting BIL (CFO) of LLPD so that it is lower than those of the protected insulator. By fulfilling this requirement, it can be guaranteed that in case of a direct or an indirect lightning strike, the LLPD will operate correctly and prevent flashovers of the protected insulator.

2. Follow current interruption. Since all power lines are connected to transformers, when there's a flashover of LLPD somewhere on the line, a power frequency short-circuit current (or follow current) starts flowing immediately through it. Thanks to the EasyQuench system, LLPD can interrupt the fault current within one half of the period.

The EasyQuench system consists of a series of small discharge/arcing chambers, being formed by two adjacent metal electrodes placed in a silicone rubber body. Electrodes are separated from each other with tiny air gaps, that break down as soon as the LLPD is subjected to lightning overvoltage.

When a follow current starts flowing through the EasyQuench system, it immediately gets split into a series of small power arcs located inside the device. Each of the miniature arcs is then quenched individually.

When power frequency follow current crosses zero, it is eliminated. The line then immediately gets back to normal operation, therefore no short circuit will be sensed by protection relays and there will be no outage or power supply interruption.

Diagram of discharge initiation:

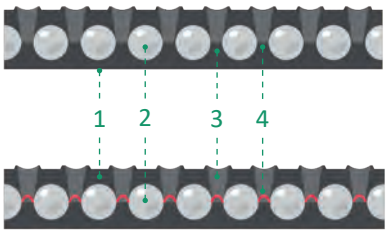


Diagram of discharge completion:

1. Silicone rubber body
2. Intermediate electrodes
3. Arc quenching chamber
4. Arc
5. Plasma jet

EasyQuench Benefits:

- **PREVENTS** outages on the line
- **PROTECTS** overhead lines from direct lightning strike and induced overvoltage
- **NO DEDICATED GROUNDING** to be arranged
- **NO MAINTENANCE** required
- Works perfectly in areas with **HIGH SOIL RESISTIVITY**
- Works under **EXTREME CLIMATIC CONDITIONS** and **HIGH-ALTITUDE LANDSCAPE**
- Quenches follow current (short circuit current) in **LESS THAN ONE SEMIPERIOD OF INDUSTRIAL POWER FREQUENCY**
- **ONE TIME** investment
- **20 YEARS** life expectancy
- **FIX AND FORGET**

Selection Guide LLPD

Highest voltage for equipment, kV*	12		15 & 24		40,5	52	72,5
Protection from**	DLS	IOV	DLS	IOV	DLS	DLS	DLS
LLPD dC10z	+	+					
LLPD dS10z	+	+					
LLPD i20z		+		+			
LLPD dC20z			+	+			
LLPD d24z			+	+			
LLPD dM35z					+		
LLPD d45z						+	
LLPD d69z							+

Note: The above data corresponds to altitude up to 1000 metres

* According to IEC 60038

**Basic indications for use LLPD d-series:

Open areas without natural shielding

Hilly, mountainous areas

River crossings

Sections subjected to frequent lightning strikes

Areas with poor accessibility

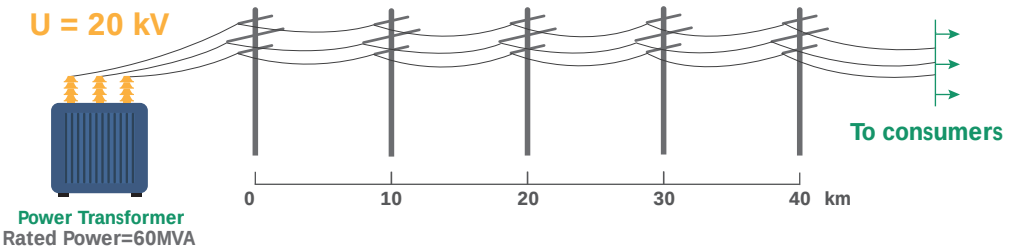
*** Basic values of maximum prospective fault current (MPFC) are:

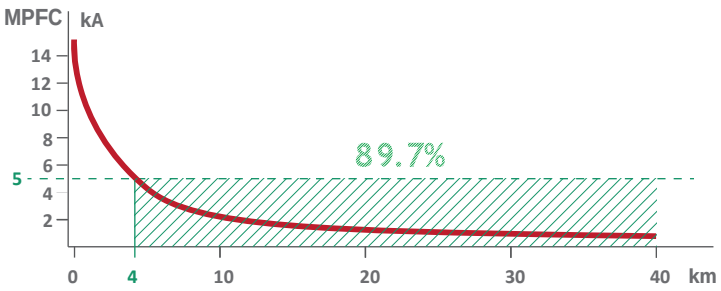
- 1.5 kA for LLPD i-series

- 5 kA for LLPD d-series

provided that the rated voltage of the LLPD matches the rated voltage of the overhead line. If MPFC is more than 5 kA, please check the information below and on page 14.

Value of MPFC depends on the distance to the power transformer which feeds the fault point. Let's consider an example:





For this standard case the prospective fault current is lower than 5 kA (max LLPD short circuit breaking capability) at 89,7% of the overhead line. It is possible to install the first LLPD 4 km away from the substation.

Installation methods

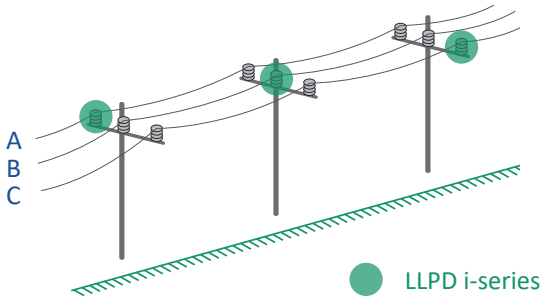
Protection against IOV

for grounded poles: steel, concrete or wooden poles with ground lead

Basic recommendations for using LLPD i-series:

Sections of an overhead line located on:

- Line is surrounded by high objects shielding it from direct lightning strikes (forest, city, over lines, etc.)
- Valley/ravine areas
- Areas subjected to frequent lightning strikes
- Areas with poor accessibility



1 piece per circuit
Phase alternation:
A-> B-> C-> A-> B-> C

Protection against IOV

for ungrounded (wooden without grounding) poles (for both bare and covered conductors)

Check page 12

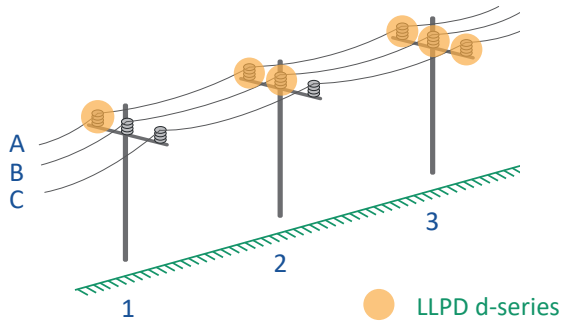
Protection against DLS and BFO

for grounded or ungrounded poles

Basic recommendations for using LLPD d-series:

Sections of an overhead line located on:

- Open areas without natural shielding
- Hilly, mountainous areas
- River crossings
- Areas subjected to frequent lightning strikes
- 3-4 poles before substation (for nominal system voltage < 35kV - considering average span of 50-70 m; considering 35 kV average span of 150-200 m)



1, 2 or 3 pcs per pole depending on:

- Ground flash density
- Terrain profile
- Shielding factor
- Line geometry
- Footing resistance
- BIL of the line
- presence of shielding wire

... and other factors*

* Streamer offers a full range of services to choose optimal configuration of LLPDs installation via our own software, check page 71 “Services”.

Installation methods for covered conductors from IOV

PIC insulation

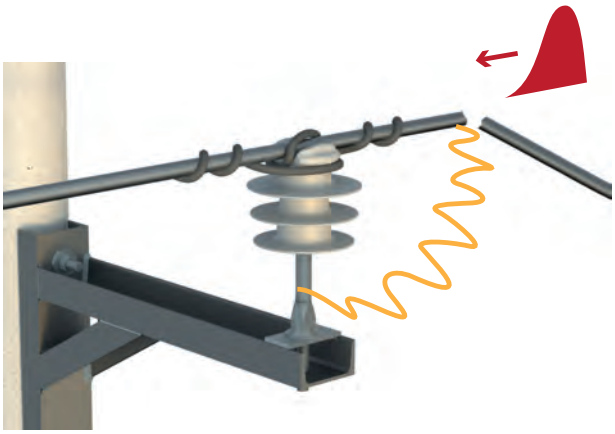
Partially Insulated Cables
Insulation: HDPE 1.5...3.5 mm

SAC insulation

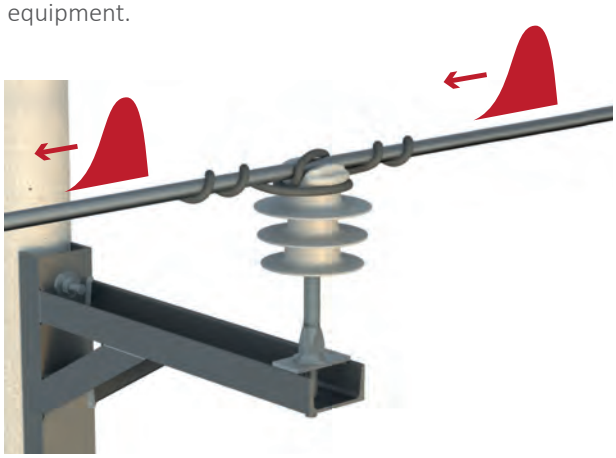
Spacer Aerial Cables
Insulation: HDPE/XLPE 5...7 mm

Process

Induced overvoltages are high enough to flashover line insulation by puncturing thin conductor insulation that leads to creation of a stable, not moving, arc, melting down cable core and thus reducing its cross-section at this location. As a result, the cable falls to the ground, causing the an overhead line outage.



Induced overvoltage might reach up to 300kV, which is rarely enough to flashover such insulation. However, overvoltages keep travelling along the line until the closest discharge point (MOA, PMT, damaged insulation). Thus all overvoltages aggregated by whole line length are applied to same points, leading to premature failures of MOAs, PMTs and other sensitive equipment.



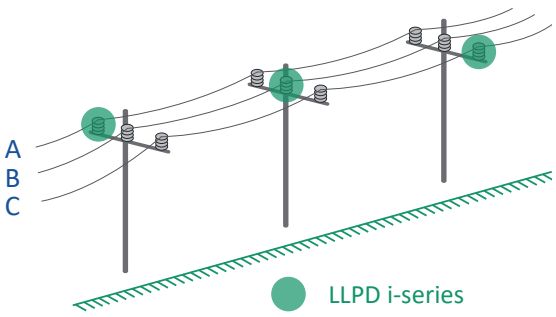
Consequences

- Outages due to short circuit
- Burnout and falling cable

- Premature failures of MOAs, PMTs and even substation equipment.

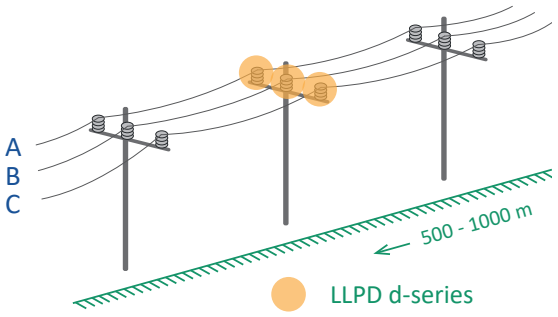
How to protect

By installation of 1x LLPD i-series per pole with phase alternation to protect each phase insulation on each pole.



1 piece per circuit
Phase alternation: A-> B-> C-> A-> B-> C

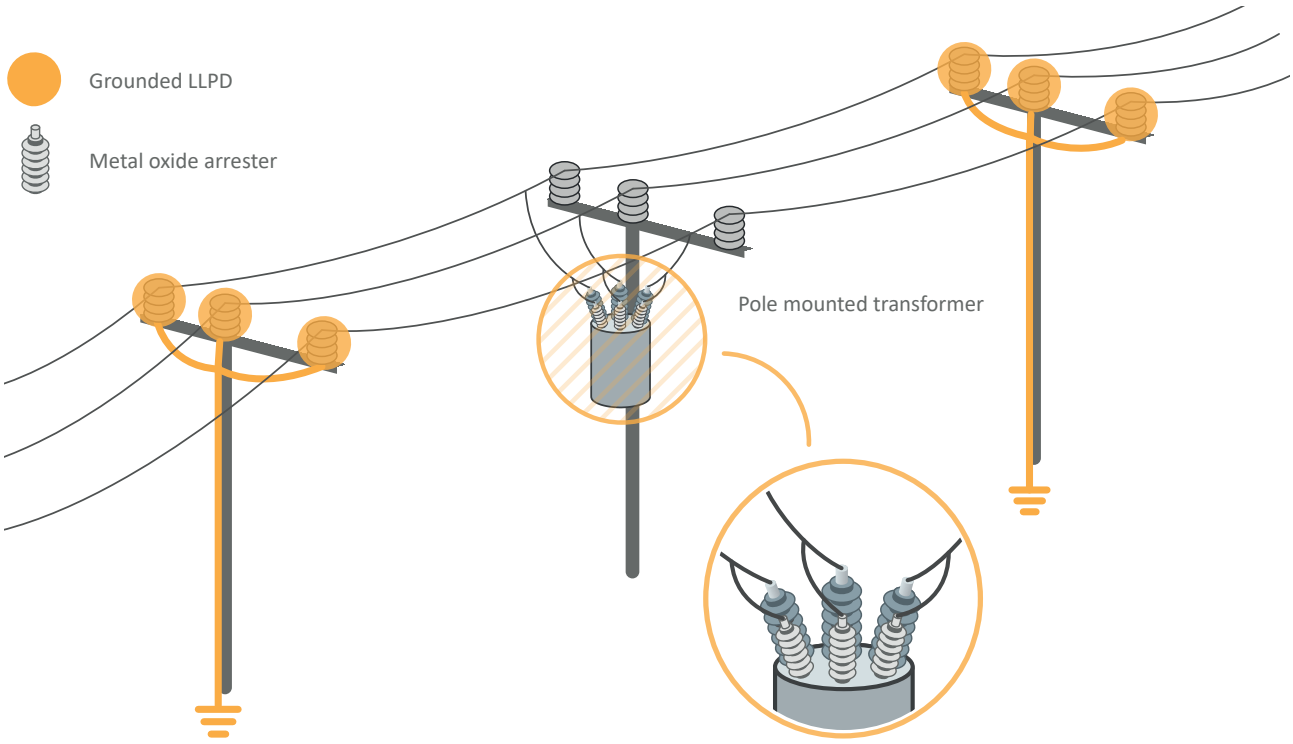
By installation of 3x LLPD d-series on one pole every 500-1000 metres to discharge travelling waves of overvoltage.



Installation method for power transformer protection

It is necessary to protect, not only the line and insulators from damage and unwanted outages, but also the pole mounted distribution transformers which are deployed along the line.

The main device for transformer protection from lightning surges is a surge arrester. Unfortunately, with frequent activations due to overvoltages, the arrester reaches the limit of its capability and is unable to discharge pulses anymore which leads to breakdowns, leaving the transformer unprotected in case of new overvoltage. This is especially true for poles with high values of footing resistance and high BIL. To avoid this situation, Streamer can suggest a solution for protecting arresters and improving the reliability of the transformer.



Streamer recommends installing 3 LLPD d-series on poles adjacent to the transformer and to ground them. In case of DLS on the line, LLPD limits surge of overvoltage on both sides of the protected transformer, reducing the load on the arresters and preventing the arresters from breaking down.

Thus, Streamer's solution allows extended lifespan of the arresters and as a result provides protection of the transformer.

Recommendations concerning short-circuit current (SCC) & insulation coordination

When the MPFC is greater the MPFC of the LLPD, Streamer recommends to the use of LLPD of a higher voltage class, while observing BIL_{LLPD} <BIL_{line} condition.

The following are possible cases to protect against large prospective fault current (PFC):

Product	Highest voltage for equipment, kV*	Nominal system voltage, kV	Prospective fault current, kA	
			Insulated (compensated) neutral	Solidly grounded neutral
LLPD d24z	12	10; 11	6,6	5,9
LLPD d24z	15	12 - 13,8	5,2	5
LLPD dM35z	24	20; 22	6,6	5,9
LLPD d45z	40,5	33; 35	6	5,5
LLPD d69z	52	45	6,2	5,6

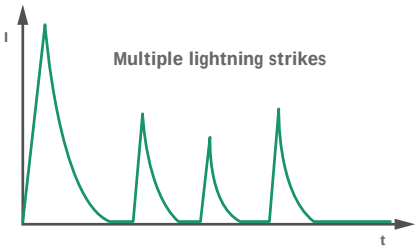
* According to IEC 60038

Lightning discharge capability

Lightning discharge capability test

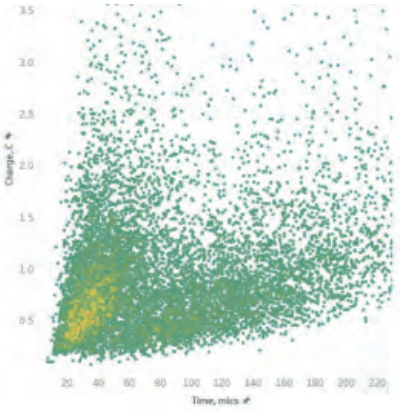
About 90% of cloud-to-ground lightning flashes are composed of two or more strikes

According to IEC 60099-8, the test is meant to prove the capability of the tested device to withstand lightning discharges having current waveforms with durations of several tens of microseconds for devices applied on shielded lines, and several hundreds of microseconds for devices on unshielded lines. The related test also covers the effects of multiple lightning strikes.



Wave shape of impulse	200-230 µs
Quantity of impulses	20
Charge, C	Declared by manufacturer

IEC 60099-8 prescribes lightning discharge capability in C to appear among other parameters on a product nameplate permanently attached to the protection device.



The graph presents probability distribution of lightning parameters provided by IEEE Std 1410-2010. Each point on the graph matches lightning with a specific charge of lightning impulse (measured in C) and specific duration of impulse (measured in µs).

In case of a direct lightning strike there is a 50% probability of observing a charge exceeding 0.8 C flowing through the protective device installed. Thus a protective device tested with 0.8 C has a 50% probability of facing an impact exceeding its proven lightning discharge capability, with unpredictable results at each direct lightning event.

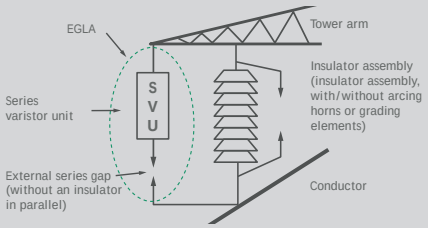
LLPD

2.8 C – Lightning discharge capability of d-LLPD

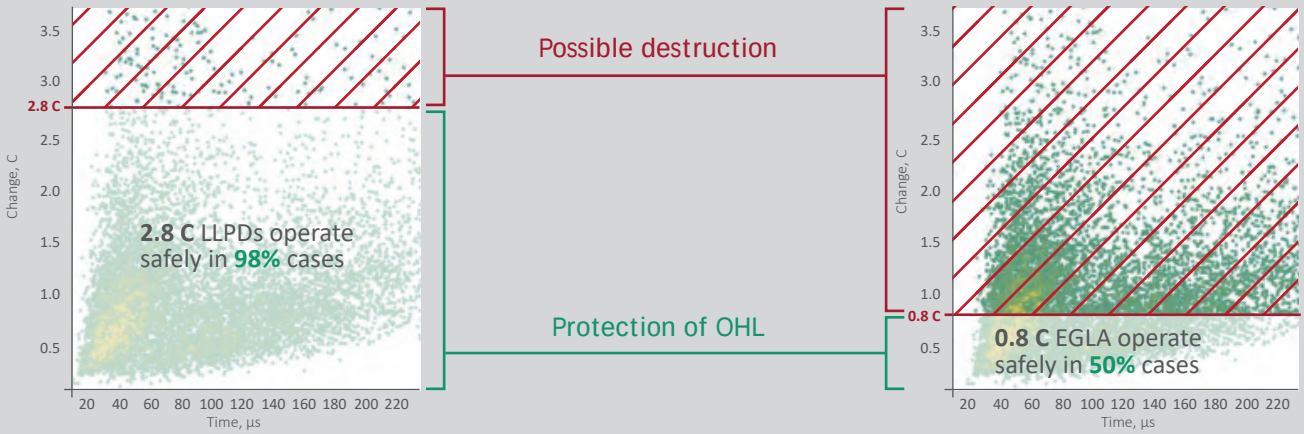
LLPD with proven 2.8 C lightning discharge capability ensures safe product operation within 98% of direct lightning strike cases.

EGLA

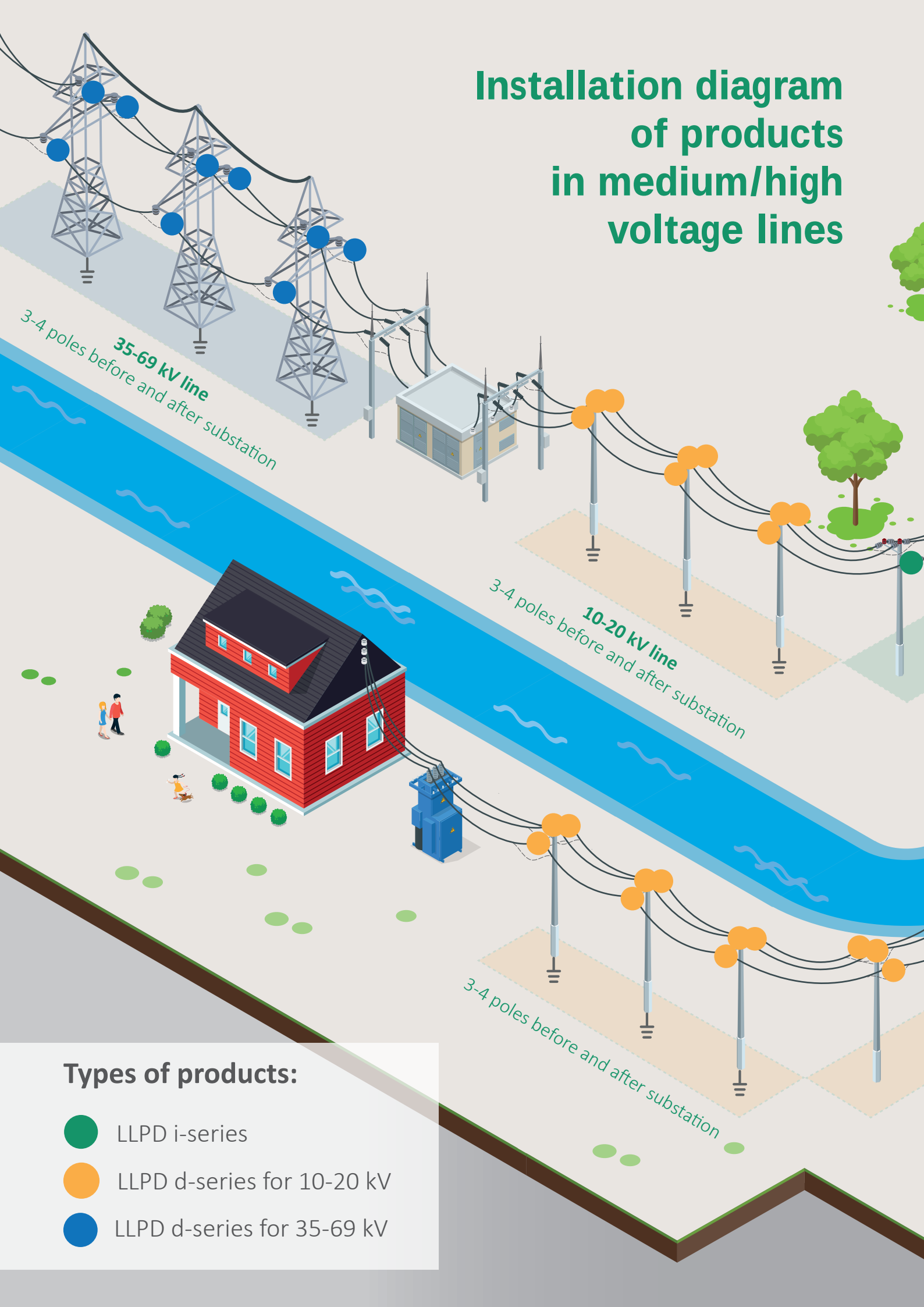
<0.8 C – Quantity of coulombs which consist in high current impulse 65 kA, 4/10 µs corresponding to “Class name X2” in EGLA classification



Protective device with proven 0.8 C lightning discharge capability ensures safe product operation within only half of direct lightning strike cases.

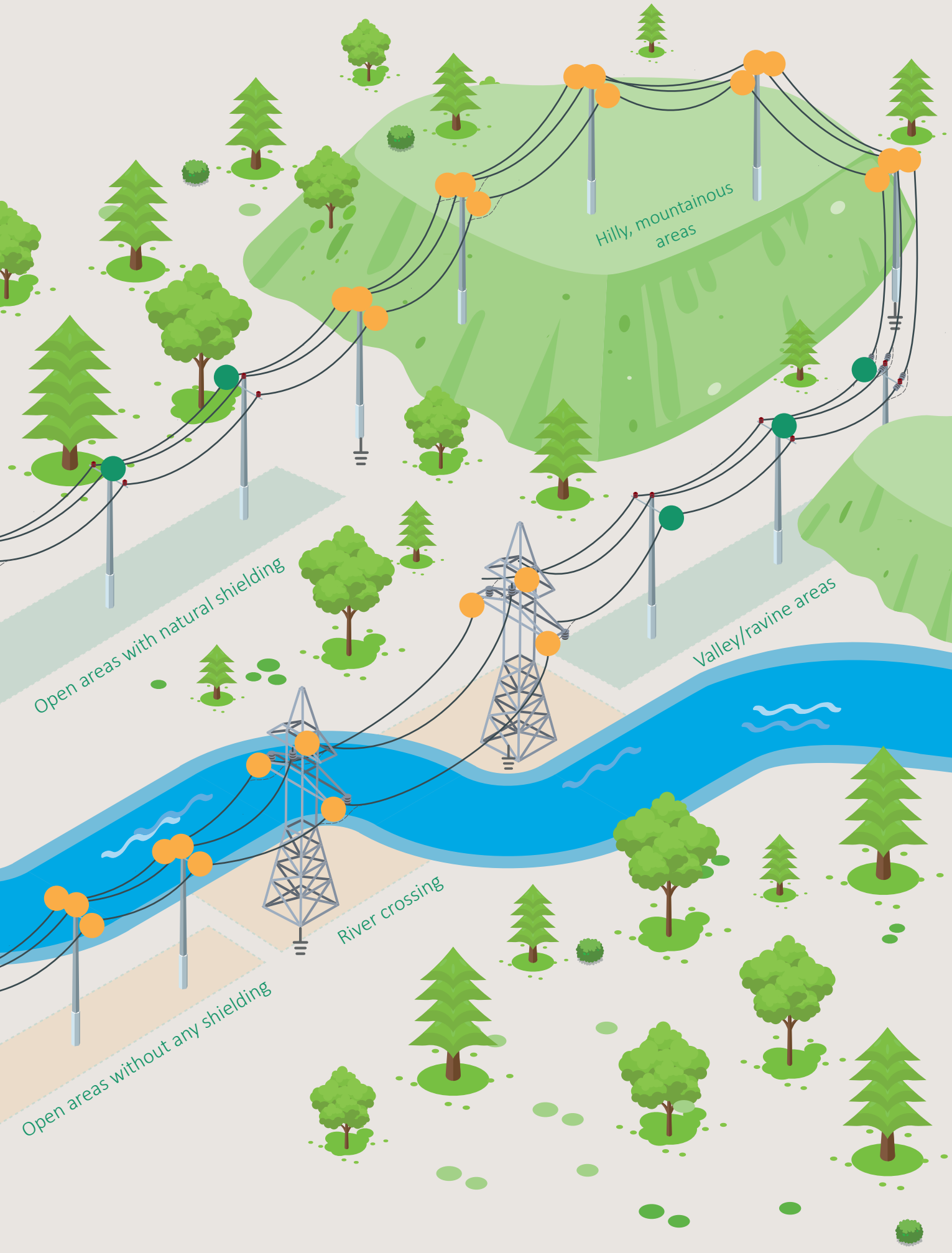


Installation diagram of products in medium/high voltage lines



Types of products:

- LLPD i-series
- LLPD d-series for 10-20 kV
- LLPD d-series for 35-69 kV


Hilly, mountainous areas
Open areas with natural shielding
Valley/ravine areas
River crossing
Open areas without any shielding

Restrictions

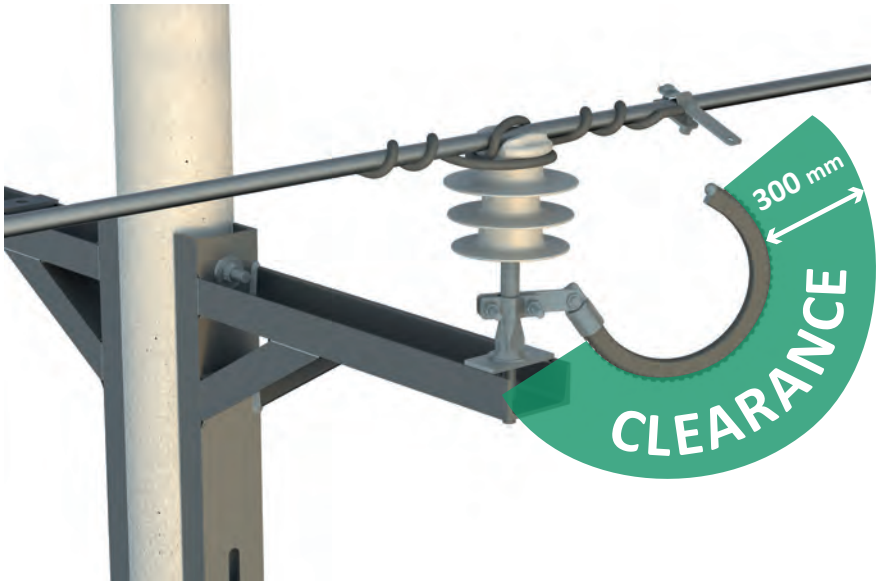
There are a few restrictions when installing LLPD:

1. There must be no conductive or grounded parts of the overhead line within a 500 mm (300 mm for LLPD i20z) radius from the edge of the EasyQuench system;

2. There should be no other LLPDs within 1000 mm radius from the edge of the EasyQuench system.

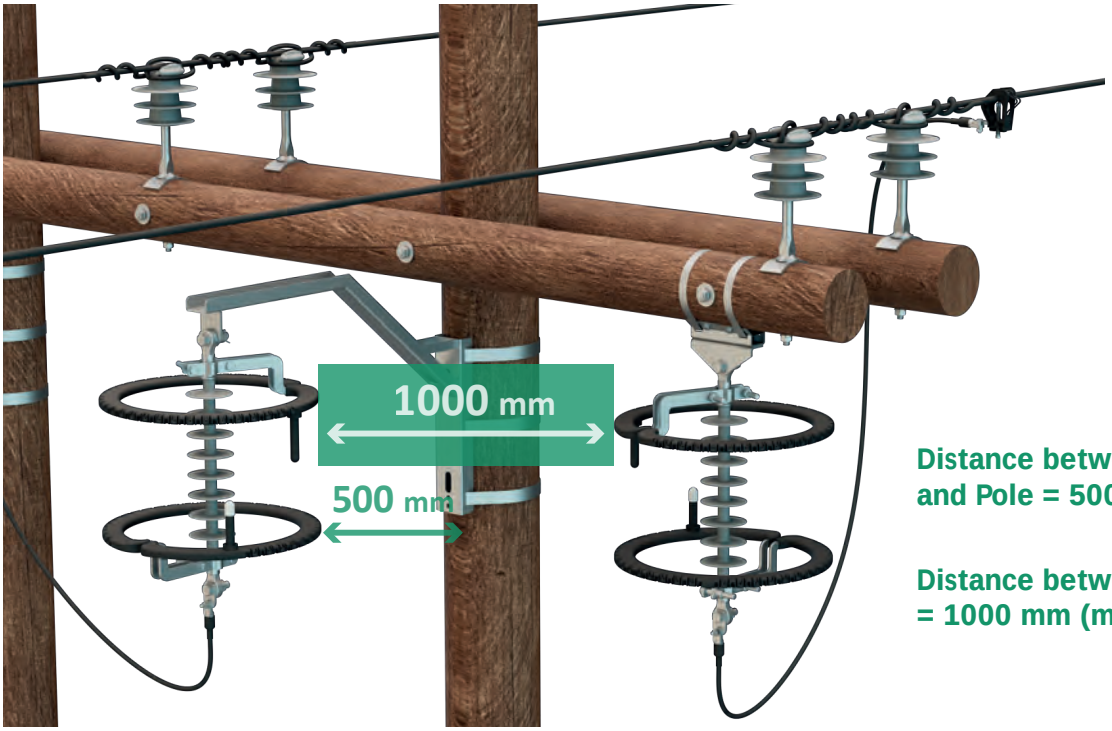
These restrictions are due to the fact that when the LLPD operates, a plasma jet is ejected from the nozzles on the LLPD's surface. When a plasma jet hits conductive or grounded parts, this may lead to conductive channel creation, through which the follow current begins to flow, creating a phase to ground or phase to phase short circuit.

LLPD i20z



LLPD dC10z
LLPD dS10z
LLPD dC20z

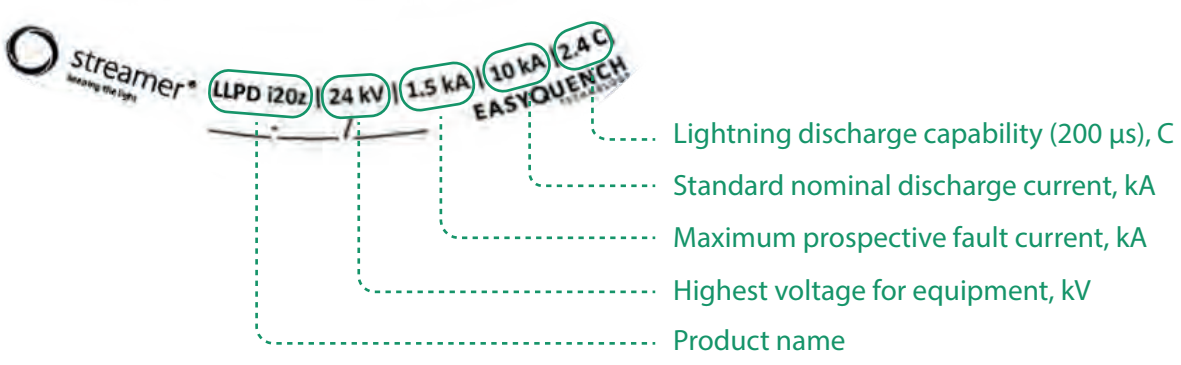
LLPD d24z
LLPD dM35z
LLPD d45z
LLPD d69z



Distance between LLPD and Pole = 500 mm (min)

Distance between 2 LLPDs = 1000 mm (min)

Transcription of marking on the example of LLPD i20z



Products:
LLPD i20z

Reference: № SAI.020.Z.WW/820

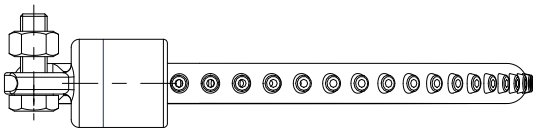
24 **Highest voltage for equipment, kV**

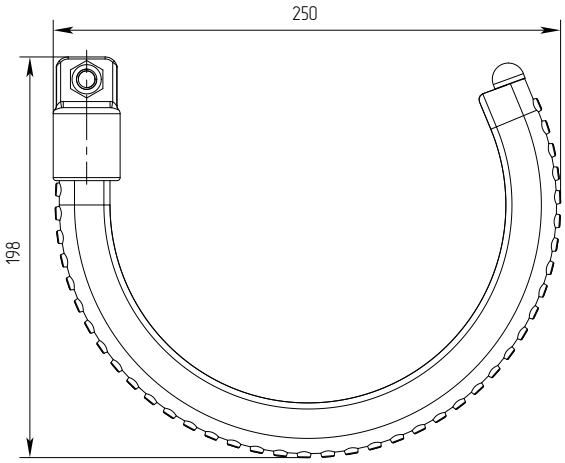
Protects from Induced Overvoltage

No maintenance is required

1. EQ system
2. Terminal electrode
3. End fitting with the attachment point

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	24
Maximum prospective fault current, kA	1,5
External air gap, mm	60-80
50% flashover voltage (60 mm air gap), kV	< 110
Power frequency withstand voltage**, kV (wet/dry)	30/40
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,4
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	3 (1/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	0,43
Maintenance	1 visual verification/ year





* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217

1. PIN/POST/PIN-POST

1a

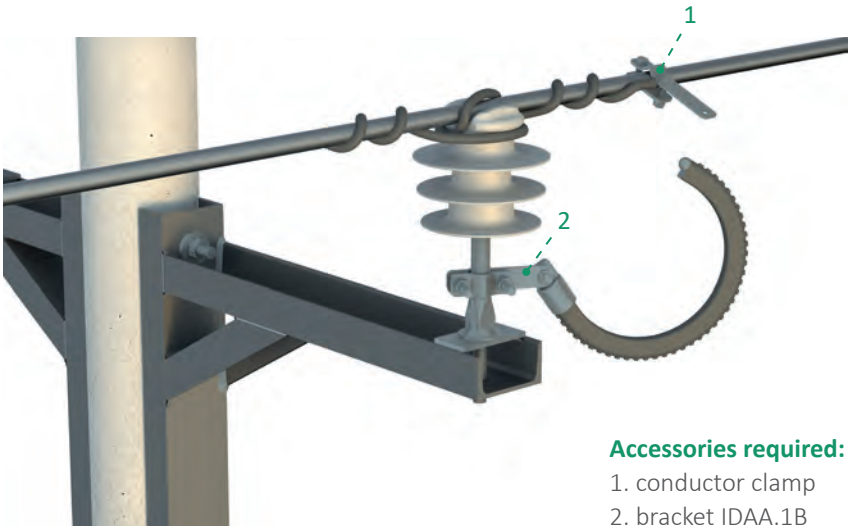
Type of line insulation
PIN

Type of pole
any

Type of cross-arm
any

Point of connection
insulator's pin

Notes
Insulator's pin must be round and should have ø≤38 mm; in case of insulator's pin ø>38 mm check options 1b, 1c, 1d.



Accessories required:
1. conductor clamp
2. bracket IDAA.1B

1b

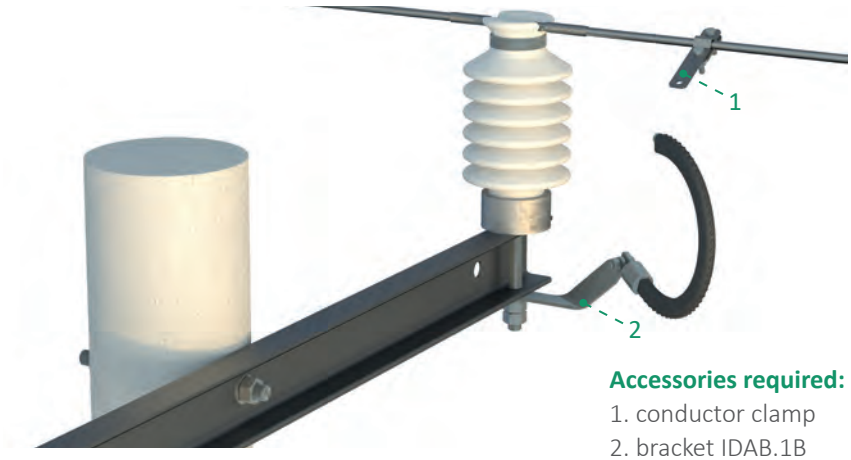
Type of line insulation
PIN-POST

Type of pole
any

Type of cross-arm
any

Point of connection
insulator's pin

Notes
Installation using existing insulator pin up to M24 nut.



Accessories required:
1. conductor clamp
2. bracket IDAB.1B

1c

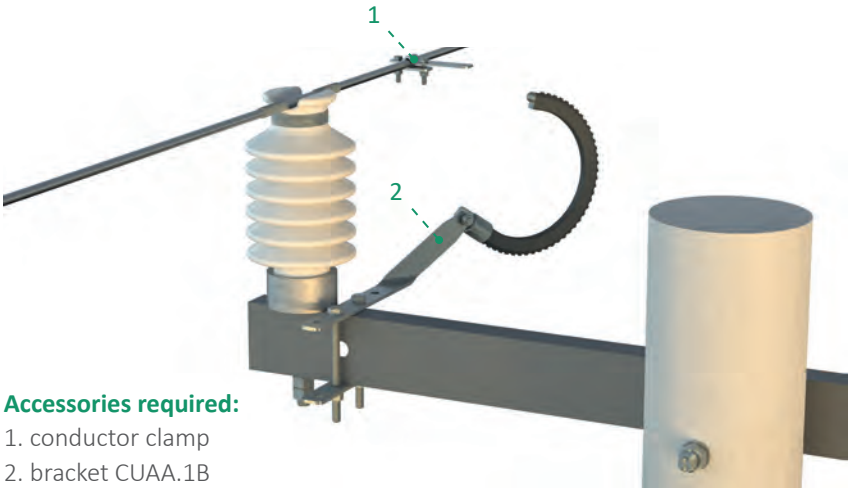
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

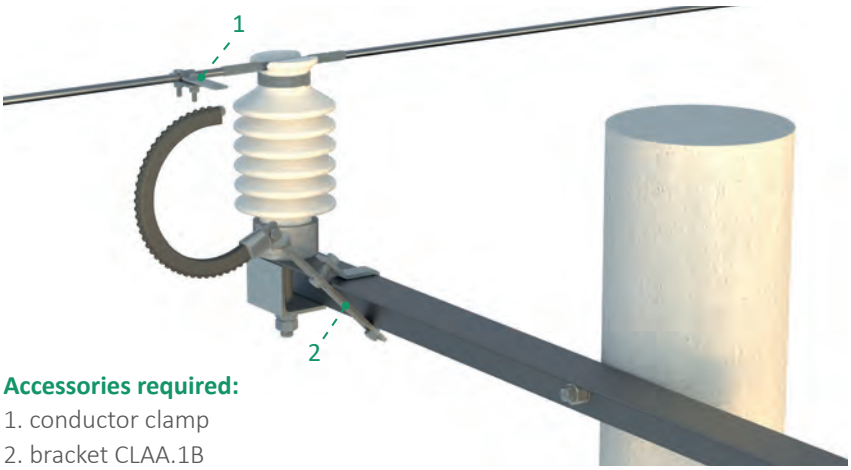
Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. conductor clamp
2. bracket CUAA.1B

1d

Type of line insulation	PIN/POST/PIN-POST
Type of pole	any
Type of cross-arm	L-bar
Point of connection	cross-arm
Notes	*Maximum permissible size of L-bar 90x90 mm.*

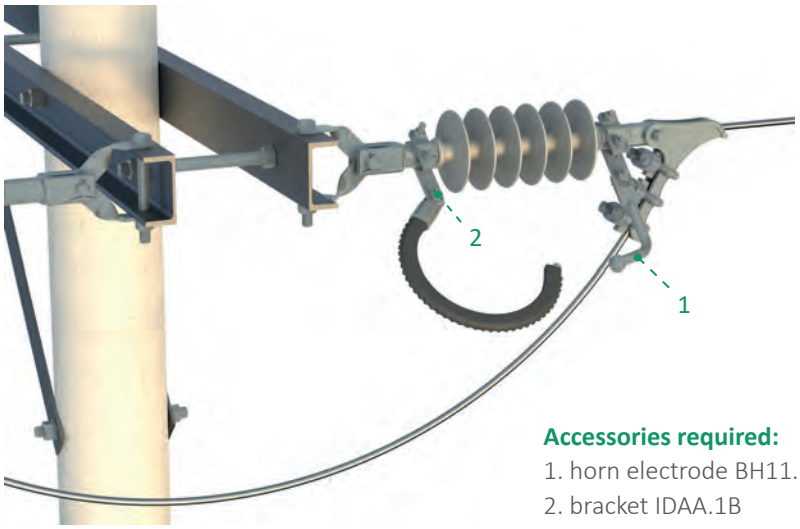


Accessories required:
1. conductor clamp
2. bracket CLAA.1B

2. TENSION

2a

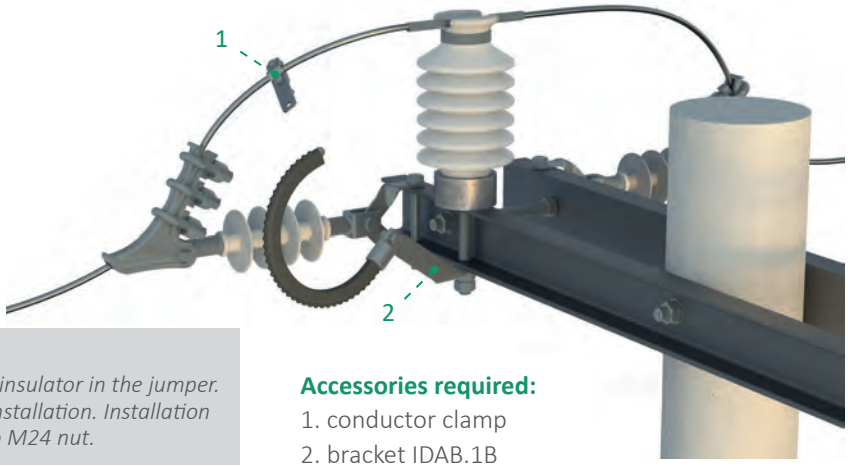
Type of line insulation	TENSION
Type of pole	any
Type of cross-arm	any
Point of connection	on insulator
Notes	*This option is the best for composite and long-rod porcelain insulators; for cap-and-pin insulators it is highly recommended to install as per 2b, 2c or 2d.*



Accessories required:
1. horn electrode BH11.1B
2. bracket IDAA.1B

2b

Type of line insulation	TENSION
Type of pole	any
Type of cross-arm	any
Point of connection	PIN of jumper's insulator
Notes	*Suitable for cases with a pin-post insulator in the jumper. The most convenient method of installation. Installation using existing insulator's pin up to M24 nut.*



Accessories required:
1. conductor clamp
2. bracket IDAB.1B

2c

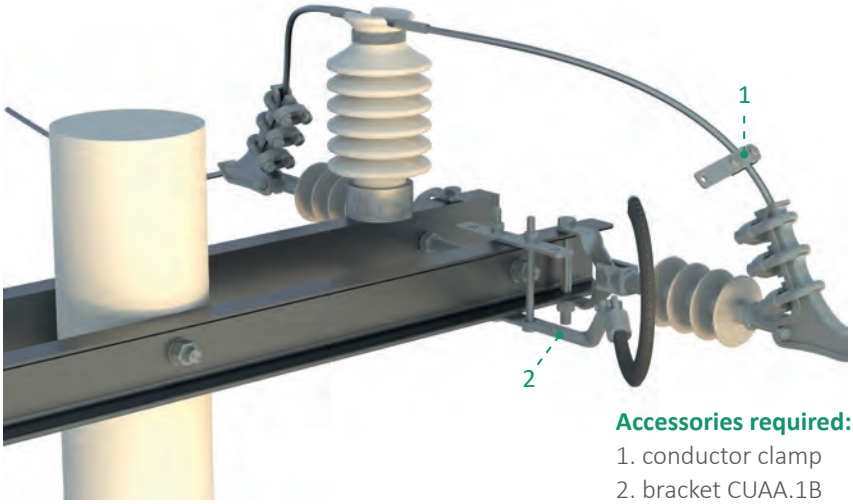
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Suitable for cases with pin or post insulator in the jumper. The most convenient method of installation.



Accessories required:
1. conductor clamp
2. bracket CUAA.1B

2d

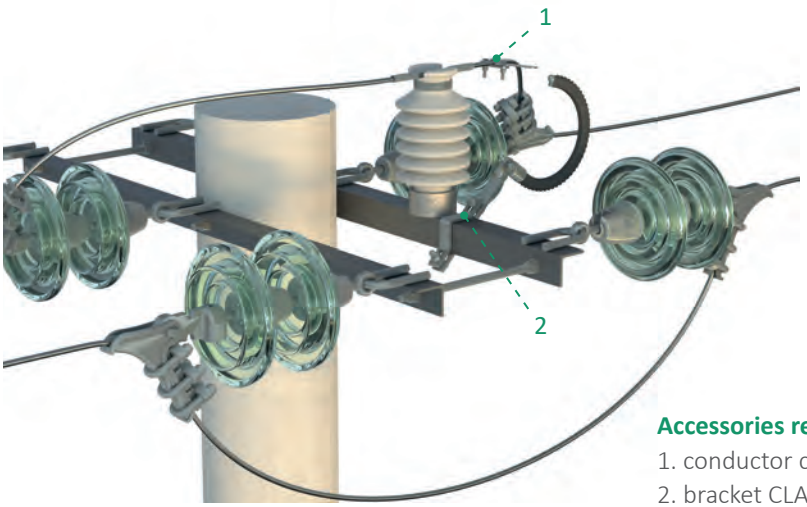
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Maximum permissible size of L-bar 90x90 mm.



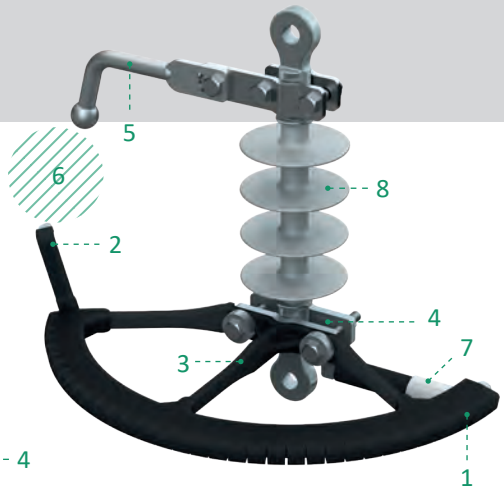
Accessories required:
1. conductor clamp
2. bracket CLAA.1B

LLPD dC10z / dS10z

Reference: № SAD.C10.Z.WW/920 / SAD.S10.Z.WW/920

- **12** — Highest voltage for equipment, kV
- Protects from Direct Lightning Strike
- Protects from Induced Overvoltage
- Protects from Back Flashover
- No maintenance is required

dS10z

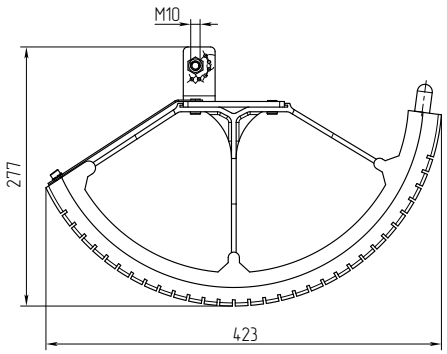


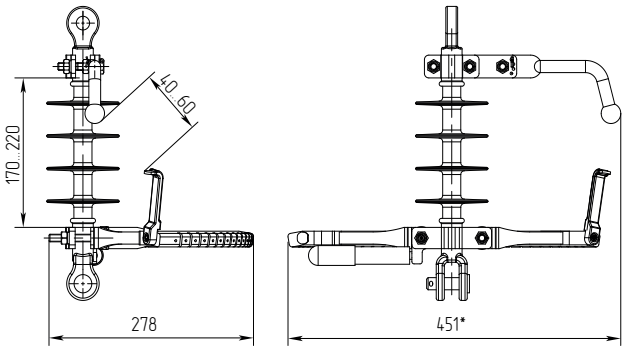
dC10z

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	12
Maximum prospective fault current, kA	5
External air gap, mm	40-60
50% flashover voltage (50 mm air gap), kV	<100
Power frequency withstand voltage**, kV (wet/dry)	20/30
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	1,1 / 1,5 (dS10z)
Maintenance	1 visual verification/ year

* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217

1. EQ system
2. Terminal electrode
3. Insulating load-bearing frame
4. Attachment point
5. Horn Electrode (not included)
6. Air gap
7. Auxiliary electrode with one-time glass indicator
8. Suspension composite insulator (not included)





1. PIN/POST/PIN-POST

1a

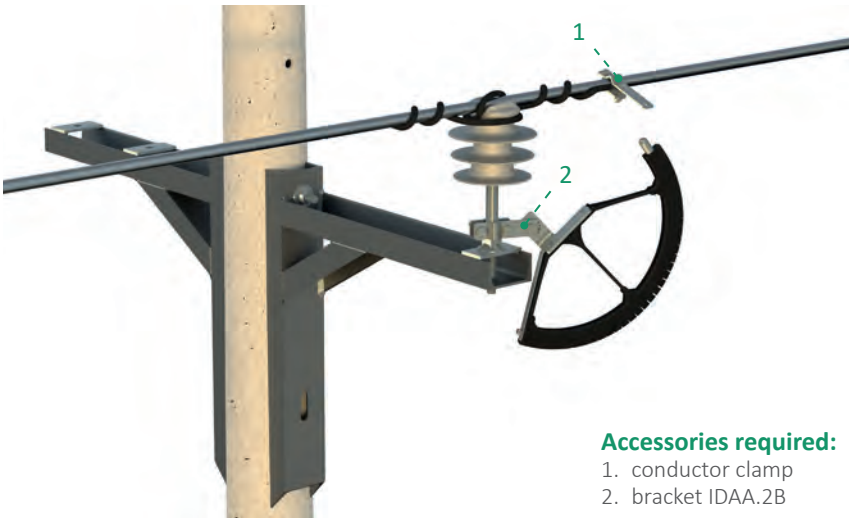
Type of line insulation
PIN

Type of pole
any

Type of cross-arm
any

Point of connection
insulator's pin

Notes
Insulator's pin must be round and should have ø ≤ 38 mm; in case of insulator's pin ø > 38 mm check options 1b, 1c, 1d, or 1e.



Accessories required:
1. conductor clamp
2. bracket IDAA.2B

1b

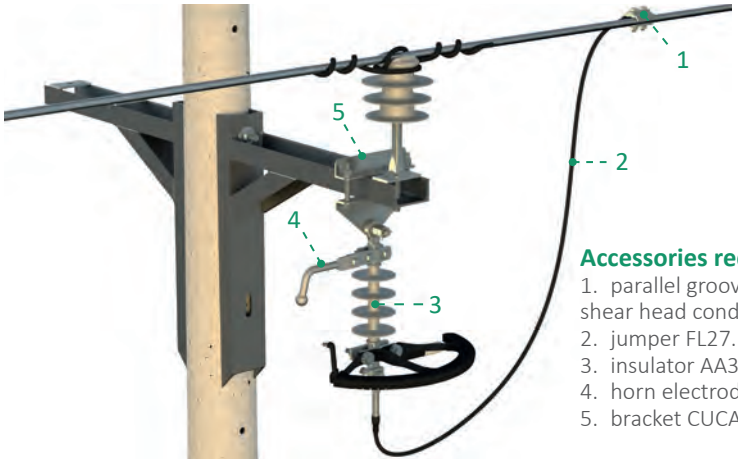
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. bracket CUCA.1B

1c

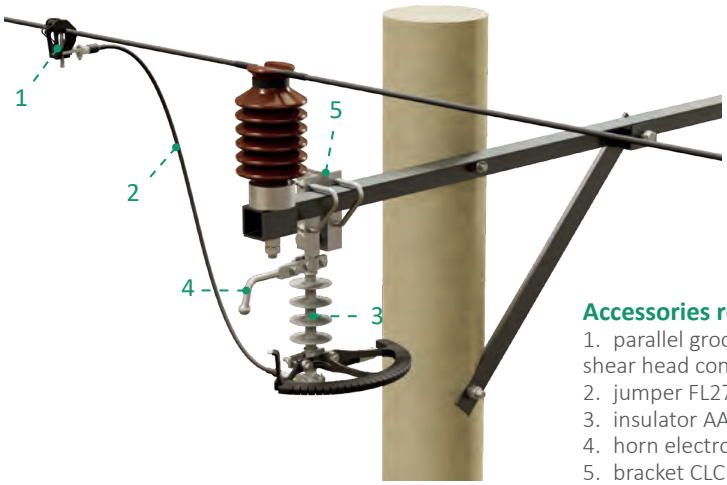
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. bracket CLCB.1B

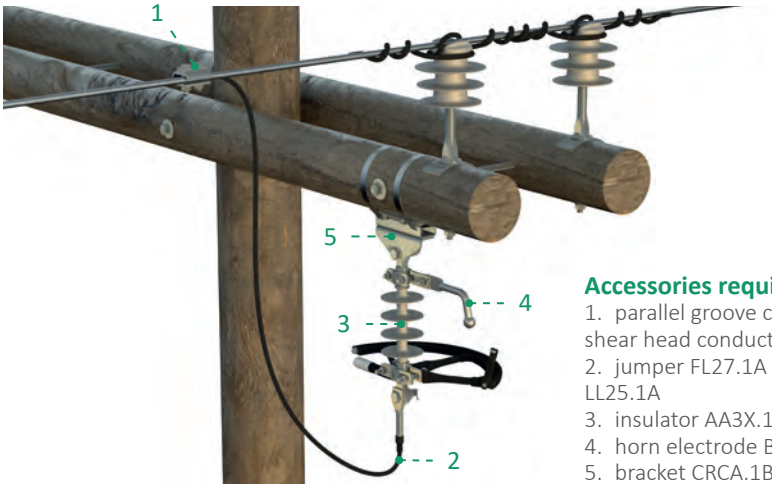
1d

Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horne electrode BH11.1B
5. bracket CRCA.1B

1e

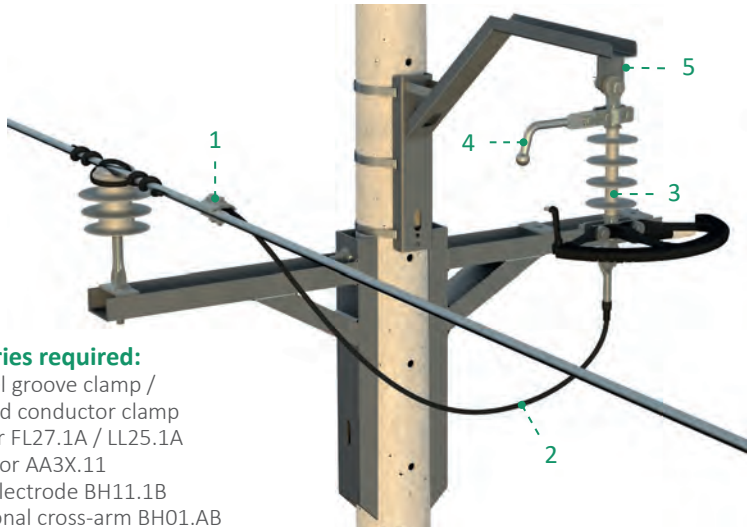
Type of line insulation
PIN/POST/PIN-POST

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horne electrode BH11.1B
5. additional cross-arm BH01.AB

2. TENSION

2a

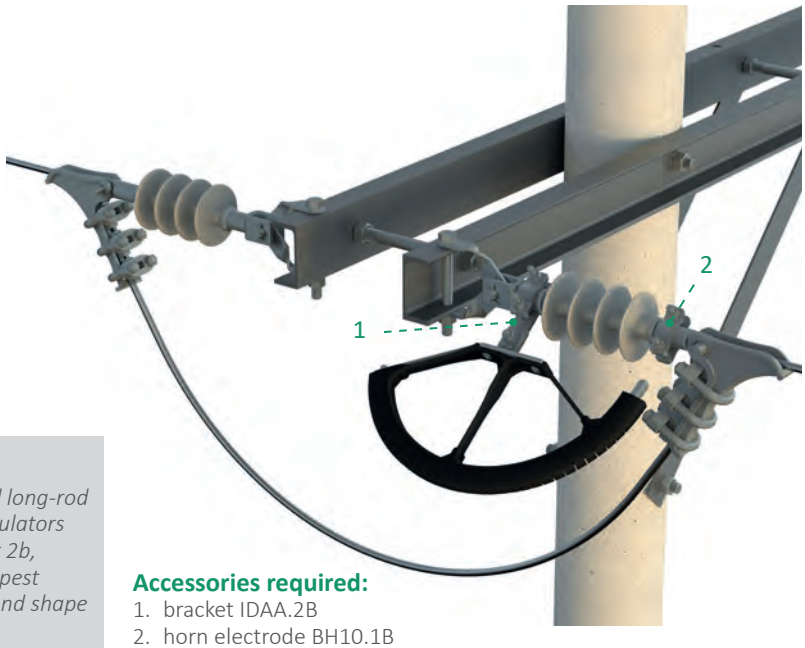
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
any

Point of connection
tension insulator

Notes
This option is the best for composite and long-rod porcelain insulators; For cap-and-pin insulators it's highly recommended to install as per 2b, 2c, 2d or 2e; This is the easiest and cheapest method, but it is essential that the size and shape of the insulator allows this.



Accessories required:
1. bracket IDAA.2B
2. horn electrode BH10.1B

2b

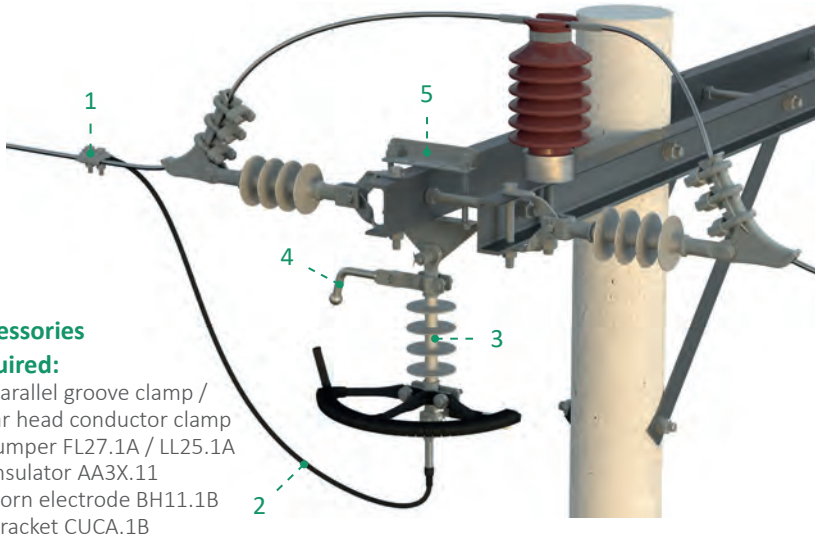
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Recommended for cap-and-pin insulators;
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. bracket CUCA.1B

2c

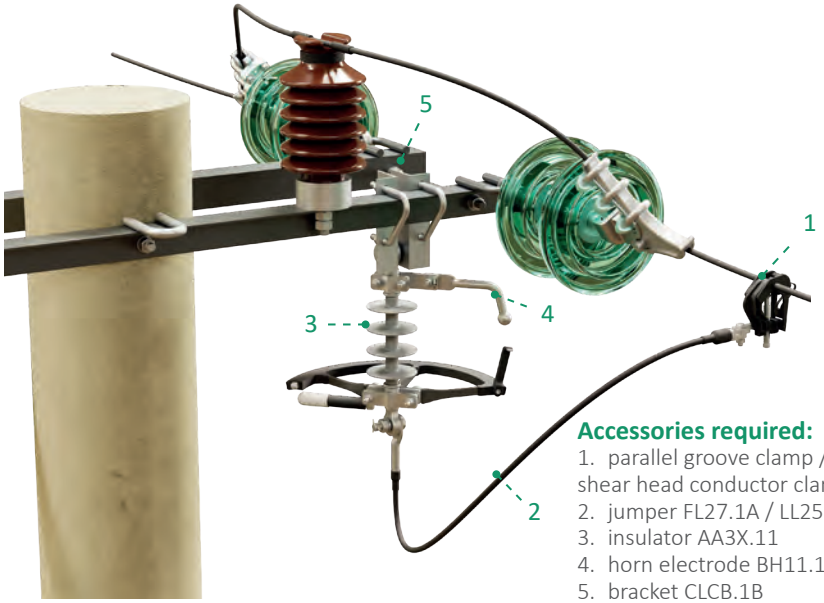
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. bracket CLCB.1B

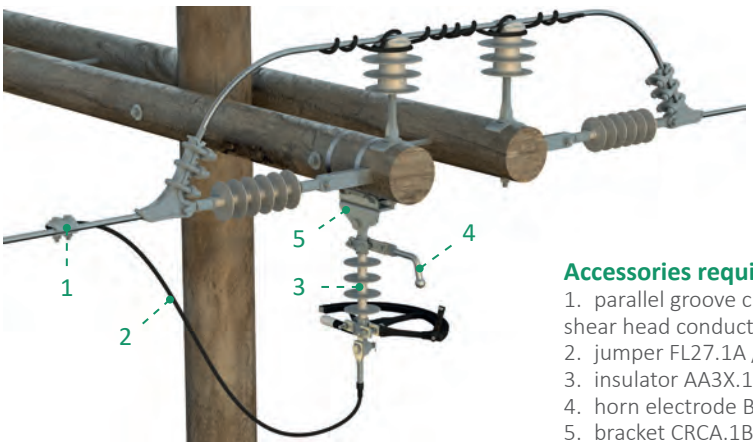
2d

Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. bracket CRCA.1B

2e

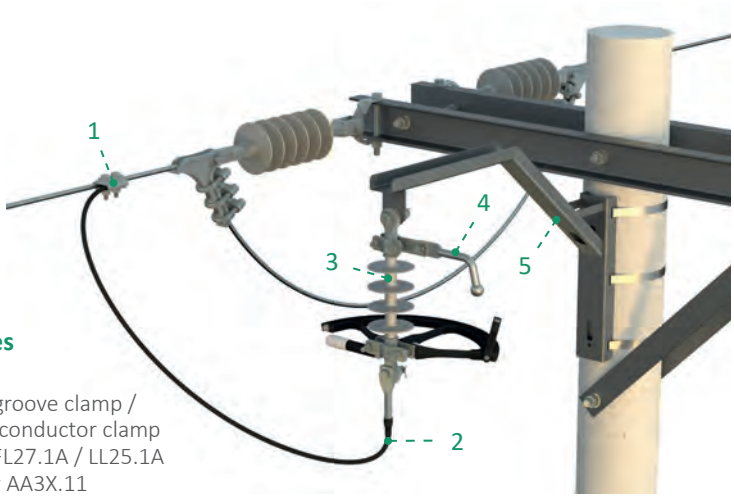
Type of line insulation
TENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation; doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. additional cross-arm BH01.AB

3. SUSPENSION

3a

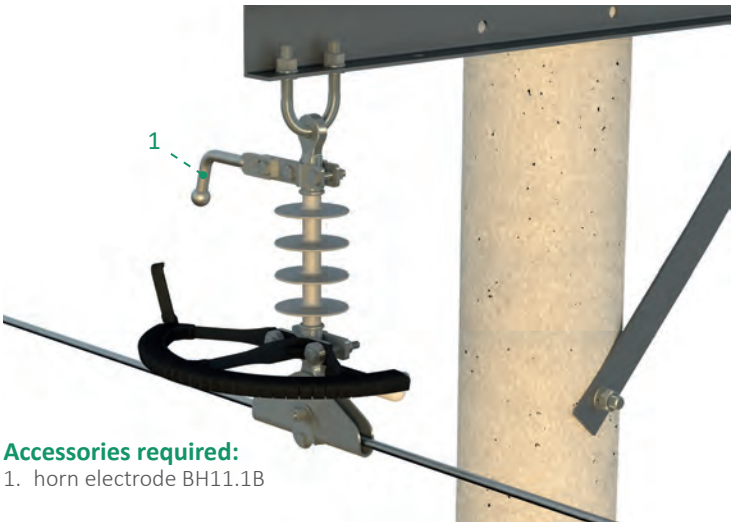
Type of line insulation
SUSPENSION

Type of pole
any

Type of cross-arm
any

Point of connection
suspension insulator

Notes
This is the easiest and cheapest method, but it is essential that the size and shape of the insulator allows this. Otherwise check option 3b.



Accessories required:
1. horn electrode BH11.1B

3b

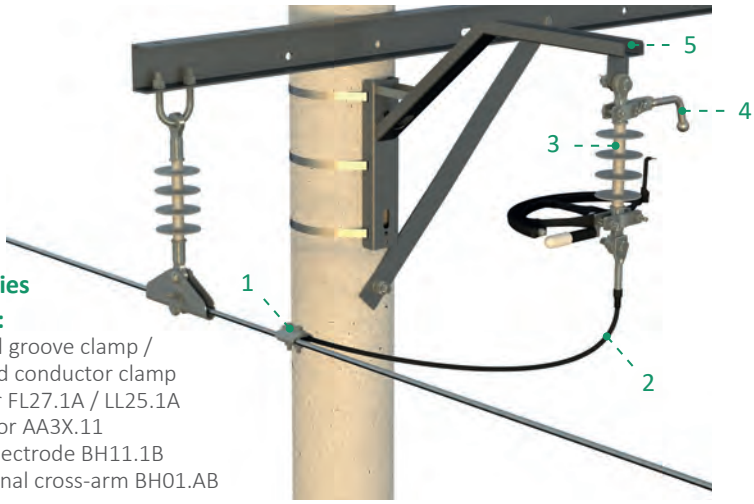
Type of line insulation
SUSPENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation; doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. additional cross-arm BH01.AB

4*. HORIZONTAL POST

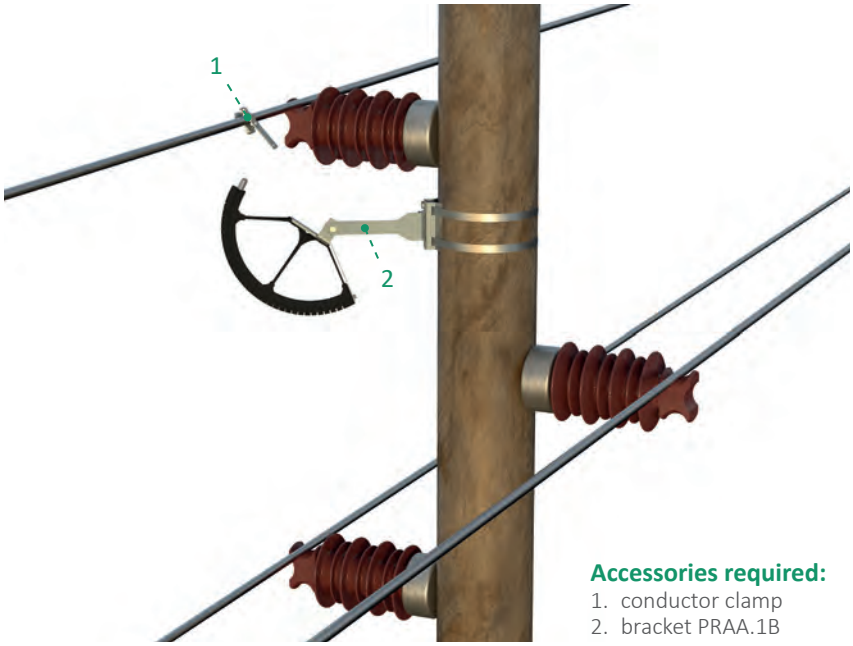
4a*

Type of line insulation
HORIZONTAL POST

Type of pole
round or tangent armless pole

Type of cross-arm
-

Point of connection
pole



Accessories required:
1. conductor clamp
2. bracket PRAA.1B

4b*

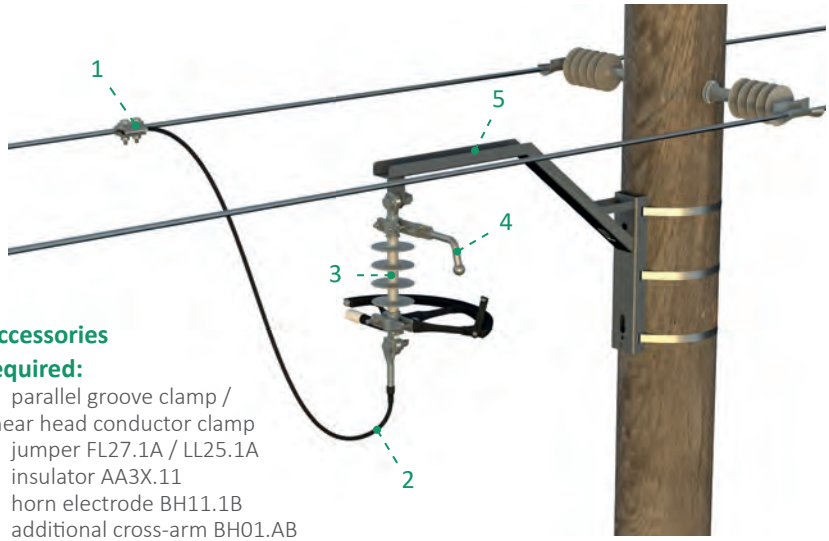
Type of line insulation
HORIZONTAL POST

Type of pole
round or tangent armless pole

Type of cross-arm
-

Point of connection
additional cross-arm

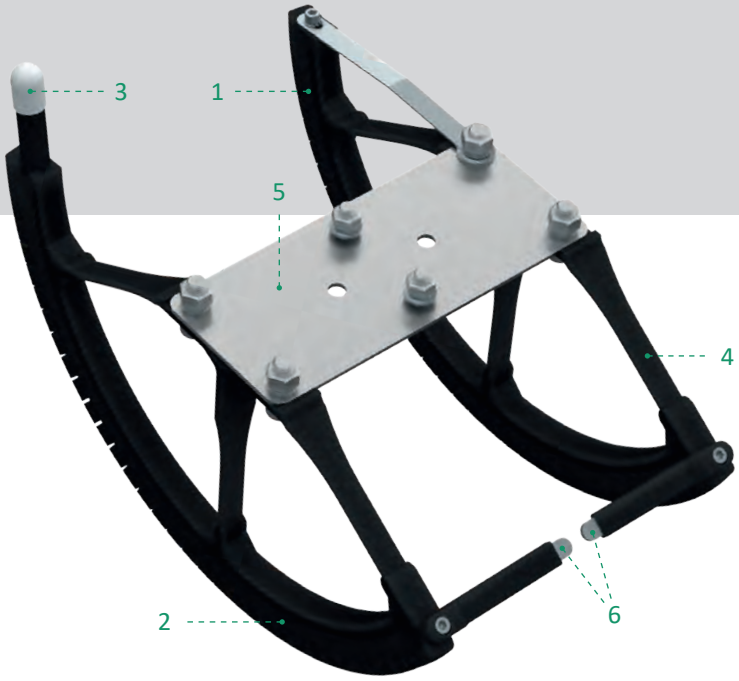
Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator AA3X.11
4. horn electrode BH11.1B
5. additional cross-arm BH01.AB

LLPD dC20z

Reference: № SAD.C20.Z.WW/920



1. Module A with EQ system
2. Module B with EQ system
3. Terminal electrode with one-time glass indicator
4. Insulating load-bearing frame
5. Attachment point
6. Auxiliary electrodes

Highest voltage for equipment, kV

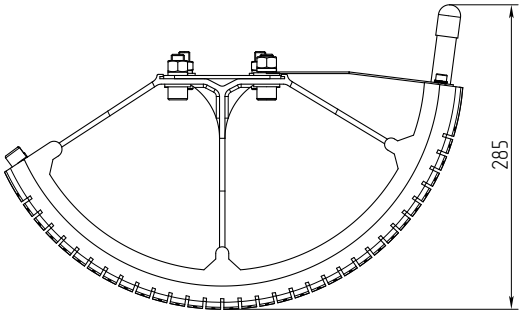
Protects from Direct Lightning Strike

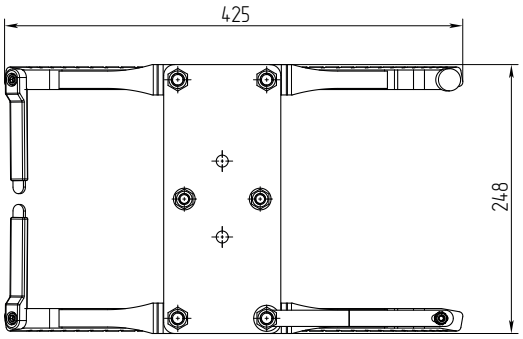
Protects from Induced Overvoltage

Protects from Back Flashover

No maintenance is required

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	24
Maximum prospective fault current, kA	5
External air gap, mm	60-80
50% flashover voltage (80 mm air gap), kV	<185
Power frequency withstand voltage**, kV (wet/dry)	40/50
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	2,6
Maintenance	1 visual verification/ year





* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217

1. PIN/POST/PIN-POST

1a

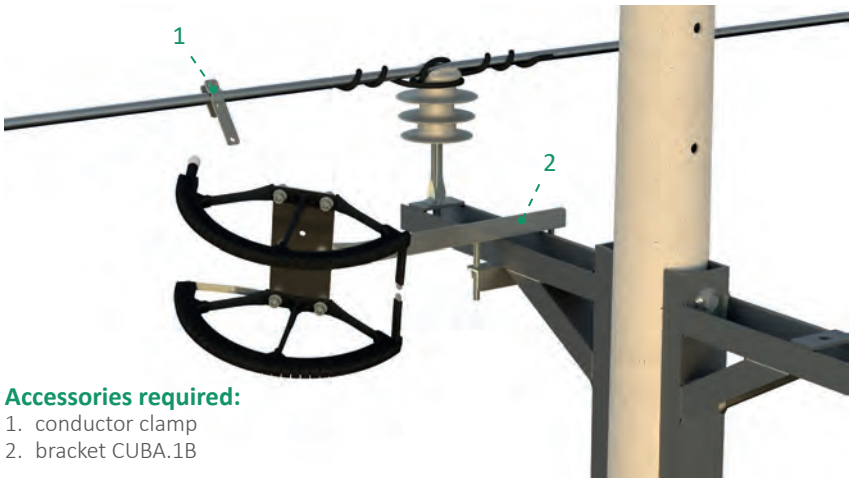
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. conductor clamp
2. bracket CUBA.1B

1b

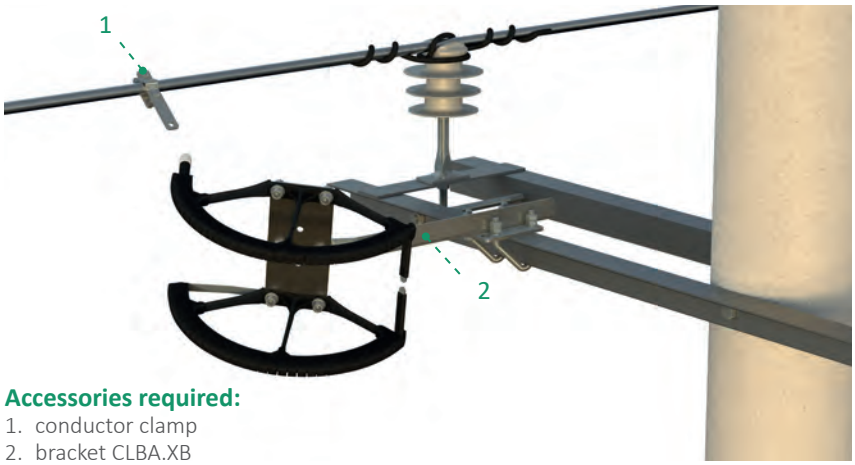
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 60x60 (with CLBA.1B) or 90x90 (with CLBA.2B).



Accessories required:
1. conductor clamp
2. bracket CLBA.XB

1c

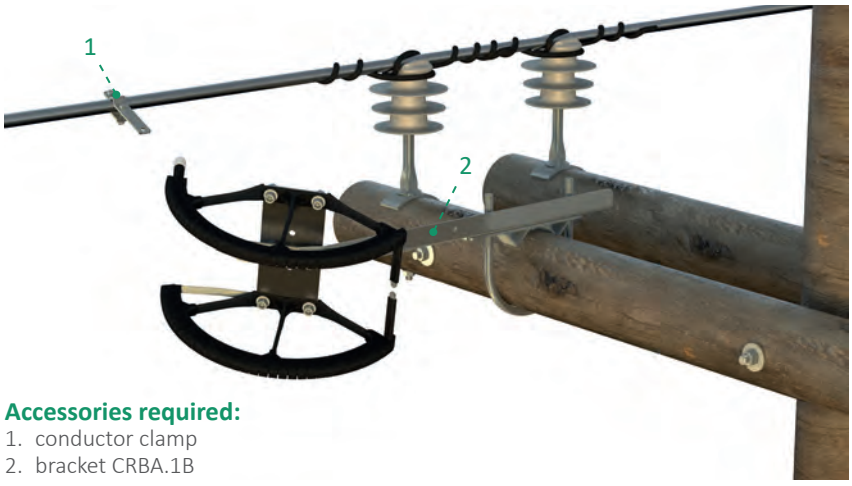
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm

Notes
Permissible diameter of cross-arm 140-180 mm.



Accessories required:
1. conductor clamp
2. bracket CRBA.1B

2. TENSION

2a

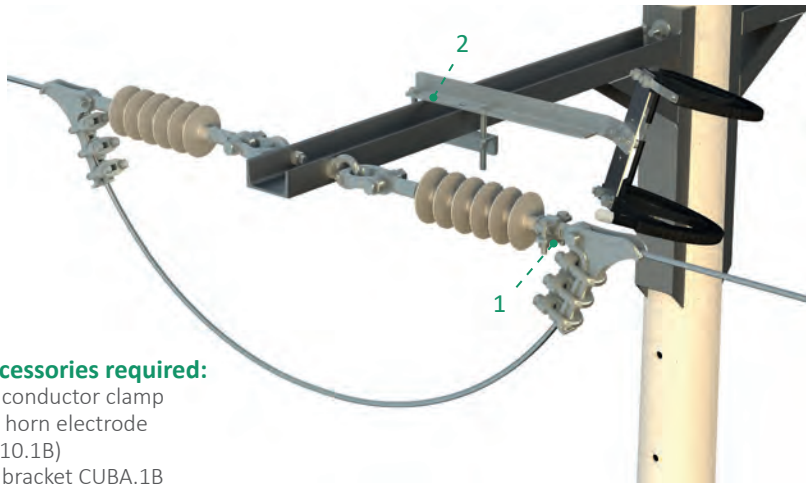
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. conductor clamp (or horn electrode BH10.1B)
2. bracket CUBA.1B

2b

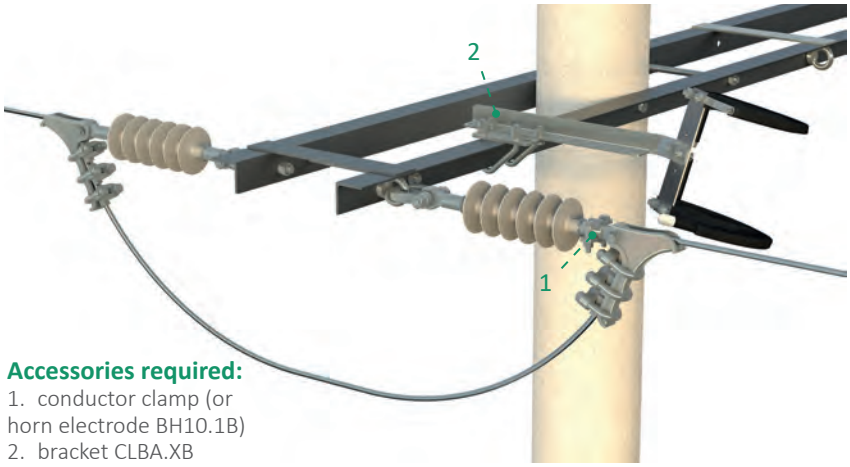
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 60x60 (with CLBA.1B) or 90x90 (with CLBA.2B).



Accessories required:
1. conductor clamp (or horn electrode BH10.1B)
2. bracket CLBA.XB

2c

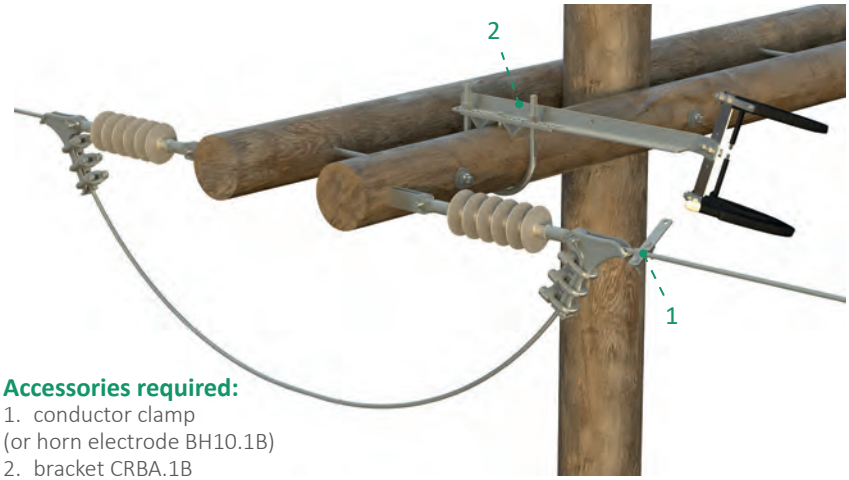
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm

Notes
Permissible diameter of cross-arm 140-180 mm.



Accessories required:
1. conductor clamp (or horn electrode BH10.1B)
2. bracket CRBA.1B

4*. HORIZONTAL POST

4a*

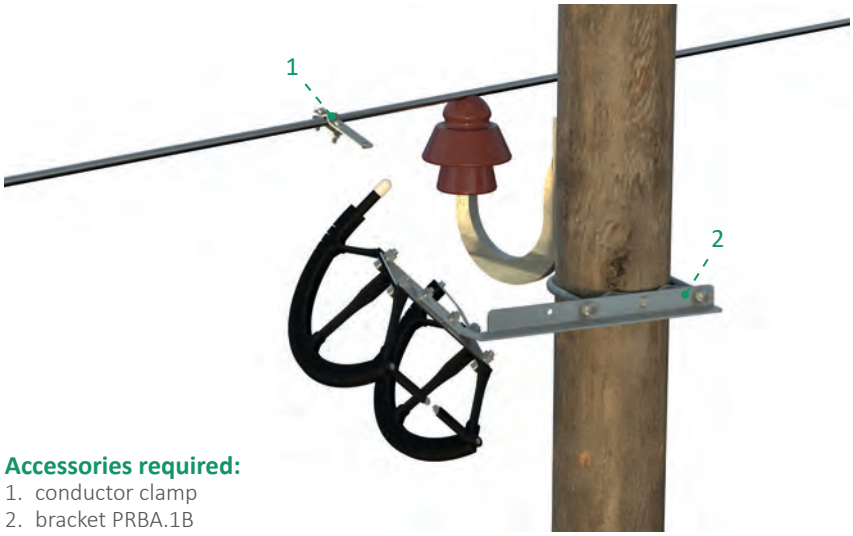
Type of line insulation
HORIZONTAL POST

Type of pole
armless pole

Type of cross-arm
-

Point of connection
pole

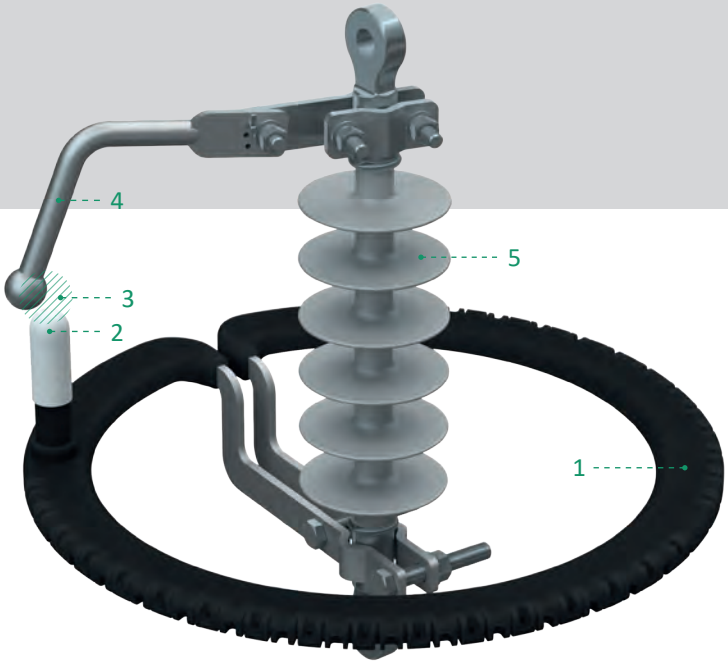
Notes
Permissible diameter of pole 150-200 mm.



Accessories required:
1. conductor clamp
2. bracket PRBA.1B

LLPD d24z

Reference: № LL.PD.D.024.B0.WW



1. Module with EQ system
2. Electrode with indicator
3. Air gap
4. Horn Electrode (not included)
5. Suspension composite insulator (not included)

24 **Highest voltage for equipment, kV**

Protects from Direct Lightning Strike

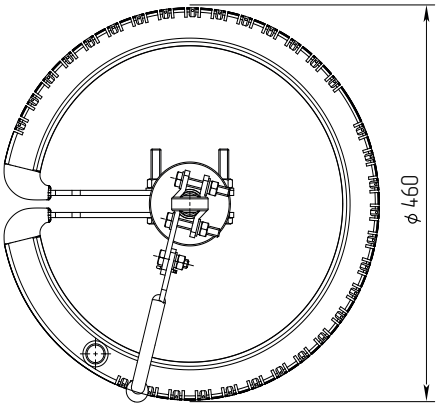
Protects from Induced Overvoltage

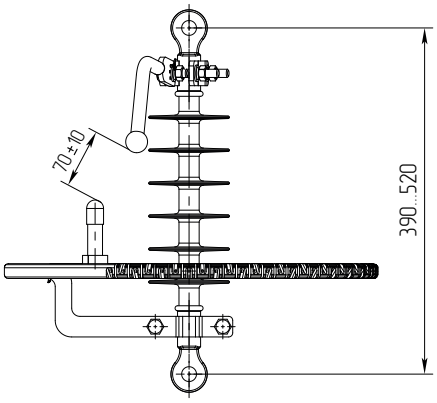
Protects from Back Flashover

No maintenance is required

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	24
Maximum prospective fault current, kA	5
External air gap, mm	60-80
50% flashover voltage (80 mm air gap), kV	<150
Power frequency withstand voltage**, kV (wet/dry)	40/50
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	2,8
Maintenance	1 visual verification/ year

* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217





1. PIN/POST/PIN-POST

1a

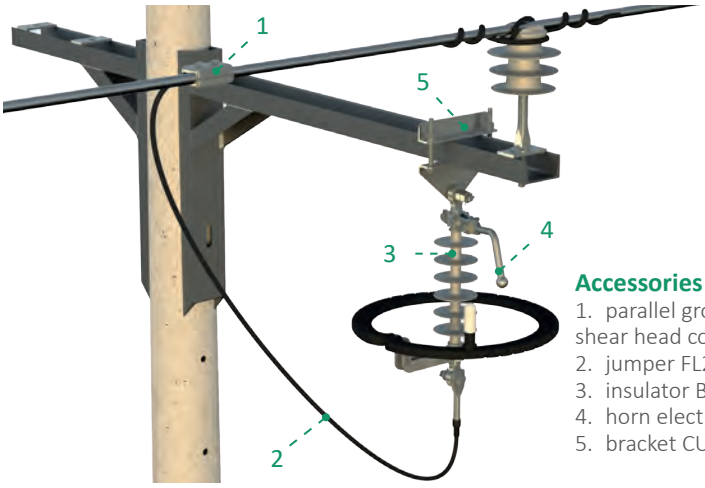
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. bracket CUCA.1B

1b

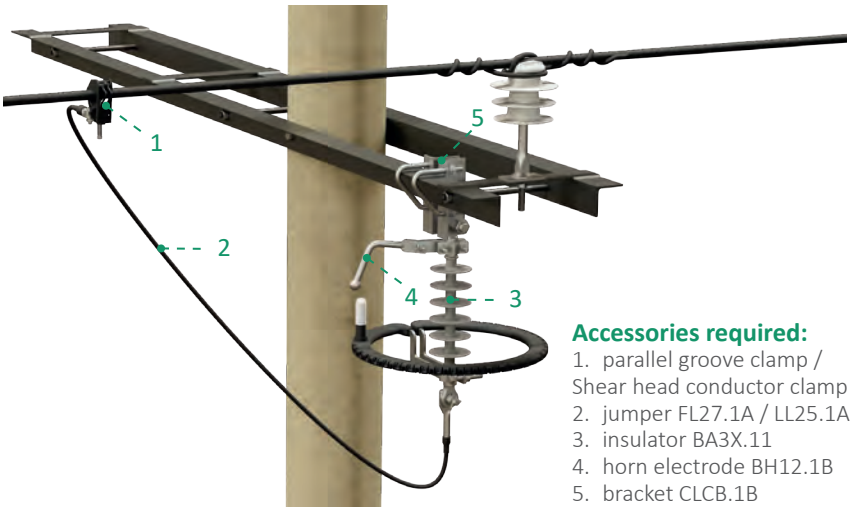
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / Shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. bracket CLCB.1B

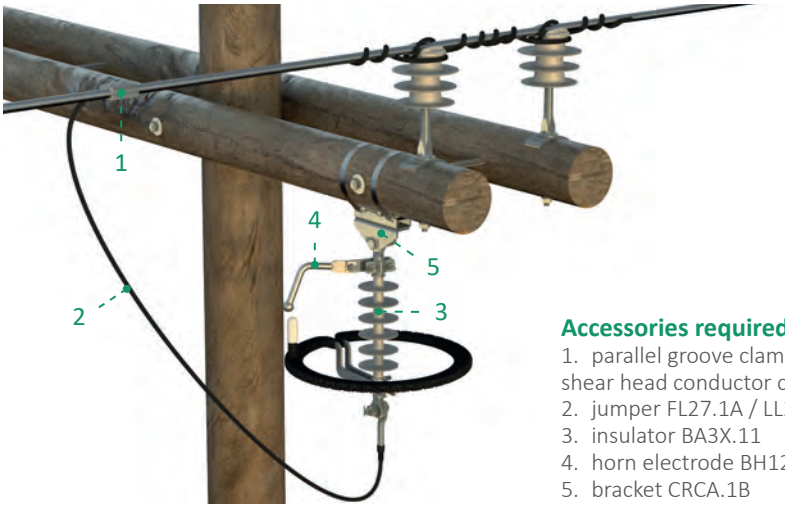
1c

Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. bracket CRCA.1B

1d

Type of line insulation
PIN/POST/PIN-POST

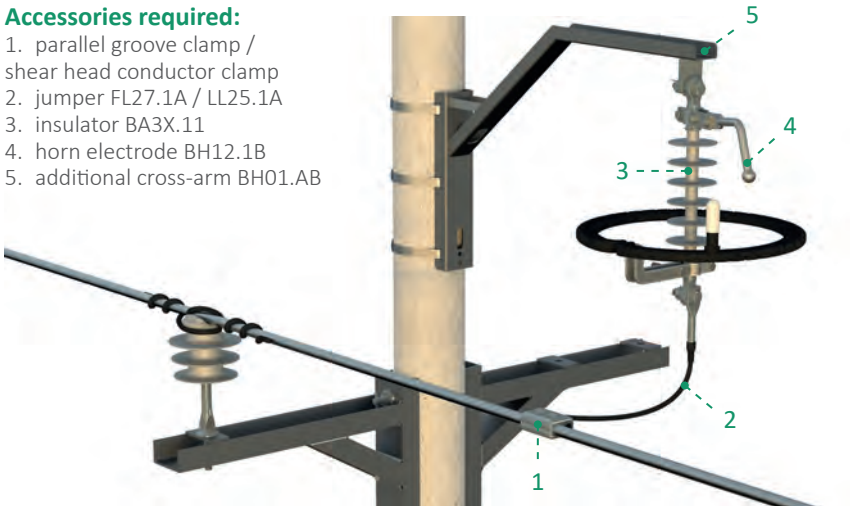
Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation; doesn't depend on type of line insulation.

Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. additional cross-arm BH01.AB



2. TENSION

2a

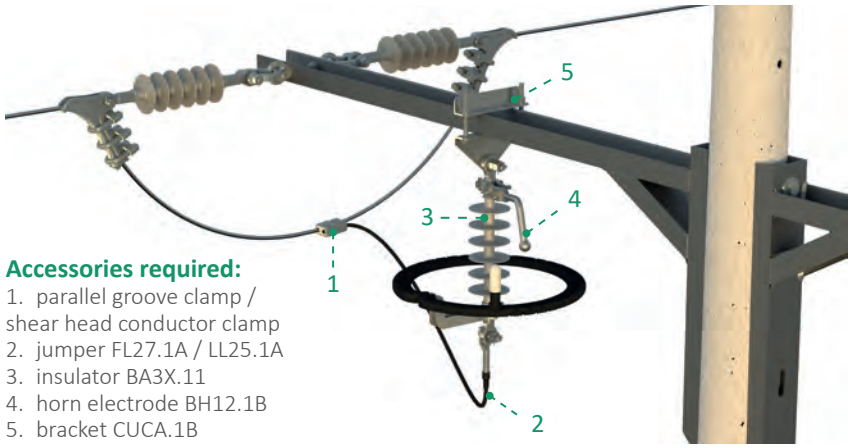
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. bracket CUCA.1B

2b

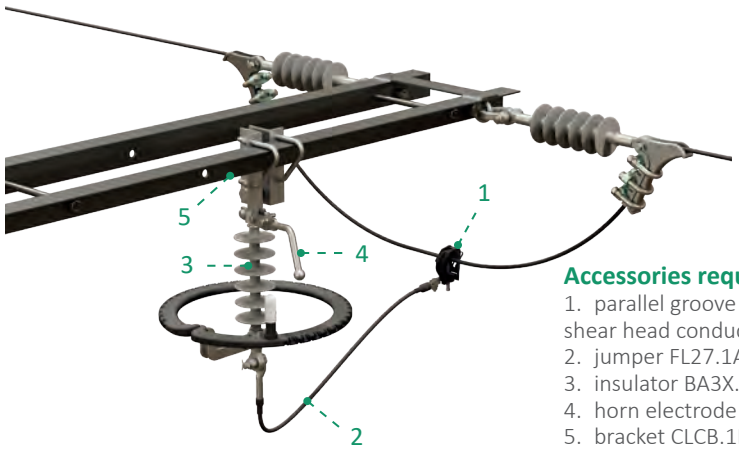
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. bracket CLCB.1B

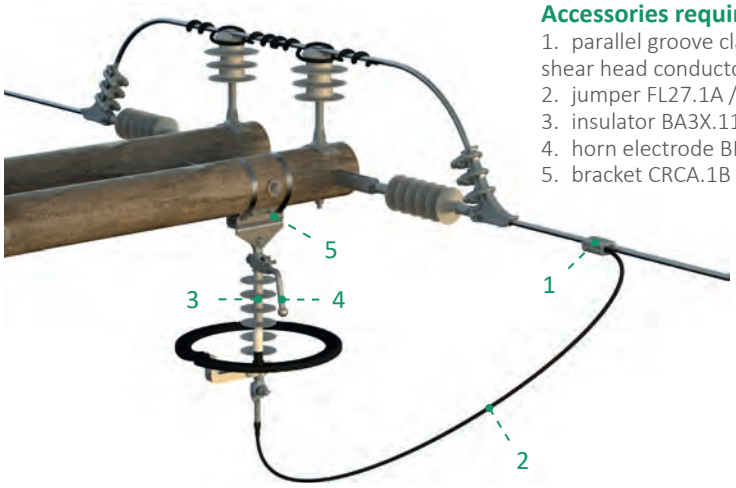
2c

Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horne electrode BH12.1B
5. bracket CRCA.1B

2d

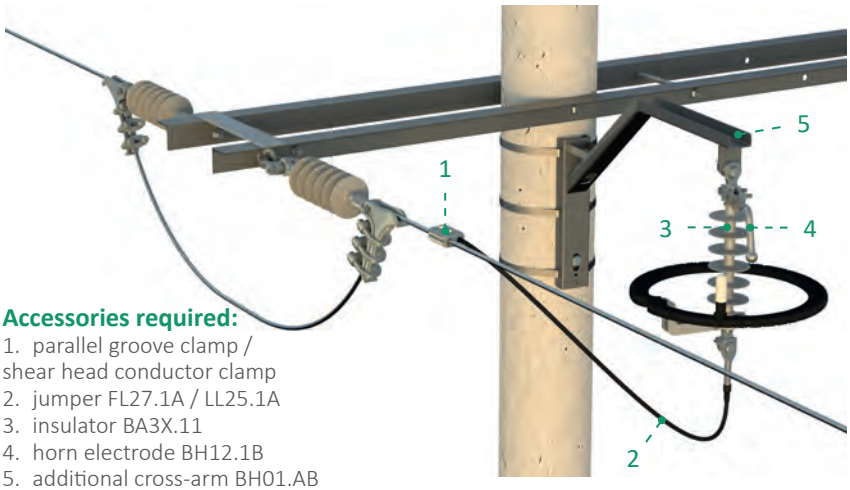
Type of line insulation
TENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horne electrode BH12.1B
5. additional cross-arm BH01.AB

3. SUSPENSION

3a

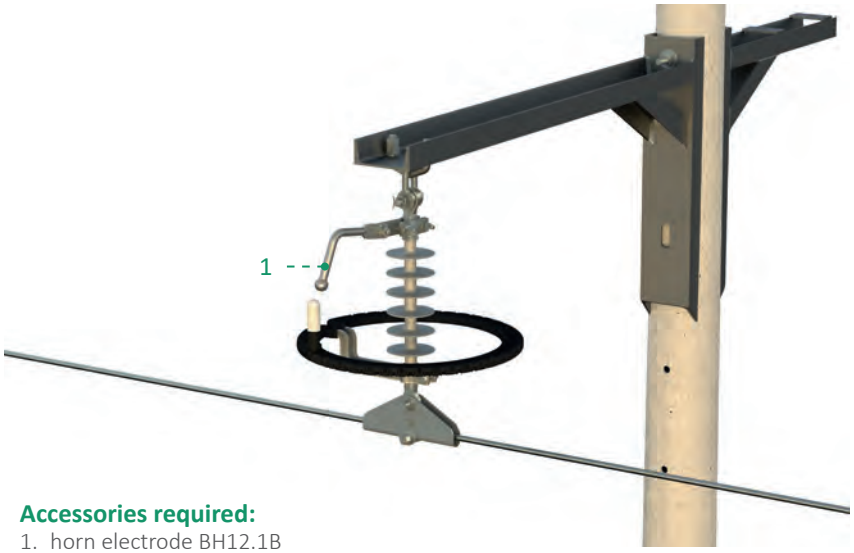
Type of line insulation
SUSPENSION (composite)

Type of pole
any

Type of cross-arm
any

Point of connection
suspension insulator

Notes
This is the easiest and cheapest method, but it is essential that the size and shape of the isolator allows this. Otherwise check option 3b.



Accessories required:
1. horne electrode BH12.1B

3b

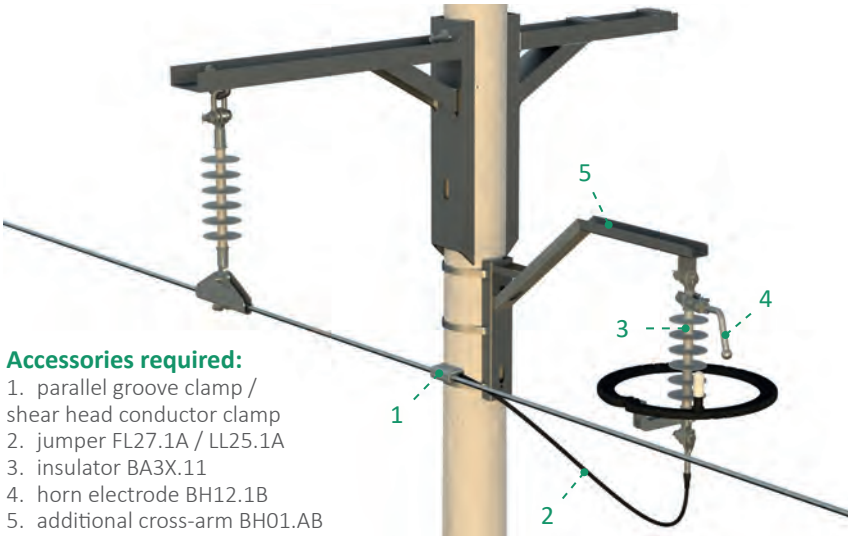
Type of line insulation
SUSPENSION (type: any)

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. additional cross-arm BH01.AB

4*. HORIZONTAL/VERTICAL POST

4a*

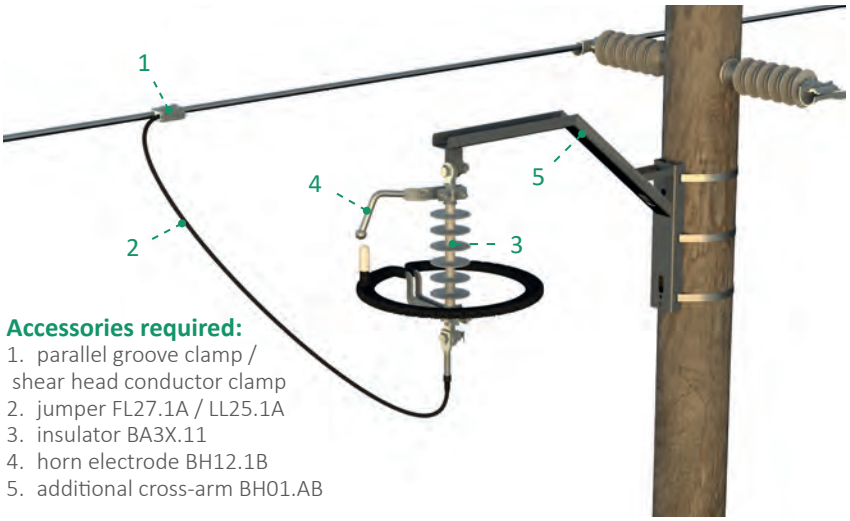
Type of line insulation
POST (Horizontal/Vertical)

Type of pole
armless pole

Type of cross-arm
-

Point of connection
pole

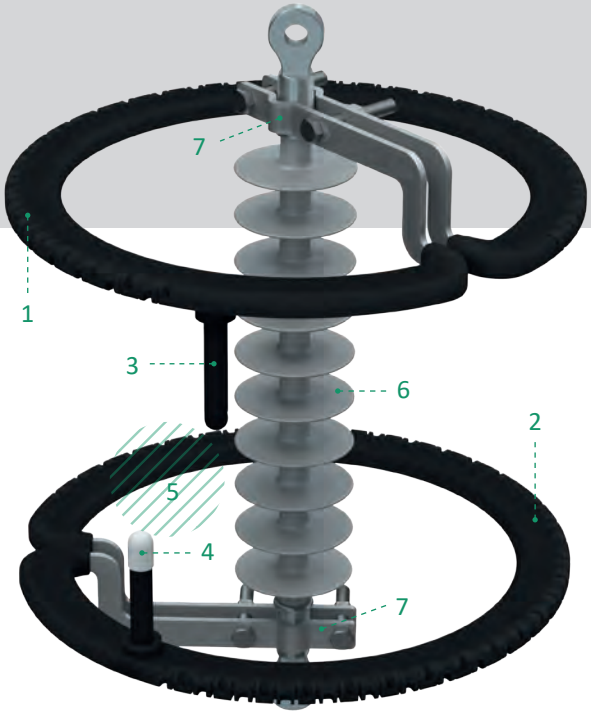
Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / shear head conductor clamp
2. jumper FL27.1A / LL25.1A
3. insulator BA3X.11
4. horn electrode BH12.1B
5. additional cross-arm BH01.AB

LLPD dM35z

Reference: № SAD.M35.Z.WW/920



1. Upper module with EQ system
2. Lower module with EQ system
3. Terminal electrode
4. Terminal electrode with one-time glass indicator
5. Air gap
6. Suspension composite insulator (not included)
7. Attachment point

40,5 Highest voltage for equipment, kV

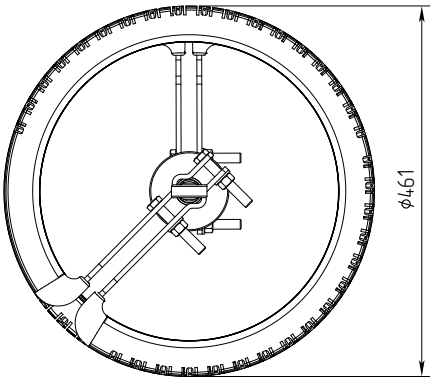
Protects from Direct Lightning Strike

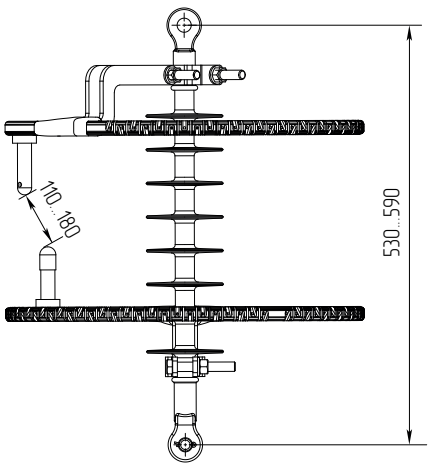
Protects from Back Flashover

No maintenance is required

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	40,5
Maximum prospective fault current, kA	5
External air gap, mm	115-180
50% flashover voltage (180 mm air gap), kV	< 200
Power frequency withstand voltage**, kV (wet/dry)	65/80
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	6,2
Maintenance	1 visual verification/ year

* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217





1. PIN/POST/PIN-POST

1a

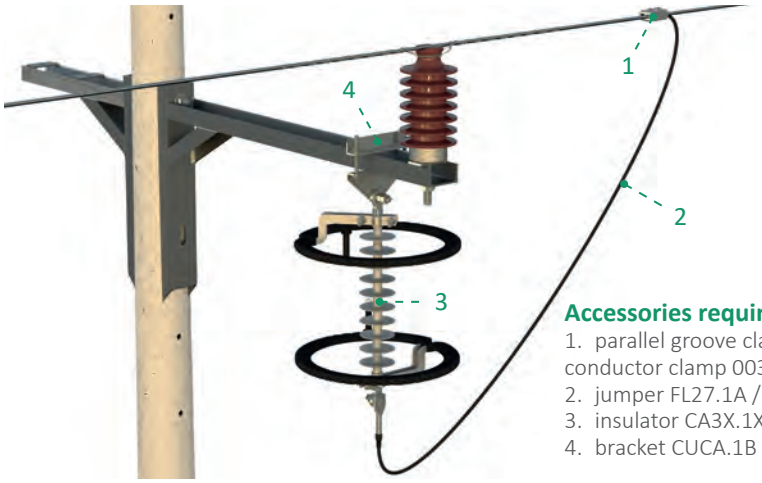
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CUCA.1B

1b

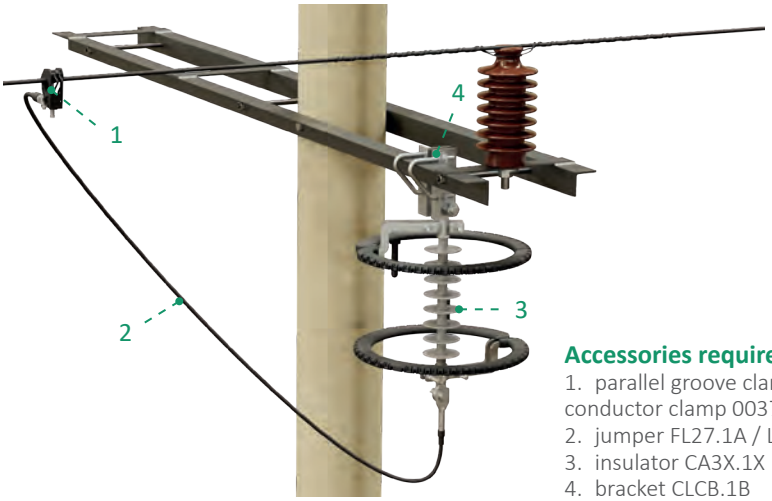
Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CLCB.1B

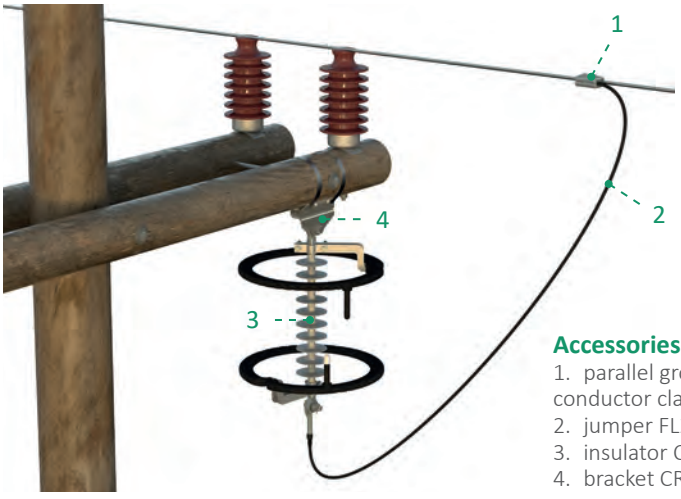
1c

Type of line insulation
PIN/POST/PIN-POST

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CRCA.1B

1d

Type of line insulation
PIN/POST/PIN-POST

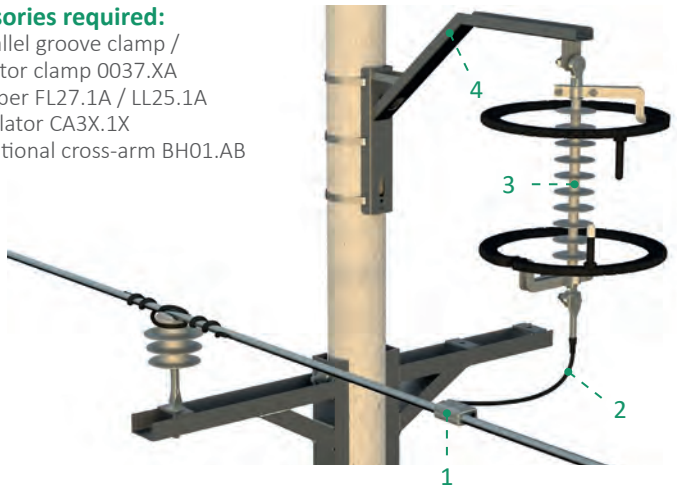
Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.

Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. additional cross-arm BH01.AB



2. TENSION

2a

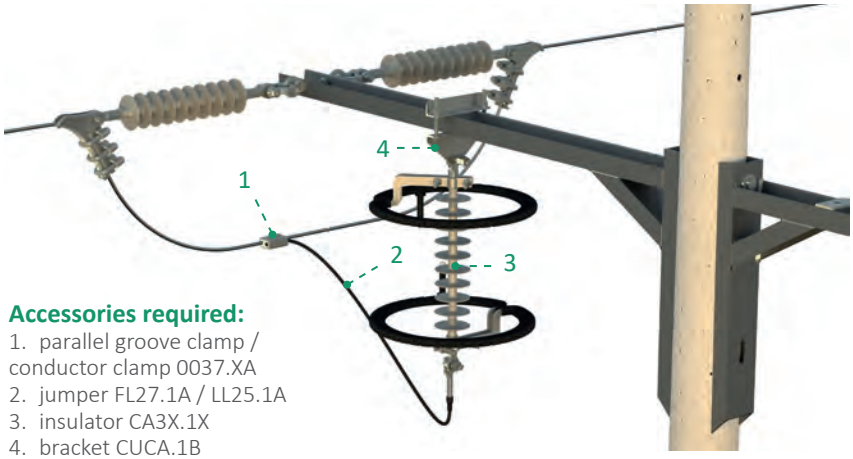
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CUCA.1B

2b

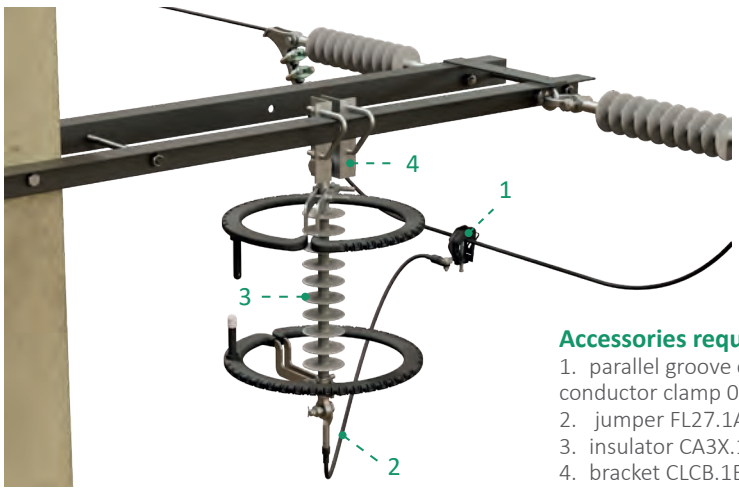
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CLCB.1B

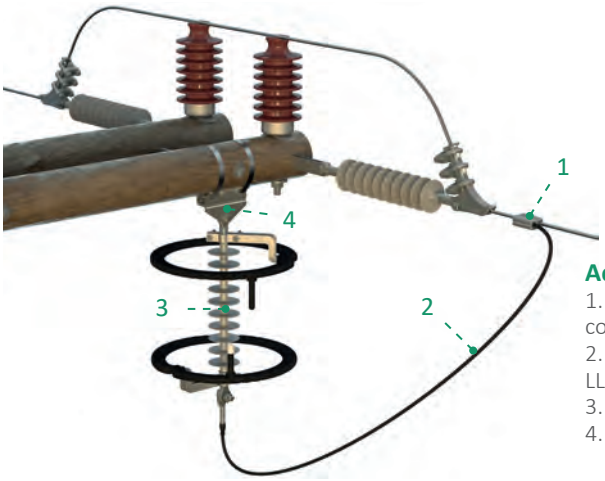
2c

Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
round

Point of connection
cross-arm



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. bracket CRCA.1B

2d

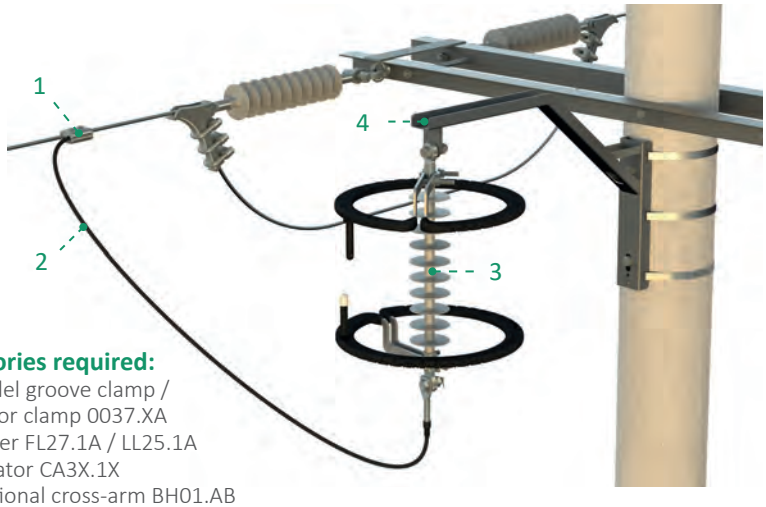
Type of line insulation
TENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. additional cross-arm BH01.AB

3. SUSPENSION

3a

Type of line insulation
SUSPENSION

Type of pole
any

Type of cross-arm
any

Point of connection
suspension insulator

Notes
This is the easiest and cheapest method, but it is essential that the size and shape of the isolator allows this. Otherwise check option 3b.

No accessories are required

3b

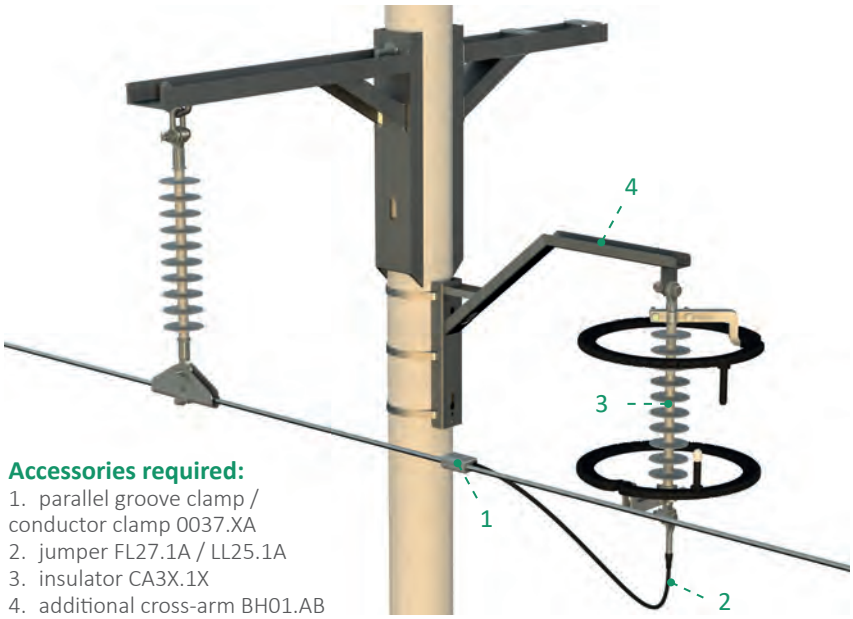
Type of line insulation
SUSPENSION (type: any)

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. additional cross-arm BH01.AB

4*. HORIZONTAL/VERTICAL POST

4a*

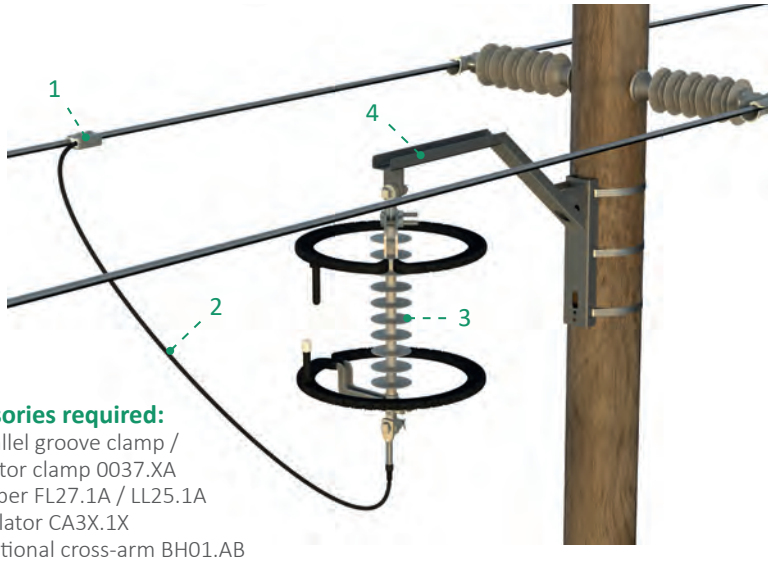
Type of line insulation
POST (Horizontal/Vertical)

Type of pole
round or tangent armless pole

Type of cross-arm
-

Point of connection
pole

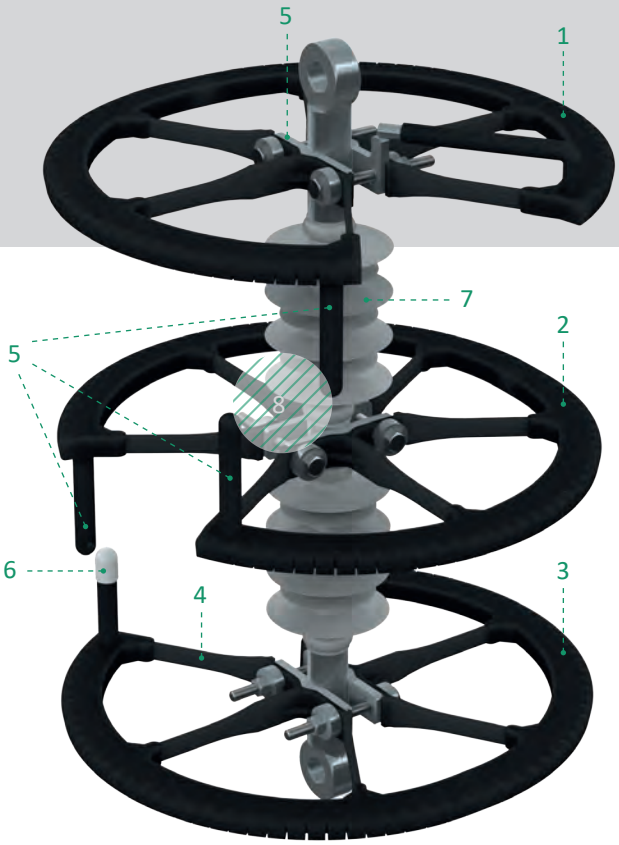
Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp / conductor clamp 0037.XA
2. jumper FL27.1A / LL25.1A
3. insulator CA3X.1X
4. additional cross-arm BH01.AB

LLPD d45z

Reference: № SAD.045.Z.WW/930



52 **Highest voltage for equipment, kV**

Protects from Direct Lightning Strike

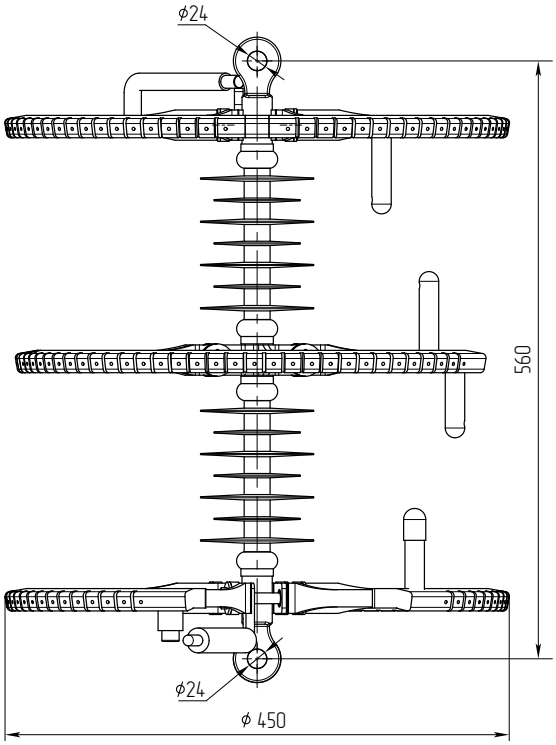
Protects from Back Flashover

No maintenance is required

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	52
Maximum prospective fault current, kA	5
External air gap, mm	80+80
50% flashover voltage, kV (80+80 mm air gap)	<280
Power frequency withstand voltage**, kV (wet/dry)	95/95
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	7
Maintenance	1 visual verification/ year

* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217

1. Upper module with EQ system
2. Intermediate module with EQ system
3. Lower module with EQ system
4. Insulating load-bearing frame
5. Terminal electrodes
6. Terminal electrode with one-time glass indicator
7. Suspension composite insulator (not included)
8. Air gap



2. TENSION

2a

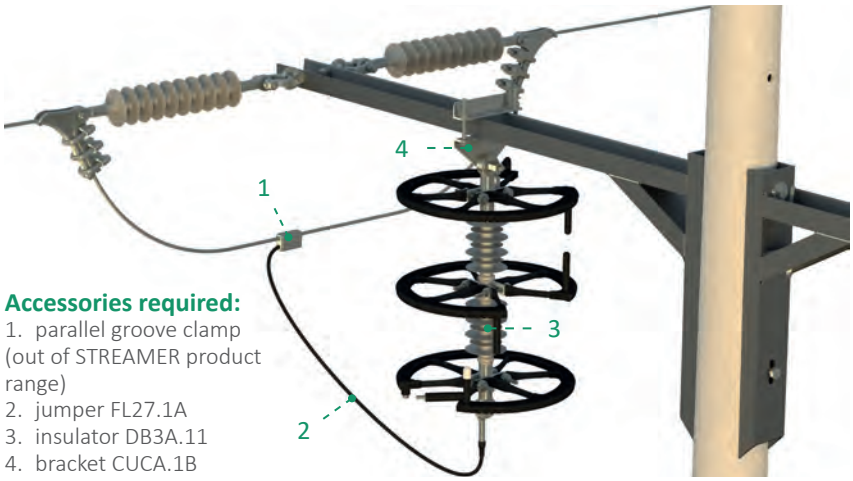
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator DB3A.11
4. bracket CUCA.1B

2b

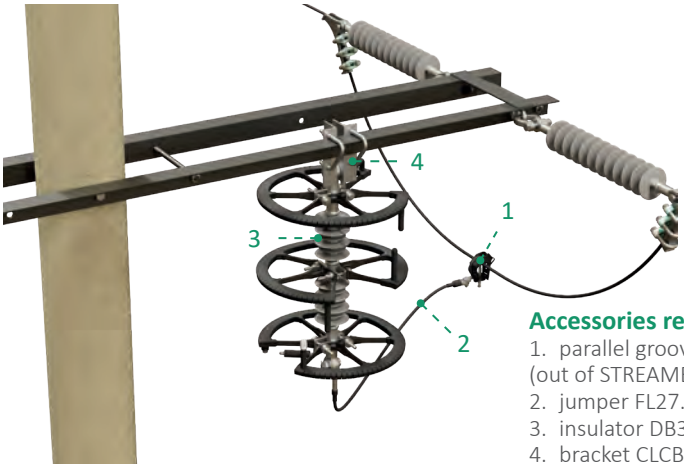
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator DB3A.11
4. bracket CLCB.1B

2c

Type of line insulation
TENSION

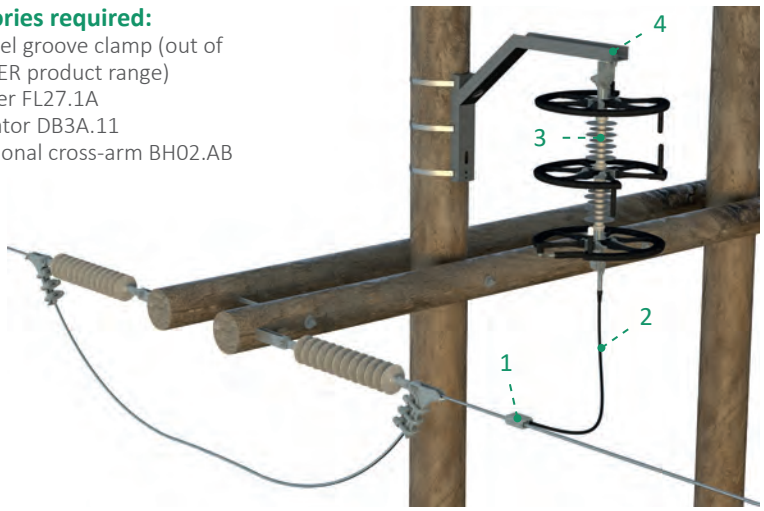
Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.

Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator DB3A.11
4. additional cross-arm BH02.AB



3. SUSPENSION

3a

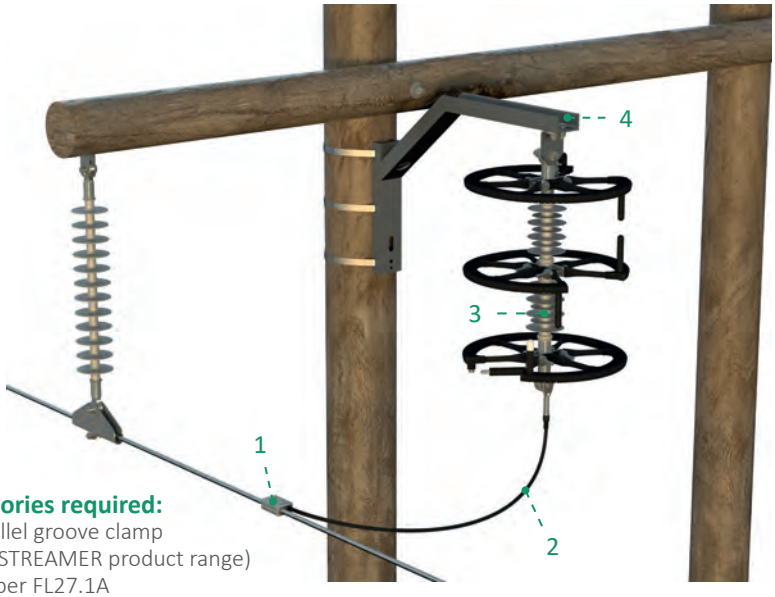
Type of line insulation
SUSPENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

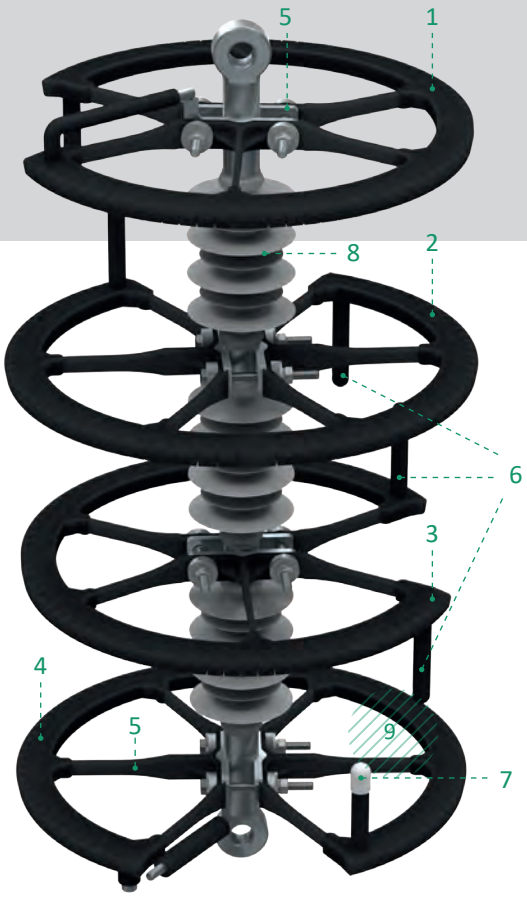
Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.



Accessories required:
1. parallel groove clamp
(out of STREAMER product range)
2. jumper FL27.1A
3. insulator DB3A.11
4. additional cross-arm BH02.AB

LLPD d69z

Reference: № SAD.069.Z.WW/920



72.5 Highest voltage for equipment, kV

Protects from Direct Lightning Strike

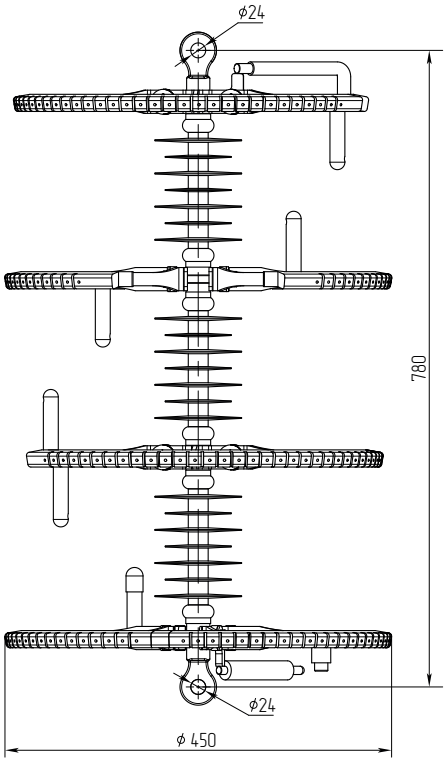
Protects from Back Flashover

No maintenance is required

ELECTRICAL LINE PARAMETERS	
Highest voltage for equipment*, kV	72,5
Maximum prospective fault current, kA	5
External air gap, mm	80+80+120
50% flashover voltage (75+75+115 mm air gap), kV	<400
Power frequency withstand voltage**, kV (wet/dry)	140/140
LIGHTNING PARAMETERS	
Lightning discharge capability (200 µs)***, C	2,8
High current impulse (4/10 µs), kA	65
Maximum quenching lightning current, kA	20 (8/50µs)
Minimum withstand amount of operations	10
GENERAL PARAMETERS	
Additional power losses on the line, %	0
Average expected lifespan, years	30
UV resistance****, h	1000
Weight, kg	9,3
Maintenance	1 visual verification/ year

* According to IEC 60038, ** According to IEC 60071-1, *** According to IEC 60099-8, **** According to ISO 4892-2, method A, IEC 62217

1. Upper module with EQ system
2. Intermediate module with EQ system 1
3. Intermediate module with EQ system 2
4. Lower module with EQ system
5. Insulating load-bearing frame
6. Terminal electrodes
7. Terminal electrode with one-time glass indicator
8. Suspension composite insulator (not included)
9. Air gap



2. TENSION

2a

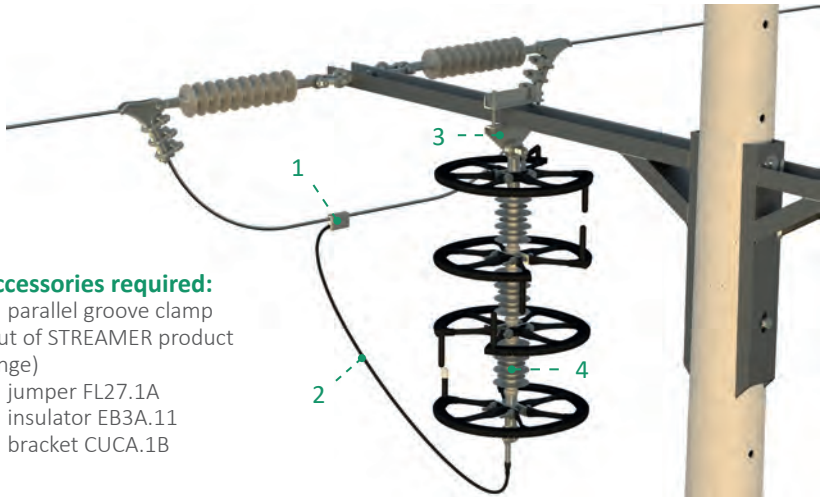
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
U-section

Point of connection
cross-arm

Notes
Maximum permissible size of cross-arm 150x130 mm.



Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator EB3A.11
4. bracket CUCA.1B

2b

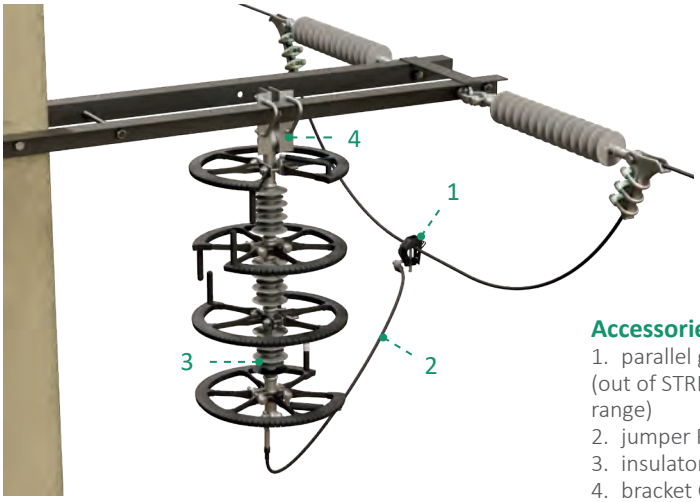
Type of line insulation
TENSION

Type of pole
any

Type of cross-arm
L-bar

Point of connection
cross-arm

Notes
Permissible size of L-bar 70x70...80x80 mm.



Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator EB3A.11
4. bracket CLCB.1B

2c

Type of line insulation
TENSION

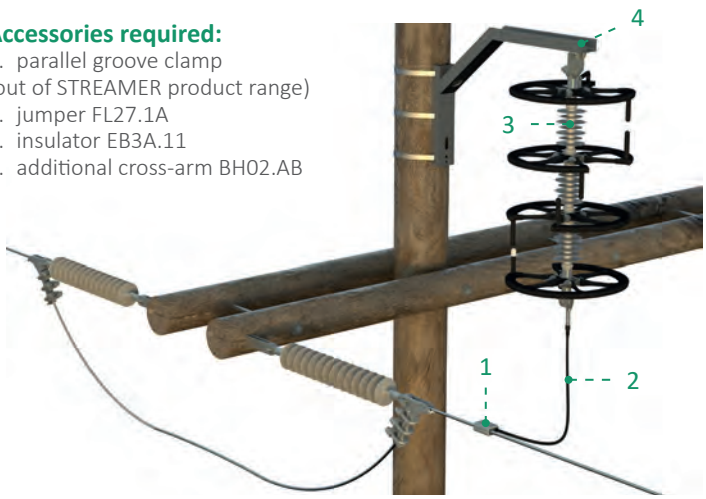
Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.

Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator EB3A.11
4. additional cross-arm BH02.AB



3. SUSPENSION

3a

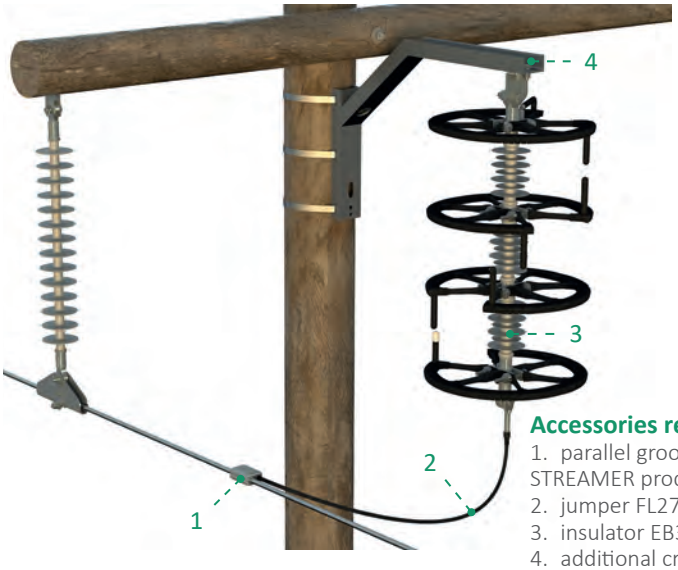
Type of line insulation
SUSPENSION

Type of pole
round

Type of cross-arm
any

Point of connection
additional cross-arm

Notes
The most versatile way of installation;
Doesn't depend on type of line insulation.

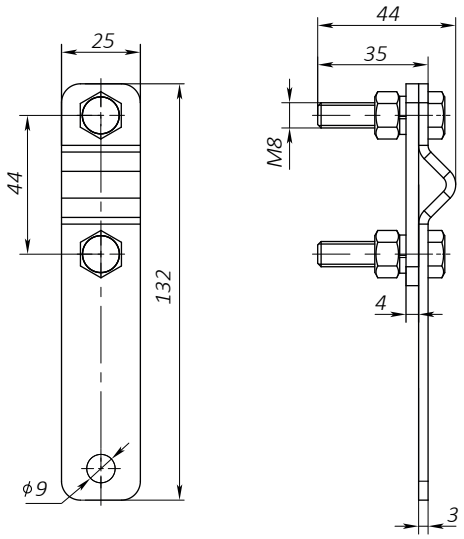


Accessories required:
1. parallel groove clamp (out of STREAMER product range)
2. jumper FL27.1A
3. insulator EB3A.11
4. additional cross-arm BH02.AB

Accessories:
Conductor clamps (non-insulated)

BA04.1B

Reference: № LL.CL.BA04.1B.WW

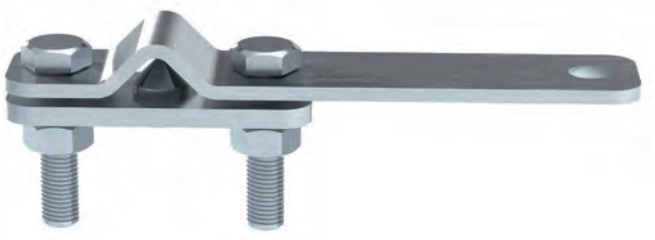


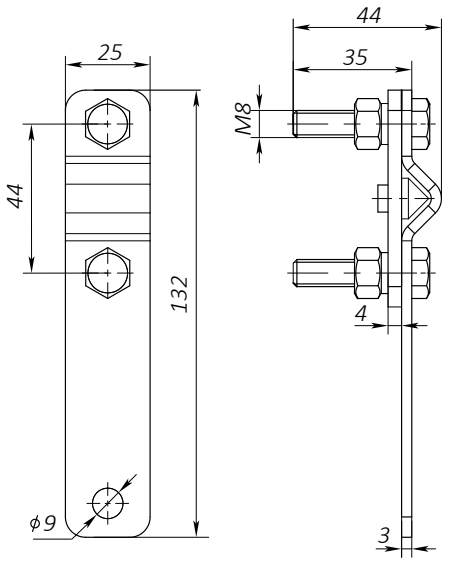
TECHNICAL DATA	
Minimum external diameter of conductor, mm	8
Maximum external diameter of conductor, mm	25
Material	Stainless Steel
Coating	No
Weight, kg	0,17

Type of conductor: bare

CA04.1B

Reference: LL.CL.CA04.1B.WW





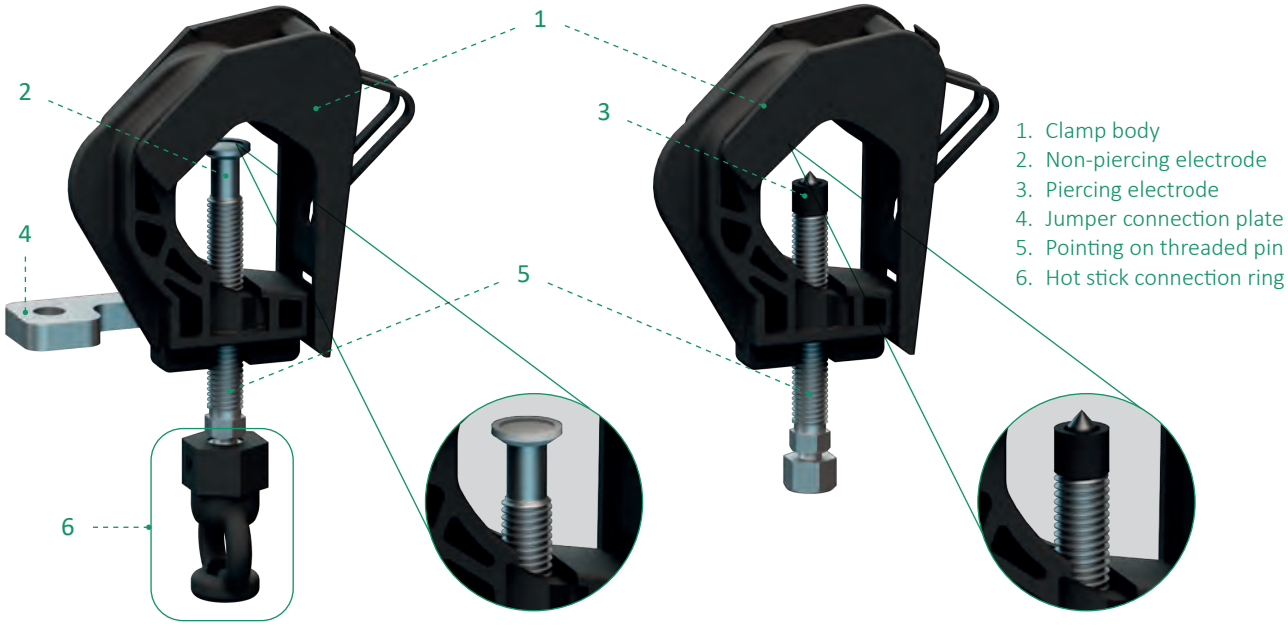
TECHNICAL DATA	
Minimum external diameter of conductor, mm	8
Maximum external diameter of conductor, mm	25
Material	Stainless Steel
Coating	No
Weight, kg	0,17
Maximum thickness of insulation layer, mm	2,5

Type of conductor: covered

Accessories:
Shear head conductor clamps

Non-Piercing

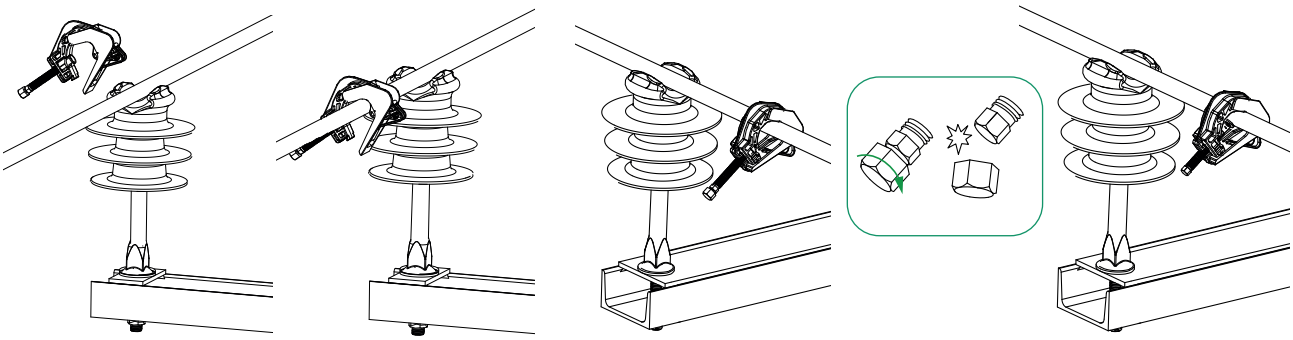
Piercing



1. Clamp body
2. Non-piercing electrode
3. Piercing electrode
4. Jumper connection plate
5. Pointing on threaded pin
6. Hot stick connection ring

- Can be installed on live-line
- Clamp pierce cable insulation up to 8 mm of thickness
- Seals piercing point thanks to IP55 protection
- Doesn`t damage cable core
- Provides optimal torque thanks to shear head
- Suitable for almost all external diameters of conductor

Installation of the clamp to the conductor



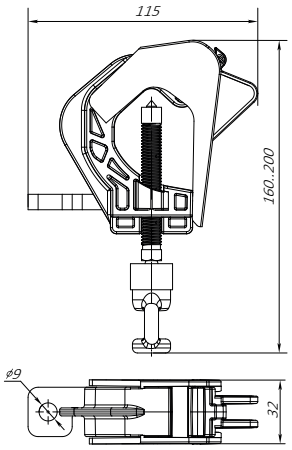
Install the clamp on the conductor

Tighten until a break off of shear head

0837.LA

Reference: LL.CC.0837.LA.WW

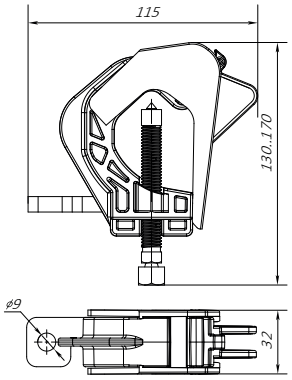
TECHNICAL DATA	
Hot-stick connection ring	+
Jumper connection plate	+
Minimum external diameter of conductor, mm	16
Maximum external diameter of conductor, mm	37
Maximum thickness of insulation layer, mm	8
Weight, kg	0,14



0837.0A

Reference: LL.CC.0837.0A.WW

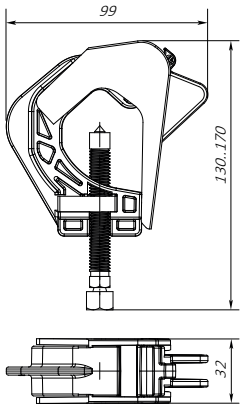
TECHNICAL DATA	
Hot-stick connection ring	-
Jumper connection plate	+
Minimum external diameter of conductor, mm	16
Maximum external diameter of conductor, mm	37
Maximum thickness of insulation layer, mm	8
Weight, kg	0,13



0837.00

Reference: LL.CC.0837.00.WW

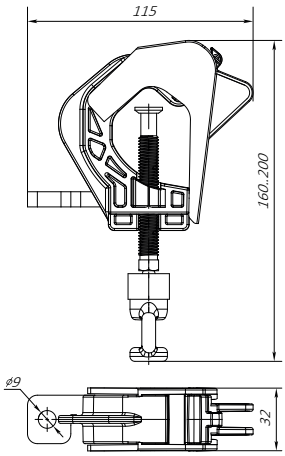
TECHNICAL DATA	
Hot-stick connection ring	-
Jumper connection plate	-
Minimum external diameter of conductor, mm	16
Maximum external diameter of conductor, mm	37
Maximum thickness of insulation layer, mm	8
Weight, kg	0,11



0037.LA

Reference: LL.CB.0037.LA.WW

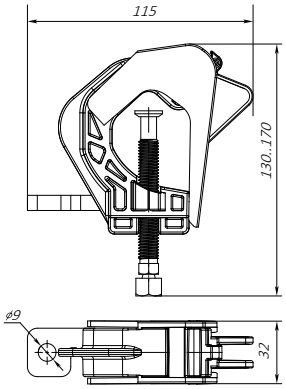
TECHNICAL DATA	
Hot-stick connection ring	+
Jumper connection plate	+
Minimum external diameter of conductor, mm	6
Maximum external diameter of conductor, mm	24
Weight, kg	0,14



0037.0A

Reference: LL.CB.0037.0A.WW

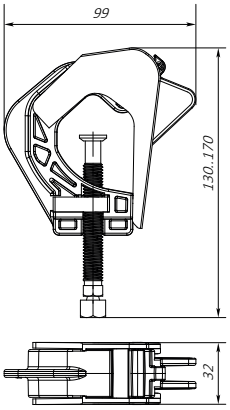
TECHNICAL DATA	
Hot-stick connection ring	-
Jumper connection plate	+
Minimum external diameter of conductor, mm	6
Maximum external diameter of conductor, mm	24
Weight, kg	0,13



0037.00

Reference: LL.CB.0037.00.WW

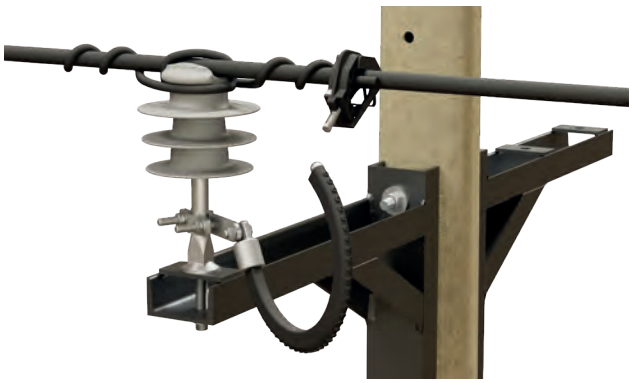
TECHNICAL DATA	
Hot-stick connection ring	-
Jumper connection plate	-
Minimum external diameter of conductor, mm	6
Maximum external diameter of conductor, mm	24
Weight, kg	0,11



Installation with LLPD:

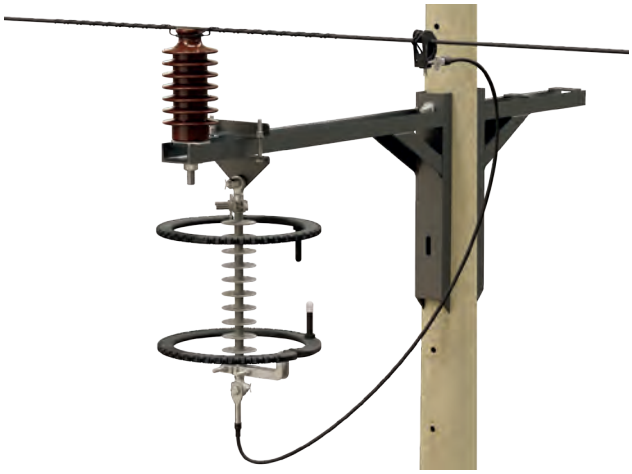
1. Installation of LLPDs without jumper

COMPATIBLE WITH
LLPD i20z
LLPD dC10z
LLPD dC20z



2. Installation of LLPDs with jumper

COMPATIBLE WITH
LLPD dS10z
LLPD d24z
LLPD dM35z



Accessories:
Jumpers

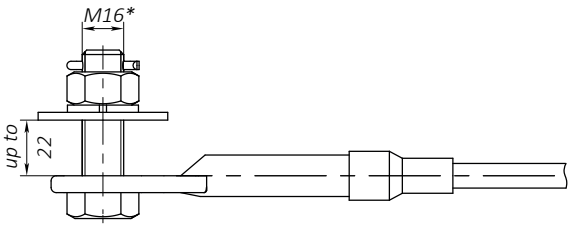
FL27.1A

Reference: LL.JU.FL27.1A.WW

TECHNICAL DATA	
Length, m	3
Terminal 1 connection option	Free end (for parallel groove clamp)
Terminal 2 connection option	cable lug
Thickness of insulation layer, mm	2,5
Weight, kg	0,65

Length can be adjusted on-site

COMPATIBLE WITH
LLPD dS10z
LLPD d24z
LLPD dM35z
LLPD d45z
LLPD d69z



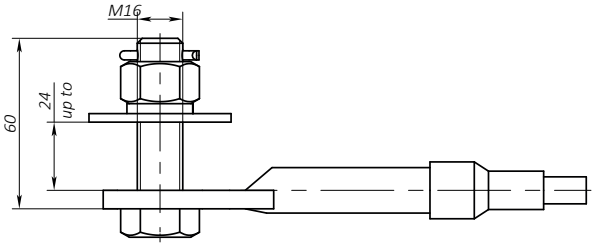
LL25.1A

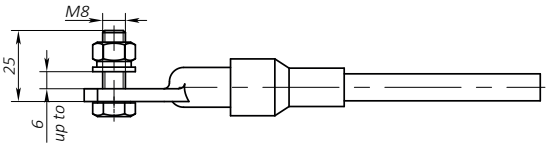
Reference: LL.JU.LL25.1A.WW

TECHNICAL DATA	
Length, m	2,5
Terminal 1 connection option	cable lug
Terminal 2 connection option	Cable lug (for shear head conductor clamps)
Thickness of insulation layer, mm	2,5
Weight, kg	0,57

Length can be adjusted on-site

COMPATIBLE WITH	
LLPD dS10z	LL.CC.0837.LA.WW
LLPD d24z	LL.CC.0837.OA.WW
LLPD dM35z	LL.CB.0037.LA.WW
LLPD d45z	LL.CB.0037.0A.WW
LLPD d69z	





Accessories: Insulators

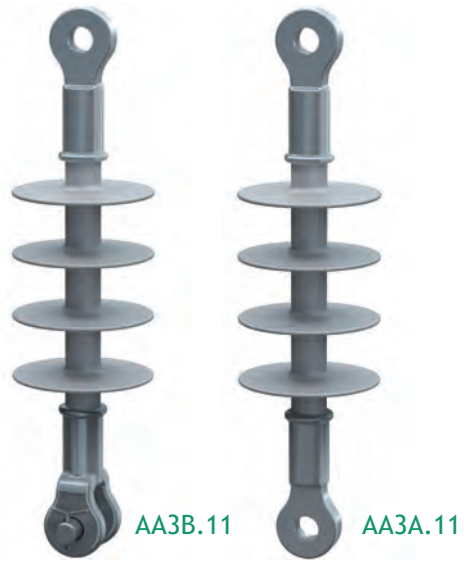
AA3X.11

Reference	LL.IN.AA3B.11.TH	grey, clevis/tongue
	LL.IN.AA3A.11.TH	grey, tongue/tongue

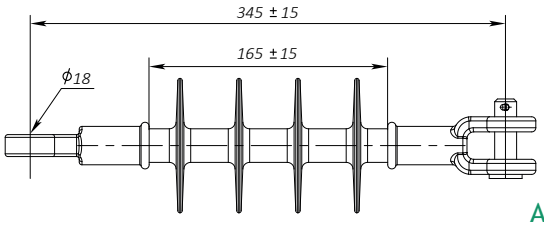
TECHNICAL DATA	
Nominal voltage, kV	15
Highest voltage for equipment, kV	17,5
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	38
Specified Mechanical Load (SML), kN	70
Creepage distance, mm	460
Weight, kg	1,17

COMPATIBLE WITH

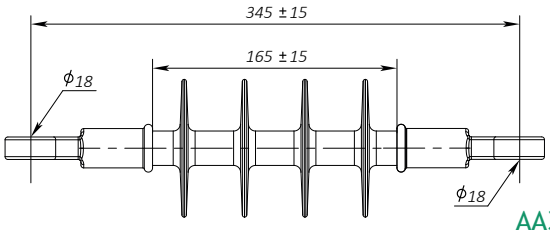
LLPD dS10z



AA3B.11 AA3A.11



AA3B.11



AA3A.11

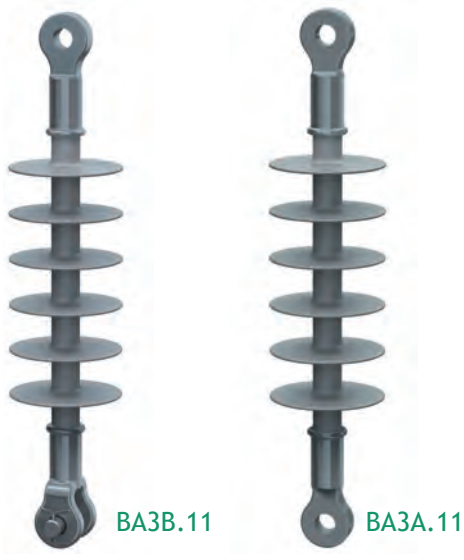
BA3X.11

Reference	LL.IN.BA3B.11.TH	grey, clevis/tongue
	LL.IN.BA3A.11.TH	grey, tongue/tongue

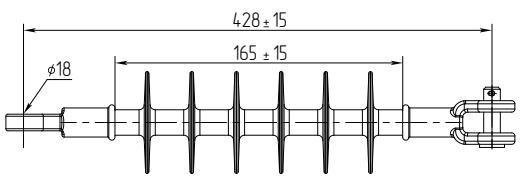
TECHNICAL DATA	
Nominal voltage, kV	20
Highest voltage for equipment, kV	24
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	50
Specified Mechanical Load (SML), kN	70
Creepage distance, mm	686
Weight, kg	1,43

COMPATIBLE WITH

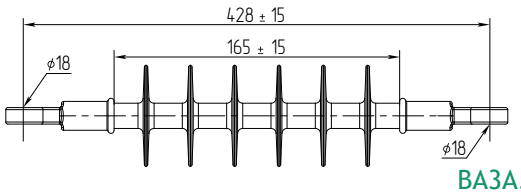
LLPD d24z



BA3B.11 BA3A.11



BA3B.11



BA3A.11

CA3X.11

Reference LL.IN.CA3B.11.TH grey, clevis/tongue
LL.IN.CA3A.11.TH grey, tongue/tongue

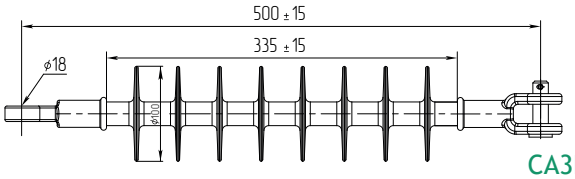
TECHNICAL DATA	
Nominal voltage, kV	35
Highest voltage for equipment, kV	40,5
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	80
Specified Mechanical Load (SML), kN	70
Creepage distance, mm	914
Weight, kg	1,6

COMPATIBLE WITH

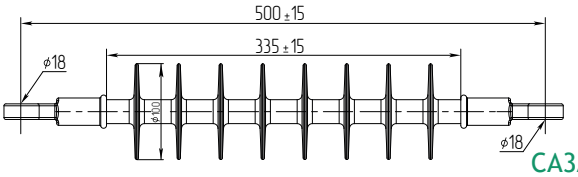
LLPD dM35z

CA3B.11

CA3A.11



CA3B.11



CA3A.11

CA3X.12

Reference LL.IN.CA3B.12.TH grey, clevis/tongue
LL.IN.CA3A.12.TH grey, tongue/tongue

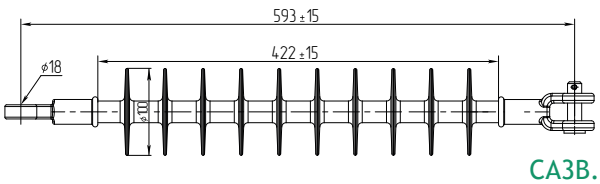
TECHNICAL DATA	
Nominal voltage, kV	35
Highest voltage for equipment, kV	40,5
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	80
Specified Mechanical Load (SML), kN	70
Creepage distance, mm	1137
Weight, kg	1,66

COMPATIBLE WITH

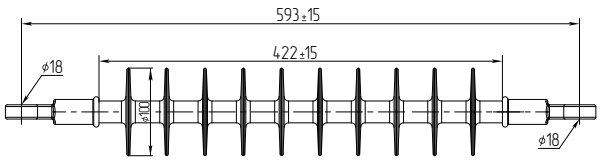
LLPD dM35z

CA3B.12

CA3A.12



CA3B.12



CA3A.12

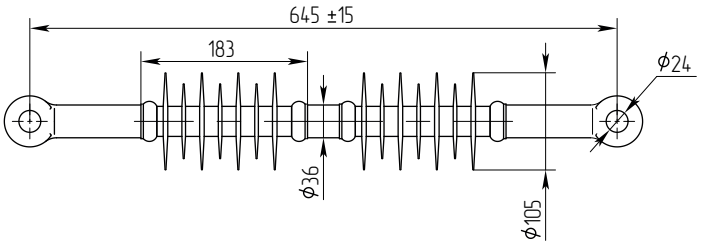
DB3A.11

Reference LL.IN. DB3A.11.CN grey, tongue/tongue

TECHNICAL DATA	
Nominal voltage, kV	45
Highest voltage for equipment, kV	52
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	95
Specified Mechanical Load (SML), kN	160
Creepage distance, mm	1130
Weight, kg	3,3

COMPATIBLE WITH

LLPD d45z



DB3A.11

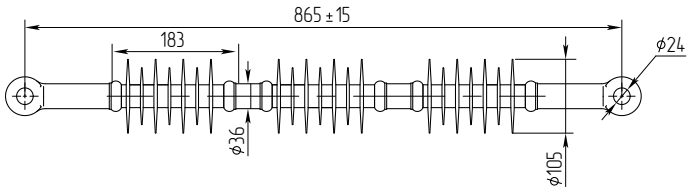
EB3A.11

Reference LL.IN.EB3A.11.CN grey, tongue/tongue

TECHNICAL DATA	
Nominal voltage, kV	69
Highest voltage for equipment, kV	72,5
Rated frequency, Hz	48-62
Power-frequency withstand voltage, kV	140
Specified Mechanical Load (SML), kN	160
Creepage distance, mm	1730
Weight, kg	4

COMPATIBLE WITH

LLPD d69z



EB3A.11

Accessories:
Horn Electrodes

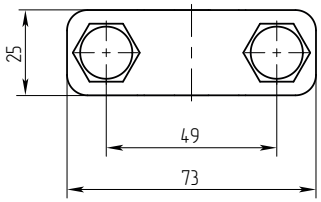
BH10.1B

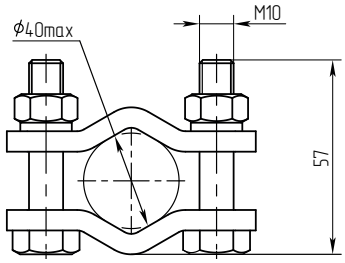
Reference: № LL.HR.BH10.1B.WW

TECHNICAL DATA	
Horn electrode length, mm	0
Maximum external diameter of insulator end fitting, mm	40
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,27

COMPATIBLE WITH

LLPD dC10z (in case of installation directly on a tension insulator), check case 2a (page 27).





BH11.1B

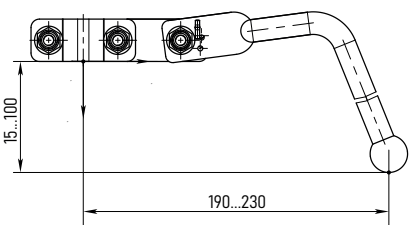
Reference: LL.HR.BH11.1B.WW

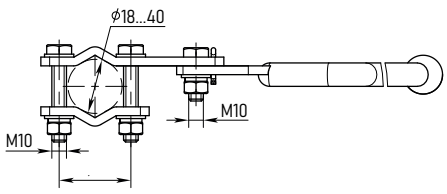
TECHNICAL DATA	
Horn electrode length, mm	75
Maximum external diameter of insulator end fitting, mm	40
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,77

COMPATIBLE WITH

LLPD dS10z

LLPD i20z (in case of installation directly on a tension insulator), check case 2a (page 23).





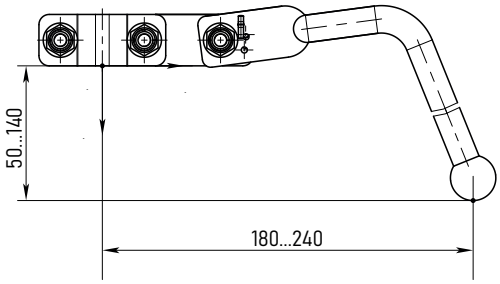
BH12.1B

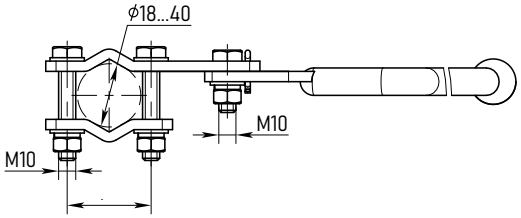
Reference: LL.HR.BH12.1B.WW

TECHNICAL DATA	
Horn electrode length, mm	115
Maximum external diameter of insulator end fitting, mm	40
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,81

COMPATIBLE WITH

LLPD d24z





Accessories:
Brackets

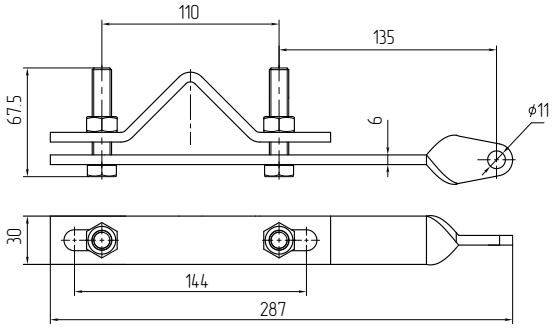
CLAA.1B

Reference: LL.BR.CLAA.1B.WW

TECHNICAL DATA	
Minimum permissible size of L-bar, mm	60x60
Maximum permissible size of L-bar, mm	90x90
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,78

Type of pole	any
Type of cross-arm	L-bar
Point of connection	cross-arm

COMPATIBLE WITH:		
LLPD i20z	1d	page 23
	2d	page 24



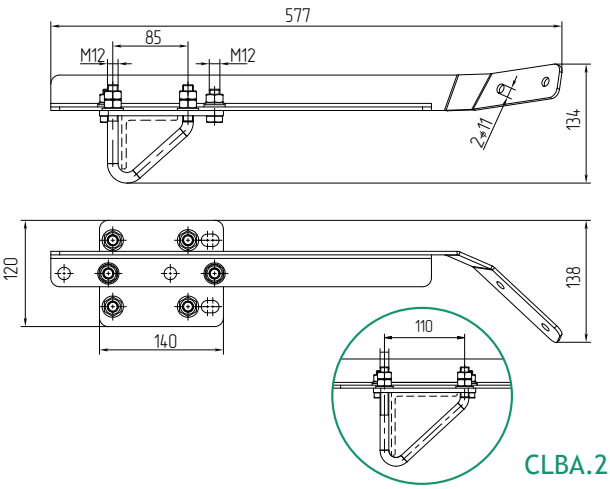
CLBA.XB

Reference: LL.BR.CLBA.1B.WW for L-bar 60x60 mm
LL.BR.CLBA.2B.WW for L-bar 90x90 mm

TECHNICAL DATA	
Permissible size of L-bar, mm	60x60 (CLBA.1B) 90x90 (CLBA.2B)
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	2,7-2,8

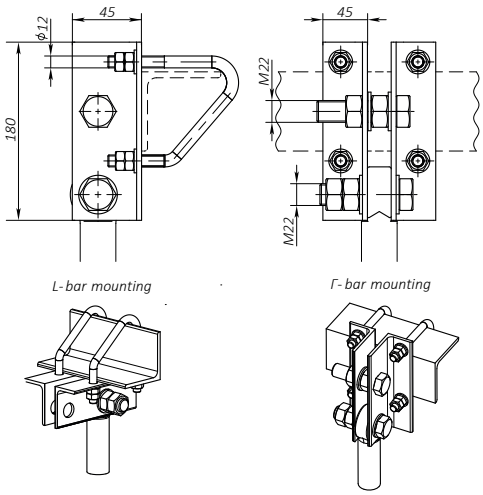
Type of pole	any
Type of cross-arm	L-bar
Point of connection	cross-arm

COMPATIBLE WITH:		
LLPD dC20z	1b	page 32
	2b	page 33



CLCB.1B

Reference: LL.BR.CLCB.1B.WW



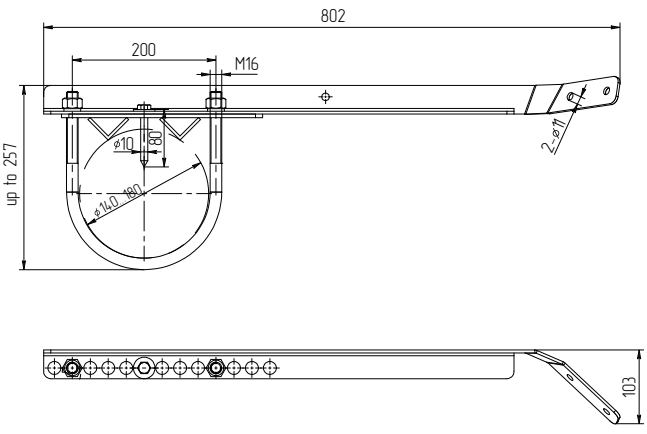
TECHNICAL DATA	
Permissible size of Γ-/L- shape L-bar , mm	70x70 ... 80x80
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	3,2
Type of pole	any
Type of cross-arm	Γ/L-bar
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD dS10z	1c	page 26	**LLPD dM35z**	1b	page 41
	2c	page 28		2b	page 42
LLPD d24z	1b	page 36	**LLPD d45z**	2b	page 46
	2b	page 37	**LLPD d69z**	2b	page 49

CRBA.1B

Reference: LL.BR.CRBA.1B.WW



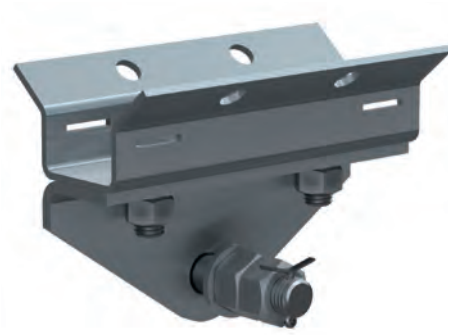
TECHNICAL DATA	
Permissible diameter of cross-arm, mm	140-180
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	2,5
Type of pole	any
Type of cross-arm	round wooden
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD dC20z	1c	page 32
	2c	page 33

CRCA.1B

Reference: LL.BR.CRCA.1B.WW

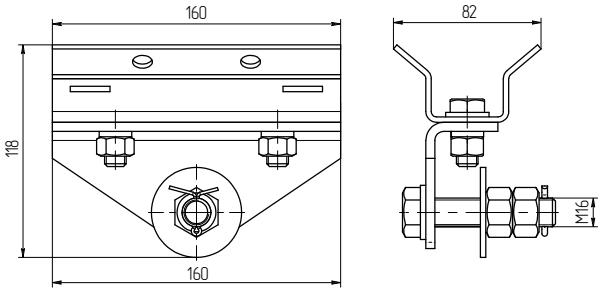


TECHNICAL DATA	
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	1,35

Type of pole	any
Type of cross-arm	round
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD dS10z	1d	page 27	**LLPD dM35z**	1c	page 41
	2d	page 28		2c	page 43
LLPD d24z	1c	page 36			
	2c	page 38			



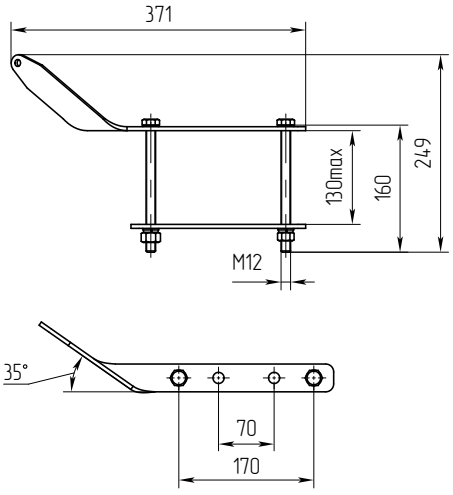
CUAA.1B

Reference: LL.BR.CUAA.1B.WW

TECHNICAL DATA	
Max. permissible size of cross-arm (WxH), mm	150x130
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	1,17
Type of pole	any
Type of cross-arm	U-section
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD i20z	1c	page 22
	2c	page 24



CUBA.1B

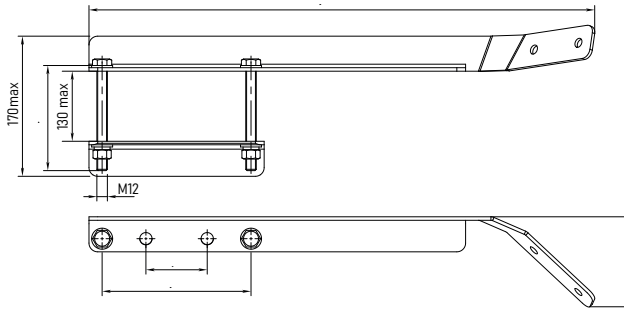
Reference: LL.BR.CUBA.1B.WW

TECHNICAL DATA	
Maximum permissible size of cross-arm (WxH), mm	150x130
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	1,95

Type of pole	any
Type of cross-arm	U-section
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD dC20z	1a	page 32
	2a	page 33



CUCA.1B

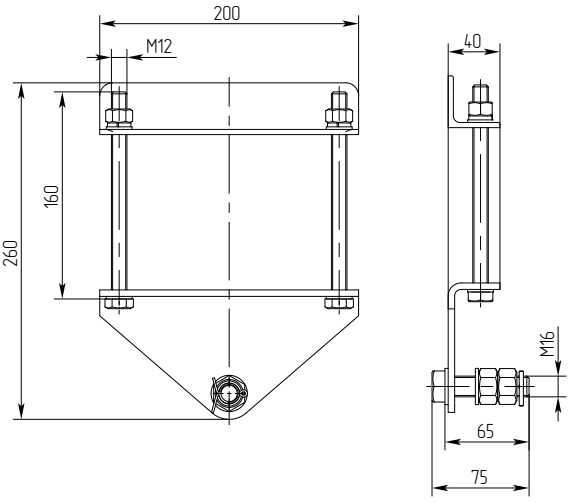
Reference: LL.BR.CUCA.1B.WW

TECHNICAL DATA	
Maximum permissible size of cross-arm (WxH), mm	150x30
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	1,76

Type of pole	any
Type of cross-arm	U-section
Point of connection	cross-arm

COMPATIBLE WITH:

LLPD dS10z	1b	page 26	**LLPD dM35z**	1a	page 41
	2b	page 28		2a	page 42
LLPD d24z	1a	page 36	**LLPD d45z**	2a	page 46
	2a	page 37	**LLPD d69z**	2a	page 49



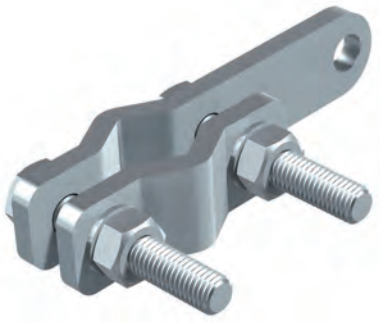
IDAA.1B

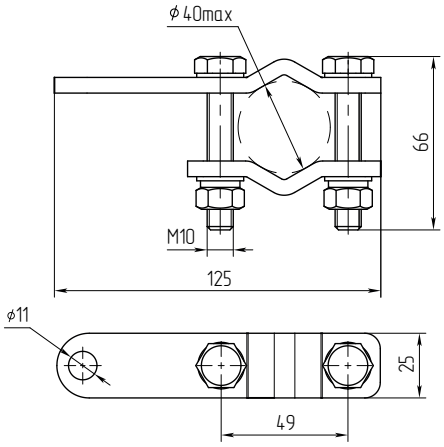
Reference: LL.BR.IDAA.1B.WW

TECHNICAL DATA	
Maximum diameter of insulator's pin, mm	40
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,34

Type of pole	any
Type of cross-arm	any
Point of connection	insulator's pin

COMPATIBLE WITH:		
LLPD i20z	1a	page 22
	2a	page 23





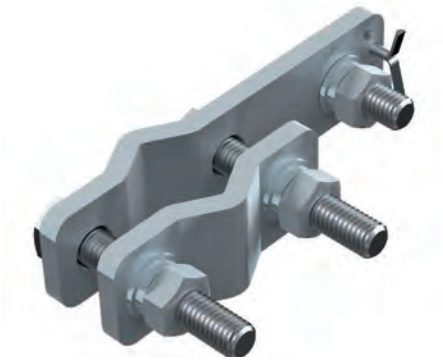
IDAA.2B

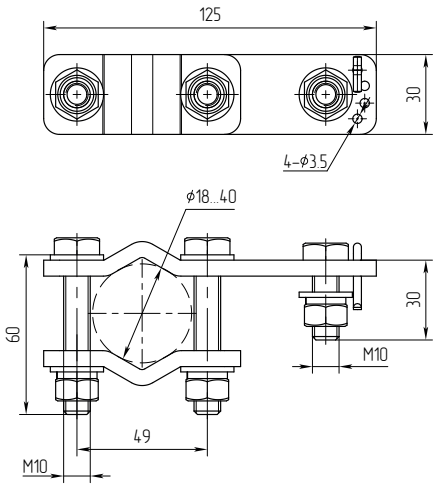
Reference: LL.BR.IDAA.2B.WW

TECHNICAL DATA	
Maximum external diameter of pin, mm	40
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,44

Type of pole	any
Type of cross-arm	any
Point of connection	insulator's pin

COMPATIBLE WITH:		
LLPD dC10z	1a	page 26
	2a	page 27



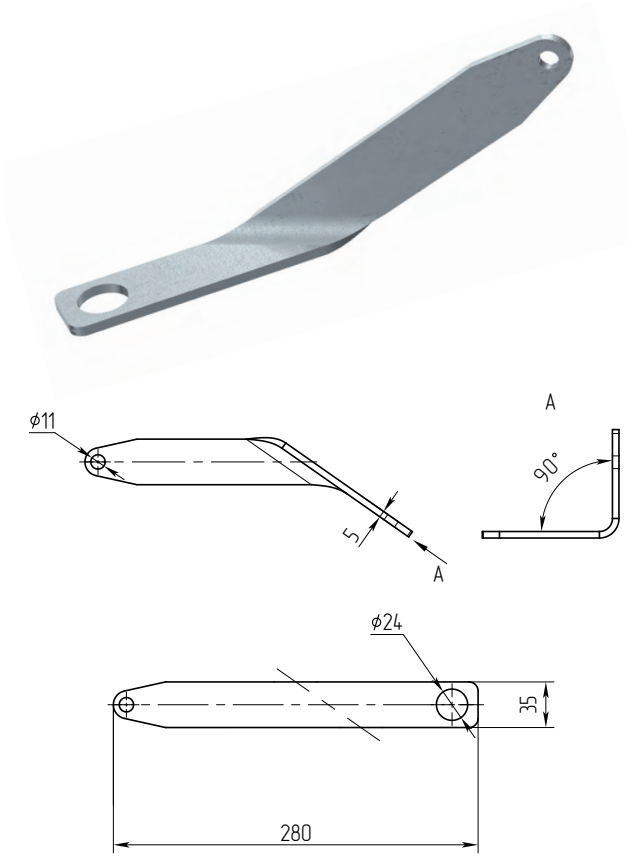


IDAB.1B

Reference: LL.BR.IDAB.1B.WW

TECHNICAL DATA	
Maximum diameter of tip of insulator's pin, mm	24
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	0,4
Type of pole	any
Type of cross-arm	any
Point of connection	PIN of insulator
Type of pole	any
Type of cross-arm	any
Point of connection	PIN of insulator

COMPATIBLE WITH:		
LLPD i20z	1b	page 22
	2b	page 23

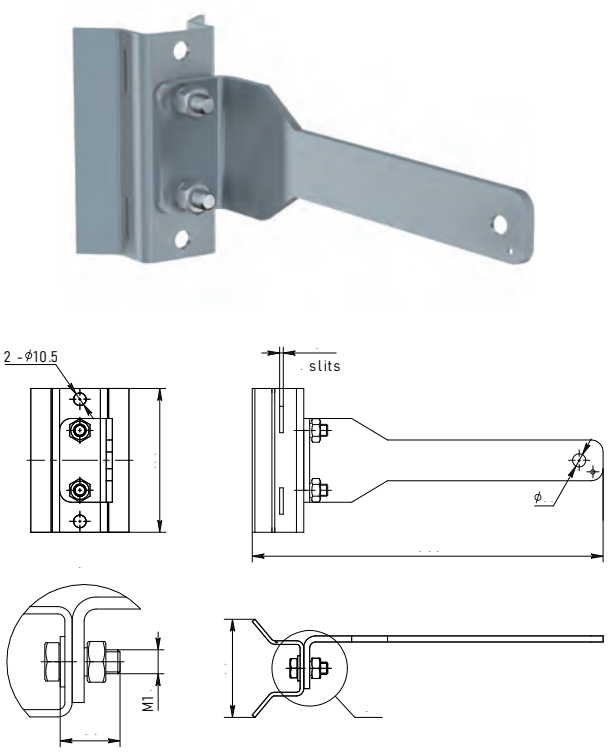


PRAA.1B

Reference: LL.BR.PRAA.1B.WW

TECHNICAL DATA	
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	1,0
Type of pole	round armless
Type of cross-arm	-
Point of connection	pole

COMPATIBLE WITH:		
LLPD dC10z	4a*	page 30



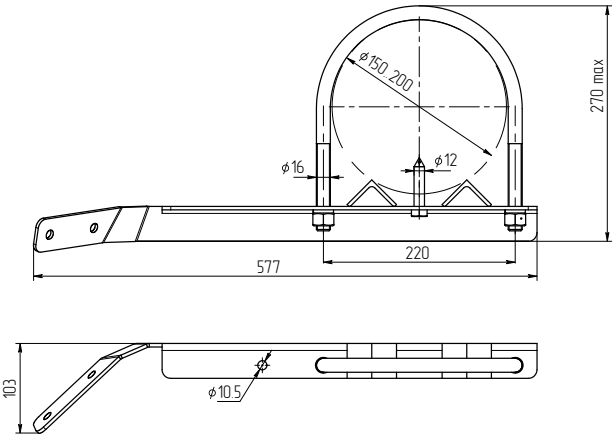
PRBA.1B

Reference: LL.BR.PRBA.1B.WW

TECHNICAL DATA	
Permissible diameter of pole, mm	150-200
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	2,5
Type of pole	armless pole (wooden)
Type of cross-arm	-
Point of connection	pole

COMPATIBLE WITH:

LLPD dC20z 4a* page 34



Accessories:
Additional cross-arms

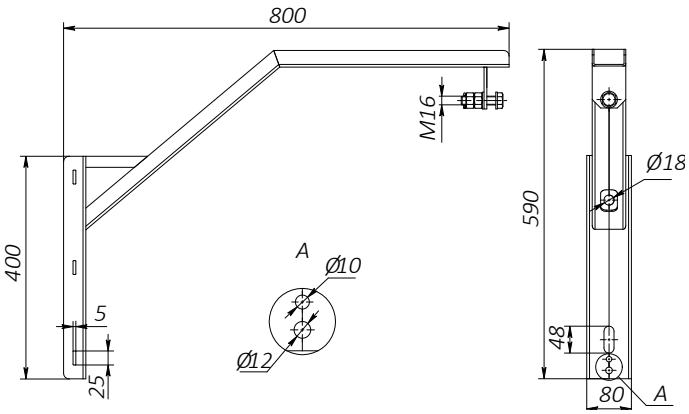
BH01.AB

Reference: LL.AC.BH01.AB.WW

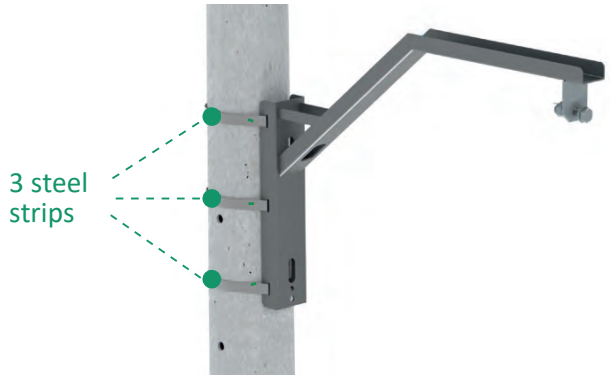
TECHNICAL DATA	
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	4,06

COMPATIBLE WITH:

LLPD dS10z	1e	page 27	**LLPD dM35z**	1d	page 42
	2e	page 29		2d	page 43
	3b	page 29		3b	page 44
	4b*	page 30		4a*	page 44
LLPD d24z	1d	page 37			
	2d	page 38			
	3b	page 39			
	4a*	page 39			



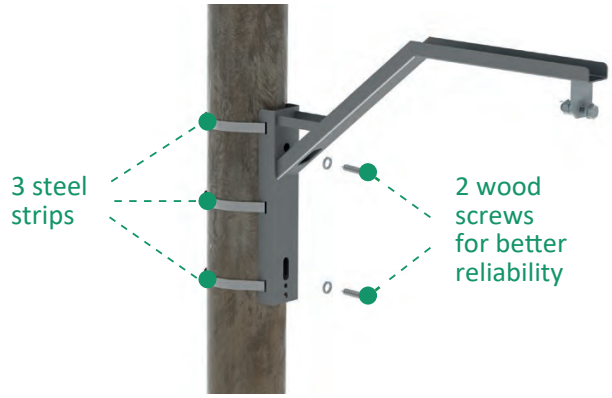
Concrete poles:

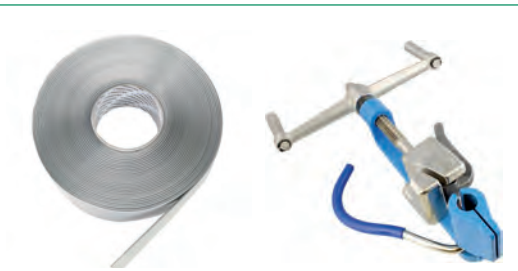


Suitable steel straps*:
Width up to 25 mm,
Thickness up to 5 mm

Suitable screws and washers*:
Wood screw (DIN 571)
M12x100/M16x80/M16x100
Washer (DIN 125): M12/M16

Wooden poles:





Mount steel straps using steel banding tool*

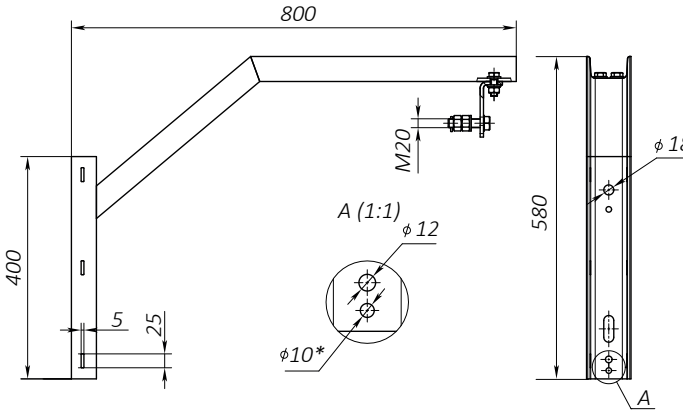
*Steel straps, screws, washers, steel banding tool are not included in package

BH02.AB

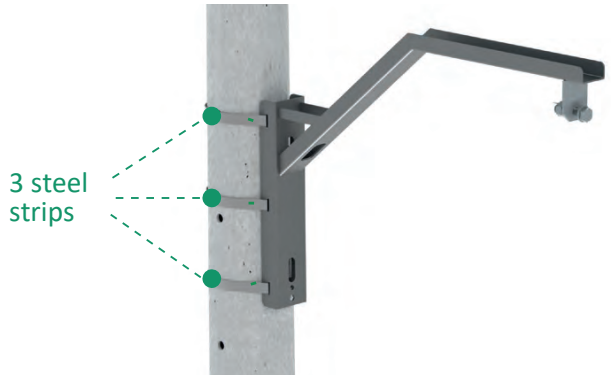
Reference: LL.AC.BH02.AB.WW

TECHNICAL DATA	
Material	Steel
Coating	Zn 75 µm (HDG)
Weight, kg	10,8

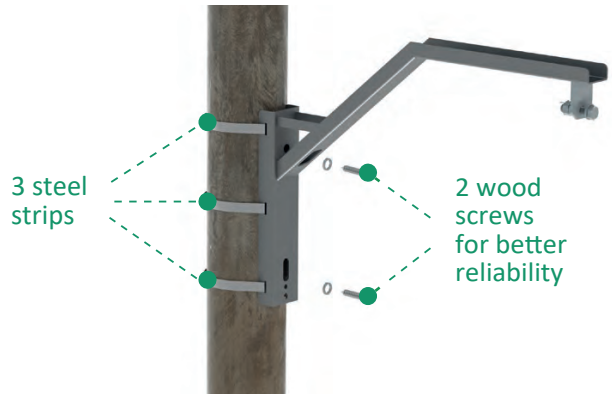
COMPATIBLE WITH:		
LLPD d45z	2c	page 46
	3a	page 47
LLPD d69z	2c	page 49
	3a	page 50



Concrete poles:



Wooden poles:



Suitable steel straps*:
Width up to 25 mm,
Thickness up to 5 mm

Suitable screws and washers*:
Wood screw (DIN 571)
M12x100/M16x80/M16x100
Washer (DIN 125): M12/M16

Mount steel straps using steel banding tool*

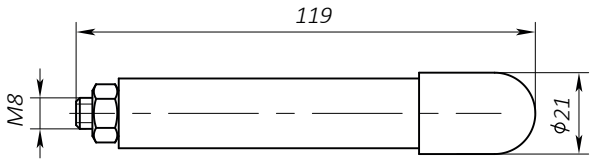
*Steel straps, screws, washers, steel banding tool are not included in package

Accessories: Indicators

0001.SA

Reference: № LL.ID.0001.SA.WW

TECHNICAL DATA	
Weight, kg	0,08
Compatible with	Conductor clamp

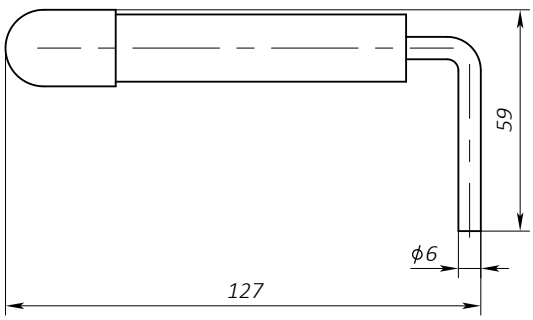


One-time indication of LLPD operation

0001.BA

Reference: № LL.ID.0001.BA.WW

TECHNICAL DATA	
Weight, kg	0,12
Compatible with	Parallel groove clamps (out of STREAMER product range)



One-time indication of LLPD operation

Streamer Electric LLPD services

Lightning activity is one of the most significant threats for overhead power lines. Lightning is an extreme, almost unpredictable and excessively hazardous phenomenon. It is not possible to prevent atmospheric discharges or predict their consequence, but we are able to mitigate this hazardous phenomenon using suitable protection solutions.

Being an experienced specialist in lightning physics and lightning protection, Streamer Electric provides several services, that help our clients to solve lightning issues or electric power lines.

1. Site survey service

Reference: LL.SR.INSP.00.WW

Data acquisition is an important step on the way to efficient lightning protection. To collect the information, it is important to be an experienced specialist in order to know what is relevant to the lightning assessment study.

The Streamer inspection team will collect essential information about specific overhead power lines on-site. Our experts visit the line in order to analyse the potential origin of outages due to lightning strikes. With our lightning assessment experience, we:

- Review the profile of the line
- Visit each different environment area
- Check all types of poles

This information helps to investigate all issues and prepare the most adapted solution taking into consideration the following basic line parameters:

- Operating voltage
- Type of terrain
- Altitude
- Evaluation of short circuit currents
- Lightning flash density

As well as detailed data about each type of pole, such as:

- Height of structures
- Type of insulators
- Materials and dimensions of structural elements

In accordance with the result of the survey, Streamer issues a detailed technical report, including collected data regarding all visited poles with photos and GPS locations, and containing comprehensive information about equipment of each pole type. This data can be used for a qualitative lightning assessment.

2. Lightning assessment service

Reference: LR.SR.LASS.00.WW

Correct assessment of lightning causes is important since according to the Pareto principle, 20% of the effort provides 80% of the results. Our lightning assessment service will help the client to achieve understanding of:

- Most dangerous line sections
- Several solutions for line protection
- Number of protective devices required and cost efficiency analysis
- The line outage status with or without protection

In order to evaluate the line lightning performance Streamer R&D team creates the mathematical model of the overhead power line using software based on the IEEE Guide for improving the lightning performance of electric power overhead distribution lines and longstanding professional experience. Our lightning assessment service includes three options:

1. Evaluation of lightning performance with/without protection
2. Selection of protective devices and their deployment in order to a reach certain level of line performance
3. Guidelines of most efficient way to deploy a certain amount of protective devices along the line.

1. Evaluation of lightning performance with or without protection

Modelization of the overhead power line based on proprietary own software in order to evaluate line lightning performance with or without protection including comparison with the current situation. As a result, several different options are suggested for line lightning protection

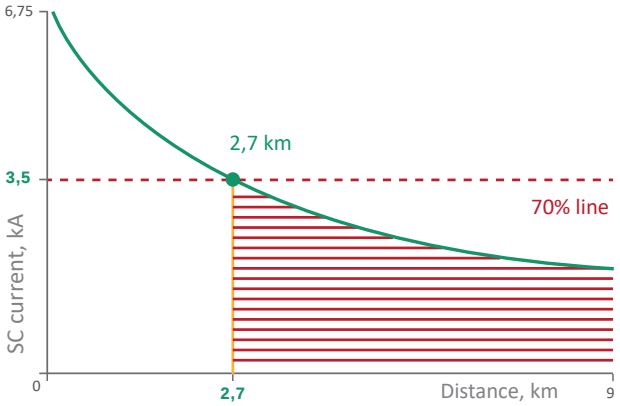


Figure 1: Prospective fault current diagram for example researched line

PARAMETER	VALUE
Line length	9 km
Nominal voltage	20 kV
Conductor section	95 mm²
Conductor height	12 m
Presence of ground wire	Yes
Transformer power	30 MVA
Short-circuit voltage U_K, %	10,5%
Footing resistance of poles	5 Ohm
Neutral arrangement	Solidly grounded
Number of circuits	Single
Pole material	Reinforced concrete
Insulator type	PF-70D
Insulation CFO	185 kV
Amount of poles	180

Table 1: Parameters of example line, used for evaluation of lightning performance

The following lightning assessment was made for an example line to demonstrate the importance of the service. Parameters of the line are provided in table 1, prospective fault current is demonstrated in figure 1.

As a result, there are three different options provided in table 2 for line lightning protection which can be chosen in accordance with improvement needed and available resources.

CASE	AMOUNT OF OUTAGES		NECESSARY AMOUNT OF LLPD	IMPROVEMENT
	Without protection	With protection		
3 LLPD dC20z per pole	4,43	0,57	378 dC20z	87,2%
2 LLPD dC20z per pole	4,43	1,04	252 dC20z	76,5%
3 LLPD dC20z per pole + LLPD i20z with PA*	4,43	2,07	126 dC20z	53,2%

** Phase alternation*

Table 2: Result of evaluation of lightning performance with/without protection

2. The selection of protective devices and their deployment in order to reach a certain level of line performance

In order to control the power quality supply indices it is important to achieve a certain level of line performance. The lightning assessment service provides this opportunity with a detailed description of the most efficient number of protective devices and their allocation along the line, that are necessary to ensure the indicated level of performance. Results are provided in table 3.

TARGETED AMOUNT OF OUTAGES PER YEAR	INITIAL AMOUNT OF OUTAGES PER YEAR	AMOUNT OF LLPD
1	4,43	270
2	4,43	151
3	4,43	82

Table 3: Result of selection of protective devices based on targeted amount of outages

3. Guidelines of the most efficient way to deploy a certain amount of protective devices along the line

Also it is necessary to understand that the efficiency of protective devices depends not only on the quantity, but also on the correct location and phase. The lightning assessment service provides a simulation of different arrangements and outage status calculation based on the specific amount of LLPD. Results are provided in table 4.

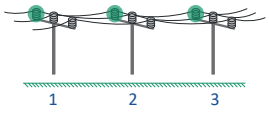
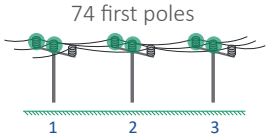
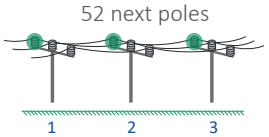
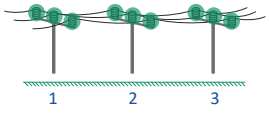
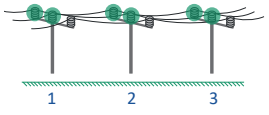
AVAILABLE LLPD AMOUNT	INITIAL AMOUNT OF OUTAGES PER YEAR	FORECASTED PERFORMANCE	MOST EFFICIENT ARRANGEMENT	
100	4,43	2,68	100 first poles 	0 next poles
200	4,43	1,54	74 first poles 	52 next poles 
300	4,43	0,88	48 first poles 	78 next poles 

Table 4: Results of guideline of most efficient way to deploy a certain amount of protective devices along the line

3. Designing services

Reference: LL.SR.DSGN.00.WW

For some challenging cases it is not possible to use traditional mounting options (with already existing accessories) and then solutions for specific poles/towers should be developed. The Streamer Electric design team can provide this service.

Reference: LL.SR.BLUP.00.WW

To gain a complete understanding of the mounting construction Streamer Electric can propose and create detailed blueprints for each client.

The Streamer design team will elaborate additional supporting design documentation which includes:

- 3D drawings for a specific construction of the pole, bracket or LLPD installation scheme
- Development of specific construction
- CAD designing documentation of construction to provide the blueprint design
- Backup documentation about deployment of new and existing equipment

4. Installation supervision

Reference: LL.SR.SINS.00.WW

During LLPD installation Streamer Electric will provide supervision service field support engineers installation, assistance and training on-site.

As a result, Streamer Electric provides a report which contains advice about LLPD installation for the current overhead power line with backup documentation about deployment of new and existing equipment.

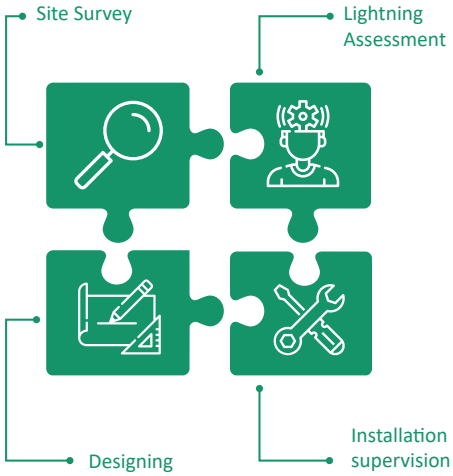
5. Turnkey solution

Reference: LL.SR.TRNK.00.WW

When the turnkey solution option is utilized, the project receives complex follow-up support, containing all available services in one package:

- Site survey
- Lightning assessment
- Design services
- Installation supervision

The multifaceted approach helps to prepare the most cost-effective solution to protect your overhead power line against lightning activity as well as detailed documentation of LLPD installation and maintenance guidelines for the service company.



For notes

Streamer Electric AG, HQ

Masanserstrasse 17
CH-7000
Chur, SWITZERLAND
Phone: +41 81 2500525

office@streamer-electric.com
www.streamer-electric.com

Streamer China

You Town Centre Block A
Chaoyang Qu,
Beijing Shi, CHINA
Phone: +86 8565 1663

Streamer Indonesia

Wilson Walton Building
Jl. Raya Tanjung Barat 155 Jagakarsa,
Jakarta, INDONESIA
Phone: +62 21 7884 0737