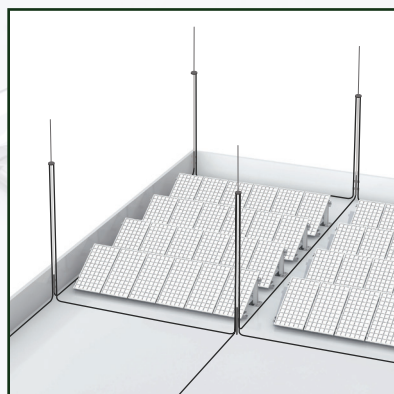
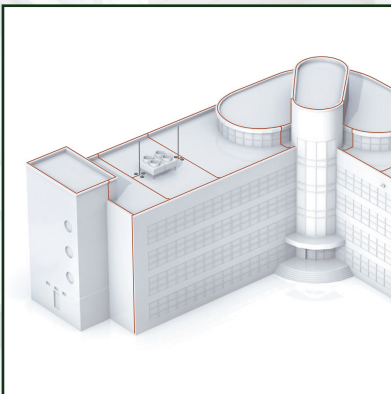
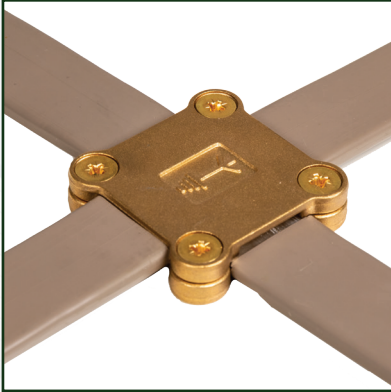


Lightning Protection  
Earthing  
Surge Protection  
Exothermic Welding  
Monitoring





## Lightweight Lightning Mast

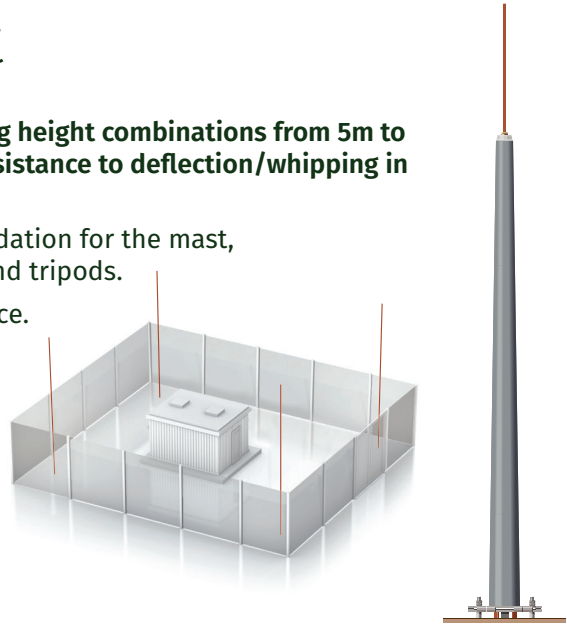
The Lightweight Lightning Mast is our premier product, offering height combinations from 5m to 20m. Its conical shape adds considerable strength and thus resistance to deflection/whipping in the wind.

It is easy to fix. In fact, the building itself can become the foundation for the mast, alleviating the need for heavy and unsightly concrete blocks and tripods.

The hinged base design allows easy inspection and maintenance.

The mast can be supplied in different colours and graphics to blend in with building architecture and landscaping designs.

*When aesthetics are important - this is the product for you.*



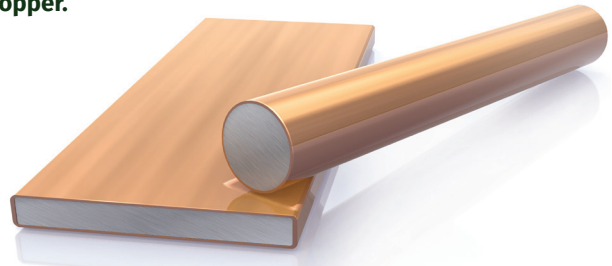
**FOR DETAILS SEE PAGES AT:24 - AT:26.**

## STRIKEBAND - a bimetallic lightning conductor for above ground applications

STRIKEBAND combines the corrosion resistance and inherent low resistivity of copper, with the lightness and flexibility of aluminium, providing a low cost, easy to use alternative to solid copper.

Seamless, high conductivity copper is bonded to a solid core of electrical grade aluminium. Copper thickness is 15% by volume of the cross-sectional area. The resultant material is easier to bend, having less spring-back than copper.

Combining longer coil lengths and a light weight makes STRIKEBAND an ideal choice where the advantages of copper above ground are required, but with cost reductions.

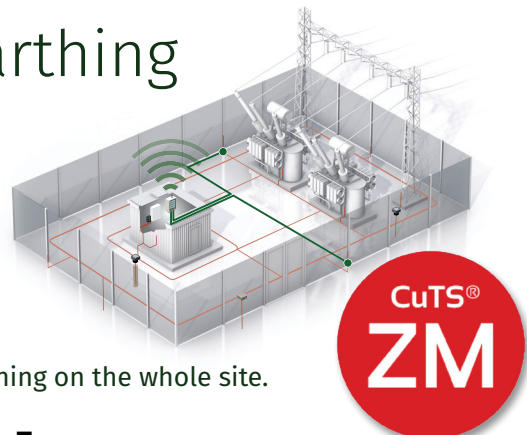


**FOR FLAT TAPE SEE PAGE COND:9. FOR CIRCULAR CONDUCTOR SEE PAGE COND:15.**

## Copper Theft Detection & Earthing Integrity Monitoring

Over time, anything buried in the ground corrodes. If that material is part of an earthing system providing a low impedance path to earth, then problems could arise.

CuTS® offers a way of monitoring the integrity of earthing systems, especially in remote sites. CuTS® can be used to monitor single asset earths on, for instance, a transformer or Earthing on the whole site.



**DETAILS OF CUTS CAN BE FOUND ON PAGES MON:4 - 7.**

<b>Introduction</b>	<b>INT:</b>
<b>Monitoring</b>	<b>MON:</b>
<b>Surge Protection</b>	<b>SPD:</b>
<b>Air Termination Network</b>	<b>AT:</b>
<b>Conductors</b>	<b>COND:</b>
<b>Fittings</b>	<b>FIT:</b>
<b>Bonding</b>	<b>BOND:</b>
<b>Earth Bars</b>	<b>EBARS:</b>
<b>Earthing</b>	<b>EAR:</b>
<b>Static Control</b>	<b>STAT:</b>
<b>KingsWeld Exothermic Welding</b>	<b>WELD:</b>
<b>Fixings</b>	<b>FIX:</b>
<b>Index</b>	<b>IND:</b>
<b>Contact Us</b>	<b>Inside Back Page</b>

For the most up-to-date version of this catalogue, visit <https://www.kingsmillearthing.co.uk/catalogue>.  
This is version v1.0/2019. November 2019.

## NAVIGATING THIS CATALOGUE

To make it easier for you to move around this catalogue, links are built in throughout.

All references to page numbers (eg INT:4, SPD:52, AT:5 etc) are clickable links. Clicking them will take you straight to that page.

Clicking the logo at the bottom of each page will take you back to this page!



## Product Introduction

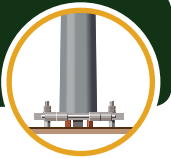
Here, at Kingsmill, we take Lightning Protection and Earthing systems seriously.

Lightning can cause huge amounts of damage, if not diverted safely to ground. This damage can manifest itself in:

- Loss of life
- Fire
- Explosions
- Chemical releases
- Structural damage
- Loss of computer and electronic systems
- Loss of public services
- Economic losses

To protect against lightning, it is important to provide a system that encompasses both structural and electronic systems protection.

**LIGHTNING  
MASTS**  
pages AT:24 - 26



**STATIC CONTROL**  
pages STAT:1 - 6



**CONVENTIONAL  
AIR TERMINALS**  
pages AT:14 - 23



**CONDUCTORS**  
COND: section



**FREE-STANDING  
AIR TERMINALS**  
pages AT:27 - 31



**EARTH BARS**  
pages EB:6 - 12



**SURGE  
PROTECTION**  
SPD: section



**INSPECTION PITS**  
pages EAR:20 - 26



Kingsmill recommend the adoption of BS:EN 62305 when designing protective systems. Such a system would include the following facets:

- Air termination network
- Down conductor system
- Equipotential bonding
- Earth termination and network
- Transient overvoltage protection (protection of electronic systems)

Our sales and technical team will be happy to guide you through both the design and component selection process.

**MONITORING**

pages **MON8 - 10**



**FITTINGS**

pages **FIT:4 - 19**



**EXOTHERMIC WELDING**

**WELD: section**



**INSULATED, HIGH VOLTAGE**

pages **AT:32 - 49**



**THEFT DETECTION AND EARTH SYSTEM MONITORING**

pages **MON:4 - 7**



This graphic is purely for illustrative purposes and shows the likely positioning of our product.



**Kingsmill Industries (UK) Ltd has been, and continues to be, involved in the development of iconic structures both in the United Kingdom and globally.**

**Examples of International Projects which Kingsmill Industries have been involved in include:**

## United Kingdom



- Crossrail
  - Grand Hotel, Brighton
  - Harrods Department Store, London
  - Palace of Westminster, London
  - Liverpool Street Rail Station
  - London Underground
  - NATS DVOR, Berryhead
  - New Wembley Stadium, London
  - Orange and Vodafone Masts and Towers, Nationwide
  - RAF Lakenheath, Suffolk
- ... and many more



*Palace of Westminster, London*

## Algeria



- Al Salah Project
- In Amenas Gas Project
- In Amenas Train 3 Reinstatement
- In Salah Gas Southern Fields Development
- Krechba Site - In Salah Compression Project
- Skikda Project
- Terga Power Plant

## Egypt



- APC, Lube Oil Complex Rehabilitation Project
- Assil and Karam Gas Development Project
- Ethydcó's Utilities & Offsites Project, Amyreya
- Gasco
- Military Officer Hospital
- WDDM Main Compression Phase VII

## Iraq



- Central Processing Facilities Phase 1 Badra Oil Field Project
- Early Production System (EPS) & Brownfield Facilities, Southern Iraq
- Kurdistan-132/33/11KV SS at Stage 6 in Dohuk Governate
- Rumaila Oil Field
- Shell Majnoon Project Green and Brown Field Sites

## Jordan



- Al Amal Hospital - Outpatient Clinics
- Al Awa'el Paper & Carton Factory
- Al Basheer Hospital New Emergency Building
- Al Eman Government Hospital - Ajloun
- Al Ghour Assafi High School
- Al Karak Government Hospital
- Al Tafeelah Technical University
- Applied Medical Sciences - Germany Jordan University
- Arab Potash Company - APC Tail Pump
- Arab Potash Company - Harvesters
- ATTARAT
- Command and Control Center
- Global Health Medical Consumable
- HASS Cooling Warehouses
- Independent Logistics Services Company
- Jordan Indian Fertilization Company
- JTI - Sudan
- King Hussain University Dormitory PV Plant
- Olive Tree Hotel
- PORTO Dead Sea
- Prince Rashed Military Hospital
- Public Security Directorate
- Queen Alia Heart Surgery Center
- Queen Alia International Airport New Free Zone
- Rehabilitation of South Aqaba Industrial Port
- Royal Hospital
- Rusayfah Primary Courts Complex
- SAMARH Resort - Dead Sea
- Seraje Tower - Abdali
- SINIORA Food Factory
- Unified Government Data Center
- United Insurance Company

## Kingdom of Saudi Arabia



- Al Rashed Abha Mall
- Alkhorayef Factory - Second Industrial City, Riyadh
- Al-Zamil Tower - King Fahad Road
- Baja Factory
- CARGO Riyadh
- Eastern Border Guard Housing Projects
- Jubail Export Refinery Project
- Kaust Hotel
- Kaust Housing
- Logistic park - Al-Kharj Road
- Panorama Mall
- Riyadh Front - Airport Road
- Schools Projects (Ministry of Education)
- Southern Border Guard Housing Projects
- Specialist Medical Center (CMC)
- Telecommunication Towers Jizan
- University Boulevard
- The Zone Mall

**Kuwait**

- Air Defense Improvement Project
- Gulf Investment Company
- MEW/129/2011/2012 - 300/132/11KV Rawdatain - W Substation
- MEW Overhead Line 300, 132 and 33KV (Kuwait Oil Company)

**Lebanon**

- 4 Points Sheraton Hotel
- ABC Mall Achrafieh
- American Embassy, Awkar
- Beirut International Airport
- Beirut Souks
- Broumana High School
- Lebanon Water Front City - La Marina Dbayeh - Business Park SP1
- Loulou'a Residential Building, Beirut
- Mazraa Public School, Beirut
- Metropolitan City Center MCC
- Ogero (Ministry of Telecom)
- Rayak Hospital, Bekaa
- Saaf Villa Saint Georges Towers
- Sama, Beirut
- St Joseph Hospital, Beirut
- Water Pumping Stations, Tripoli

**Libya**

- Chemical Injection Packages
- Gas Utilization Project - Phase 2
- LP Gas Compressor Station - Zueitina Oil Co.
- Waha Oil Company

**Yemen**

- PTC Yemen (Public Telecommunication Company)
- Spacetel Yemen (GSM Operator)
- Telecom Towers

**Qatar**

- Abdul-Ghani Commercial Tower
- Al Boroq Tower
- Al Jazeera Network Building
- Al Mana Mall
- Al Muftah Tower
- Al Nakheel Tower
- Al Ramez Tower
- Al Seelyia Tower
- Al Waab Mall
- Barzan Camp
- Buzwair Building
- Cable Factory - Al Jaber Engineering
- Cambridge School - Al Helal
- Circular Tower Golden Sand Hotel
- Communication Building at Shahaniya & Miknis (Ministry of Interior)
- Dr Ali Fteis Office Tower
- Dukhan Tower
- Economic Zone
- Falcon Tower
- Golden Bay Tower
- GTL Pearl - Effluent Treatment Plant
- GTL Pearl - Site Preparation
- Guard Residence at Al Wajba
- Interim Data Center (Qatar Foundation)
- Maritime Coastal Station at Al Wusail (Q-TEL)
- Marwa Tower
- MES School
- Nabina Villa Sheikh Suhaim Villa
- New Diplomatic Area Zone 66
- New Training Center Dukhan (Qatar Petroleum)
- Phase VIII Substation (KAHRAMAA)
- Police station, communication building at Zubara (Ministry of Interior)
- Qatar Aluminum (QATALUM)
- Qatar Power Transmission System Expansion - Phase IX - GTC/240B/2008
- Qatar Power Transmission System Expansion Phase VIII Substation GTC/144/2006
- Qatar University
- Salwa Resort
- Sky Guard - Qatar Army
- Viva Bahria VB-02-09-11-17-22-23 (The Pearl Qatar)
- Zekreet Office Building (RASGAS)

**United Arab Emirates**

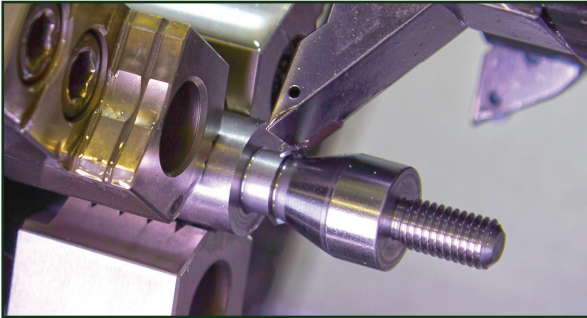
- 132/11kV Substation for Bluewaters Island by Meraas Development
- Abu Dhabi International Airport
- ADDC - Baniyas Residential Development
- Akoya Oxygen by Damac
- Department of Transportation - Rerouteing of 220kV & 400kV Overhead Transmission lines
- DEWA - Burj Khalifa Substation No. 1289
- DEWA - World Trade Centre District Substation No. 1282
- District Cooling Plant at Palazzo Versace
- Dubai Festival City
- Dubai Metro
- Jebel Ali School
- Jumeirah Village Triangle by Nakheel
- Mohammad Bin Zayed City
- RTA - Earthing for Bus Shelters
- The Address Fujairah Resort & Spa
- TRANSCO - 220kV GIS Switching Station in Abu Dhabi
- TRANSCO - 400kV Substation & Overhead lines in RAK
- Zayed National Museum

*Dubai Festival City, Dubai*



# Manufacturing

Highly skilled staff using state-of-the-art equipment to manufacture high quality products is only part of the Kingsmill success story.



Our design services, logistics, customer service and after-sales support ensure Kingsmill are the only supplier you need for your Lightning Protection and Earthing requirements.

# Quality Assurance

Kingsmill are proud to be certified in accordance with ISO 9001:2015.



CERTIFICATE No. 7077  
ISO 9001:2015

We are also registered with UK supply groups.



# ATLAS



**As leading manufacturers of Lightning Protection and Earthing products Kingsmill are delighted to be Associate Members of ATLAS.**

The **Association of Technical Lightning & Access Specialists (ATLAS)** has been representing the leading installers in the lightning protection and steeplejack industry since 1946.

At the forefront of all industry developments, ATLAS is committed to improving working practices, technical excellence and the skills of the workforce to provide the highest quality service to the industry's clients.

- Financial stability and proven track record
- Recognised technical standards
- Commitment to health and safety
- Competent and qualified workforce
- Access to the latest guidance and information
- Collaborative working
- Forum for sharing best practice

**Kingsmill are proud to be suppliers to ATLAS members.**

# Standards

Kingsmill design, manufacture and supply Lightning Protection and Earthing Systems in accordance with current European and British Standards.

## **BS:EN 62305 series**

---

BS:EN 62305 addresses sources and types of damage that can be expected from effects of lightning, as well as determining the risk of damage to a structure. The standard also contains prescriptive guidelines on how to install both structural lightning protection as well as protection for electronic systems contained within those structures.

**BS:EN 62305-1:** General principles

**BS:EN 62305-2:** Risk management

**BS:EN 62305-3:** Physical damage to structures and life hazard  
(structural lightning protection, equipotential bonding and earthing)

**BS:EN 62305-4:** Electrical and electronic systems within structures (electronic systems or surge protection)

## **BS:EN 62561 series - Lightning Protection components**

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This suite of standards outline the test parameters for the components of a lightning protection system:

**BS:EN 62561-1:** Connection components

**BS:EN 62561-2:** Conductors and electrodes

**BS:EN 62561-3:** Isolating spark gaps

**BS:EN 62561-4:** Conductor fasteners

**BS:EN 62561-5:** Earth electrode inspection housings and earth electrode seals

**BS:EN 62561-6:** Lightning strike counters

**BS:EN 62561-7:** Earth enhancing compounds

## **BS 7671 - Requirements for electrical installations - the IET wiring regulations**

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Includes guidance on the application of surge protection devices and earthing materials.

## **BS 7430 - Protective earthing of electrical installations**

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For protective earthing of electrical installations.

## **BS 7354 - Code of practice for the design of high voltage open terminal systems**

---

This standard sets out the requirements and materials for earthing in power applications.

## **IEEE 80 - Sub-station earthing**

---

IEEE 80 sets the principles for designing a safe sub-station earth grid. It deals with the aspects of minimising “step” and “touch” potentials: material selection, equipotential bonding, insulation, coordination etc.

## **BS:EN 61643-11 Low voltage power - Surge Protection Devices**

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Low voltage power SPD parameters and test requirements.

## **BS:EN 61643-21 Telecommunication and signalling - Surge Protection Devices**

---

Telecommunication and signalling SPD parameters and test requirements.

Technical specifications additionally associated with the BS:EN 61643 series of standards, notably DD CLC / TS 61643-12 SPDs for low voltage power and DD CLC / TS 61643-22 SPDs for telecommunication and signalling networks. These documents deal with SPD parameters, SPD selection and SPD coordination.

## BS:EN 62305

Lightning Protection design follows the BS:EN 62305 series of documents:

## General principles - how to design a Lightning Protection system (Part 1)

BS:EN 62305-1 introduces key concepts that we used in designing a Lightning Protection System.

### The sources of damage are identified ...

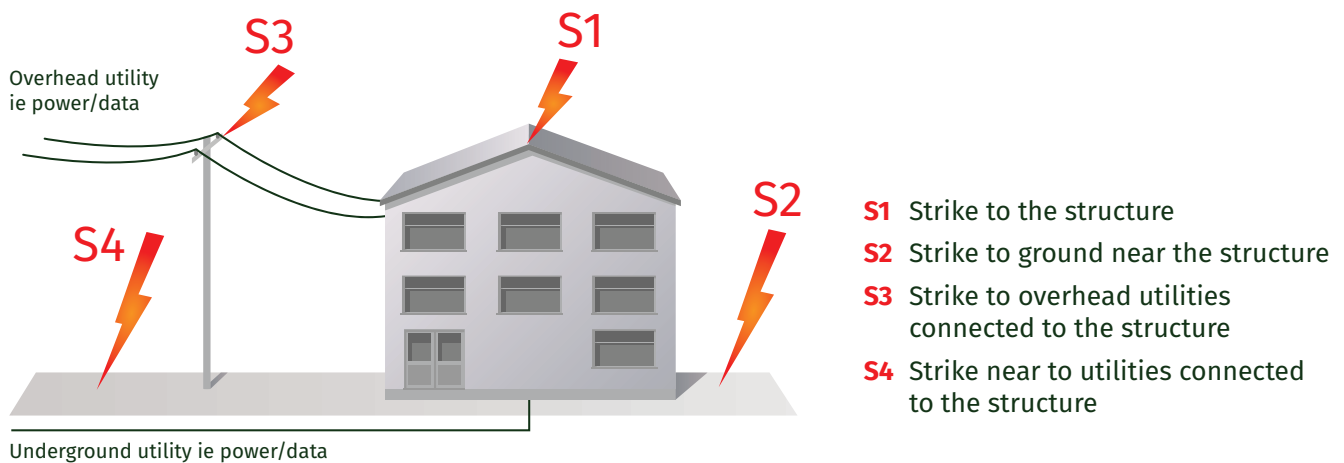


Figure 1: Sources of damage arising from a lightning strike

### The types of damage and loss are identified ...

#### Types of damage resulting from a lightning strike

- D1** Injury to life through step and touch voltages
- D2** Physical damage ie fire, explosion etc
- D3** Failure/malfunction of electronic systems arising from lightning electromagnetic pulse

#### Types of loss arising from lightning damage

- L1** Loss of human life
- L2** Loss of services to the public
- L3** Loss of cultural heritage
- L4** Loss of economic value ie consequential loss of output and financial impact

### A Lightning Protection Level (LPL) is defined ...

BS:EN 62305-1 defines a Lightning Protection Level (LPL) for the building/structure along with a maximum lightning current associated with that LPL. This LPL is key to the correct application of Lightning Protection. This is considered through Parts 3 and 4 of the standard.

Lightning Protection Level (LPL)	Maximum current kA (10/350µs waveform)	Class of Lightning Protection System (LPS)	Maximum current one metallic service (50% of current)	Maximum current per mode – 3 phase (L1, L2, L3, N, E) 4 wires + earth
I	200	I	100	25
II	150	II	75	18.75
III & IV	100	III & IV	50	12.5

Figure 2: Lightning Protection Levels, as defined by BS:EN 62305-1



## Current division

BS:EN 62305 Part 1 introduces the concept of “current division”. It is assumed that the maximum current due to a lightning strike would be 200kA and that this would flow equally (50%) through the structural lightning protection system (100kA) and 50% through any connected metallic services eg power cables, pipes, etc.

If only one metallic service is connected, eg a power cable, then 100kA would flow through that cable and, in the case of two metallic services, 50kA per service and so on. (The current flowing on a power cable is further divided by the number of cores, as shown in figure 2.)

## Lightning Protection Zones

Part 1 also introduces the concept of Lightning Protection Zones (LPZ). These are important because they help determine the correct “type” of Surge Protection Device that should be used in a particular zone.

Lightning current SPDs are used at the border of Zones 0 and 1, whereas overvoltage surge arresters are used on the border of Zones 1 and 2, as well as on the border of Zones 2 and 3.

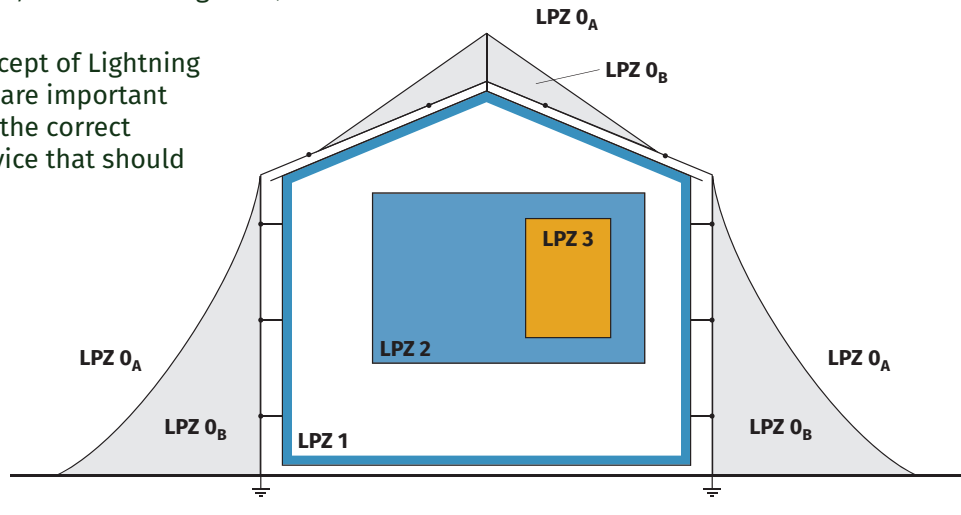


Figure 3: Lightning Protection Zones

## Risk management (Part 2)

BS:EN 62305-2 prescribes how to assess the risk of lightning in respect of loss of life, loss of vital service, economic loss, loss of heritage and physical damage.

This assessment is critical to the correct application of BS:EN 62305-3 and BS:EN 62305-4 and thus the type of product and system to be installed.

The risk management procedure sets out to consider a number of risks associated with the potential losses from lightning induced damage. It combines this with data for ‘local lightning activity’.

Things to note from this assessment:

- Where structural Lightning Protection is required, Type 1 Surge Protection Devices (SPDs) are always required for metallic electrical services (electricity, data etc). These must form an integral part of any structural Lightning Protection System.
- Where structural Lightning Protection is not required, BUT there is a risk of indirect damage to utility services entering the structure, Type 1 SPDs are required in the case of overhead connections and Type 2 SPDs for underground cable connections.

### Physical damage to structures and life hazard (Part 3)

In the event of the risk assessment stating that Structural Lightning Protection is required, BS:EN 62305-3 assigns a Lightning Protection Class (LPS) to the LPL and deals, in a prescriptive way, with the application of different design principles to create a structural lightning protection system. The designer has a number of material selection criteria and design concepts available, thus enabling him to overcome protection problems, as well as address corrosion, through the selection of appropriate materials.

LPL	Class of LPS
I	I
II	II
III	III
IV	IV

Fig 4: Relation of Lightning Protection Level to Lightning Class

#### The key elements decided being ...

##### Air Termination system

Using a mesh system, protective angle, rolling sphere method or combination of these.

##### Separation distances

To avoid sparking or flash-over from the lightning conductor system to conductive metal parts of the building/structure.

##### Routing of down conductors

##### Equipotential bonding

To avoid flash-over - employing physical bonding, the use of Surge Protection Devices (SPDs) or Isolating Spark Gaps (ISGs).

##### Earthing

To dissipate the lightning current safely to earth.

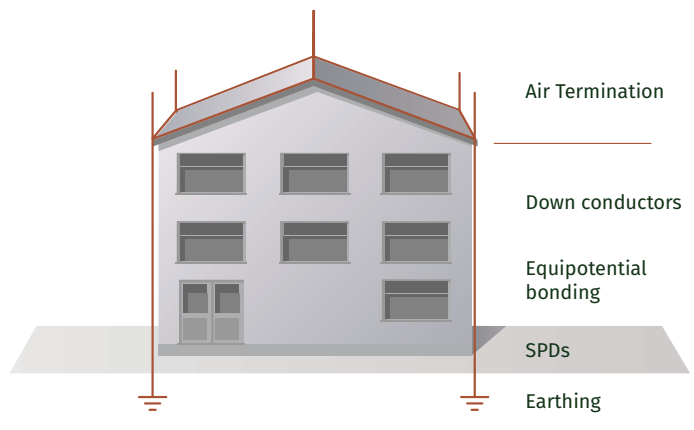


Figure 5: Structural Lightning Protection

### Electrical and electronic systems within structures (Part 4)

BS:EN 62305-4 sets out the rules for applying surge protection devices (SPDs) to protect the contents of the building from the secondary effects of lightning, and from internally generated switching transients.

Should the risk assessment dictate that a structural Lightning Protection System (LPS) is required, the system designer should always fit equipotential bonding Surge Protection Devices (SPDs). *These are referred to as Lightning Current Arresters in our product selection pages.*

If the assessment dictates that an LPS is not required, but there is an indirect risk that electrical services entering the structure could be affected, the designer should always fit SPDs.

A Lightning Protection system that employs the use of “structural Lightning Protection/Earthing” alone does not effectively protect electronic systems.

Effective protection is only achieved through the use of “coordinated SPDs”:

**Type 1:** lightning current arresters (tested with a 10/350µs waveform)

**Type 2:** surge arresters (tested with an 8/20µs waveform)

**Type 3:** surge arresters, fine protection (tested with an 8/20µs waveform)

BS:EN 62305-4 employs a principle of using Lightning Protection Zones (LPZ) to progressively reduce a potential 6,000 volt transient overvoltage to a safe voltage below that of the withstand voltage of the equipment to be protected. SPDs are located at the boundaries of these zones.

Kingsmill offer combined Type 1 + 2 SPDs as an easy and economical choice.

**Kingsmill Surge Protection Devices are set out in the Surge Protection section.**

# Summary

A good Lightning Protection system must include:

## **Air Termination/Down Conductor System**

- To intercept the lightning strike
- Comprises Air Terminals, conductors, Fixings and Clamps

## **Equipotential Bonding**

- To minimise dangerous flashover from the Lightning Protection System to metallic/connective parts of the structure and its contents
- To route lightning current safely towards the Earthing System

## **Earth Network**

- To safely dissipate the lightning current to earth
- Comprises Conductors, Earth Rods, Clamps and Bonds

## **Surge Protection**

- To safely arrest any overvoltage carried through power and data lines as a result of lightning
- Comprises surge and overvoltage arresters

# Using this catalogue

Our product range has been set out in separate chapters, each having an introduction and each being related to a key aspect of good Lightning Protection design.

- Air Termination Network
- Conductors
- Monitoring
- Fittings
- Bonding
- Earth Bars
- Earthing
- Surge Protection
- Fixings
- Exothermic Welding

**Confused?! Kingsmill offer a design advisory service to assist you in making a decision.**

<b>Introduction</b>	<b>MON:2 - 3</b>
<b>CuTS</b> Copper Theft Detection and Earthing Integrity Monitoring	<b>MON:4 - 7</b>
<b>Jupiter TMS</b> Monitoring of lightning induced transients	<b>MON:8</b>
<b>Jupiter OLS</b> Optical lightning surveillance	<b>MON:9</b>



Kingsmill are passionate about protecting infrastructure from the devastating impact of lightning activity. Not only do Kingsmill offer a wide range of protection solutions, we also offer systems designed to monitor activity.

**TRANSIENT  
MONITORING**  
page **MON:8**



The **Jupiter Transient Monitoring System (TMS)** is a high-speed data acquisition device, that continuously monitors power, control and communication systems for transient overvoltage activity. The system can quickly identify transient signals that could compromise system operation and based upon accurate waveform characterisation, efficiently pinpoint the source.

**JUPITER OLS**  
pages MON:9 - 10



Jupiter OLS is a site-specific, high-speed video based lightning location system, that detects 100% of lightning return strokes and pinpoints the location of lightning strikes with unprecedented accuracy.

**CuTS<sup>®</sup>**  
**ZM**  
**THEFT DETECTION**  
pages MON:4 - 7



CuTS<sup>®</sup> Copper Theft Detection and Earthing Integrity Monitoring technology monitors earthing infrastructure in real time for theft, degradation and failure, providing operating companies with immediate, accurate intelligence on safety risks and service status.



# Copper Theft Detection & Earthing Integrity Monitoring



## Theft

**Every year, copper is stolen from installations, whether they are:**

- Cell phone sites
- Substations
- Industrial complexes
- Commercial complexes
- Domestic dwellings

**It is an ever-increasing problem resulting in:**

- Costly downtime
- Safety issues including danger to life
- Replacement material and installation costs

CuTS offers a way of monitoring theft. It works on most metals, so the application doesn't have to be copper based. For example, CuTS works just as well on steel structures.

## Earth integrity monitoring

Over time, anything buried in the ground corrodes. If that material is part of an earthing system providing a low impedance path to earth, then problems could arise.

CuTS® offers a way of monitoring the integrity of earthing systems, especially in remote sites. CuTS® can be used to monitor single asset earths on, for instance, a transformer or Earthing on the whole site.

**CuTS® technology monitors earthing infrastructure in real time for theft, degradation and failure, providing operating companies with immediate, accurate intelligence on safety risks and service status.**

- Protecting staff and public from death and serious injury
- Minimising outage risk and unplanned maintenance
- Reducing consequential damages and other financial loss
- CuTS® - Detecting earthing conductor theft and degradation as it happens
- Integrates with existing security & control infrastructure eg SCADA
- Reports degradation of safety infrastructure
- Proactively anticipate faults/optimize maintenance
- Root cause analysis
- Quick fault resolution
- Reduce operational down time for services
- Meet contractual performance commitments

CuTS® is a scalable solution designed for service environments where safety and continuity are paramount. CuTS® technology monitors earthing infrastructure in real time for theft, degradation and failure, providing operating companies with immediate, accurate intelligence on asset status. Monitoring enhances site safety, protecting both staff and public from death and serious injury. It also minimises risk of outage, asset damage and unplanned maintenance thereby reducing engineering costs, consequential damages and other financial loss.

## Typical applications

### Power Transmission/Distribution

- Substation grounding
- Power cables

### Telecoms

- Mobile base station grounding
- General site grounding

### Rail infrastructure

- Communications site grounding
- Substation grounding

Wires are connected between representative points of the grounding infrastructure and the CuTS® unit. The inductive properties of the monitored infrastructure are then continuously compared to a controlled reference. The CuTS® unit incorporates a unique and highly sensitive patented inductance/impedance change monitoring system. Changes to the monitored grounding infrastructure (such as the theft of metal), induce changes in the measured inductance. On board algorithms apply filters and thresholds to understand the change and effectively manage non-relevant spurious site conditions such as voltages, ground connectivity, fault conditions or electrical discharges. Once analysed, appropriate notifications of the change are communicated.

Configuration is achieved through simple tuning/adjustment at installation via the CuTS® management interface. Notifications are sent to a cloud based interface via an IoT modem, and/or can be incorporated into existing monitoring platforms.

## The impact of copper theft

### Safety and service are the primary issues arising from copper theft from substations

#### *The Facts*

- Theft of copper from substations is common
- It represents serious safety and operational risk

#### *Resultant outage and costs*

- Resultant damage to plant is often substantially more costly than the cost of replacing stolen material
- Service outage (loss of service) may result in regulatory and/or compensation costs

#### *Risk mitigation*

- Requires there to be knowledge of the event
- Undetected events are potentially lethal on site
- Undetected events can be a risk to the public at service delivery points



# Technology

## Features

---

- Detects damage and physical disconnection of the earthing system (ie theft)
- Detects changes in grounding infrastructure
- System is difficult to circumvent
- High impedance sensor input
- Not susceptible to false alarms
- Easy to install with no disconnections
- Embedded Lightning and Surge Protection

## Benefits

---

- Alerts operator upon damage, disconnection or other physical change, such as corrosion
- Secure against knowledgeable thieves
- Does not interfere with grounding integrity
- Avoids unnecessary investigation time
- Common deployment procedure across all sites
- No service interruptions to the site
- Ensures minimal failure due to storms and operational surge events
- Low cost compared to 24 hour manned monitoring . . .

. . . Thus providing 360° 24 hour all-round monitoring (*vs camera systems which require constantly manned monitoring, are susceptible to false alarms, have limited field of vision and might not cover the whole site*)

# Commercial

## Features

---

- Monitors grounding infrastructure above and below ground, providing unique data
- Accurate location based fault detection
- Permanently installed with very low asset and maintenance costs
- Automated remote monitoring
- Designed for remote or city sites
- Flexible communications options

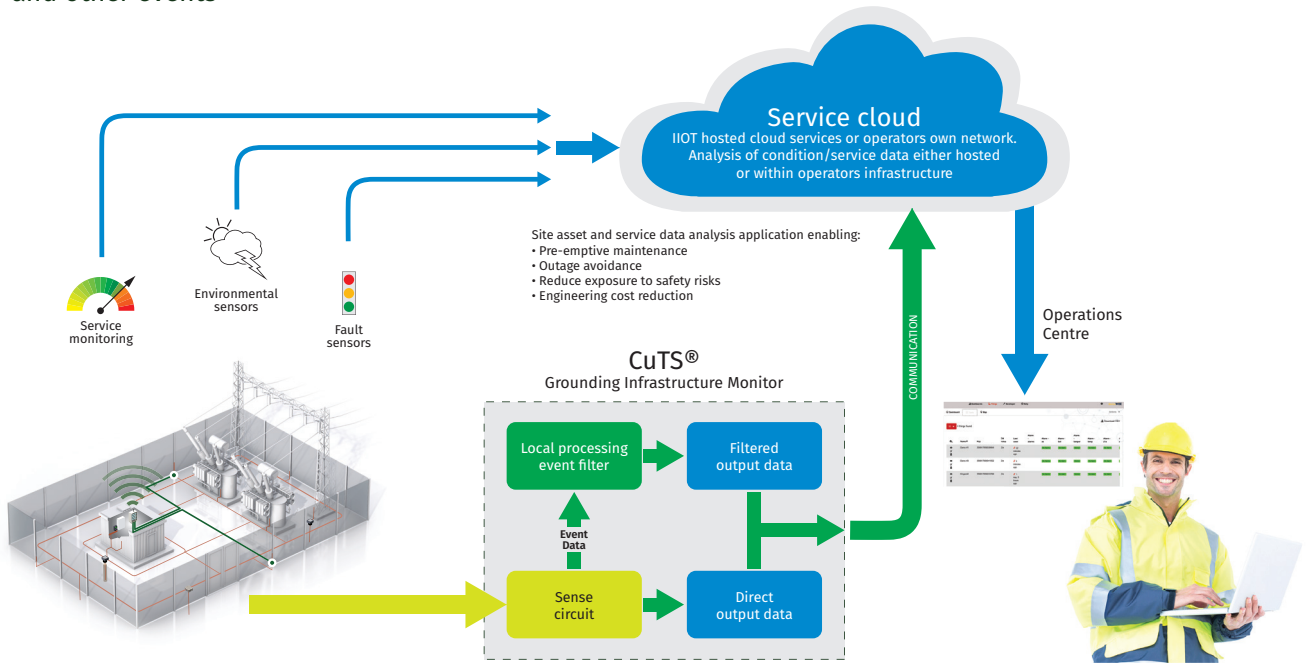
## Benefits

---

- Enhances asset and site safety
- Reduces outage time when site compromised
- Reduces engineering fix time and costs
- Low lifetime cost
- Cost reduction through reduced physical inspection
- Minimises costs and maximises operational gain from common deployment
- Provides future proofing for changing technologies communications systems

How it works

- CuTS® monitors metallic infrastructure for change due to cutting, removal, damage or degradation
- CuTS® system looks for changes in the monitored infrastructure inductance characteristics
- The monitored infrastructure is coupled into a sensing circuit via sense wire inputs which detect minor changes (down to below 0.02µH)
- When change occurs beyond the adjustable thresholds, the unit alarm is activated, sending secure alerts
- Filter thresholds include the extent of change detected and duration of change - this copes with site faults and other events

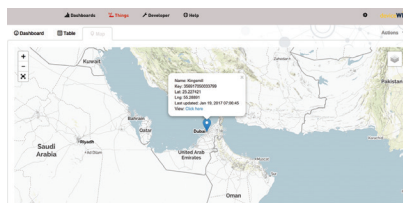


Client portal

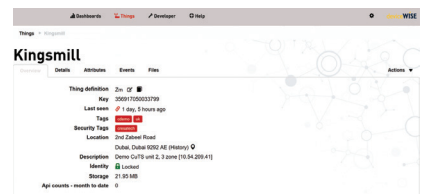
Clients are provided with their own Portal Dashboard from where they can monitor all sites and activity. Examples of client data that is available through the Portal Dashboard are shown below:

Name	Key	Def status	Last test	Alarms	Alarm - 1s	Alarm - 5s	Alarm - 15s	Alarm - 30s	Alarm - 1m	Alarm - 5m	Alarm - 15m	Alarm - 30m
Quays 01	3000170000000000	2m	17/02/2020 10:00:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
Quays 02	3000170000000000	2m	17/02/2020 10:00:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
Quays 03	3000170000000000	2m	17/02/2020 10:00:00	OK	OK	OK	OK	OK	OK	OK	OK	OK
Quays 04	3000170000000000	2m	17/02/2020 10:00:00	OK	OK	OK	OK	OK	OK	OK	OK	OK

All sites status table



Site map view



Site details

Contact us for a full demonstration of the CuTS Copper Theft Detection & Earthing Integrity Monitoring system.

# Jupiter Transient Monitoring System - TMS

Lightning strikes can induce hazardous transients on power and data lines, resulting in damage to electronic systems and costly downtime and repairs.

Damaging transients can also be generated from within a facility. These are known as Switching Transients and result from the operation of large inductive loads, for example, large banks of lighting and production process machinery.

Today, more than ever before, our everyday lives depend upon the continuous and reliable operation of electronic systems, whether they are located in retail centres, medical facilities, air traffic control, utilities, banks, Government departments, commercial and industrial facilities.

The Jupiter Transient Monitoring System (TMS) is a high-speed data acquisition device, that continuously monitors power, control and communication systems for transient overvoltage activity.

The Jupiter TMS system can quickly identify transient signals that could compromise system operation and based upon accurate waveform characterisation, efficiently pinpoint the source.

Alerts are immediate and the unit is rugged and proven immune to the electromagnetic effects of lightning.



## Benefits

- Accurate measurement of direct, or indirectly coupled, lightning and switching transients
- High bandwidth, high fidelity current, voltage and electromagnetic field measurements
- Near real time alerts, reporting and characterisation of recorded transient events

## Specifications

Power	24V DC
Communication	Cell or fibre LAN
Channels	4 Analog Channels
Input	Balanced Differential
Input Range	±200mV - ±200V
Sampling Rate	80MS/s (up to 125MS/s)
Resolution	14 bits
Memory	4GB
Example Sensor Types	Magnetic Field Sensors, Electric Field Sensors, Current Sensors, Voltage Sensors

## How can Jupiter TMS work for you?

### Bandwidth:

Jupiter TMS has greater than 40MHz of analog bandwidth - more than an order of magnitude higher than typical power quality monitors. Jupiter TMS will accurately resolve all high-speed transient waveforms, allowing users to fully characterise damaging transient events.

### Signal Conditioners:

The analog front-end of Jupiter TMS is customisable for handling AC and DC voltages in addition to the outputs of various transducers, including current probes, electromagnetic field sensors and environmental sensors. Users define trigger thresholds for all connected sensors through a graphical interface.

### Zero-Deadtime Recording:

Most data acquisition systems cannot resolve transient signals that arrive repeatedly in quick-time succession - the systems are effectively blind while data is being saved and processed. Jupiter TMS is capable of triggering continuously without losing a single data point. The result? You know every time your system or facility has been exposed to a dangerous transient signal.

### Transient Immunity:

Jupiter TMS captures accurate, high-fidelity transient measurements while ensuring the captured data is not degraded by the effects of those same transients. The proven design was born through the rigorous demands of the USA's Space Program - where failures are not an option.

# Jupiter Optical Lightning Surveillance - OLS

Jupiter OLS is a site-specific, high-speed video based lightning location system, that detects 100% of lightning return strokes and pinpoints the location of lightning strikes with unprecedented accuracy.

Existing commercially available location systems only identify the general strike locations of lightning flashes, fail to detect more than 10% of individual ground strikes, may misreport strike locations by up to several kilometres and can ignore lightning discharges with multiple attachment points – a phenomenon that can occur in approximately 50% of cloud-to-ground lightning flashes.

Jupiter OLS was developed following years of research into the physics of lightning, high-speed data acquisition systems and state of the art sensing equipment. The performance and value of this system has been validated during extended deployment and testing at NASA's Kennedy Space Center, where the systems monitor critical NASA payloads and facilities.

## Benefits

- > **Aviation and Aerospace**  
Avoid closures, unnecessary launch delays, and simplify inspections after storms occur.
- > **Insurance and Warranty Claims**  
Substantiate claims and deter fraud.
- > **Military and Security**  
Timely intelligence for mission critical assets.
- > **Energy**  
Monitor the functionality of lightning-vulnerable nuclear, solar, wind, oil and gas production, storage and distribution systems.
- > **Communication, Data & Operation Centres**  
When downtime is simply not acceptable, depend on Jupiter OLS.

## Coverage and configuration

Each Jupiter OLS installation is configured specifically for the site and monitored assets. Smaller sites can be monitored with a single camera, and two or more cameras may be required to provide multi-angle image captures and/or precision surveillance of larger sites.

## Technical specifications

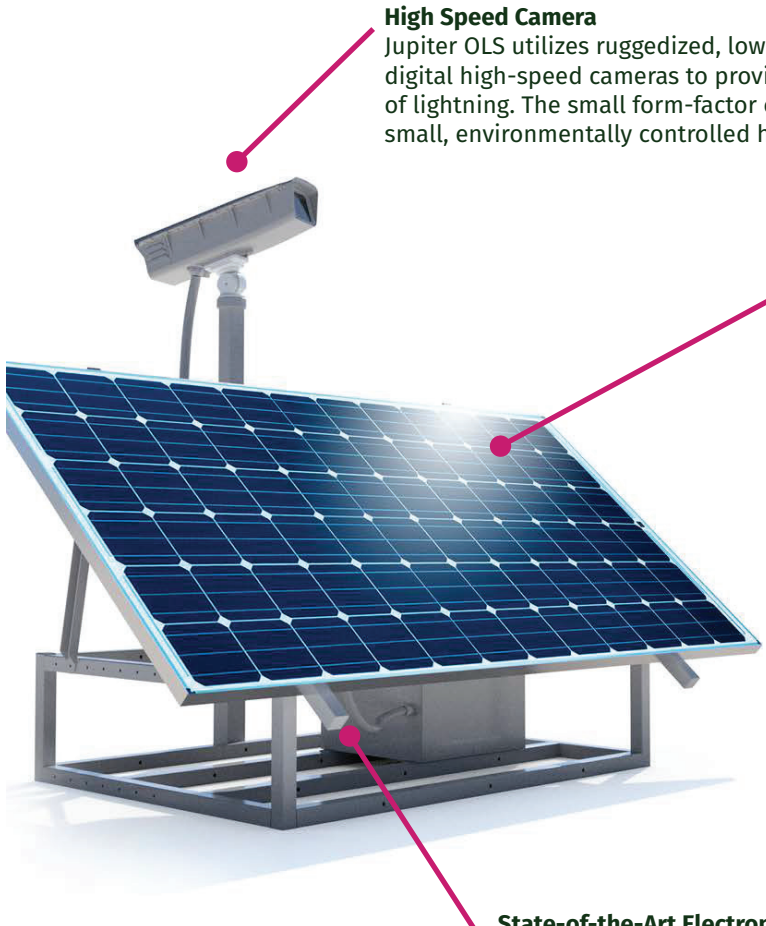
General	
Power	Solar, AC
Communication	Cell or fibre LAN
Infrastructure required	None
Photographs	
Resolution	1280 x 1024px
Frame Rate	100 - 1800fps
Bit Depth	12 bit colour or monochrome
Pixel Size	5.6µm
Enclosure	
ANSI/IEC 60529	IP66, protected against dust and high pressure water jets from any direction, resists coastal and industrial environments

## Customisable features

- > Number, position and mounting of Jupiter OLS units
- > Camera framing rates and lensing
- > Communication, alarm and reporting protocols
- > Power input

## Jupiter OLS is lightning fast

The heart of Jupiter OLS is a unique, high-speed image acquisition and processing system designed to quickly and accurately capture the optical radiation of lightning. The system automatically photographs and records critical data about the lightning strike and immediately sends actionable alerts. Jupiter OLS monitors all lightning interaction with your assets and facilities 24/7 with zero system downtime.



**High Speed Camera**  
Jupiter OLS utilizes ruggedized, low-power, zero dead-time digital high-speed cameras to provide high-resolution imagery of lightning. The small form-factor cameras are deployed in small, environmentally controlled housings.

**Solar Powered**  
The Jupiter OLS system can be powered exclusively via an integrated photovoltaic array, requiring no external power input or other supporting communication infrastructure. Power is conditioned to be immune to the electromagnetic effects of very close lightning, making Jupiter OLS a robust lightning monitoring system.

**State-of-the-Art Electronics and Software**  
Lightning images are automatically acquired, processed, time-tagged with microsecond accuracy, and quickly delivered to the user via secure email and web interfaces. Jupiter OLS is designed using the most advanced aerospace-grade components to provide years of maintenance-free operation with zero system down time. The robust performance of the Jupiter OLS system has been fully tested and qualified at Kennedy Space Center, including prolonged exposure to extreme heat, humidity, and harsh corrosive and electromagnetic environments.

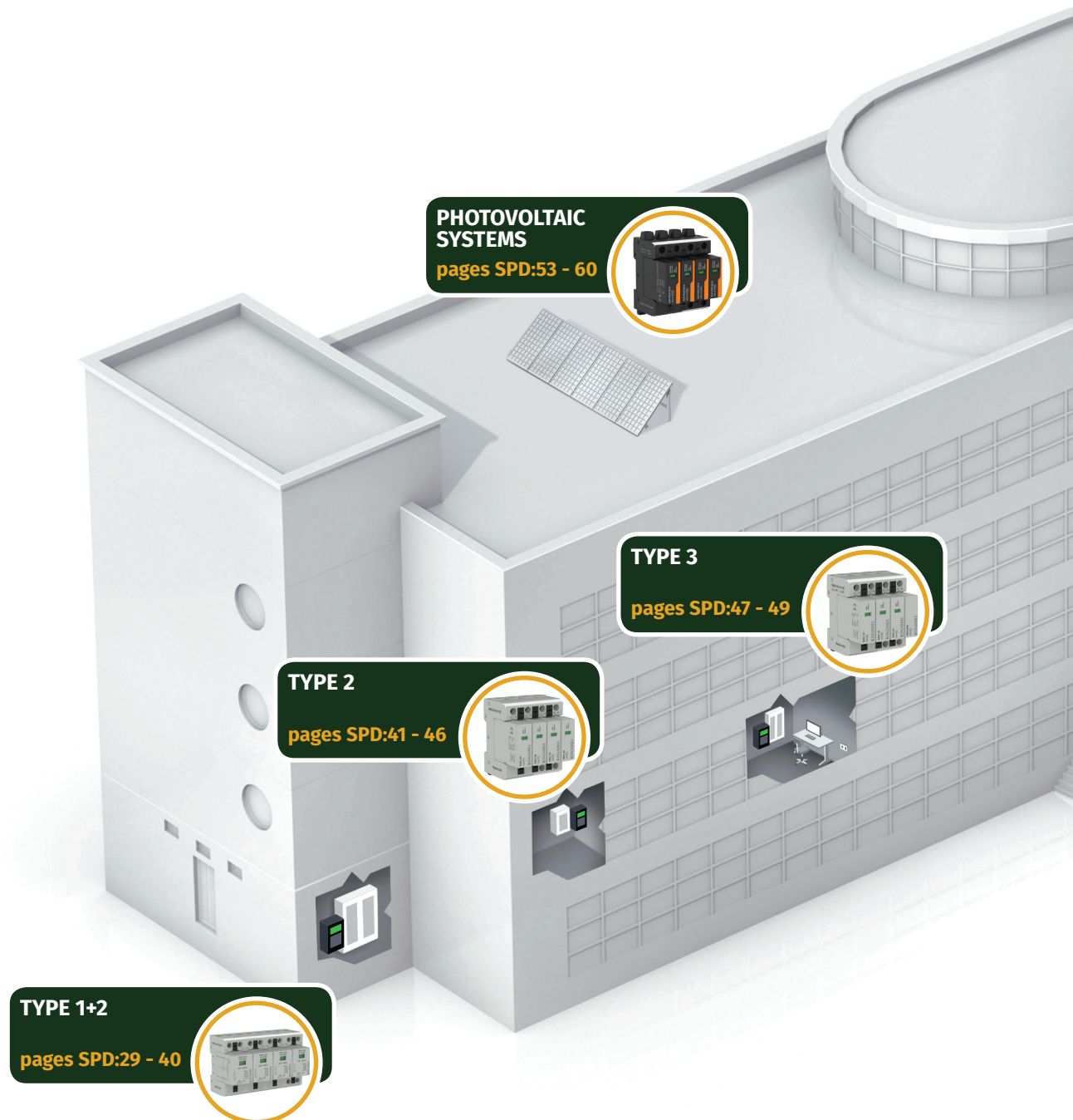
**Note:** Jupiter OLS is a monitoring and surveillance system. It does not provide warning of potential lightning strikes nor protection against lightning strikes. For assistance in these areas, contact Kingsmill.

◀ Typical ground-based, solar-powered Jupiter OLS installation



<b>Overview</b>	<b>SPD:2 - 3</b>
<b>Introduction</b> Why surge protection is important	<b>SPD:4 - 10</b>
<b>Applying Surge Protection</b> How to select a protector	<b>SPD:11 - 26</b>
<b>Mains Power Protectors</b> Datasheets for Lightning Current and Surge Arresters - Type 1+2, Type 2 and Type 3	<b>SPD:27 - 49</b>
<b>Charging Station Protection</b> Guide for the selection of SPDs for the protection of Electric Vehicle Charging Stations and protector details	<b>SPD:50 - 52</b>
<b>Photovoltaic Protection</b> Guide for the protection of Photovoltaic Systems (with protector details)	<b>SPD:53 - 60</b>
<b>LED Street, Industrial and Security Lighting Protection</b> Guide for the protection of Street Lighting and LED Lighting (with protector details)	<b>SPD:61 - 69</b>
<b>Low Voltage, Telephone and Data Lines Protection</b> Range of Low Voltage, Data and Telephone Line SPDs	<b>SPD:70 - 84</b>
<b>Enclosures</b> For use with our range of Mains Power SPDs	<b>SPD:85</b>
<b>Dimensions and wiring diagrams</b>	<b>SPD:86 - 91</b>
<b>SPD coordination table</b>	<b>SPD:92</b>

Kingsmill offer a range of Surge Protection Devices to protect electronic equipment from the damage caused by the secondary effects of lightning.



**PHOTOVOLTAIC  
SYSTEMS**

pages SPD:53 - 60



**TYPE 3**

pages SPD:47 - 49



**TYPE 2**

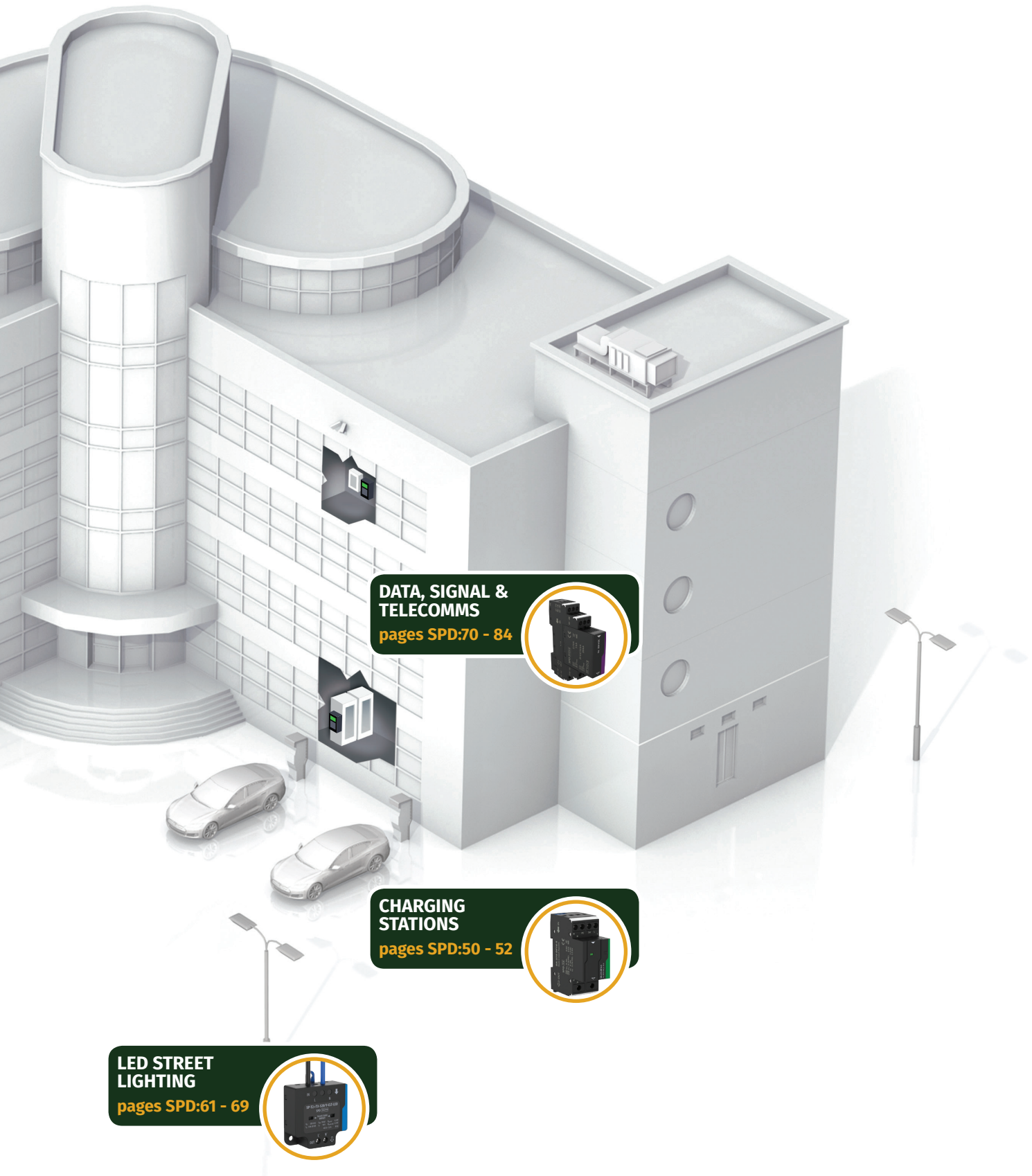
pages SPD:41 - 46



**TYPE 1+2**

pages SPD:29 - 40





**DATA, SIGNAL & TELECOMMS**  
pages SPD:70 - 84



**CHARGING STATIONS**  
pages SPD:50 - 52



**LED STREET LIGHTING**  
pages SPD:61 - 69



# The need for Surge Protection

The protection of electronic systems is often ignored, yet the damage to such systems, caused by lightning, can be catastrophic.



**The probability of electronic systems being damaged by lightning is many times greater than that of the building itself being struck by lightning!**

## Why?

Imagine a building. It's a relatively small target for lightning to hit, yet we will spend money on installing structural protection and have it tested annually, but ignore the dangers posed by lightning induced transients or surges.

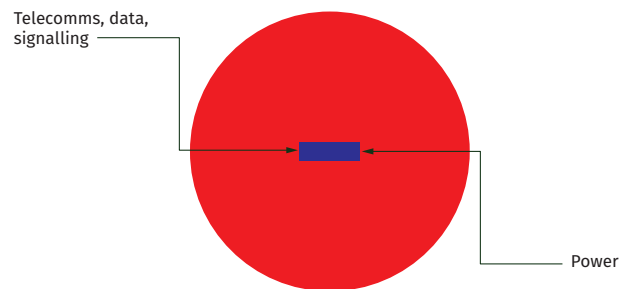
Our homes, places of work, factories, offices, hospitals, airports, etc are all interconnected by overhead and buried cables forming a huge spider's web, that is easily affected by lightning.

## Fact

Lightning up to 1km away can damage electronic systems. Now, draw a 2km diameter circle around your building - that is a large target area for lightning to hit, compared to the size of the building itself.

The resultant mains borne transients from the secondary effects of lightning can be as high as 6,000 volts and have the capacity to destroy electronic systems. Smaller transients may cause degradation to electronic components and disruption of system performance.

But the threat to electronic systems does not end there. Transient voltages caused by electrical switching are common.

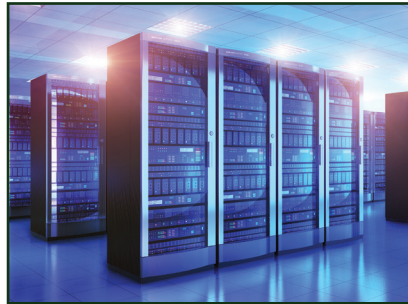




## Dependency

Electronic systems have invaded our everyday lives and we now depend on them to a huge extent:

- Business (where such systems control administration and manufacturing operations),
- Hospitals (where our lives can depend on the functioning of electronic equipment),
- Security services (police, fire and ambulance),
- Leisure (when we go shopping or even to the cinema or entertainment complex)
- Personal communications (email and phone).



## Susceptibility

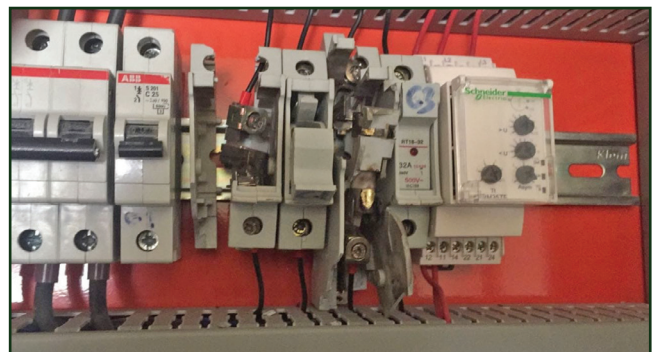
We can also see that the electronics supporting our everyday lives have become increasingly sophisticated and miniaturised. So much so that they are now more susceptible to damage or degradation.

Put this in the context of a 2km diameter target area for lightning - a spiders web of power and data cables - then we have a recipe for disaster!

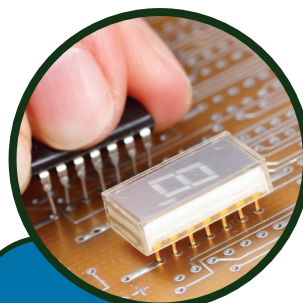
Imagine what would happen if we didn't have these systems - inconvenience, lack of service, perhaps even life threatening situations.

The consequences to operators of such systems are damage, degradation, and disruption.

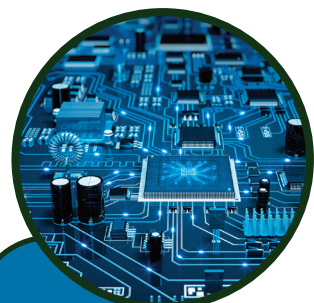
All of this can be costly but the good news is that it can be prevented!



1960s



1980s



2000s



# How do lightning and electrical switching events affect my electronic systems?

## 1 - Resistive Coupling

Lightning simply striking the ground injects a huge current of up to 200,000A into the ground.

This current flows away from its point of entry into the ground. It does this through the most readily available conductive medium, the ground itself (soil, rock etc). However, the earth terminations and electrical cables of electronic installations are often better conductors of current than the ground itself.

This resulting current flows through the earth, neutral and phase conductors, as well as data lines which are connected to buildings further away. It flows through the electronics and electrical systems of the buildings closest to the strike point. As it does so, devastating transient voltages appear, causing damage to sensitive electronic equipment.

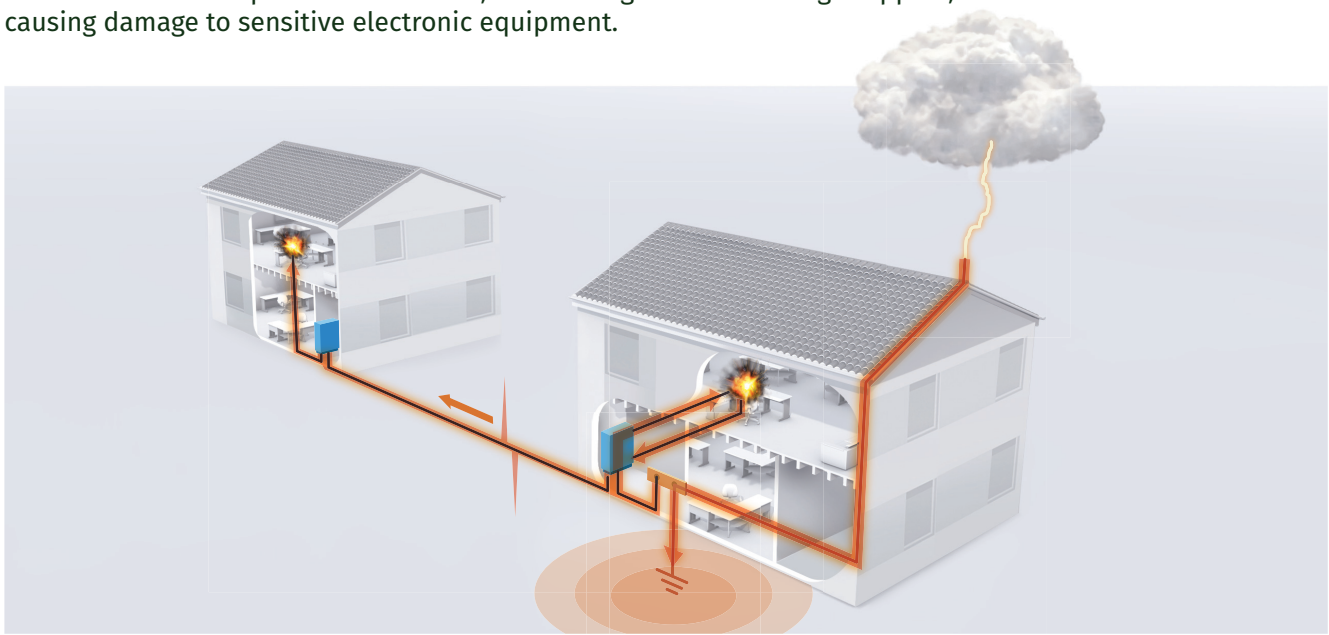


Figure SPD:1. Resistive Coupling - Example 1 (striking a structure)

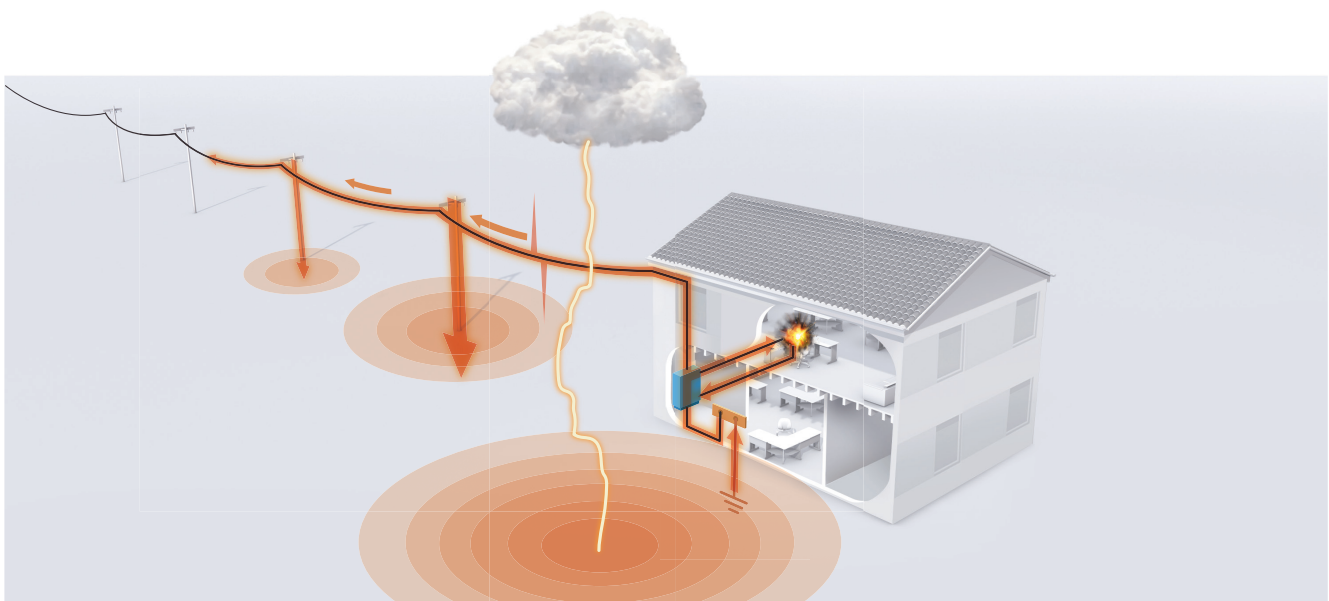


Figure SPD:2. Resistive Coupling - Example 2 (striking the ground near to a structure)

## 2 - Inductive (Magnetic) Coupling

The building may have structural lightning protection, but if data and power cables inside the building are routed close to a lightning down conductor, any lightning strike to the building will cause current to flow through the down conductors, resulting in an electromagnetic field that will induce transient voltages in the buildings internal power and data cables (*figure SPD:3*). The same can happen in an unprotected building too, the lightning current from a direct strike now finds its path to earth through the building's structure (reinforcing bars, steel columns etc) as well as internal pipework, cables and conduits.

Similarly, cloud to cloud lightning discharges (*figure SPD:4*) can induce transients in overhead power, data and telephone lines. This is because lightning is a massive discharge of current. When a current flows it creates an electromagnetic field and cables passing through this field have a voltage induced on them.



Figure SPD:3. Inductive Coupling - Example 1 (induced electro-magnetic field)

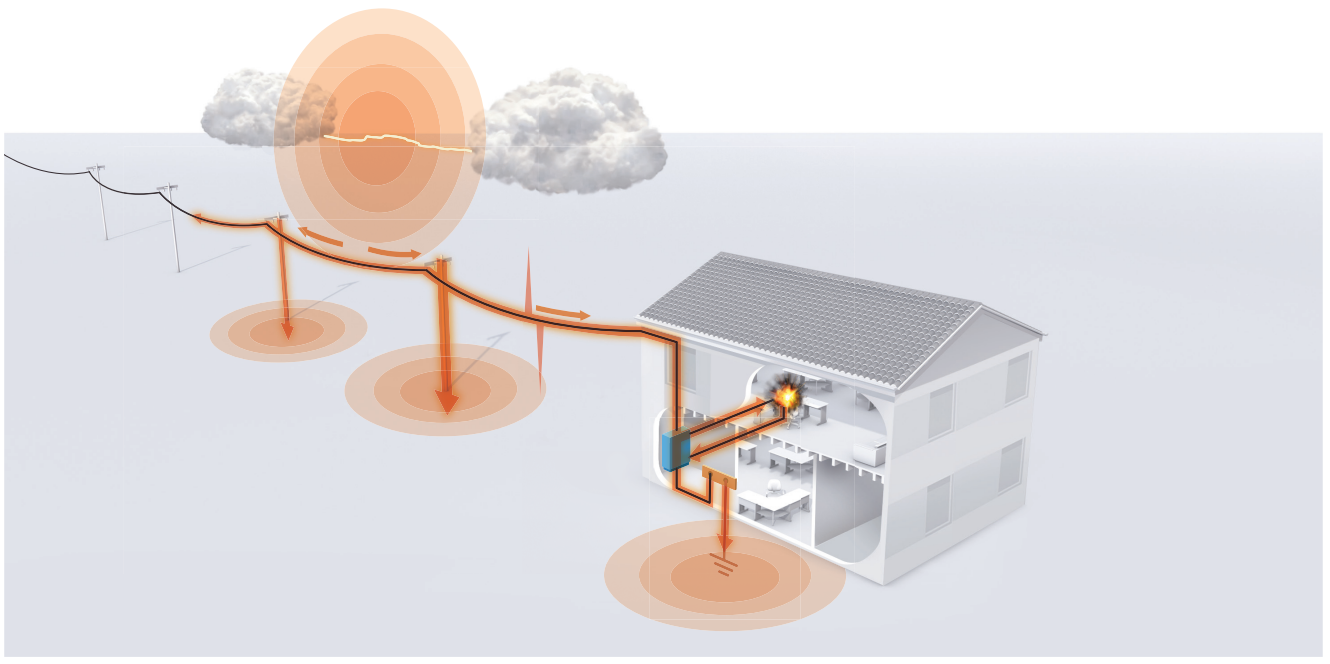


Figure SPD:4. Inductive Coupling - Example 2 (cloud to cloud lightning)

## 3 - Direct Strike

If an HV power line is struck directly by lightning, it will flashover to earth with one line flashing over before the others, creating a line to line transient that easily passes through supply transformers to reach electronic systems.

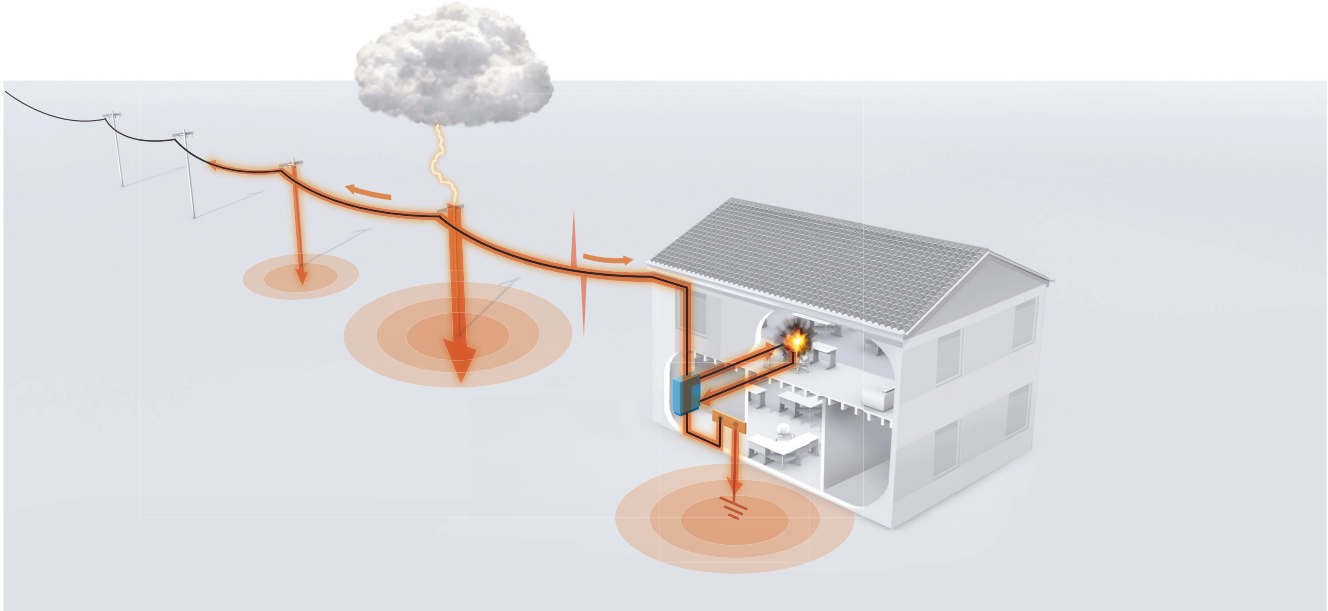


Figure SPD:5. Direct strike to an overhead HV power line

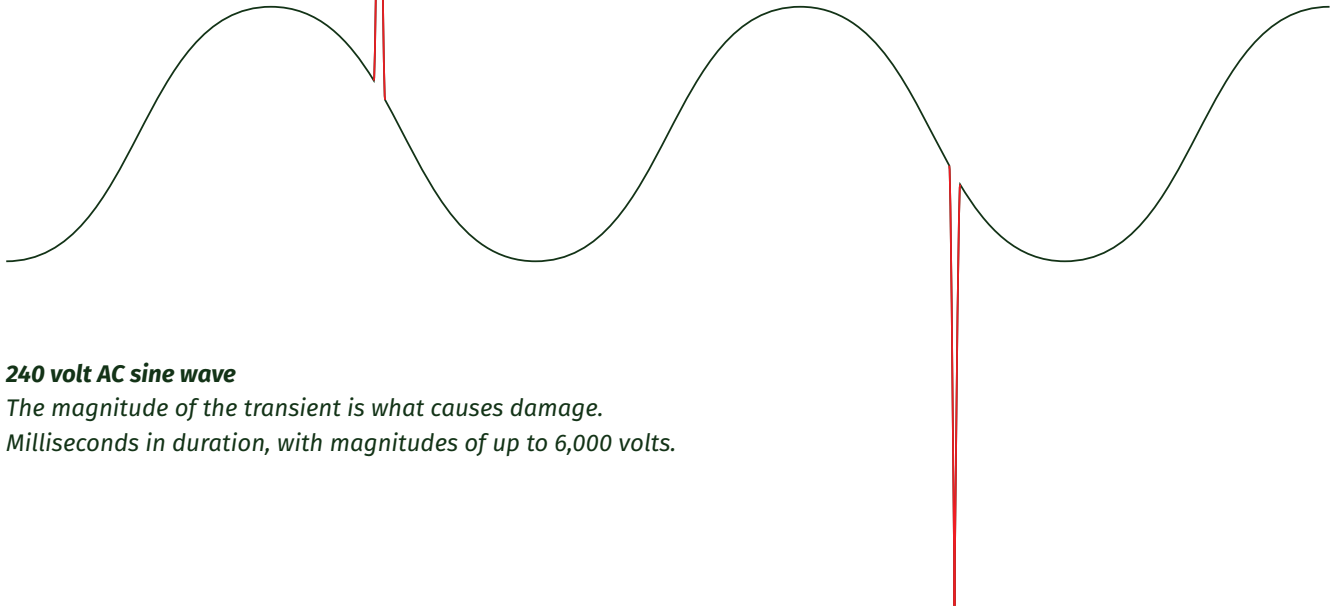
## 4 - Electrical Switching



We have already established that when a current flows through a conductor it creates a magnetic field. This field stores energy, higher currents and long lengths of conductor create more stored energy. When the current flowing along a conductor (the power supply) is switched off, the energy in the magnetic field is released in the form of a transient which can then flow through unprotected electronic equipment.

Switching events are commonplace. Inductive loads such as motors, transformers, electrical drives, large banks of lighting, industrial process equipment and so on are all sources of switching events.

What does a lightning induced transient look like?



**240 volt AC sine wave**

*The magnitude of the transient is what causes damage.*

*Milliseconds in duration, with magnitudes of up to 6,000 volts.*

What problems will a lightning induced or electrical switching transient cause?

### Damage

Depending upon the severity of the transient, damage can range from burnt-out circuit boards, to impaired operation of components on the circuit board. This latter damage is harder to pinpoint, but is often caused by lightning induced transients. IEC 60664 places this level at 15,400 volts for electronic equipment.

### Disruption

Here there is no physical damage, but the logic levels of the electronic system are disrupted. This can cause such things as data loss, corruption of software, loss of data, unexplained computer crashes and so forth.

The type of damage is very much influenced by a number of factors - equipment susceptibility (EN60664-1 states 1,500V as the minimum withstand voltage for electronic equipment). As the components of systems become smaller, susceptibility to damage and degradation worsen.

### Degradation

Long term exposure to transients, which can be from electrical switching (quite common) or the secondary effects of lightning are often unknown to the operator of the electronic systems. But these transients degrade electronic componentry, reducing the lifetime of those systems and equipment. Almost like a silent killer creeping up on you.

### Downtime

... (or the ability to use the system) is caused through inoperative systems.

## Consequential loss

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Consequential loss is the inability to use the electronic system - this can be extremely expensive and includes, but is not limited to:

- Replacement hardware
- Replacement software
- Loss of service
- Loss of revenue from suspended sales or manufacturing/process activity
- Cost of labour

The loss (or cost) varies from organisation to organisation, but it is not only inconvenient to have these problems, they can be prevented.



It is vitally important to reduce the size of lightning induced transients from 6,000 volts, to below the withstand voltage of the equipment to be protected (often cited as 1,500 volts).

This is the performance of European type units and the new Kingsmill range.



# Applying Surge Protection

In a well-designed system, it is important that for each building, both the incoming and outgoing circuits are protected by surge protection devices (where the cables enter and exit the building).

This includes:

- Mains power supplies – including UPS
- Telephone lines
- Data communication lines
- Instrumentation, control, signalling lines
- Coaxial lines for CCTV, TV, & antenna cables

Field based electronic equipment also need to be protected.

All power, data and telephone lines should be bonded to the main earthing bar in the structure. The live conductors of these services must be equipotentially bonded by an SPD, at the point where the service enters the structure.

Should the BS:EN 62305-2 risk assessment dictate that a Structural Lightning Protection System (LPS) is required, the system designer should always fit equipotential bonding Surge Protection Devices (SPDs). These are referred to as Lightning Current Arresters in our product selection pages.

If the assessment dictates that structural lightning protection is not required, but there is an indirect risk that electrical services entering the structure could be affected, then the designer should always fit Surge Protection Devices.

A lightning protection system that employs the use of “equipotential bonding SPDs or lightning current arrestors” alone, does not effectively protect electronic systems.

Additional protection is also required if equipment is located more than 10m away from the location of the first upstream SPD. The purpose of this is to protect electronic systems from internally generated transients, as well as from transients that have become magnified (through oscillation), due to travelling long distances (over 10m) from the upstream SPDs. See section on Recommended Protective Distances (pages SPD:20 - 22) and figures SPD:10 - 12.

Effective protection is only achieved through the use of “coordinated SPDs” – in other words, a set of SPDs installed in a cascade, such that service entrance/lightning current SPDs and equipment protection/surge arrester SPDs compliment each other. The combination of both lightning current and surge arrester products, in different locations is what provides effective protection. Coordination becomes vital where transient overvoltages need to be controlled downstream of the service entrance position.

Protector coordination is detailed on page SPD:92.

There are three types of SPD. They are classified according to the location in which they are installed:

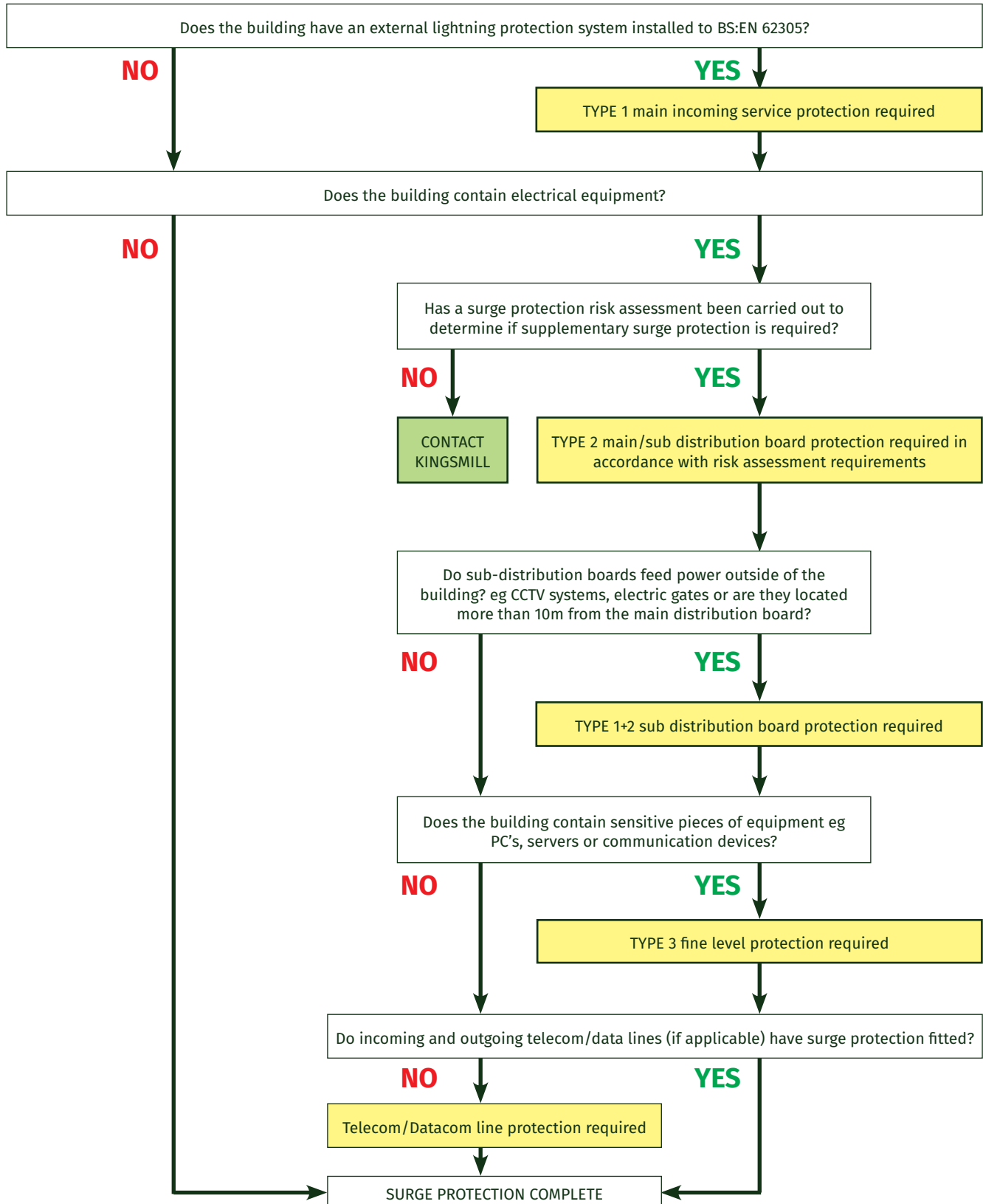
**Location:** Boundary of LPZ0 and LPZ1 - where lightning current could enter a building or structure  
**Power:** Type 1 - lightning current arresters (*tested with a 10/350 $\mu$ s waveform*)  
**Data:** Category D

**Location:** Boundary of LPZ1 and LPZ2 - protecting from internally induced transients (switching and the effects of oscillation over 10m) as well as the indirect effects of lightning  
**Power:** Type 2 - surge arresters (*tested with an 8/20 $\mu$ s waveform*)  
**Data:** Category C1

**Location:** Boundary of LPZ2 and LPZ3 - typically installed next to the equipment being protected, serving as “fine protection”  
**Power:** Type 3 - surge arresters - fine protection (*tested with an 8/20 $\mu$ s waveform*)  
**Data:** Category C2

# Device Selection - basic overview

The following flow chart will assist in determining the products to be selected:



## Protector Selection - detailed requirements

*In order to select a protector, the following information has to be determined:*

**STEP 1:** Carry out a risk assessment to determine the Lightning Protection Level (LPL)

**STEP 2:** Assign the Lightning Protection Zones (LPZ x)  
*This will involve determining the locations of distribution boards and equipment to be protected*

**STEP 3:** Determine the voltage protection level ( $U_p$ )

**STEP 4:** Determine the number of metallic services entering the building and establish the kA rating of the device

**STEP 5:** Determine the earthing system type into which the SPD will be connected

**STEP 6:** Establish the positioning of each device  
*(taking into account protective distances)*

**STEP 7:** Assess cable routing and other considerations

**STEPS 1 & 2 . . .**

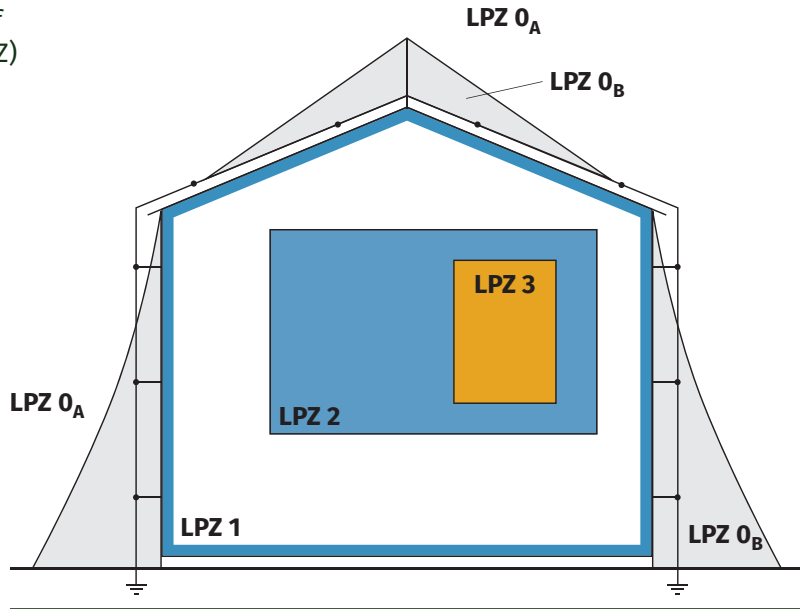
*From BS:EN 62305 . . .*

**Lightning Protection Zones**

BS:EN 62305-4 employs a principle of using Lightning Protection Zones (LPZ) to progressively reduce a potential 6,000 volt transient overvoltage to a safe voltage.

This voltage must be below that of the withstand voltage of the equipment to be protected.

SPD's are located at the boundaries of these zones.



*Figure SPD:6. Lightning Protection Zones*

**STEP 3 . . .**

**Determine the voltage protection level**

It is important that a protector does not 'let through' harmful voltages to the equipment that it is protecting. In the table below, "withstand level" equates to  $U_p$  or voltage protection level. In the case of everyday electronic equipment, this is 1,500 volts.

**Withstand voltage of the equipment being protected**

Not only is it important to select an SPD that can withstand the current associated with the location in which it is to be placed, BUT It is also important that an SPD does not let-through to the equipment, a transient that is larger than the equipment's withstand voltage.

EN 60664-1 classifies the low voltage distribution system into "impulse withstand categories".

These categories also include the definition of the maximum allowed overvoltage that a piece of equipment can withstand (withstand voltage).

Impulse withstand category	Withstand level	Type and location of equipment
I	1.5kV	Electronic equipment/outlet
II	2.5kV	Sub-distribution board/electrical equipment
III	4.0kV	Main distribution board
IV	6.0kV	Electricity supply meter

*Table SPD:1. Withstand impulse categories*

*Kingsmill mains protection devices have a let-through voltage of less than 1,500 volts therefore protecting Type I, II, III and IV electrical equipment (as defined above).*



## STEP 4 . . .

# Selection of mains Surge Protection Devices

Once we have determined:

- The Lightning Protection Level (LPL) and Lightning Protection System (LPS), see *Risk Assessment*
- Whether a structural Lightning Protection System is required or not, and
- The Lightning Protection Zones in which to locate the SPDs, together with the purpose of the SPD . . .
- The number of metallic services entering the structure

When evaluating the existence of a metallic service, it is important to establish whether it is continuous and provides a solid path to earth.

NOTE: some metallic services connect to non-metallic or insulating material close to the structure (ie water pipes, gas pipes, fibre optics etc).

## Determine the size or kA rating of the required SPDs

### **Service entrance protection/equipotential bonding - Type 1 SPDs - lightning current arresters (mains supply)**

Only Type 1 SPDs are selected using the LPL and LPS calculated from BS:EN 62305.

When lightning (200kA) strikes a building with structural lightning protection, it is assumed that 50% of the current (100kA) flows directly to earth through the building's lightning protection conductors. The rest is assumed to flow through the metallic services. So, if there was only one metallic service supplying the building, 50% of the current (100kA) would be assumed to flow through it. If that metallic service was a three phase electricity supply, then the 100kA would be equally split between each of the modes (lightning current flows to earth so, in a three phase system, there are four modes (or ways) in which lightning will flow - L1 to E; L2 to E; L3 to E and N to E - known as "common mode").

If there is more than one metallic service entering a building, the 100kA is split equally between each service. If that second service happens to be a power supply, then it is further split by mode, as illustrated below:

Lightning Protection Level (LPL)	Maximum current kA (10/350 waveform)	Class of Lightning Protection System (LPS)	ONE METALLIC SERVICE			TWO METALLIC SERVICES		
			Maximum current (50% of current)	Maximum current per mode - 3 phase (L1, L2, L3, N, E) 4 wires + earth	Maximum current per mode - single phase (L, N) 2 wires + earth	Maximum current (25% of current on each service)	Maximum current per mode - 3 phase (L1, L2, L3, N, E) 4 wires + earth	Maximum current per mode - single phase (L, N) 2 wires + earth
I	200	I	100	25	50	50	12.5	25
II	150	II	75	18.75	37.5	37.5	9.37	18.75
III & IV	100	III & IV	50	12.5	25	25	6.25	12.5

Table SPD:2. Illustration of the principle of division of current

*Cautionary note - when taking water and gas pipes into account, it may be that at the point of entry to the building, they are metallic, BUT a short distance away they may be of non-conducting material, and therefore not reliable earths.*

Only points where power, data and telecom cables enter or exit the building are sized in accordance with BS:EN 62305-4.

This includes the power supplies of roof mounted plant, external lighting, etc. In these cases the SPD should be placed as close as possible to the equipment or at the sub-distribution board supplying the equipment.

SPD's at these locations are known as Type 1 protectors and are tested with a 10/350µs waveform.

Lightning Protection Level (LPL)	Maximum current kA (10/350µs waveform)	Class of Lightning Protection System (LPS)	Maximum current one metallic service (50% of current)	Maximum current per mode - 3 phase (L1, L2, L3, N, E) 4 wires + earth	Maximum current per mode - single phase (L, N) 2 wires + earth	3 phase	Structure type
I	200	I	100	25	50	KM1+2-25- series	Housing, commercial, industrial
II	150	II	75	18.75	37.5	-	-
III & IV	100	III & IV	50	12.5	25	KM1+2-12.5- series	Housing with no LPS fitted, class III & IV buildings, between buildings

Table SPD:3. Protector selection by LPL, LPS and current division

We offer a range of **Combined Type 1+2 protectors**, utilising the combined benefits of fast acting switching from the GDT (spark gap) and voltage limiting from varistors. This ensures that the voltage protection level is below the “withstand voltage for electrical/electronic equipment” (defined in EN 60664-1).

It can also be noted that where the risk assessment from BS:EN 62305-2 says SPDs are required but structural protection is not, then the SPD selection can be modified such that:

<b>If connected by overhead service</b>	Type 1 SPD	Rated at 12.5kA per mode, <b>we recommend the use of a combined Type 1+2 device</b> , to ensure that electronic equipment is properly protected.
<b>If connected by underground cable</b>	Type 2 SPD	Since underground cables are not subject to direct lightning and thus see only partial lightning current. <i>However, if the building has an aerial, satellite dish, A/C unit or PV array, which might act as a Lightning Conductor, we recommend using a Type 1+2 protector.</i>

## Protection between buildings

Where services exit one building and re-enter another building, Type 1+2 protectors should be used at the distribution board supplying the out-going circuit and again at the incoming distribution board of the next building.

The same would apply to data and telecommunication lines.

*Our combined Type 1+2 SPDs are tested using both 10/350µs and 8/20µs waveforms.*

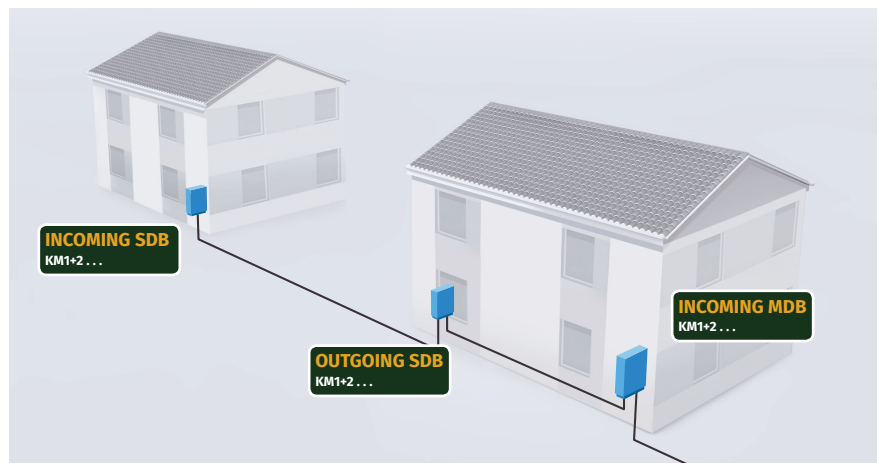


Figure SPD:7. SPD protection between electrically connected buildings

### Internal protection - Type 2 SPDs – surge arresters (mains supply)

Type 2 SPDs are used where the sub-distribution board (SDB) is between 10m and 50m from the main distribution board (MDB) - due to the transient being magnified by the effect of oscillation on cable lengths of over 10m. They are also used in cases where a Spark Gap is used as a Type 1 protector.

Type 2 protectors are also used to safeguard internally generated transient overvoltages, for example, from electrical switching events.

Type 2 SPDs are tested with an 8/20µs waveform.

### Internal protection - Type 3 SPDs – surge arresters – fine protection (mains supply)

Type 3 SPDs are located at socket outlets or switches supplying sensitive electronic equipment and are used to further reduce the size of transients that may affect electronic systems. Such devices are installed within 5m of the equipment to be protected.

Type 3 SPDs are tested with an 8/20µs waveform.

The Kingsmill range of mains power Surge Protection Devices is coordinated to allow ease of installation without the need for considering minimum cable inductance requirements.

**STEP 5 . . .**

The next task before a final SPD part number can be selected, is to determine the earthing system used in the building. This will be either TN-S, TN-C-S, TN-C or TT.

The differences between the various systems are in how the Neutral and Earth conductors enter the building, and whether, as in the case of TN-C-S. A combined Neutral and Earth, is separated out in the Main Distribution Board.

**Determine the installation's Earthing System**

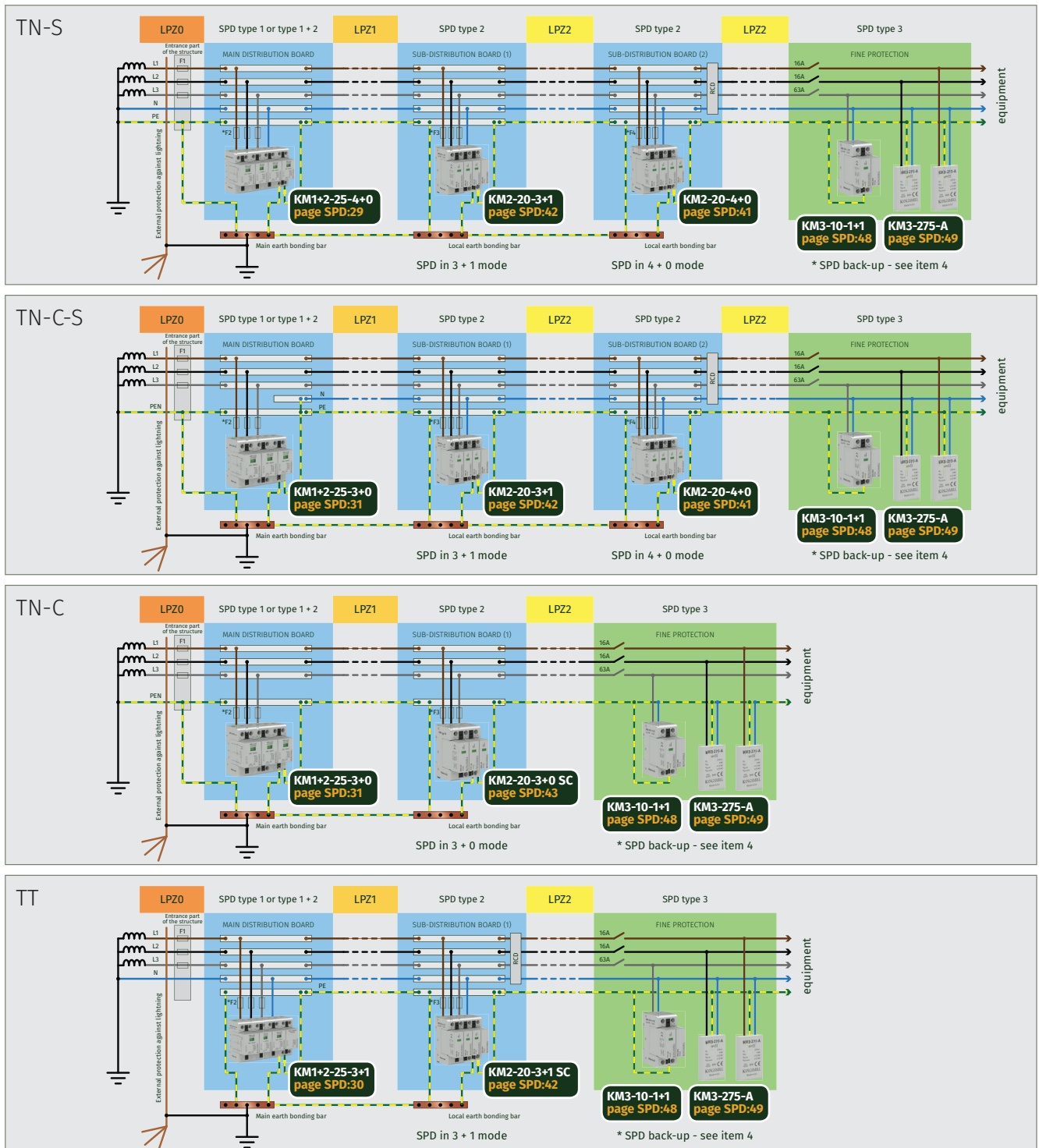


Figure SPD:8. Illustration of TN-S, TN-C-S, TN-C and TT earthing systems

## Connection Type - *definition*

It is important to select the correct SPD for both its location as well as purpose. Kingsmill mains protector part numbers are made from a number of elements:

- KM** = Kingsmill
- 1+2, 2+3** = Lightning Protection Level (see page SPD:14)
- 25, 12.5 & 10** = kA per mode (see page SPD:15)
- x + 0 and x + 1** = connection format for the modes (see the explanation, below)
- SC** = remote contacts for signalling (included as a standard feature)

**eg = KM1+2-25-4+0 SC**

SPDs are factory configured in two connection formats, CT1 (x+0) and CT2 (x+1). These are shown below:

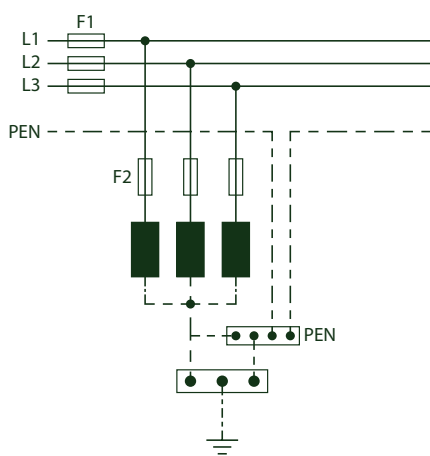


Figure SPD:9a. CT-1-X+0 - TN-C

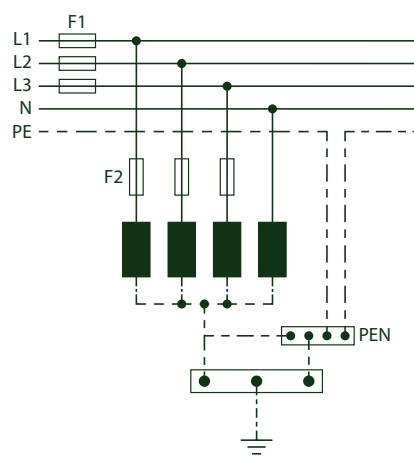


Figure SPD:9b. CT-1-X+0 - TN-S

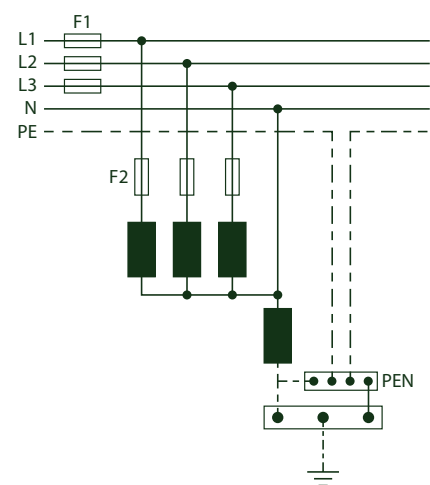


Figure SPD:9c. CT-2-X+1 - TN-S/TT

In the case of the x + 0 or CT1 connection the phase L1, L2, L3 and neutral conductors are connected to earth via the SPD. These are lightning current or equipotential bonding SPDs, whose primary purpose is to guard against the effects of lightning surges. Such surges appear as phase conductor and neutral conductor to earth, known as “common mode”.

Common mode surges are larger in magnitude than differential mode (switching) and can result in flashover and insulation break-down if the voltage withstand voltage (see Table 1) is exceeded.

Hence, lightning equipotential bonding SPD’s protect in common mode.

In the case of the x + 1 or CT 2 connection the phase conductors (L1, L2 & L3) are connected to earth via the SPD module connecting the neutral to earth. These devices are associated with switching and appear as line to line or line to neutral surges, known as “differential mode”. The neutral conductor module is rated for the full kA rating ie for LPLI that’s 100kA.

It can be seen from the earthing system diagrams (on page SPD:17) that different connection types are used in different applications.



# Connection Type - *selection*

## TN-S/TN-C-S systems

---

Type 1 or combined Type 1+2 SPDs are placed at the service entrance for the incoming supply (main distribution board). These devices protect against the effect of lightning electromagnetic impulses. The devices are ALWAYS connected in the x+0 (or CT1 format), with phase and neutral conductors connected to earth via the SPD.

In the case of Type 2 protectors located at downstream sub-distribution boards, a choice can be made:

- The SPD can be in the x+0 (CT1 connection type) – to further reduce the effects of lightning electromagnetic impulses, *or it can be*
- Connected in the x+1 (CT2 connection type) to restrict transient overvoltage generated internally, for example, from switching overvoltages.

In commercial and residential buildings it is better to select Type 2 SPDs in the x+0 mode, but in industrial complexes, due to switching overvoltages, it is better to select the x+1 (CT2 type).

Devices installed before the neutralising point in TN-C-S (4 wire) would require 3+0. Devices to be installed after the neutralising point (5 wire) would require 4+0.

## TN-C system

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In TN-C systems, Type 1, combined Type 1+2 and Type 2 protectors can only be connected in the x+0 format.

## TT system

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TT supply networks, in which only neutral conductors - L1, L2, L3 - are routed from the power source.

All protector types should ALWAYS be connected in the x+1 format.

## STEP 6 . . .

### Protective Distances

We learnt from pages SPD:15 and 16 and figure 7, that protectors need to be installed at the service entrance position and as close as possible to the equipment being protected.

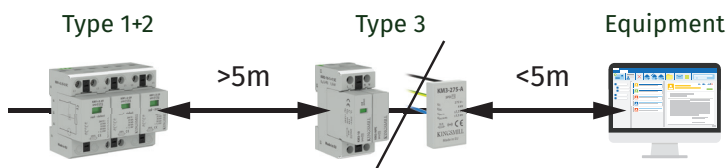
If the distances between SPDs or the SPD and the equipment being protected are too long, reflected voltages may appear on the line which could destroy the connected equipment or cause breakdown of the cable insulation. Such reflections can cause the up-stream SPD “let-through voltage” or  $U_p$  (voltage protection level) to double. This effect occurs if the equipment is disconnected inside or its input impedance is high.

If the distance between the SPD and the equipment being protected is less than 10m, such reflections can be ignored. However, if the distance is greater than 10m additional SPDs must be installed.

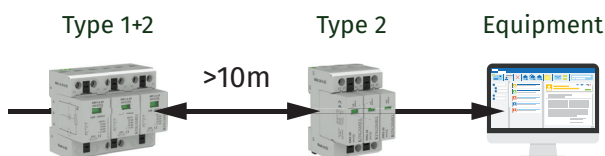
#### Type 1+2 devices:

Kingsmill offer “Combined Type 1+2” devices for use at service entrance positions. These devices have a let-through voltage (or  $U_p$ ) of <1.5kV (below the withstand voltage for electrical equipment in EN 60664-1 page SPD:14).

**A** If the distance between the Type 1+2 SPD and the terminal equipment is <10m, additional protection is not required. If additional fine protection is required and the terminal equipment is >5m away, a Type 3 device should be fitted as close as possible to the terminal equipment.



**B** If the distance between the Type 1+2 SPD and the SDB or terminal equipment being protected is >10m away, a Type 2 device must be installed downstream of the Type 1+2 device.



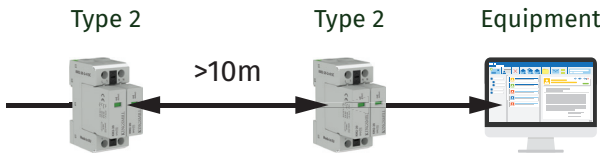
**C** If the distance between the SPD and the SDB or terminal equipment being protected is >50m, it is recommended that a Type 1+2 device with  $I_n = 30kA$  (8/20 $\mu s$ ) is fitted. This will work as a strong Type 2 SPD protector, coping with transient overvoltages and different earth potentials that might occur (particularly if the equipotential bonding of earths is not continuous).



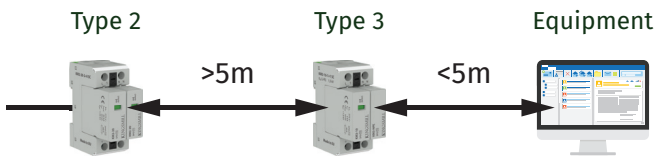
Figure SPD:10. Type 1+2 devices protective distances

**Type 2 devices:**

**D** If the distance between the Type 2 SPD and the next downstream SDB or the terminal equipment being protected is <math><10\text{m}</math>, additional protection is not required.



**E** If fine protection is required and the terminal equipment is >math>>5\text{m}</math> away, a Type 3 device should be fitted as close as possible to the terminal equipment.



**F** If the distance between the Type 2 SPD and the SDB or terminal equipment being protected is >math>>10\text{m}</math>, an additional Type 3 device should be fitted downstream.

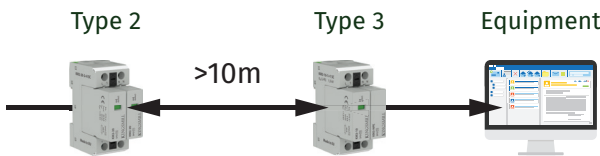
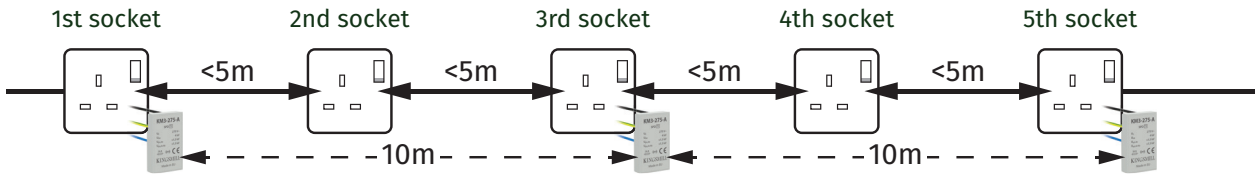


Figure SPD:11. Type 2 devices protective distances

### Type 3 devices:

**G** When using the Type 3 socket outlet protector (KM3-275-A, page SPD:49), the protector should always be installed at the first socket outlet downstream of the distribution board supplying it and thereafter every 10m of circuit length.



**H** However, if the socket outlet circuit is running on the inside of a wall that has a down conductor fitted to the outside, each socket outlet within 5m of the down conductor position should be protected individually with KM3-275-A protectors.

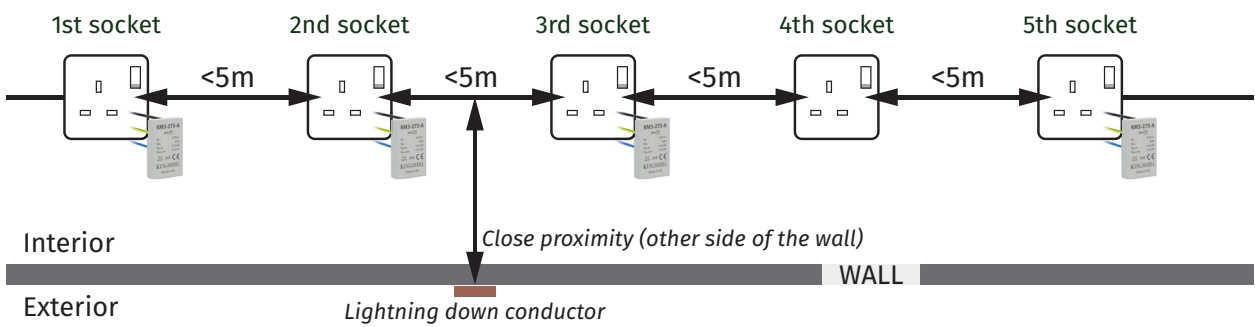


Figure SPD:12. Type 3 devices protective distances



## STEP 7 . . .

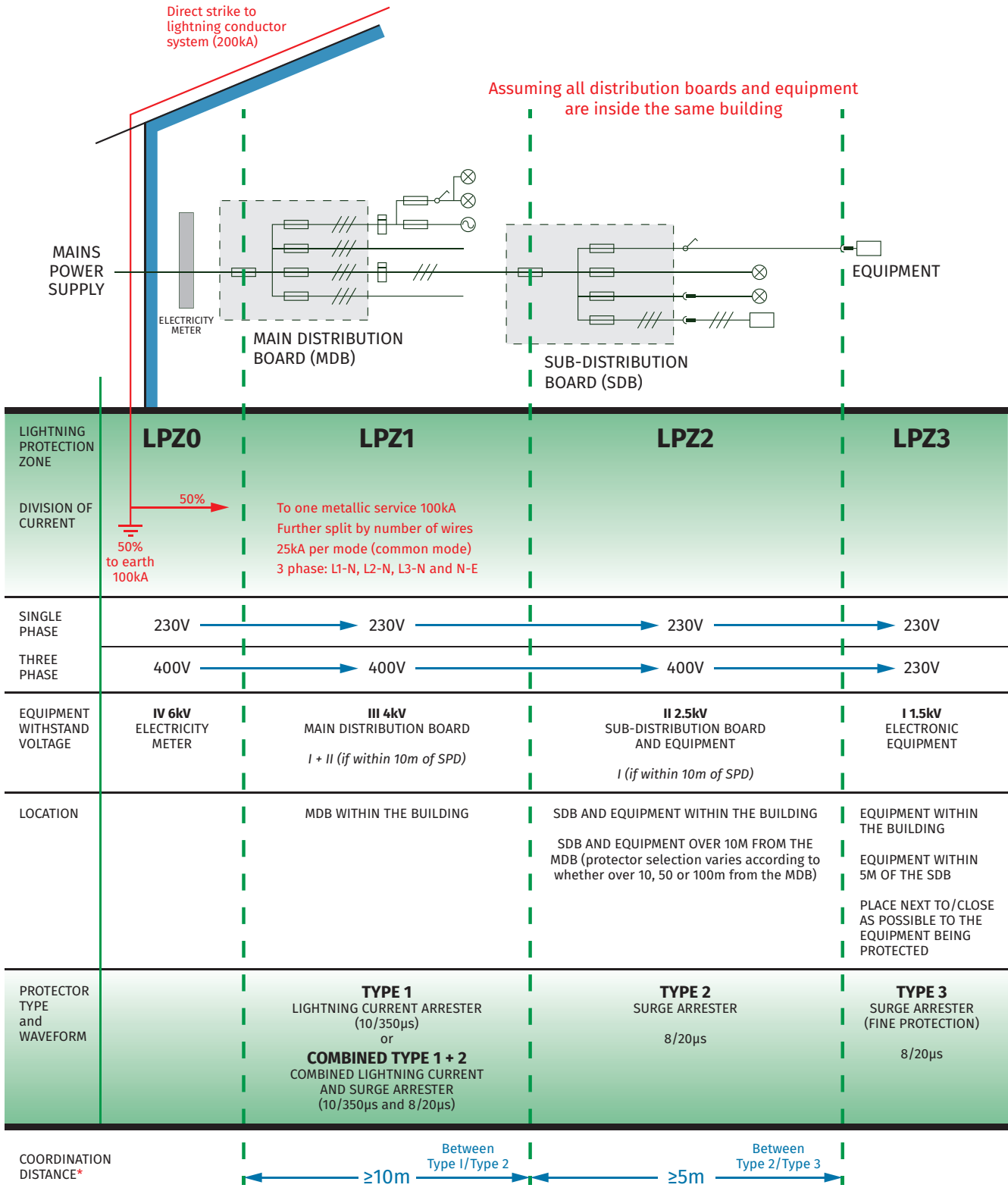
### Assess cable routeing and other considerations

---

Cable routeing and the connection of SPD's can affect the performance of the SPD and the level of protection that it can provide:

- Cable routeing should avoid proximity to lightning protection down conductors
- Large inductive loops between communication and power cabling should be avoided
- Cable screening should be considered
- Connecting leads must be as short as possible
- Avoid long distances (over 10m) between the SPD and the equipment being protected to avoid oscillations
- Examine use of electromagnetic shielding on cables
- Determine locations of distribution boards and the connected equipment to be protected
- Determine length of circuit cables

## Summary of criteria for applying protectors



\*We only supply combined Type 1+2 protectors thus removing the issue of coordination distance

### PROTECTOR PROTECTIVE DISTANCES - refer to pages SPD:20 - 22

Figure SPD:13. Summary of criteria for applying protectors

# Simplifying the selection of mains SPDs

The following tables simplify product selection (where distribution boards and equipment to be protected are located inside the same building). For installation in houses, commercial and industrial buildings.

In all TN-C cases, the Type 1+2 SPD is placed before the neutralising point.

Earthing System	Lightning Protection Level (LPL)	Main Distribution Board	Sub-Distribution Board		Electronic Equipment (>5m from MDB)
		BOUNDARY OF LPZ 0 AND LPZ 1 TYPE 1/COMBINED TYPE 1+2	BOUNDARY OF LPZ 1 AND LPZ 2 TYPE 2 (unless feeding outside circuits)		BOUNDARY OF LPZ 2 AND LPZ 3 TYPE 3 AND FINE PROTECTION
TN-C	I & II	KM1+2-25-3+0 SC (pSPD:31)	>10m from MDB	KM2-20-3+0 SC (pSPD:43)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-3+0 SC (pSPD:37)	
			>100m from MDB	KM1+2-25-3+0 SC (pSPD:31)	
TN-C	III & IV	KM1+2-12.5-3+0 SC (pSPD:37)	>10m from MDB	KM2-20-3+0 SC (pSPD:43)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-3+0 SC (pSPD:37)	
TN-S	I & II	KM1+2-25-4+0 SC (pSPD:29)	>10m from MDB	KM2-20-4+0 SC (pSPD:41)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-4+0 SC (pSPD:35)	
			>100m from MDB	KM1+2-25-4+0 SC (pSPD:29)	
TN-S	III & IV	KM1+2-12.5-4+0 SC (pSPD:35)	>10m from MDB	KM2-20-4+0 SC (pSPD:41)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-4+0 SC (pSPD:35)	
TN-C-S	I & II	KM1+2-25-3+0 SC (pSPD:31)	>10m from MDB	KM2-20-4+0 SC (pSPD:41)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-4+0 SC (pSPD:35)	
			>100m from MDB	KM1+2-25-4+0 SC (pSPD:29)	
TN-C-S	III & IV	KM1+2-12.5-3+0 SC (pSPD:37)	>10m from MDB	KM2-20-4+0 SC (pSPD:41)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-4+0 SC (pSPD:35)	
TT	I & II	KM1+2-25-3+1 SC (pSPD:30)	>10m from MDB	KM2-20-3+1 SC (pSPD:42)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-3+1 SC (pSPD:36)	
			>100m from MDB	KM1+2-25-3+1 SC (pSPD:30)	
TT	III & IV	KM1+2-12.5-3+1 SC (pSPD:36)	>10m from MDB	KM2-20-3+1 SC (pSPD:42)	KM3-10-3+1 SC (pSPD:47)
			>50m from MDB	KM1+2-12.5-3+1 SC (pSPD:36)	

Table SPD:4. Application of Surge Protection Devices on three phase electrical systems

In table SPD:5 (below) it is assumed that in a single phase installation, such as a house, there are always two metallic services. Therefore, the table reflects 25% via a water main or other metallic service and 25% of current shared equally by the modes of a single phase supply (L1, N).

Earthing System	Lightning Protection Level (LPL)	Main Distribution Board (MDB)	Sub-Distribution Board (SDB)		Electronic Equipment (>5m from MDB)
		BOUNDARY OF LPZ 0 AND LPZ 1 TYPE 1/COMBINED TYPE 1+2	BOUNDARY OF LPZ 1 AND LPZ 2 TYPE 2 (unless feeding outside circuits)		BOUNDARY OF LPZ 2 AND LPZ 3 TYPE 3 AND FINE PROTECTION
TN-C	I & II	KM1+2-25-1+0 SC (pSPD:34)	>10m from MDB	KM2-20-1+0 SC (pSPD:46)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-1+0 SC (pSPD:40)	
			>100m from MDB	KM1+2-25-1+0 SC (pSPD:34)	
TN-C	III & IV	KM1+2-12.5-1+0 SC (pSPD:40)	>10m from MDB	KM2-20-1+0 SC (pSPD:46)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-1+0 SC (pSPD:40)	
TN-S	I & II	KM1+2-25-2+0 SC (pSPD:32)	>10m from MDB	KM2-20-2+0 SC (pSPD:44)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-2+0 SC (pSPD:38)	
			>100m from MDB	KM1+2-25-2+0 SC (pSPD:32)	
TN-S	III & IV	KM1+2-12.5-2+0 SC (pSPD:38)	>10m from MDB	KM2-20-2+0 SC (pSPD:44)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-2+0 SC (pSPD:38)	
TN-C-S	I & II	KM1+2-25-1+0 SC (pSPD:34)	>10m from MDB	KM2-20-2+0 SC (pSPD:44)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-2+0 SC (pSPD:38)	
			>100m from MDB	KM1+2-25-2+0 SC (pSPD:32)	
TN-C-S	III & IV	KM1+2-12.5-1+0 SC (pSPD:40)	>10m from MDB	KM2-20-2+0 SC (pSPD:44)	KM3-10-1+1 SC (pSPD:48) KM3-275-A (pSPD:49)
			>50m from MDB	KM1+2-12.5-2+0 SC (pSPD:38)	
TT	I & II	KM1+2-25-1+1 SC (pSPD:33)	>10m from MDB	KM2-20-1+1 SC (pSPD:45)	KM3-10-1+1 SC (pSPD:48)
			>50m from MDB	KM1+2-12.5-1+1 SC (pSPD:39)	
			>100m from MDB	KM1+2-25-1+1 SC (pSPD:33)	
TT	III & IV	KM1+2-12.5-1+1 SC (pSPD:39)	>10m from MDB	KM2-20-1+1 SC (pSPD:45)	KM3-10-1+1 SC (pSPD:48)
			>50m from MDB	KM1+2-12.5-1+1 SC (pSPD:39)	

Table SPD:5. Application of Surge Protection Devices on single phase electrical systems

## Example of protector placement

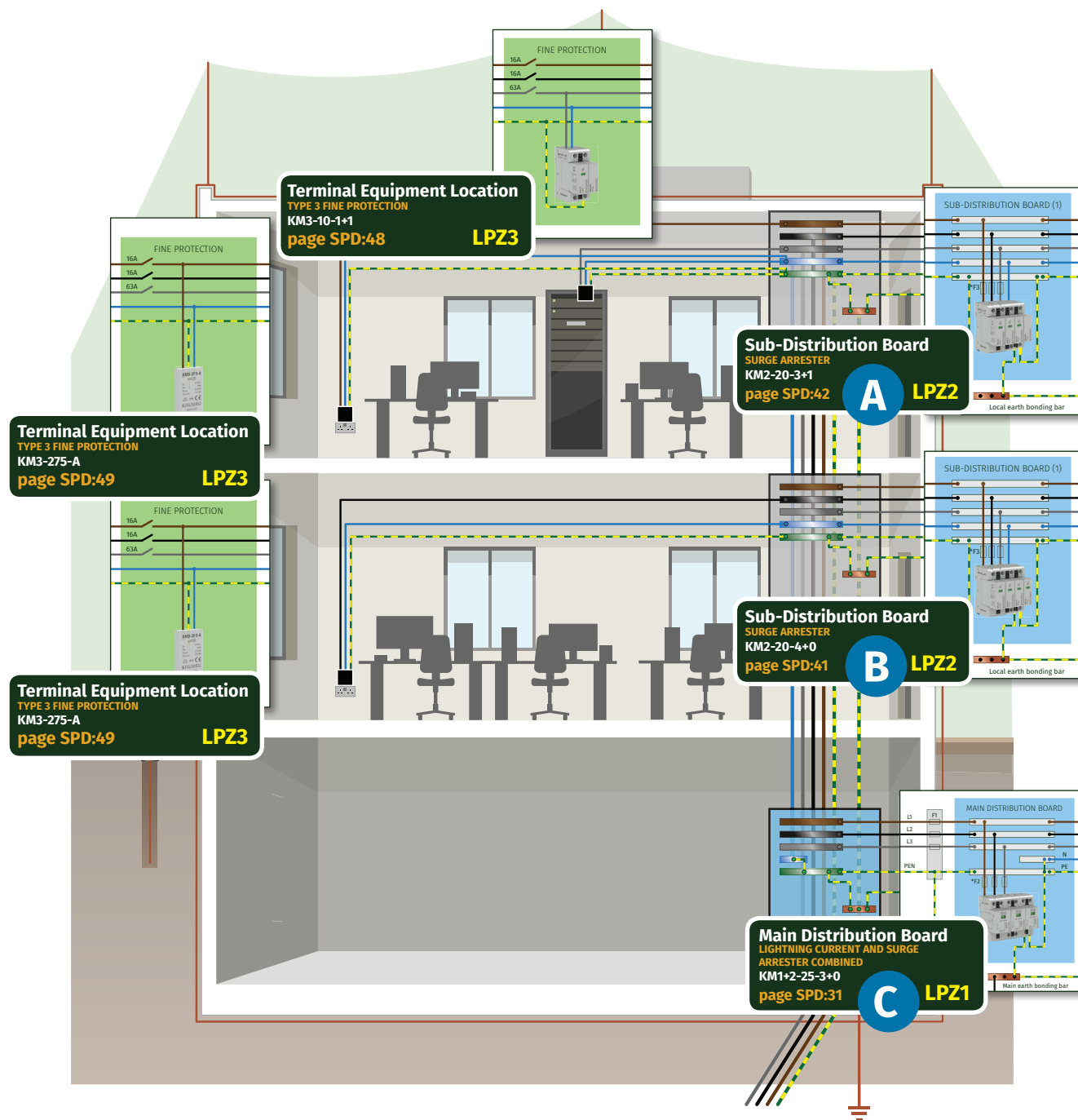


Figure SPD:14. Example of TN-C-S SPD product placement

- A** Differential mode - switching transients
- B** Common mode - equipotential bonding
- C** Equipotential bonding lightning current and surge arrester



# Mains Surge Protection Products

## 25kA combined Type 1 & 2 lightning current and surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase	Page
KM1+2-25-4+0 SC	25kA	TNS (MDB) / TN-C-S (SDB)	4	Three	SPD:29
KM1+2-25-3+1 SC	25kA	TT	4	Three	SPD:30
KM1+2-25-3+0 SC	25kA	TN-C / TN-C-S	3	Three	SPD:31
KM1+2-25-2+0 SC	25kA	TNS (MDB) / TN-C-S (SDB)	2	Single	SPD:32
KM1+2-25-1+1 SC	25kA	TT	2	Single	SPD:33
KM1+2-25-1+0 SC	25kA	TN-C	1	Single	SPD:34



## 12.5kA combined Type 1 & 2 lightning current and surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase	Page
KM1+2-12.5-4+0 SC	12.5kA	TNS (MDB) / TN-C-S (SDB)	4	Three	SPD:35
KM1+2-12.5-3+1 SC	12.5kA	TT	4	Three	SPD:36
KM1+2-12.5-3+0 SC	12.5kA	TN-C / TN-C-S	3	Three	SPD:37
KM1+2-12.5-2+0 SC	12.5kA	TNS (MDB) / TN-C-S (SDB)	2	Single	SPD:38
KM1+2-12.5-1+1 SC	12.5kA	TT	2	Single	SPD:39
KM1+2-12.5-1+0 SC	12.5kA	TN-C	1	Single	SPD:40



## 20kA Type 2 surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase	Page
KM2-20-4+0 SC	20kA	TNS / TN-C-S	4	Three	SPD:41
KM2-20-3+1 SC	20kA	TT	4	Three	SPD:42
KM2-20-3+0 SC	20kA	TN-C	3	Three	SPD:43
KM2-20-2+0 SC	20kA	TNS / TN-C-S	2	Single	SPD:44
KM2-20-1+1 SC	20kA	TT	2	Single	SPD:45
KM2-20-1+0 SC	20kA	TN-C / TN-S / TT	1	Single	SPD:46



## 10kA Type 3 surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase	Page
KM3-10-3+1 SC	10kA	TN-C / TN-S / TN-C-S / TT	4	Three	SPD:47
KM3-10-1+1 SC	10kA	TN-C / TN-S / TN-C-S / TT	2	Single	SPD:48



## 2kA Type 3 surge protection module

Part number	Earthing system	Number of poles	Phase	Page
KM3-275-A	TN-C / TN-S / TN-C-S / TT	N/A	Single	SPD:49



## Product Features

Remote signalling



Biconnect terminals



Reversible installation



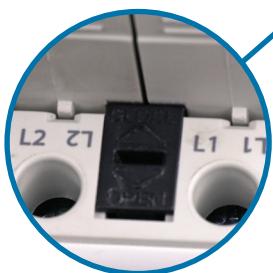
DIN rail mountable



Optical lifetime status indication



Lock system for fixing of modules



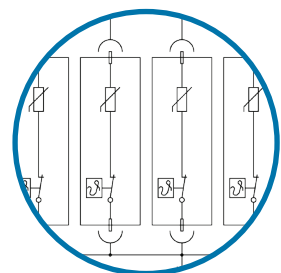
Pluggable modules



Mechanical coding



Safety thermodynamic disconnecter



All Kingsmill mains SPDs have pluggable modules and remote status signalling as standard

## Type 1+2 lightning current and surge arrester

High performance four-pole Type 1+2 surge arrester. Use in TN-S and TN-C-S system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >100m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- High performance lightning current arrester
- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II

SYSTEM: THREE PHASE TN-S

MDB: BOUNDARY of LPZ0 & LPZ1

SDB: BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM1+2-25-4+0 SC	
System	Three phase TN-S & TN-C-S/4 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	260V AC
Nominal load current for "V" connection	$I_L$	125A
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	25kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		1300g (nett), 1365g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-25

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:86

## Type 1+2 lightning current and surge arrester



Heavy duty varistor and spark gap based Type 1+2 surge arresters. Use in TT system main distribution boards on the boundary of LPZ0 and LPZ1. Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** THREE PHASE TT / TN-S

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

### Electrical specification

Order number	KM1+2-25-3+1 SC	
System	Three phase TT/TN-S/4 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	260V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal load current for "V" connection	$I_L$	125A
Lightning impulse current (10/350 $\mu$ s) L-N	$I_{imp}$	25kA
Lightning impulse current (10/350 $\mu$ s) N-PE	$I_{imp}$	100kA
Nominal discharge current (8/20 $\mu$ s) L-N	$I_n$	30kA
Nominal discharge current (8/20 $\mu$ s) N-PE	$I_n$	100kA
Maximum discharge current (8/20 $\mu$ s) L-N	$I_{max}$	60kA
Maximum discharge current (8/20 $\mu$ s) N-PE	$I_{max}$	100kA
Voltage protection level L-N/N-PE	$U_p$	1.5kV
Voltage protection level L-PE	$U_p$	2.2kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time L-N/N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		1295g (nett), 1355g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:86

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-25
Spare Module N-PE	KM1+2-25-NPE

## Type 1+2 lightning current and surge arrester

Heavy duty varistor and spark gap based Type 1+2 surge arrester. Use in TN-C and TN-C-S system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (see distance criteria, below).

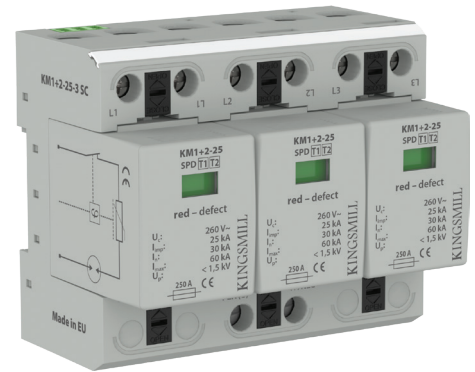
Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- High performance lightning current arrester
- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II

**SYSTEM:** THREE PHASE TN-C & TN-C-S

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM1+2-25-3+0 SC	
<b>System</b>	<b>Three phase TN-C &amp; TN-C-S/3 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	260V AC
Nominal load current for "V" connection	$I_L$	125A
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	25kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		975g (nett), 1025g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-25

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:86



### Type 1+2 lightning current and surge arrester



High performance two pole Type 1+2 surge arrester. Use in TN-S and TN-C-S system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >100m away from the MDB).

Suitable for houses, commercial and industrial buildings.

#### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

#### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

#### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

#### LPL I + II

**SYSTEM:** SINGLE PHASE TN-S & TN-C-S

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

#### Electrical specification

Order number	KM1+2-25-2+0 SC	
<b>System</b>	<b>Single phase TN-S/TN-C-S 2 pole</b>	
Nominal voltage	U <sub>n</sub>	230V AC
Nominal voltage	U <sub>o</sub>	230V/400V AC ± 10%
Maximum operating voltage	U <sub>c</sub>	260V AC
Nominal load current for "V" connection	I <sub>L</sub>	125A
Lightning impulse current (10/350µs)	I <sub>imp</sub>	25kA
Nominal discharge current (8/20µs)	I <sub>n</sub>	30kA
Maximum discharge current (8/20µs)	I <sub>max</sub>	60kA
Voltage protection level	U <sub>p</sub>	1.5kV
Short-circuit current rating	I <sub>sCCR</sub>	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time	t <sub>a</sub>	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		700g (nett), 755g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:86

#### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

## Type 1+2 lightning current and surge arrester

Heavy duty varistor and spark gap based Type 1+2 surge arrester.  
Use in TT system main distribution boards on the boundary of LPZ0 and LPZ1. Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.



### LPL I + II

SYSTEM: SINGLE PHASE TT

MDB: BOUNDARY of LPZ0 & LPZ1

SDB: BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM1+2-25-1+1 SC	
System	Single phase TT/2 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	260V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal load current for "V" connection	$I_L$	125A
Lightning impulse current (10/350 $\mu$ s) L-N	$I_{imp}$	25kA
Lightning impulse current (10/350 $\mu$ s) N-PE	$I_{imp}$	50kA
Nominal discharge current (8/20 $\mu$ s) L-N	$I_n$	30kA
Nominal discharge current (8/20 $\mu$ s) N-PE	$I_n$	50kA
Maximum discharge current (8/20 $\mu$ s) L-N	$I_{max}$	60kA
Maximum discharge current (8/20 $\mu$ s) N-PE	$I_{max}$	100kA
Voltage protection level L-N/N-PE	$U_p$	1.5kV
Voltage protection level L-PE	$U_p$	2.2kV
Short-circuit current rating	$I_{sCCR}$	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time L-N/N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		650g (nett), 690g (gross)

### Accessories

Spare modules are available.

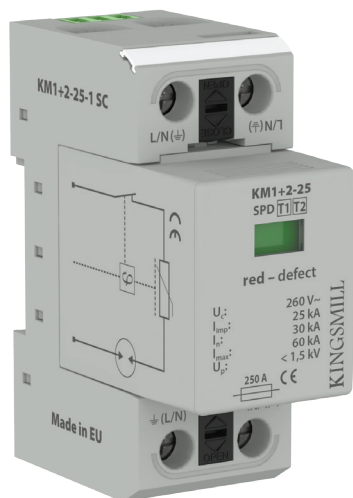
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-25

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:86

## Type 1+2 lightning current and surge arrester



High performance single pole Type 1+2 surge arrester. Use in TN-C system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >100m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** SINGLE PHASE TN-C

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 (if >100m away from MDB)

### Electrical specification

Order number	KM1+2-25-1+0 SC	
<b>System</b>	<b>Single phase TN-C/1 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	260V AC
Nominal load current for "V" connection	$I_L$	125A
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	25kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		250A gL/gG
Maximum overcurrent protection for "V" connection		125A gL/gG
Response time	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		2.5mm <sup>2</sup> - 50mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		2.5mm <sup>2</sup> - 35mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		335g (nett), 365g (gross)

### DIMENSIONS & WIRING DIAGRAMS:

SEE PAGE SPD:86

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

## Type 1+2 lightning current and surge arrester

Varistor based Type 1+2 surge arrester. Use in TN-S and TN-C-S system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >50m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II

**SYSTEM:** THREE PHASE TN-S & TN-C-S  
**MDB:** -  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** THREE PHASE TN-S & TN-C-S  
**MDB:** BOUNDARY of LPZ0 & LPZ1  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM1+2-12.5-4+0 SC	
<b>System</b>	<b>Three phase TN-S/TN-C-S/4 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	12.5kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		560g (nett), 605g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

**DIMENSIONS & WIRING DIAGRAMS:**  
 SEE PAGE SPD:87

## Type 1+2 lightning current and surge arrester



Combination of varistor SPD and encapsulated spark gap connected in the 3 + 1 mode. Use in TT system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >100m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** THREE PHASE TT

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** THREE PHASE TT

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### Electrical specification

Order number	KM1+2-12.5-3+1 SC	
<b>System</b>	<b>3 phase TT/4 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Lightning impulse current (10/350 $\mu$ s) L-N	$I_{imp}$	12.5kA
Lightning impulse current (10/350 $\mu$ s) N-PE	$I_{imp}$	50kA
Nominal discharge current (8/20 $\mu$ s) L-N	$I_n$	30kA
Nominal discharge current (8/20 $\mu$ s) N-PE	$I_n$	50kA
Maximum discharge current (8/20 $\mu$ s) L-N	$I_{max}$	60kA
Maximum discharge current (8/20 $\mu$ s) N-PE	$I_{max}$	100kA
Voltage protection level at 5kA L-N	$U_p$	0.9kV
Voltage protection level L-N/N-PE/L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication L-N		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		545g (nett), 595g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5
Spare Module N-PE	KM1+2-12.5-NPE

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:87



## Type 1+2 lightning current and surge arrester

Varistor based Type 1+2 surge arrester. Use in TN-C system sub-distribution boards on the boundary of LPZ0 and LPZ1 and main distribution boards on the boundary of LPZ1 and LPZ2 (if >50m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II

**SYSTEM:** THREE PHASE TN-C

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** THREE PHASE TN-C & TN-C-S

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

## Electrical specification

Order number	KM1+2-12.5-3+0 SC	
System	Three phase TN-C & TN-C-S/3 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	12.5kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		435g (nett), 480g (gross)

### Accessories

Spare modules are available.

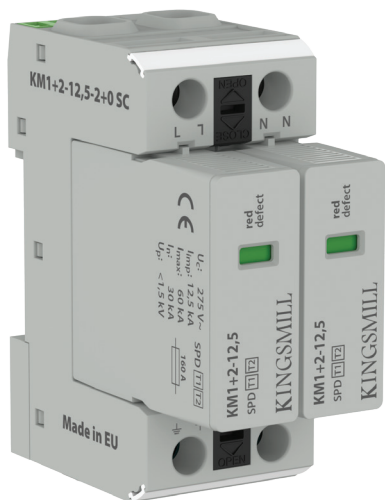
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:87

## Type 1+2 lightning current and surge arrester



Varistor based two pole Type 1+2 surge arrester. Use in TN-S and TN-C-S system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >50m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** SINGLE PHASE TN-S & TN-C-S

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TN-S & TN-C-S

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### Electrical specification

Order number	KM1+2-12.5-2+0 SC	
<b>System</b>	<b>Single phase TN-S &amp; TN-C-S/2 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	12.5kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		310g (nett), 330g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:87

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

## Type 1+2 lightning current and surge arrester

Combination of varistor SPD and encapsulated spark gap connected in the 1 + 1 mode. Use in TT system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >100m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II

**SYSTEM:** SINGLE PHASE TT

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TT

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM1+2-12.5-1+1 SC	
<b>System</b>	<b>1 phase TT/2 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Lightning impulse current (10/350 $\mu$ s) L-N	$I_{imp}$	12.5kA
Lightning impulse current (10/350 $\mu$ s) N-PE	$I_{imp}$	25kA
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s) L-N/N-PE	$I_{max}$	60kA
Voltage protection level at 5kA L-N	$U_p$	0.9kV
Voltage protection level L-N/N-PE/L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication L-N		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		250g (nett), 290g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5
Spare Module N-PE	KM1+2-12.5-NPE

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:87

## Type 1+2 lightning current and surge arrester



Varistor based single pole Type 1+2 surge arrester. Use in TN-C system main distribution boards on the boundary of LPZ0 and LPZ1 and sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >50m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** SINGLE PHASE TN-C

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TN-C

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

## Electrical specification

Order number	KM1+2-12.5-1+0 SC	
<b>System</b>	<b>Single phase TNC/1 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Lightning impulse current (10/350 $\mu$ s)	$I_{imp}$	12.5kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T1, T2
Weight		160g (nett), 185g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:87

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM1+2-12.5

## Type 2 surge arrester

Varistor based four-pole Type 2 surge arrester. Use in TN-S and TN-C-S system sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >10m away from the MDB).

Suitable for houses, commercial and industrial buildings.

## Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

## Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

## LPL I + II

**SYSTEM:** THREE PHASE TN-S & TN-C-S  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

## LPL III + IV

**SYSTEM:** THREE PHASE TN-S & TN-C-S  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

## Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

## Electrical specification

Order number	KM2-20-4+0 SC	
<b>System</b>	<b>Three phase TN-S &amp; TN-C-S/4 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_O$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.35kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid		1/35mm <sup>2</sup>
Cross-section of connected conductors stranded		1/25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		410g (nett), 435g (gross)

## Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:88



## Type 2 surge arrester



Combination of varistor SPD and encapsulated spark gap connected in the 3 + 1 mode. Use in TT systems on the boundary of LPZ1 and LPZ2.

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** THREE PHASE TT

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

### LPL III + IV

**SYSTEM:** THREE PHASE TT

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >50m away from MDB

## Electrical specification

Order number	KM2-20-3+1 SC	
<b>System</b>	<b>Three phase TT/4 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s) L-N/N-PE	$I_{max}$	40kA
Voltage protection level at 5kA L-N	$U_p$	0.9kV
Voltage protection level mode L-N	$U_p$	1.35kV
Voltage protection level mode N-PE/L-PE	$U_p$	1.5kV
Ability to independently switch off the following current N-PE	$I_{f1}$	0.1kA
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		405g (nett), 450g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:88

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20
Spare Module N-PE	KM2-NPE

**Type 2 surge arrester**

Varistor based three-pole Type 2 surge arrester. Use in TN-C system sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >10m away from the MDB).

Suitable for houses, commercial and industrial buildings.

**Features**

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

**Benefits**

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)



Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

**LPL I + II**

**SYSTEM:** THREE PHASE TN-C

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

**LPL III + IV**

**SYSTEM:** THREE PHASE TN-C

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

**Standards**

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

**Electrical specification**

Order number	KM2-20-3+0 SC	
System	TN-C/3 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_O$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.35kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1/35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1/25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		325g (nett), 365g (gross)

**Accessories**

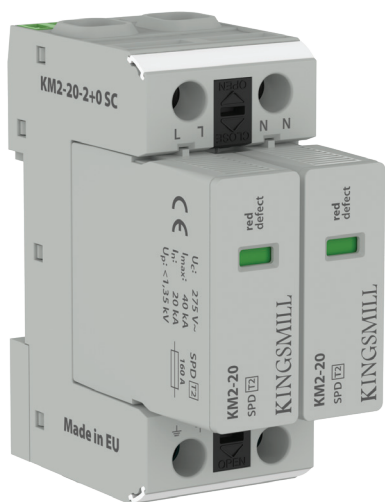
Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:88

## Type 2 surge arrester



Single pole Type 2 surge arrester. Use in TN-S and TN-C-S system sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >10m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** SINGLE PHASE TN-S & TN-C-S  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TN-S & TN-C-S  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

## Electrical specification

Order number	KM2-20-2+0 SC	
<b>System</b>	<b>TN-S &amp; TN-C-S/2 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.35kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		230g (nett), 265g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:88

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20

## Type 2 surge arrester

Combination of varistor SPD and encapsulated spark gap connected in the 1 + 1 mode. Use in TT systems on the boundary of LPZ1 and LPZ2.

Suitable for houses, commercial and industrial buildings.

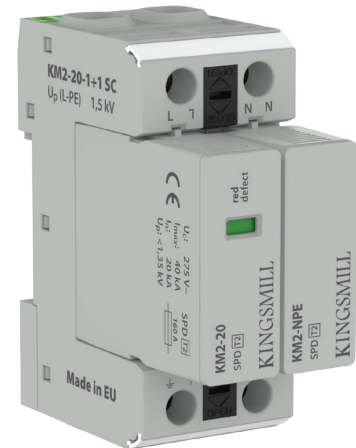
### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.



### LPL I + II

**SYSTEM:** SINGLE PHASE TT

**MDB:** BOUNDARY of LPZ0 & LPZ1

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >100m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TT

**MDB:** -

**SDB:** BOUNDARY of LPZ1 & LPZ2 if >100m away from MDB

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM2-20-1+1 SC	
System	Single phase TT/2 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s) L-N/N-PE	$I_{max}$	40kA
Voltage protection level at 5kA L-N	$U_p$	0.9kV
Voltage protection level mode L-N	$U_p$	1.35kV
Voltage protection level mode N-PE/L-PE	$U_p$	1.5kV
Ability to independently switch off the following current N-PE	$I_{fi}$	0.1kA
Short-circuit current rating	$I_{sCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		225g (nett), 255g (gross)

### Accessories

Spare modules are available.

Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20
Spare Module N-PE	KM2-NPE

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:88

## Type 2 surge arrester



Single pole Type 2 surge arrester. Use in TN-C (L-PEN), TN-S (L-PE) and TT (L-N) system sub-distribution boards on the boundary of LPZ1 and LPZ2 (if >10m away from the MDB).

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II

**SYSTEM:** SINGLE PHASE TN-C  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

### LPL III + IV

**SYSTEM:** SINGLE PHASE TN-C  
**SDB:** BOUNDARY of LPZ1 & LPZ2 if >10m away from MDB

### Electrical specification

Order number	KM2-20-1+0 SC	
<b>System</b>	<b>Single phase TN-C/1 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC/350V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	20kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA
Voltage protection level at 5kA	$U_p$	0.9kV
Voltage protection level	$U_p$	1.35kV
Short-circuit current rating	$I_{SCCR}$	50kA
Maximum overcurrent protection		160A gL/gG
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2
Weight		120g (nett), 140g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:89

### Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N (L-PE)	KM2-20



## Type 3 surge arrester

Combination of varistor SPD and encapsulated spark gap connected in the 3 + 1 mode. Use in TN-C, TN-S, TN-C-S and TT systems on the boundary of LPZ2 and LPZ3. Locate as close as possible to the equipment to be protected.

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.

### LPL I + II and LPL III + IV

**SYSTEM:** THREE PHASE TN-C, TN-S, TN-C-S and TT

**LOCATION:** BOUNDARY of LPZ2 & LPZ3 if the electronic equipment is >5m away from SDB



### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM3-10-3+1 SC	
<b>System</b>	<b>Three phase TN-C, TN-S, TN-C-S, TT/4 pole</b>	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal discharge current (8/20 $\mu$ s) L-N	$I_n$	5kA
Nominal discharge current (8/20 $\mu$ s) N-PE	$I_n$	10kA
Test voltage L-N	$U_{oc}$	10kV
Test voltage N-PE	$U_{oc}$	20kV
Voltage protection level	$U_p$	1kV
Voltage protection level mode L-N/N-PE	$U_p$	1.5kV
Maximum overcurrent protection		63A gL/gG or C 63A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1/35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1/25mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T3
Weight		395g (nett), 440g (gross)

### Accessories

Spare modules are available.

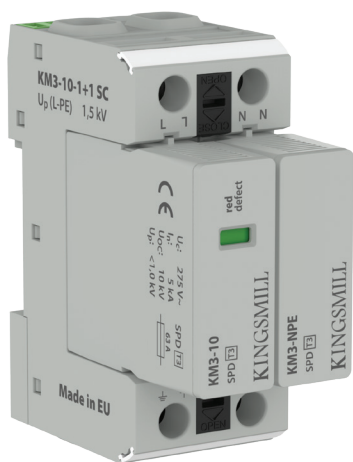
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N	KM3-10
Spare Module N-PE	KM3-NPE

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:89

## Type 3 surge arrester



Combination of varistor SPD and encapsulated spark gap connected in the 1 + 1 mode. Use in TN-C, TN-S, TN-C-S and TT systems on the boundary of LPZ2 and LPZ3. Locate as close as possible to the equipment to be protected.

Suitable for houses, commercial and industrial buildings.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

- No follow-through current
- No leakage current
- Coordinated range (install in close proximity to each other)

*Kingsmill fully coordinated mains devices provide complete protection from entry point to equipment.*

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### LPL I + II and LPL III + IV

**SYSTEM:** SINGLE PHASE TN-C, TN-S, TN-C-S and TT

**LOCATION:** BOUNDARY of LPZ2 & LPZ3 if the electronic equipment is >5m away from SDB

### Electrical specification

Order number	KM3-10-1+1 SC	
System	Single phase TN-C, TN-S, TN-C-S, TT /2 pole	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage L-N	$U_c$	275V AC
Maximum operating voltage N-PE	$U_c$	255V AC
Nominal discharge current (8/20 $\mu$ s) L-N	$I_n$	5kA
Nominal discharge current (8/20 $\mu$ s) N-PE	$I_n$	10kA
Test voltage L-N	$U_{oc}$	10kV
Test voltage N-PE	$U_{oc}$	20kV
Voltage protection level	$U_p$	1kV
Voltage protection level mode L-N/N-PE	$U_p$	1.5kV
Maximum overcurrent protection		63A gL/gG or C 63A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>
Fault indication L-N		Red indication field
Fault indication N-PE		no
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T3
Weight		215g (nett), 250g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:89

### Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module L-N	KM3-10
Spare Module N-PE	KM3-NPE

## Type 3 surge protection module

Compact type 3 surge arrester for final circuit protection.

Install close to low voltage equipment for additional protection. Use with single phase power supply systems.

Provides audible fault indication.

### Features

- Compact design
- Fits in a wall socket
- Simple installation
- Audible fault indication
- Equipment protection up to 5m of device on connected circuit
- Suitable up to 16A circuits

### Benefits

- Can be fitted in ducts, trunking or flush type wiring boxes
- Provides "fine" protection to individual sockets or circuits



### LPL I + II and LPL III + IV

**SYSTEM:** SINGLE PHASE TN-C, TN-S, TN-C-S and TT

**LOCATION:** BOUNDARY of LPZ2 & LPZ3 if the electronic equipment is >5m away from SDB

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Electrical specification

Order number	KM3-275-A	
System	TN-C / TN-S / TN-C-S / TT	
Nominal voltage	$U_n$	230V AC
Maximum operating voltage	$U_c$	275V AC
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	2kA
Test voltage L-N/N-PE/L-PE	$U_{oc}$	4kV
Voltage protection level L-N/N-PE/L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{sCCR}$	1.5kA
Maximum overcurrent protection		B 16A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Fault indication		acoustic signalling
Degree of protection		IP20
Range of operating temperatures (min - max)		-20°C - +70°C
Mounting		installation box
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T3
Weight		20g (nett), 40g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:89

# Charging Stations Protection

## Why protect?

As we learnt from the introduction (page SPD:4), electronic systems are susceptible to damage resulting from lightning activity (direct and indirect). Failure to protect can lead to costly hardware replacement as well as lost revenue.

## What to protect?

- Rectifier for the DC charging output
- Rectifier for powering the control unit
- Battery - in case of charging station with energy accumulation
- Communication between the control unit and the charging connector (eg RS485)
- Signal from the charging connector (eg temperature measurement)
- Communication between antenna and control unit (eg Ethernet) for data cable longer than 1 metre

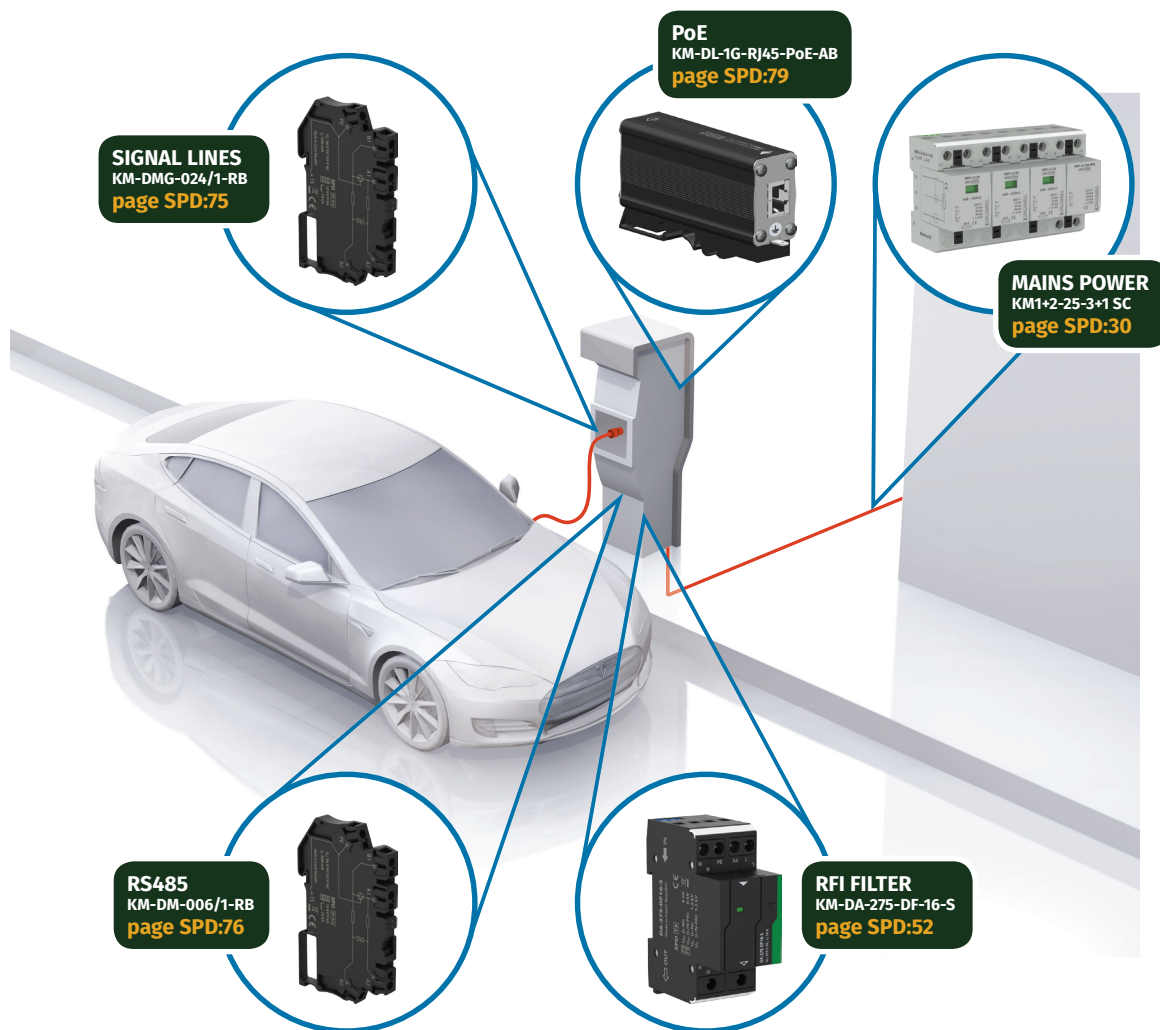
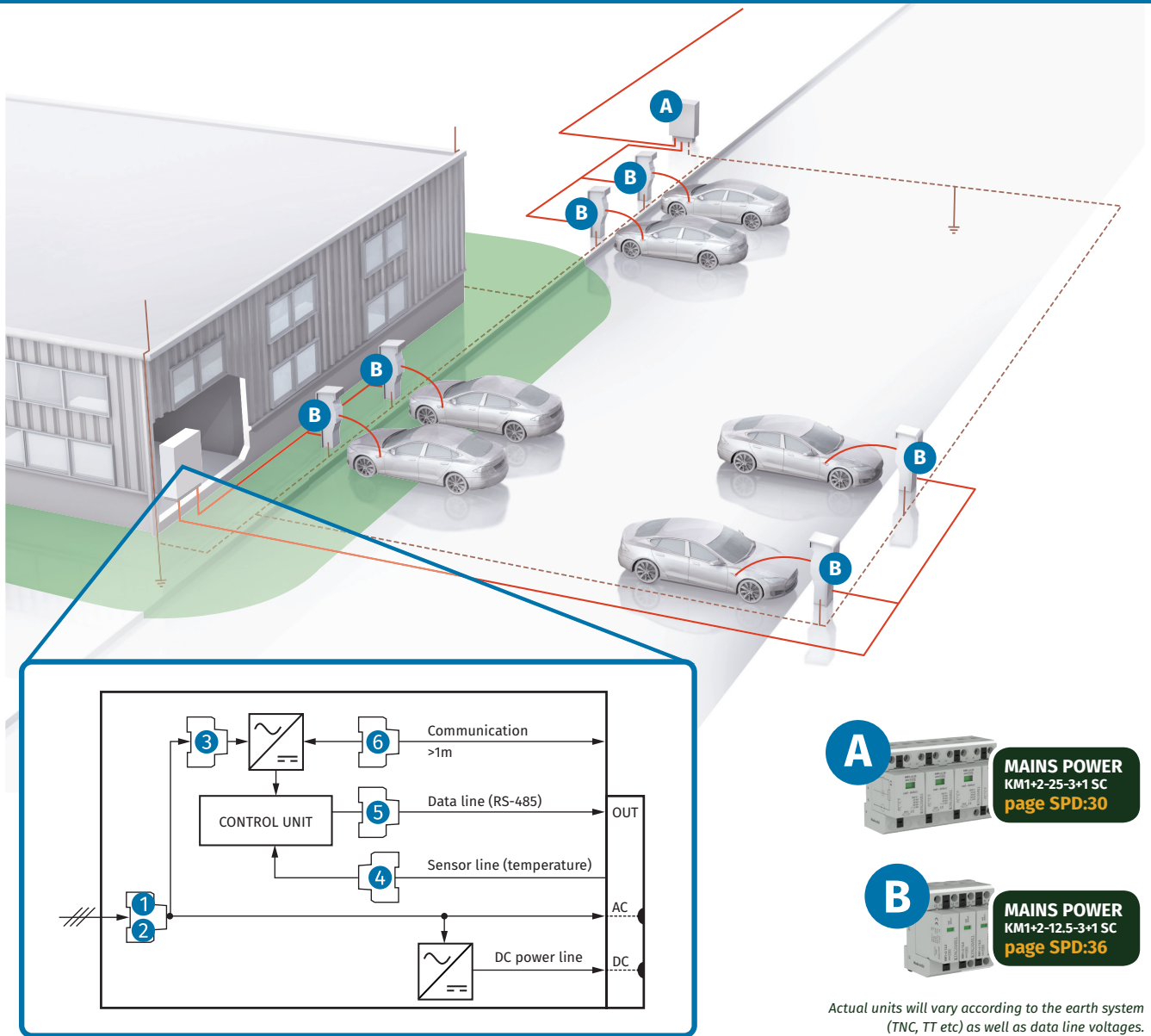


Figure SPD:15. Placement of SPDs at an electric vehicle charging station



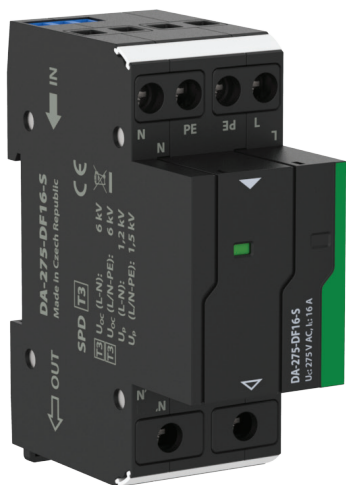
### Example of types of SPDs for the protection of charging stations

- 1 Three-pole combined high performance lightning current arrester. Actual units will vary according to the earth system (TNC, TT etc) as well as data line voltages.
- 2 Three-pole combined high performance lightning current arrester. Install on cabling in the ground.
- 3 Type 3 surge protection with integrated noise-suppressing RF filter.
- 4 Two-stage overvoltage protection of signal lines.
- 5 Two-stage overvoltage protection of RS-485 signal lines.
- 6 Two-stage overvoltage protection of Power over Ethernet lines. For cable longer than 1 metre.

Figure SPD:16. Placement of SPDs in a car park situation



## Type 3 surge arrester with RFI filter



Protect low voltage power lines against the impact of surge voltage and RF disturbance. Locate as close as possible to the equipment to be protected.

Suitable for charging stations.

### Features

- Remote signalling
- Reversible installation
- Biconnect terminals
- Locking pluggable modules
- Optical lifetime status indication

### Benefits

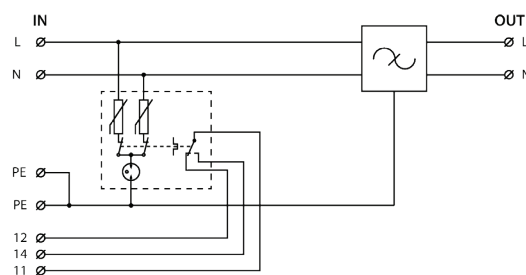
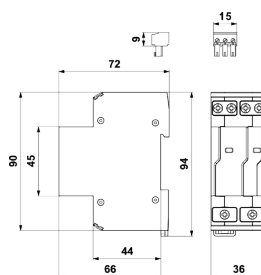
- No follow-through current
- No leakage current

## Electrical specification

Order number	KM-DA-275-DF-16-S	
System	TN-C / TN-C-S / TN-S / TT	
Nominal voltage	$U_n$	230V AC
Nominal voltage	$U_o$	230V/400V AC $\pm$ 10%
Maximum operating voltage	$U_c$	275V AC
Nominal load current	$I_L$	16A
Nominal discharge current (8/20 $\mu$ s) L-N / N-PE	$I_n$	3kA
Nominal discharge current (8/20 $\mu$ s) L+N-PE	$I_n$	5kA
Test voltage L-N / N-PE	$U_{oc}$	6kV
Test voltage L+N-PE	$U_{oc}$	10kV
Voltage protection level mode L-N	$U_p$	1.2kV
Voltage protection level mode N-PE/L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	6kA
Maximum overcurrent protection		16A gL/gG or C 16A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Filter attenuation at 1MHz (50 $\Omega$ /50 $\Omega$ ) unsymmetrical		30dB
Cross-section of connected conductors solid/stranded (max)		6mm <sup>2</sup>
Fault indication		Red indication field
Remote indication		Potential-free change-over contact
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC
Cross-section of remote indication conductors solid/stranded (max)		1.5mm <sup>2</sup>
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T3
Weight		175g (nett), 205g (gross)

## Dimensions and wiring diagram

### KM-DA-275-DF-16-S



# Photovoltaic Protection



## The need to protect

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Photovoltaic (PV) arrays and their associated equipment are expensive assets to purchase and so the need to protect them from the effects of lightning is of paramount importance.

Kingsmill have a range of Earthing, Structural Lightning Protection and Surge Protection products that can be used to provide protection against both the direct and indirect effects of lightning. Products relating to Earthing and Structural Lightning Protection are dealt with in their respective sections.

## Application of Surge Protection Devices

---

A solar photovoltaic system (solar power) is made up of a number of key elements:

- photovoltaic array (solar panel)
- battery charger
- bank of batteries
- inverter to convert DC voltage to AC voltage.

Panels may be protected by a structural lightning protection system, the metallic supports of the arrays should be connected to earth and the heart of the system, the inverter, requires to be protected by Surge Protection Devices.

The inverter should be protected on both the DC side and the AC side, additionally, if the PV arrays are over 10m away from the inverter, an SPD must be installed at the junction box that is local to that PV array.

The system should comply with HD 60364 covering the installation of solar photovoltaic systems, CLC/TS 50539-12 SPD's for PV application, as well as the BS:EN 62305 series for Lightning Protection.

## Basic Principle

The core (key device) of the whole photovoltaic system is the inverter, therefore lightning and transient overvoltage protection should be focused here and it should be incorporated into the whole Lightning Protection System. Additionally, photovoltaic units and their support structures should be integrated into the earthing design.

### SPD selection for DC side:

- $U_{CPV}$  maximum continuous operating voltage
- $U_{OCSTC}$  standardised test circuit voltage of the string of PV arrays

$$U_{CPV} \geq 1.2 \times U_{OCSTC}$$

Where the PV arrays are separated from the lightning protection system, by the “separation distance” calculated in BS:EN 62305-3 and this distance is maintained, OR in the case of no external structural protection, then **fit a Type 2 PV surge arrester**.

- If the distance between the PV arrays and the inverter is over 10m, a PV SPD has to be fitted to both ends of the DC cable (PV array junction box and DC inverter side).

Where the distance between the PV arrays and the external lightning protection system is not maintained, then **fit a combined Type 1 and 2 PV lightning current and surge arrester**.

- Always install a PV SPD at both ends of the DC cable (PV array junction box and DC inverter side).

The DC side of the PV system can be either unearthed (insulated) in which case **A** (*below*) shows how SPD's should be connected OR with one pole earthed, **B** (*below*) shows how SPD's should be connected.

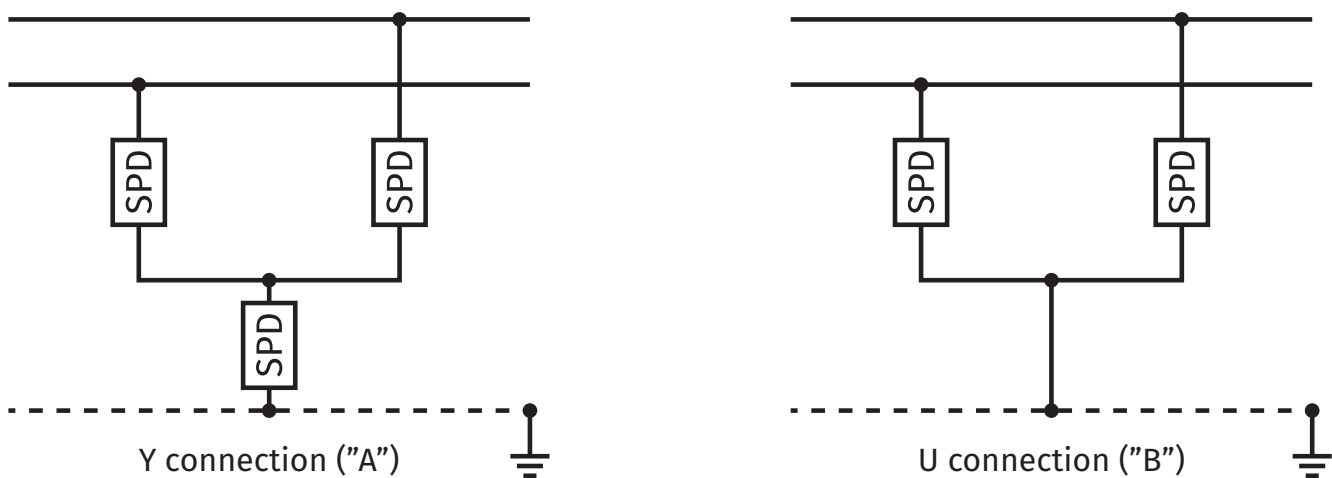


Figure SPD:17. Difference between Y and U connections

**All Kingsmill surge protection products for photovoltaic systems are tested in accordance with EN 50539-11.**

The main distribution board (AC mains) would have a combined Type 1 & 2 protector fitted. In addition, any communication lines also require protection.

Examples of SPD locations are provided in the following diagrams (units will vary according to site conditions).



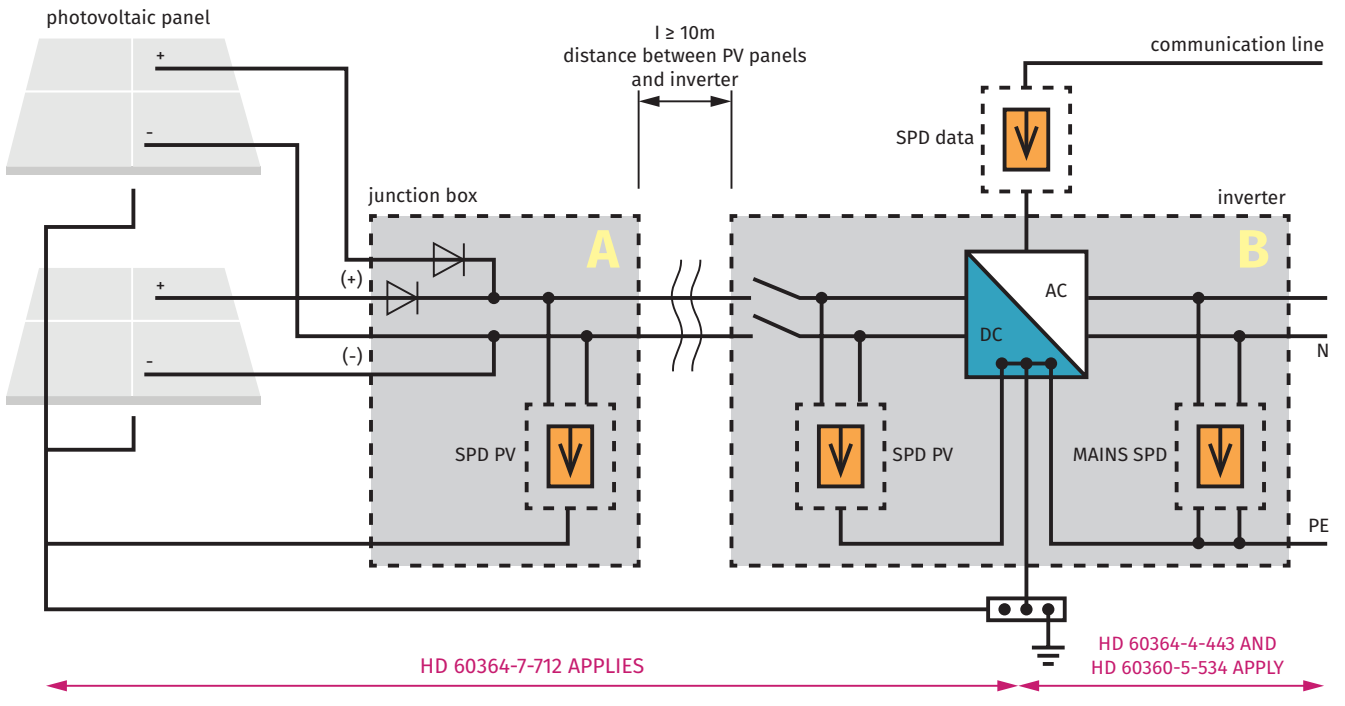


Figure SPD:18. General circuit diagram for SPD protection of solar photovoltaic systems

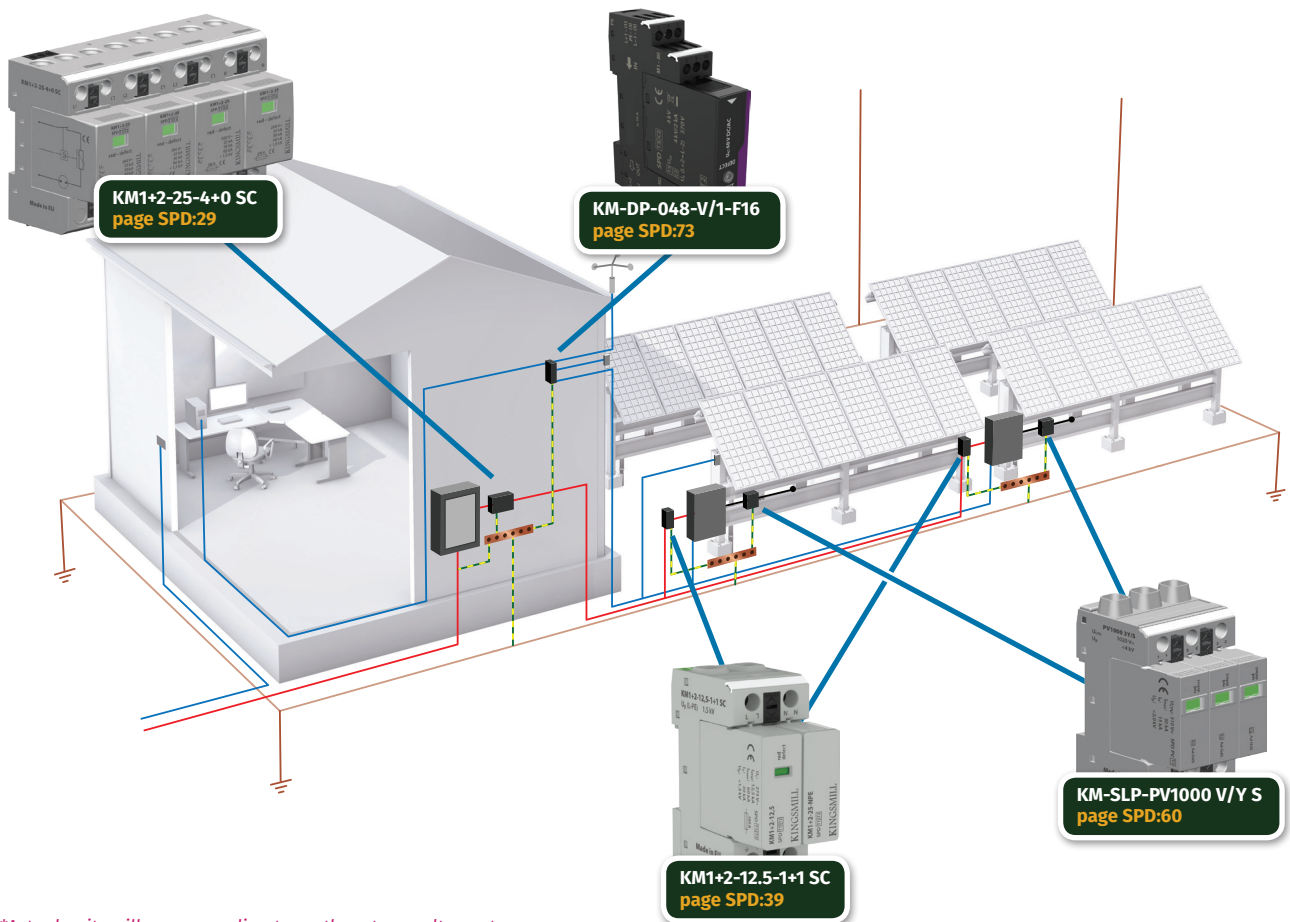
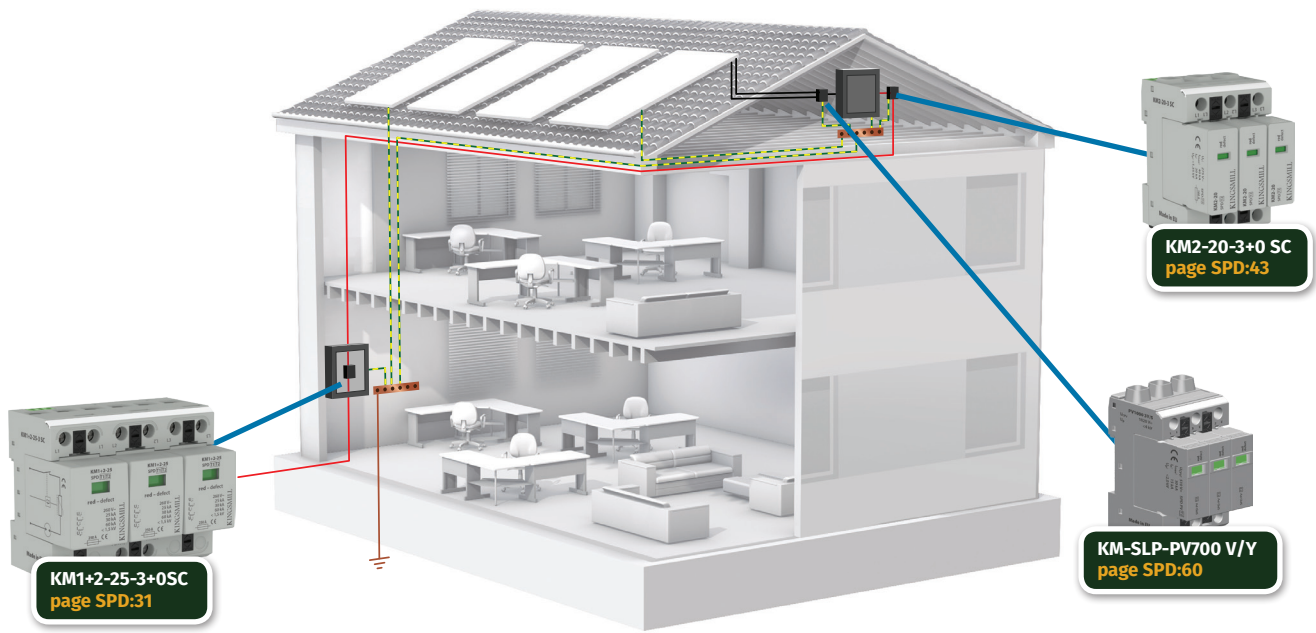


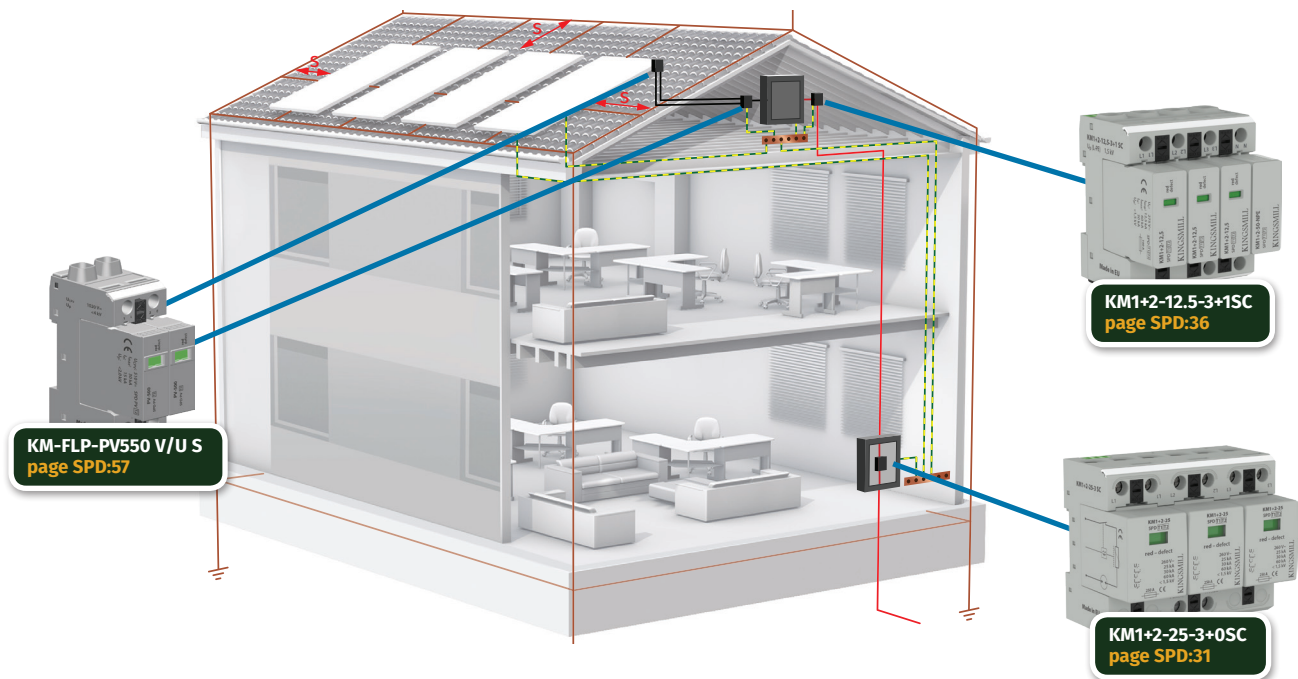
Figure SPD:19. Example - photovoltaic array with a decentralised inverter



*\*Actual units will vary according to earth system, voltage etc*

Figure SPD:20. Example - roof mounted solar panels  
(without external LPS or where the separation distance "s" between PV panels and external LPS is maintained)

If no external Lightning Protection System is installed then a Type 2 PV SPD is sufficient. If the separation distance between the PV panel and the LPS is  $\geq s$  then a Type 2 PV SPD is sufficient. If the separation distance between the PV panel and the external Lightning Protection System is  $< s$  then the PV panel should be connected to the LPS and a Type 1 PV SPD is recommended.



Separation distance "s" = distance between two conductive parts at which no dangerous sparking can occur

*\*Actual units will vary according to earth system, voltage etc*

Figure SPD:21. Example - roof mounted solar panels  
(where the separation distance "s" between PV panels and external LPS is not maintained)



## Type 1+2 surge arrester - 'U' connection

Surge arresters for use in photovoltaic systems with 'U' connection.  
Protects both poles.

### Features

- Pluggable module
- Visual fault signalling
- Module locking
- Remote fault signalling

### Application

Use on photovoltaic systems up to 560 volts.

### Benefits

Ideal for use with photovoltaic systems where the separating spark-over distance is without a Lightning Protection system.

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).



### Electrical specification

Order number	KM-FLP-PV550 V/U S	
Type of SPD	PVT1, PVT2	
Maximum operating voltage mode 1/2 l-connection	$U_{CPV}$	1120V DC
Maximum operating voltage mode 1/3, 2/3	$U_{CPV}$	560V DC
Lightning impulse current (10/350µs)	$I_{imp}$	12.5kA
Total discharge current (10/350µs)	$I_{Total(10/350)\mu s}$	25kA
Nominal discharge current (8/20µs)	$I_n$	30kA
Maximum discharge current (8/20µs)	$I_{max}$	60kA
Voltage protection level mode 1/2	$U_p$	4.8kV
Voltage protection level mode 1/3, 2/3	$U_p$	2.4kV
Short-circuit current rating	$I_{SCPV}$	1000A DC
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)	1mm <sup>2</sup> - 35mm <sup>2</sup>	
Cross-section of connected conductors stranded (min - max)	1mm <sup>2</sup> - 25mm <sup>2</sup>	
Fault indication	Red indication field	
Remote indication	Potential-free changeover contact	
Remote indication contacts	250V/0.5A AC, 250V/0.1A DC	
Cross-section of remote indication conductors	1.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +80°C	
Mounting	DIN rail 35mm	
According to standard	EN 50539-11:2013	
ETIM Class	EC001457	
Weight	250g (nett), 280g (gross)	

### Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module	KM-FLP-PV275U V/0

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:90

## Type 1+2 surge arrester - 'Y' connection



Lightning current and surge arrester for use in photovoltaic systems with 'Y' connection. Protects both poles.

### Benefits

Ideal for use with photovoltaic systems where the separating spark-over distance is without a Lightning Protection system.

### Features

- Pluggable module
- Visual fault signalling
- Module locking
- Remote fault signalling

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Application

Use on systems up to 1000 volts.

## Electrical specification

Order number	KM-FLP-PV1000 VS/Y	
Type of SPD	PVT1, PV T2	
Maximum operating voltage mode 1/3, 2/3	$U_{CPV}$	1000V DC
Total discharge current (10/350 $\mu$ s)	$I_{Total(10/350)\mu}$	12.5kA
Nominal discharge current (8/20 $\mu$ s)	$I_n$	30kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	60kA
Voltage protection level mode 1/2	$U_p$	3.6kV
Voltage protection level mode 1/3, 2/3	$U_p$	3.6kV
Short-circuit current rating	$I_{SCPV}$	1000A DC
Response time	$t_a$	25ns
Cross-section of connected conductors solid (min - max)	2.5mm <sup>2</sup> - 50mm <sup>2</sup>	
Cross-section of connected conductors stranded (min - max)	2.5mm <sup>2</sup> - 35mm <sup>2</sup>	
Fault indication	Red indication field	
Remote indication	Potential-free changeover contact	
Remote indication contacts	250V/0.5A AC, 250V/0.1A DC	
Cross-section of remote indication conductors	1.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +80°C	
Mounting	DIN rail 35mm	
According to standard	EN 50539-11:2013 / PV T2	
ETIM Class	EC001457	
Weight	325g (nett), 365g (gross)	

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:90

### Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module	KM-FLP-PV500Y V/0

## Type 2 surge arrester - 'U' connection

Surge arresters for use in photovoltaic systems with 'U' connection.

Protects both poles.

### Features

- Pluggable module
- Visual fault signalling
- Module locking
- Remote fault signalling

### Application

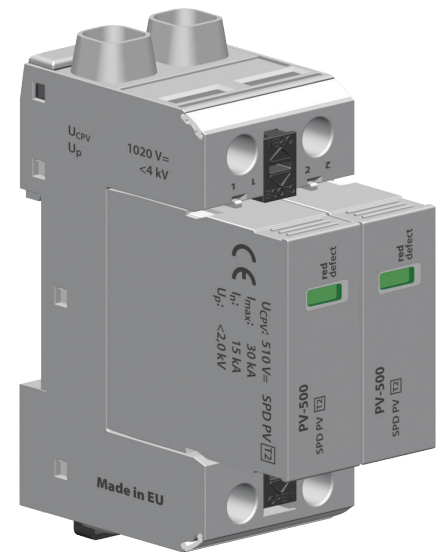
Use on photovoltaic systems up to 170 volts and 510 volts.

### Benefits

Ideal for use with photovoltaic systems where the separating spark-over distance is without a Lightning Protection system.

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).



### Electrical specification

Order number		KM-SLP-PV170 V/U S	KM-SLP-PV500 V/U S
Type of SPD		PVT2	
Maximum operating voltage mode 1/2 l-connection	$U_{CPV}$	340V DC	1020V DC
Maximum operating voltage mode 1/3, 2/3	$U_{CPV}$	170V DC	510V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	15kA	15kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA	40kA
Voltage protection level mode 1/2	$U_p$	1.2kV	4kV
Voltage protection level mode 1/3, 2/3	$U_p$	0.6kV	2kV
Short-circuit current rating	$I_{SCPV}$	1000A DC	1000A DC
Response time	$t_a$	25ns	25ns
Cross-section of connected conductors solid (min - max)		1mm <sup>2</sup> - 35mm <sup>2</sup>	
Cross-section of connected conductors stranded (min - max)		1mm <sup>2</sup> - 25mm <sup>2</sup>	
Fault indication		Red indication field	
Remote indication		Potential-free changeover contact	
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC	
Cross-section of remote indication conductors		1.5mm <sup>2</sup>	
Degree of protection		IP20	
Range of operating temperatures (min - max)		-40°C - +80°C	
Mounting		DIN rail 35mm	
According to standard		EN 50539-11:2013	
ETIM Class		EC000941	
Weight		230g (nett), 260g (gross)	250g (nett), 280g (gross)

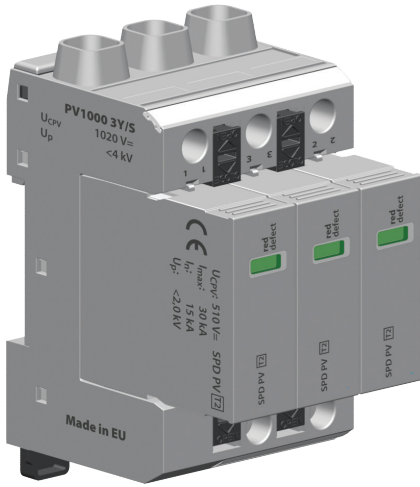
### Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module (170V DC)	KM-SLP-PV170U V/O
Spare Module (510V DC)	KM-SLP-PV500U V/O

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:90

## Type 2 surge arrester - 'Y' connection



Surge arresters for use in photovoltaic systems with 'Y' connection. Protects both poles.

### Benefits

Ideal for use with photovoltaic systems where the separating spark-over distance is without a Lightning Protection system

### Features

- Pluggable module
- Visual fault signalling
- Module locking
- Remote fault signalling

### Standards

BS:EN 62305 (lightning protection) and EN 61643-11 (surge protection devices).

### Application

Use on systems up to 750 volts, 1020 volts and 1500 volts.

## Electrical specification

Order number		KM-SLP-PV700 V/Y S	KM-SLP-PV1000 V/Y S	KM-SLP-PV1500 V/Y S
Type of SPD		PV T2	PV T2	PV T2
Maximum operating voltage mode 1/3, 2/3	$U_{CPV}$	750V DC	1020V DC	1500V DC
Nominal discharge current (8/20 $\mu$ s)	$I_n$	20kA	15kA	15kA
Maximum discharge current (8/20 $\mu$ s)	$I_{max}$	40kA	40kA	40kA
Voltage protection level mode 1/2	$U_p$	3.6kV	4kV	6.4kV
Voltage protection level mode 1/3, 2/3	$U_p$	3.6kV	4kV	6.4kV
Short-circuit current rating	$I_{SCPV}$	1000A DC	1000A DC	1000A DC
Response time	$t_a$	25ns	25ns	25ns
Residual current mode 1/3, 2/3 (AC)	$I_{PE}$	n/a	n/a	0.2000mA AC
Residual current mode 1/3, 2/3 (DC)	$I_{PE}$	n/a	n/a	0.0005mA DC
Cross-section of connected conductors solid (min - max)			1mm <sup>2</sup> - 35mm <sup>2</sup>	
Cross-section of connected conductors stranded (min - max)			1mm <sup>2</sup> - 25mm <sup>2</sup>	
Fault indication		Red indication field		
Remote indication		Potential-free changeover contact		
Remote indication contacts		250V/0.5A AC, 250V/0.1A DC		
Cross-section of remote indication conductors		1.5mm <sup>2</sup>		
Degree of protection		IP20		
Range of operating temperatures (min - max)		-40°C - +80°C		
Mounting		DIN rail 35mm		
According to standard		EN 50539-11:2013		
ETIM Class		EC000941		
Weight		315g (nett), 360g (gross)	325g (nett), 365g (gross)	420g (nett), 450g (gross)

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:90

## Accessories

Spare modules are available. Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module (750V DC)	KM-SLP-PV350Y V/0
Spare Module (1020V DC)	KM-SLP-PV500Y V/0
Spare Module (1500V DC)	KM-SLP-PV750Y V/0

# LED Street, Industrial and Security Lighting Protection

Public lighting systems, street lighting for example, as well as lighting for large industrial premises, can be extensive, with cable lengths running into hundreds of metres.

Such systems are exposed to risks of overvoltages induced by lightning strikes, as well as switching events. Transient overvoltages in extensive installations may reach values that are higher than the specified withstand voltage of the light source (luminaire), thus leading to damage.

As we saw from the introduction section, page INT:9, BS:EN 62305-2 sets out the sources of damage to installations:

S1 Direct lightning strike to the installation.

S2 Lightning strike within the proximity of the installed equipment, switching phenomena in MV and HV grids near to the installation.

S3 Direct lightning strike to the connected mains supply.

S4 Lightning strike near to the connected mains supply.

The standards IEC 60364-5-53 Chapter S34 and IEEE C62.41.2 also recommend the fitting of SPDs at the power input of an electrical installation.

## Application of Surge Protection Devices in lighting installations

### LOCATION: connection of street lighting cables to the mains supply distribution board

A Combined Type 1 & 2 lightning current and surge arrester is connected to the main distribution board (MDB). Where the supply to the MDB is via an overhead line, it is advisable to use the KM1+2-25- series (for the maximum expected kA per mode of 25kA). Where the MDB is supplied by underground cables it is possible to use the KM1+2-12.5- series. The table on page SPD:15 defines the maximum kA that would be expected to appear per mode on a 3 phase system, resulting from lightning activity.

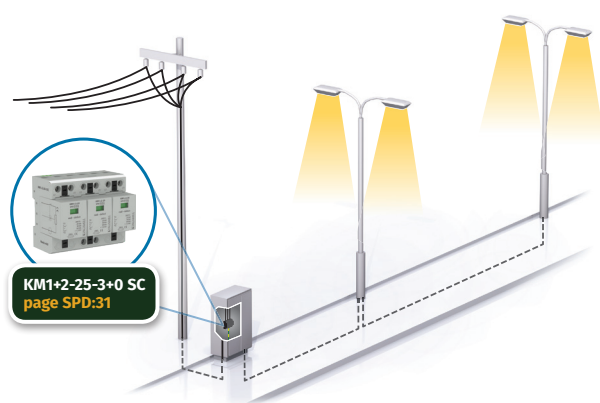


Figure SPD:22. SPD at the connection point of street lighting system to the distribution mains - overhead power line

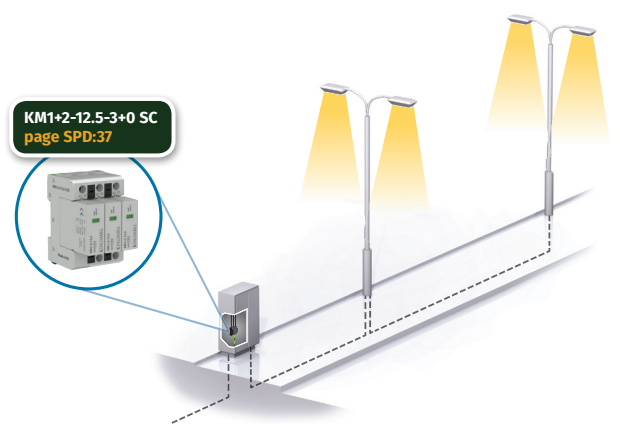


Figure SPD:23. SPD at the connection point of street lighting system to the distribution mains - cable connection



Where fluctuating voltages exist, or where the voltage might exceed the normally specified tolerance, and in places where the disconnection of load causes a voltage increase (ie during the night), it is advisable to use an SPD with a higher  $U_c$  (maximum operating voltage) or SPD's where the switching and limiting elements are connected in series – MOV & GDT technology. In this latter case the Kingsmill products are the KM1+2-25-series and the KM1+2-20... VB series.

### LOCATION: where the lighting system is prone to the effects of direct lightning strikes

Where the height of the lighting column exceeds that of the surrounding buildings the luminaire is, in effect, situated in lightning protection zone LPZ0<sub>A</sub>, where the risk of direct lightning strike (S1) is present. Similarly, if the Lighting Column is outside the protective area afforded by a building's Lightning Protection System, the luminaire is effectively in zone LPZ0<sub>A</sub>. In both cases the application of Surge Protection Devices are recommended.

Lighting at sports stadiums requires a higher Lightning Protection Level (LPL) to be considered, in addition to the installation of lightning conductors.

Street lighting in urban locations may be considered to be of Lightning Protection Levels III or IV, where the maximum current per mode on a three-phase system would be 12.5kA.

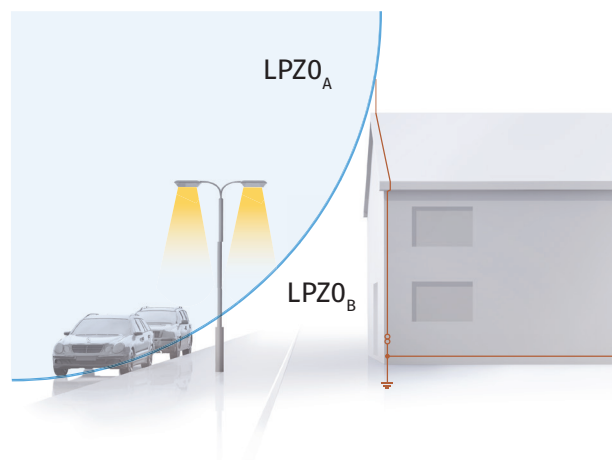


Figure SPD:24. Street lighting in the LPZ0A zone

**From BS:EN 62305 . . .**

Lightning Protection Level (LPL)	Maximum current kA (10/350 waveform)	Class of Lightning Protection System (LPS)	Maximum current one metallic service (50% of current)	Maximum current per mode – 3 phase (L1, L2, L3, N, E) 4 wires + earth	3 phase
I	200	I	100	25	KM1+2-25- series
II	150	II	75	18.75	-
III & IV	100	III & IV	50	12.5	KM1+2-12.5- series

BS:EN 62305 assumes that 50% of the current in a direct lightning strike will be diverted to earth.

The remaining 50% will be split equally across connected conductive metallic pathways - in this case, the cables supplying the street lighting. Lightning seeks a path to earth (common mode) and the current, is further sub-divided by the number of modes (in a three phase supply, these are L1 to E; L2 to E; L3 to E and N to E).

KM1+2-12.5- protectors can be found on pages SPD:35 - 40.

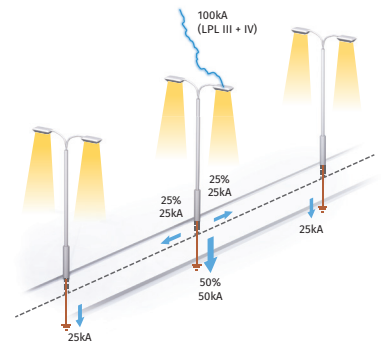


Figure SPD:25. Distribution of a lightning current which has struck a street lighting lamppost

In many cases, street lighting is supplied from a three-phase cable. However, at the individual lighting column only one phase is connected to the luminaire and its control gear.

The street lighting distribution board would be fitted with a three-phase SPD and the individual lighting column with a single phase, 12.5kA per mode (25kA total discharge) SPD - our KM1+2-12.5-1+1 SC. (The diameter of most lighting column bases is usually large enough to accommodate the size of the SPD.)

Where the cable length from the SPD mounted in the lighting column base, to the luminaire, exceeds 10m in height, then IEC 61643-12 dictates that an additional SPD is installed at the luminaire.

Our KM-SP-T2+T3-320/Y-CLT-LED (where the distance is less than 10m use the KM-DA-320-LED) is suitable.

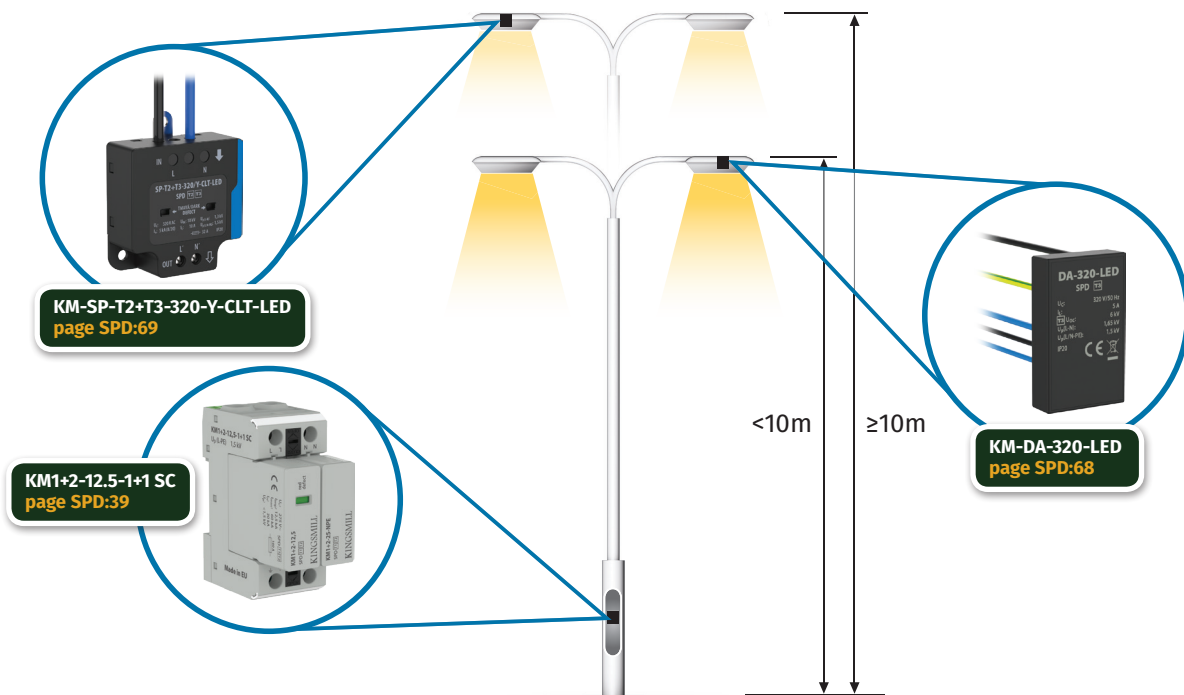


Figure SPD:26. Using the SPD on street lighting posts of up to and above 10m height

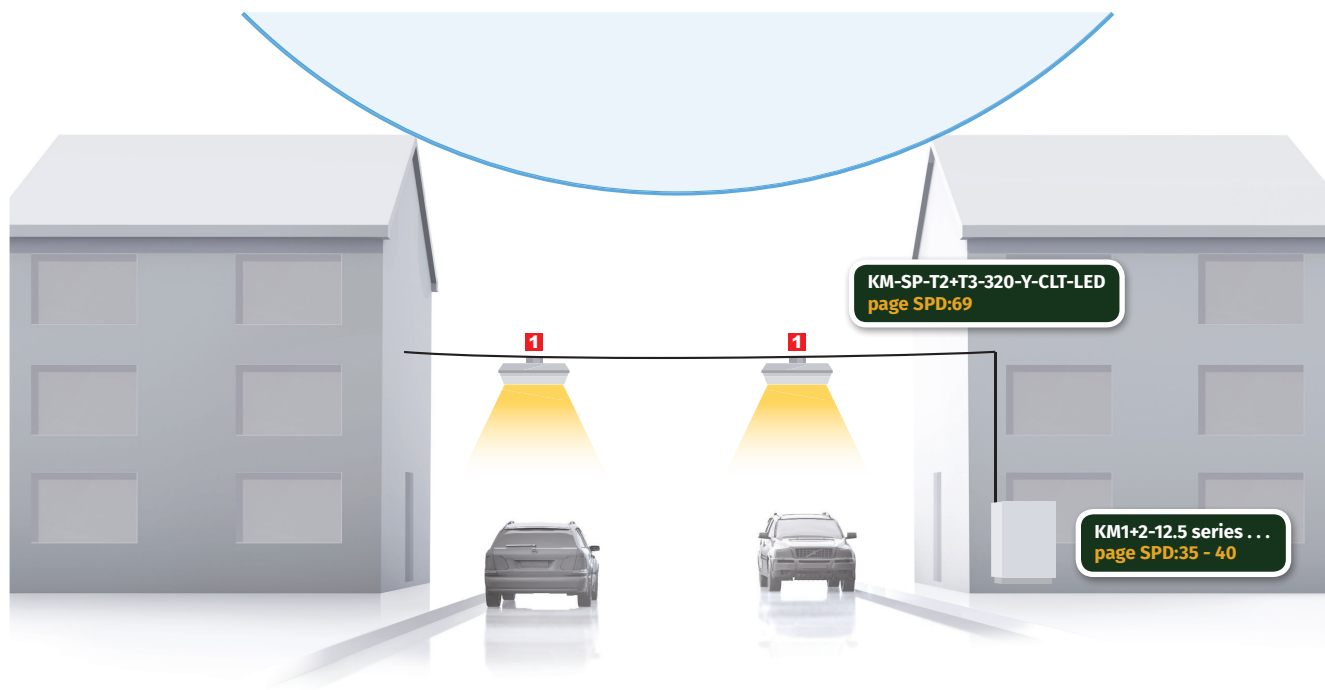


Figure SPD:27. KM-SP-T2+T3-320/Y-CLT-LED [1] with light fittings in the LPZ0<sub>B</sub> zone, fixed onto a cross-wire suspension line (suspension cable) between two buildings.

LED systems can also be affected by induced voltages if the street lighting circuit is in close proximity to MV and HV cables. SPDs are also required in such applications. In addition, the installation of a buried earth conductor, earthed at both ends, can also help reduce the effect of voltages induced in this way.

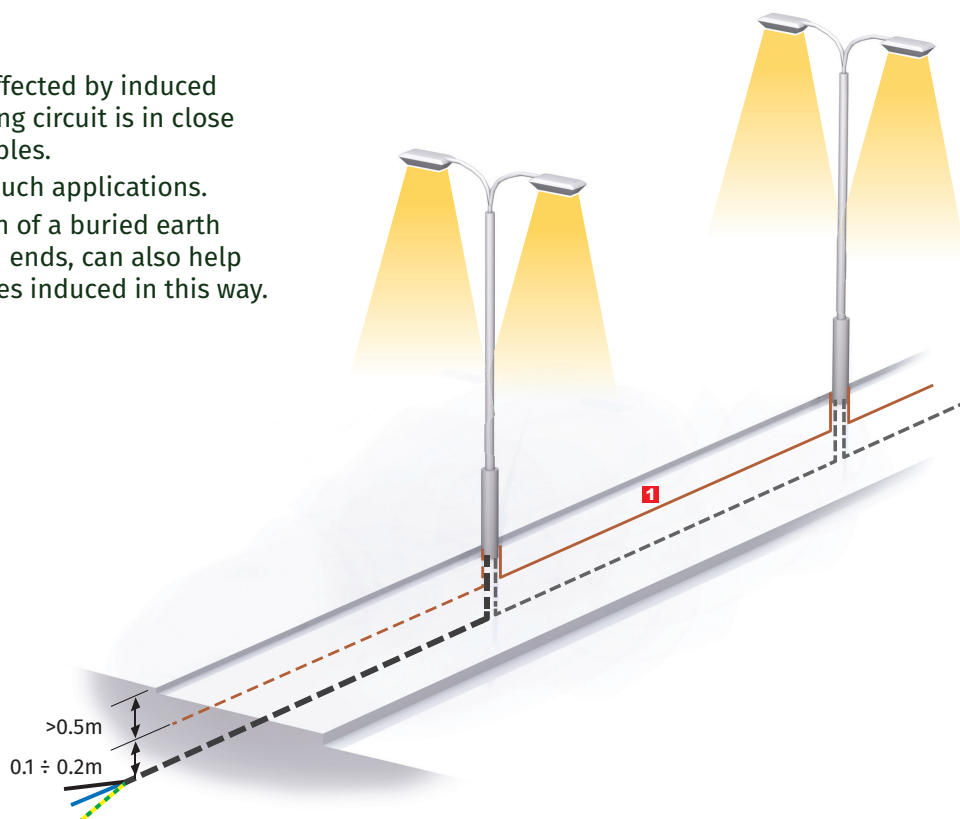


Figure SPD:28. Compensation conductor [1] for the limitation of induction effects

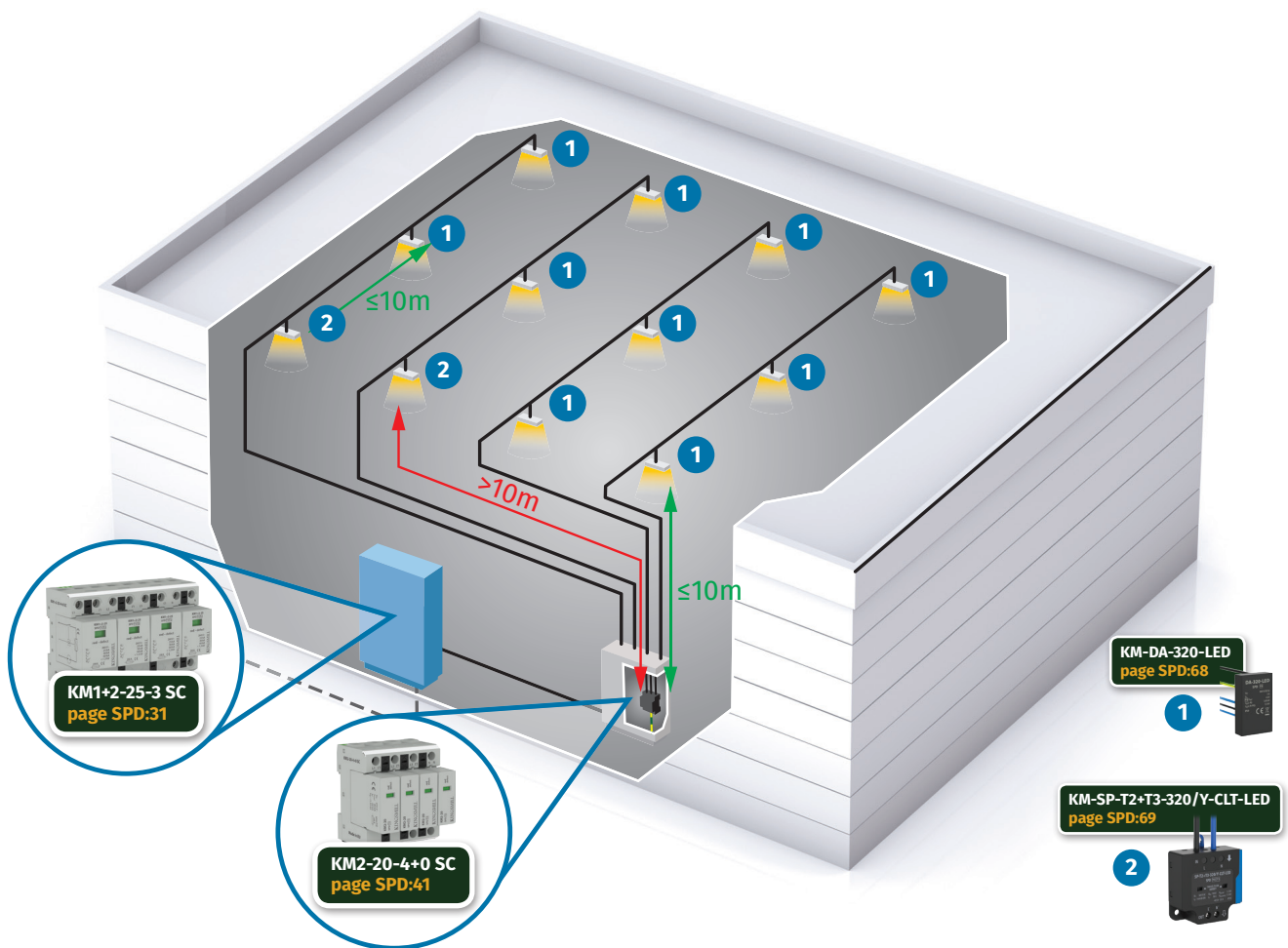
**LOCATION: protecting an industrial lighting system from induced voltages, resulting from lightning**

Transient overvoltages can be induced on the cables supplying lighting through resistive coupling, inductive coupling and electrical switching (see pages SPD:6 - 8).

Such overvoltages might harm the sensitive electronics used in controlling modern day LED luminaires.

SPDs are installed at the MDB and SDB locations as previously described in addition to the individual lighting circuits.

In the case of lighting installed under the roof of an industrial complex, eg high bay lighting, it is advisable to avoid parallel routing of cables with lightning conductors. If such routing is not possible, then it is recommended to fit an SPD at each luminaire (our KM-SP-T2+T3-320/Y-CLT-LED).



In the case of large industrial buildings, the sub-distribution board (SDB) supplying the lighting circuits should be fitted with a Type 2 SPD (our KM2-20- series). The MDB should be fitted with a combined Type 1 & 2 SPD (our KM1+2-25- series).

Figure SPD:29. Protection of luminaires installed in an extensive building object: KM-DA-320-LED [1] for  $\leq 10\text{m}$  distance from the upstream SPD connected to the same phase conductor; KM-SP-T2+T3-320/Y-CLT-LED [2] for distances  $>10\text{m}$ .

- The KM-DA320-LED is used where the first LED luminaire is  $\leq 10\text{m}$  from the SPD in the distribution board supplying that circuit. Additionally, a KM-DA-320-LED is fitted for every 10m of lighting circuit thereafter.
- In the case that the first LED luminaire is located  $\geq 10\text{m}$  away from the SPD protecting the distribution board supplying that circuit, a KM-SP-T2+T3/320/Y-CLT-LED is installed. Thereafter, for every 10m of lighting circuit a KM-DA-320-LED would be fitted.

KM-SP-T1+T2-320/Y-CLT-LED SPDs are primarily intended for use in locations with a high degree of risk. For example, luminaires in the LPZ0A zone (*figure SPD:24*). They are also used where the lighting column height exceeds 10m, or where the first luminaire on a lighting circuit is more than 10m away from an MDB/SDB fitted with surge protection.

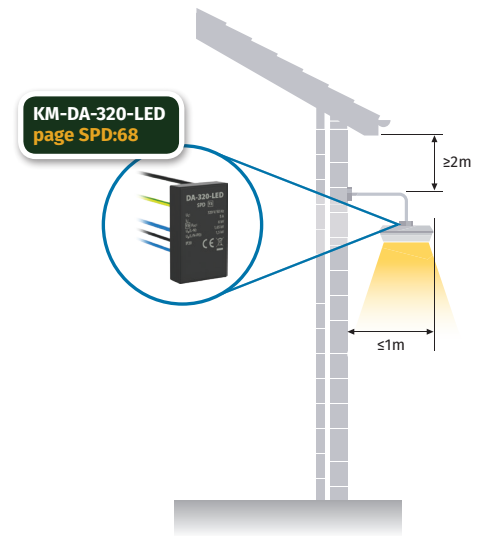


Figure SPD:30. Light fitting mounted on the external wall of a building (of up to maximum 45m), conforming to EN 60728-11 ed.2.

## Features and Benefits

The KM-DA-320-LED and KM-SP-T2+T3-320/Y-CLT-LED are designed as in-line products, suitable for mounting inside light fittings.

The SPDs can also be fitted in parallel and the SPD output is used for the indication of the status of the SPD.

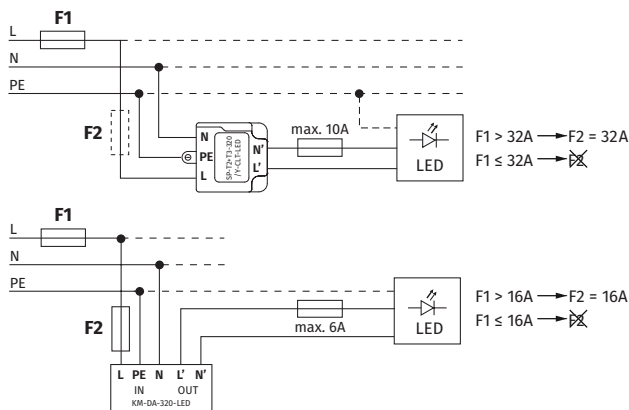


Figure SPD:31. Series (in-line) SPD connection to protected equipment

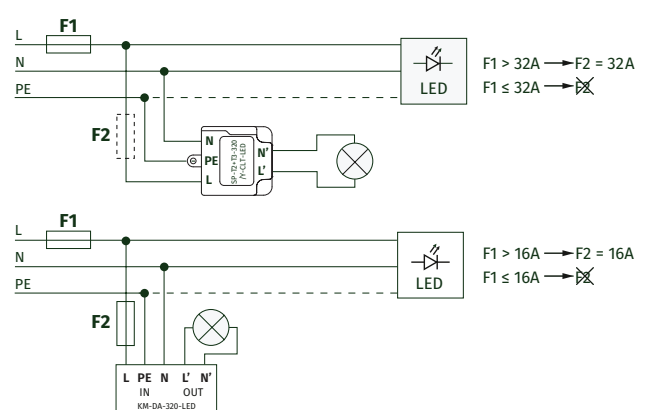


Figure SPD:32. SPD wired in parallel to protected equipment

If an SPD fails, it fails safe, disconnecting the luminaire.

Failure of the KM-SP-T2+T3-320/Y-CLT-LED is also indicated by darkened display openings, to identify the failure in the case of disconnected power supply.

The SPD should be fitted as close as possible to the luminaire.

Comply with the requirements of IEEE (ANSI) C62.41.2 - C location - located externally.

The internal connections of the KM-DA-320-LED and KM-SP-T2+T3-320/Y-CLT-LED are symmetrical, meaning that if phase and neutral is crossed, this does not affect the SPD.

The SPD's can also be used where luminaires are connected between phases, provided that the  $U_c$  maximum operating voltage is not exceeded.

The KM-SP-T2+T3-320/Y-CLT-LED earth terminal is a lug. The screw connecting the lug to the PE conductor, could also be used to secure the SPD to the luminaire.

An auxiliary plastic adapter makes it possible to the SPD to a 35mm DIN rail (TH 35), provided that the latter is not equipped with a lug to connect to the PE conductor.



## Using SPDs for light fittings designed in accordance with class I and II equipment

**Class I** luminaires have the SPD connected as shown below. If the light fitting is part of the TN-C earthing system, the SPD may be inserted into the point where the PEN conductor is dis severed (the PEN conductor at the input is connected both to the N and PE terminals. Illustrated in figure SPD:33.

**Class II** luminaires have the SPD installed at the interface between the installation and the protected electrical equipment, while connecting the SPD to the protective earth conductor (PE). Illustrated in figure SPD:34.

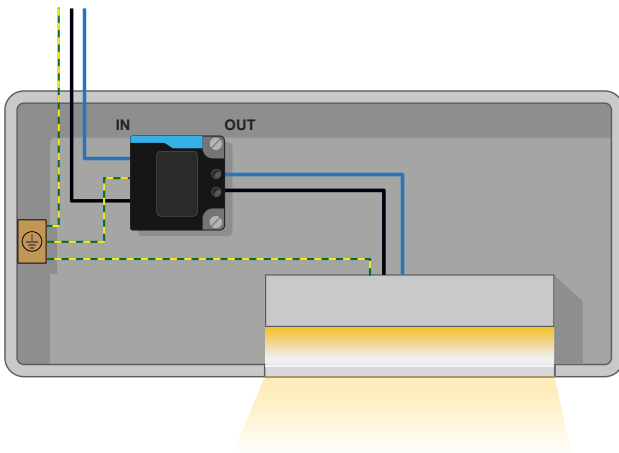


Figure SPD:33. SPD connected to equipment in protection class I

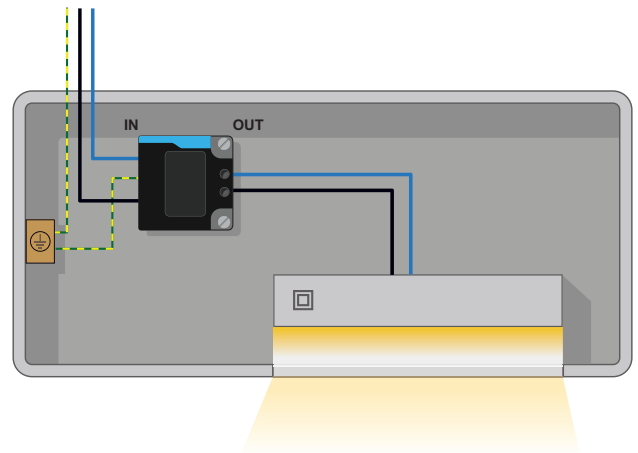


Figure SPD:34. SPD connected to equipment in protection class II

## Type 3 surge arrester - LED lighting



Surge arrester for protection of LED lights.

Install close to protected equipment in low voltage power circuits.

### Features

- Compact size
- Fault signalling by supply interruption

### Benefits

Simple installation in applications with limited space.

### Application

Install close to protected LED lighting equipment in low voltage power circuits.

### Standards

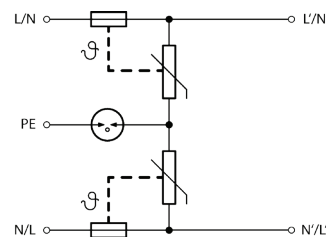
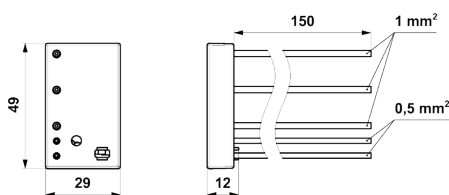
EN 61643-11 (for surge protection devices).

## Electrical specification

Order number	KM-DA-320-LED	
Nominal voltage	$U_n$	230V AC
Maximum operating voltage	$U_c$	320V AC
Nominal load current	$I_L$	5A
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	3kA
Nominal discharge current (8/20 $\mu$ s) L+N-PE	$I_n$	5kA
Test voltage L-N/N-PE	$U_{oc}$	6kV
Test voltage L+N-PE	$U_{oc}$	10kV
Test voltage L-PE	$U_{oc}$	6kV
Voltage protection level L-N	$U_p$	1.65kV
Voltage protection level mode N-PE/L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{SCCR}$	1.5kA
Maximum overcurrent protection		16A gL/gG or B 16A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Fault indication		loss of voltage
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		installation box
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T3
Weight		30g (nett), 45g (gross)

## Dimensions and wiring diagram

### KM-DA-320-LED



## Type 2 + 3 surge arrester - LED lighting

Type 2 + 3 surge arrester for protection of LED lights.

Install close to protected equipment in low voltage power circuits.

### Benefits

Simple installation in applications with limited space.

### Standards

EN 61643-11 (for surge protection devices).

### Features

- Compact size
- Fault signalling by supply interruption

### Application

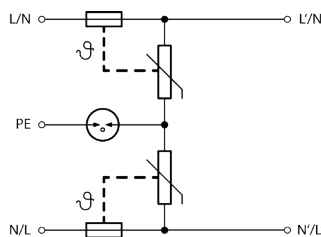
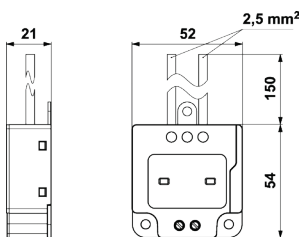
Install close to protected equipment in low voltage power circuits.



### Electrical specification

Order number	KM-SP-T2+T3-320/Y-CLT-LED	
Nominal voltage	$U_n$	230V AC
Maximum operating voltage	$U_c$	320V AC
Nominal load current	$I_L$	10A
Nominal discharge current (8/20 $\mu$ s) L-N/N-PE	$I_n$	5kA
Maximum discharge current (8/20 $\mu$ s) L-N/N-PE	$I_{max}$	10kA
Test voltage L-N/N-PE/L-PE	$U_{oc}$	10kV
Voltage protection level mode L-N	$U_p$	1.3kV
Voltage protection level mode N-PE	$U_p$	1.5kV
Voltage protection level mode L-PE	$U_p$	1.5kV
Short-circuit current rating	$I_{sCCR}$	3kA
Maximum overcurrent protection		32A gL/gG or C 32A
Response time L-N	$t_a$	25ns
Response time N-PE	$t_a$	100ns
Cross-section of connected conductors solid (max)		2.5mm <sup>2</sup>
Cross-section of connected conductors stranded (max)		1.5mm <sup>2</sup>
Fault indication		loss of voltage, dark grey indication field
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
According to standard		EN 61643-11:2012, IEC 61643-11:2011 / T2, T3
Weight		55g (nett), 105g (gross)

### Dimensions and wiring diagram



KM-SP-T2+T3-320/Y-CLT-LED

# Low voltage, telecom and data lines protection

Where low voltage, data and telecom lines enter and exit the building, they must also be included in the Lightning Protection System. These include:

- Electromagnetic shielding
- Telephone lines
- Data communication lines
- Instrumentation, control, signalling lines
- Coaxial lines for CCTV, TV, & antenna cables

Field based electronic equipment also needs to be protected.

By their nature, low voltage, data and telecom lines are not as robust as mains power cables and as such do not carry the same magnitude of lightning current. However, the size of that voltage/current is large in comparison to the system operating voltage and, as such, these lightning induced transients can still cause irreparable and expensive damage.

Since transients can be induced from the large electro-magnetic field created during a lightning strike, care needs to be taken over the routing of such cables.

When selecting a data, telephone or low voltage protector, extra care must be taken to ensure that clamping performance of the SPD does not impede the data/signal transmission voltage.

SPD's in this category are normally installed "in-line" and they have "dirty" (voltage in) and "clean" (voltage out) terminals, thus extra care must be taken to ensure that input conductors are not connected to the wrong terminal.

Positioning is important too, they should be installed within the cabinet supplying the equipment, and the "clean output" cables should be routed away from the "dirty input" cables.

Shielding of cables can also assist in reducing the impact of lightning currents.

Similarly, the use of fibre-optic cables will reduce the impact of lightning currents. Although, bonding to earth should take place at both ends of the cable if the fibre-optic cable has a metallic shield.

The parameters for low voltage and telecommunication SPD's are outlined in the tables following:

LPL	Boundary of LPZ 0 and 1	Boundary of LPZ 1 and 2	Boundary of LPZ 2 and 3
Peak test current per mode	25kA	40kA	3kA (with 6kV)
Telecom & signalling test category B2 10/700 V waveform	D1	C2	C3
Surge test waveform	10/350 current	Combined 8/20 current and 1.2/50 voltage	Combined 8/20 current and 1.2/50 voltage
Peak test current per mode	2.5kA	2kA (with 4kV)	0.5kA (with 1kV)

*Table SPD:6. Application of SPDs in a low voltage situation along with associated test parameters.*

**From BS:EN 62305 . . .**

**Low voltage - surge currents associated with Lightning Protection Levels**

Source of damage	Current waveform	LPL I	LPL II	LPL III & IV
Flashes to the structure (S1)	10/350	10kA	7.5kA	5kA
Flashes near the structure (S2)	8/20	0.2kA	0.15kA	0.1kA
Flashes to lines connected to the structure (S3)	8/20	10kA	7.5kA	5kA
Flashes near to lines connected to the structure (S4)	8/20	5kA	3.75kA	2.5kA

**Telecommunication - surge currents associated with Lightning Protection Levels**

Source of damage	Current waveform	LPL I	LPL II	LPL III & IV
Flashes to the structure (S1)	10/350	10kA	7.5kA	5kA
Flashes near the structure (S2)	8/20	0.2kA	0.15kA	0.1kA
Flashes to lines connected to the structure (S3)	8/20	2kA	1.5kA	1kA
Flashes near to lines connected to the structure (S4)	8/20	0.16kA	0.085kA	0.035kA

It is important to select an SPD such that its operation does not block signal voltages and that it can withstand the expected surge currents as shown above by Lightning Protection locations.

*Figure SPD:35. Surge currents associated with low voltage networks.*

The Kingsmill range of protectors is outlined on pages SPD:72 to 84. If you do not see the protector that you require, please ask our sales team, as the range is continuously growing.

Protectors for use in the different Lightning Protection zones are denoted as follows (in the product data tables following this introduction).

LPZ transition	Marking
LPZ0 - LPZ1	ST 1
LPZ1 - LPZ2	ST 2
LPZ2 - LPZ3	ST 3

Protectors are installed at the position of the equipment being protected, but in the case of our Krone LSA-Plus configuration SPDs, at the rack itself.

*Table SPD:7. SPD marking by LPZ.*



## Surge arrester for data, signal and telecomms



**Type:** D1, C2  
**Location:** ST 1+2+3

Lightning current arrester with coarse and fine surge protection for the protection of 2 core signalling lines.

### Benefits

- Can be installed at line entry into the building as well as close to protected devices
- Coarse and fine surge protection (core - core) in differential mode
- Coarse surge protection in common mode (line - PE)

### Features

- Pluggable module
- Line separated from protective earth via GDT
- Coupling resistance (R - resistance)

### Standards

EN 61643-11 (for surge protection devices).

### Application

Install at the boundary of LPZ0 and LPZ1 zones at the line entry into the building.

## Electrical specification

Order number	KM-BDG-230-V/1-FR1	
Connection (input - output)	terminals - terminals	
Nominal voltage	$U_n$	230V DC
Maximum operating voltage	$U_c$	177V AC/250V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core/GND-PE	$I_n$	10kA
C2 Total discharge current (8/20 $\mu$ s) cores-PE	$I_{total}$	20kA
D1 Impulse discharge current (10/350 $\mu$ s) core-core	$I_{imp}$	2.5kA
D1 Total discharge current (10/350 $\mu$ s) cores-PE	$I_{total}$	5kA
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	350V
C3 Voltage protection level mode GND-PE/core-GND at 1kV/ $\mu$ s	$U_p$	550V
Response time core-core	$t_a$	1ns
Response time core-PE/core-GND	$t_a$	100ns
Serial resistance per core	R	3.3 $\Omega$
Threshold frequency core-core	f	16MHz
Cross-section of connected conductors (solid) (min - max)	0.14mm <sup>2</sup> - 4mm <sup>2</sup>	
Cross-section of connected conductors (stranded) (min - max)	0.14mm <sup>2</sup> - 2.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +70°C	
Mounting	DIN rail 35mm	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / D1, C2	
ETIM Class	EC 001625	
Weight	90g (nett), 115g (gross)	

**DIMENSIONS & WIRING DIAGRAMS:**  
SEE PAGE SPD:91

## Accessories

Spare modules are available.  
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module	KM-BDG-230-V/1-0

## Surge arrester for low voltage AC/DC power supplies

Surge protection device for all types of low voltage electric and electronic equipment rated up to 48 volts (nominal).

### Features

- Pluggable module
- Visual fault signalling
- Use on systems up to 48 volts

### Application

Install close to protected equipment in low voltage power circuits.

### Benefits

Middle conductor separated from protective earth via GDT.

### Standards

EN 61643-11 (for surge protection devices).



Type: T3, C2

Location: ST 2

### Electrical specification

Order number	KM-DP-048-V/1-F16	
Connection (input - output)	terminals - terminals	
Nominal voltage	$U_n$	48V AC
Maximum operating voltage (AC/DC)	$U_c$	60V AC / 60V DC
Nominal load current	$I_L$	16A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	2kA
C2 Voltage protection level mode core-core at In	$U_p$	370V
C2 Voltage protection level mode core-PE at In	$U_p$	750V
Test voltage L+ - L- / L+ (L-) - PE / M - PE		4kV
Voltage protection level L+ - L-		0.37kV
Voltage protection level L+ (L-) - PE / M-PE		0.75kV
Maximum overcurrent protection		16A gL/gG or B 16A
Response time L+ - L-		25ns
Response time L+ (L-) - PE / M-PE		100ns
Cross-section of connected conductors (solid) (min - max)		0.14mm <sup>2</sup> - 4mm <sup>2</sup>
Cross-section of connected conductors (stranded) (min - max)		0.14mm <sup>2</sup> - 2.5mm <sup>2</sup>
Fault indication		Red indicator
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +70°C
Mounting		DIN rail 35mm
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012, EN 61643-11:2012, IEC 61643-11:2011 / T3, C2	
ETIM Class	EC000942	
Weight	95g (nett), 120g (gross)	

### Accessories

Spare modules are available.

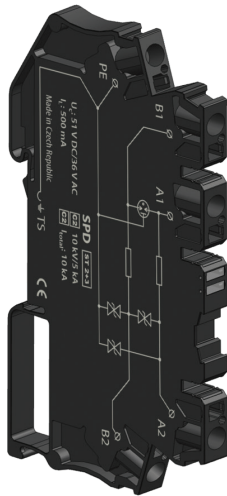
Replace when fault indication indicator turns from green to red.

DESCRIPTION	ORDER NUMBER
Spare Module	KM-DP-048-V/1-0

**DIMENSIONS & WIRING DIAGRAMS:**

SEE PAGE SPD:91

## Surge current arrester for data, signal and telecomms



Coarse and fine surge protection for 2 core telecommunications and signalling networks.

Use to protect RS-485 instrumentation and control lines, electronic security and fire detection systems.

### Features

- Screwless terminals
- Coupling impedance (resistance)
- Use on systems up to 48 volts

### Benefits

Coarse and fine surge protection in differential mode (core - core) and common mode (core - PE).

### Application

Install close to equipment for protection of communication interfaces.

### Standards

EN 61643-11 (for surge protection devices).

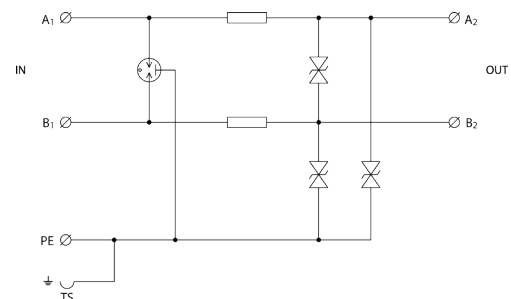
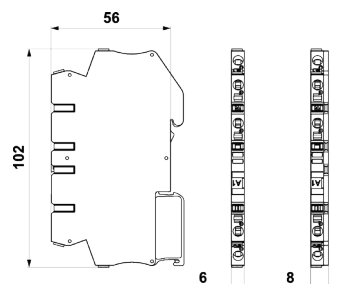
Type: C2, C3  
Location: ST 2+3

## Electrical specification

Order number	KM-DM-048/1-RB	
Connection (input - output)	screwless terminals - screwless terminals	
Nominal voltage	$U_n$	48V DC
Maximum operating voltage (AC/DC)	$U_c$	36V AC/51V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	5kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	10kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	80V
C2 Voltage protection level mode core-PE at $I_n$	$U_p$	95V
C3 Voltage protection level mode core-core/core-PE at 1kV/ $\mu$ s	$U_p$	65V
Response time core-core/core-PE	$t_a$	1ns
Serial resistance per core	R	1.6 $\Omega$
Threshold frequency core-core	f	5MHz
Cross-section of connected conductors (solid) (min - max)	0.08mm <sup>2</sup> - 4mm <sup>2</sup>	
Cross-section of connected conductors (stranded) (min - max)	0.08mm <sup>2</sup> - 2.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +70°C	
Mounting	DIN rail 35mm	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3	
ETIM Class	EC 001625	
Weight	35g (nett), 60g (gross)	

## Dimensions and wiring diagram

### KM-DM-048/1-RB



## Two-stage surge current arrester for signal lines

Coarse and fine surge protection for 2 core signalling networks.

### Features

- Screwless terminals
- Coupling impedance (resistance)
- Use on systems up to 24 volts

### Application

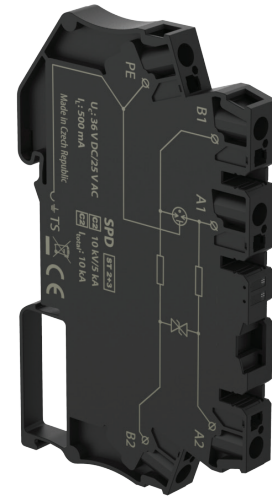
Install close to equipment for protection of communication interfaces.

### Benefits

Coarse and fine surge protection in differential mode (core - core) and coarse protection in common mode (core - PE).

### Standards

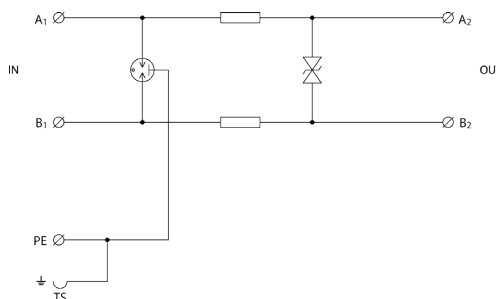
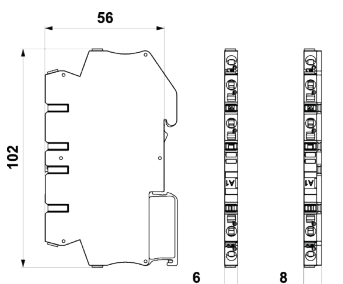
EN 61643-11 (for surge protection devices).



### Electrical specification

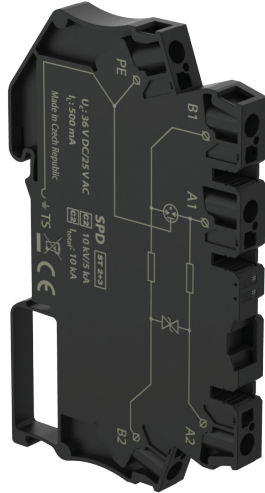
Order number	KM-DMG-024/1-RB	
Connection (input - output)	screwless terminals - screwless terminals	
Nominal voltage	$U_n$	24V DC
Maximum operating voltage (AC/DC)	$U_c$	25V AC/36V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	5kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	10kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	50V
C2 Voltage protection level mode core-PE at $I_n$	$U_p$	350V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	45V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	500V
Response time core-core	$t_a$	1ns
Response time core-PE	$t_a$	100ns
Serial resistance per core	$R$	1.6 $\Omega$
Threshold frequency core-core	$f$	4MHz
Cross-section of connected conductors (solid) (min - max)	0.08mm <sup>2</sup> - 4mm <sup>2</sup>	
Cross-section of connected conductors (stranded) (min - max)	0.08mm <sup>2</sup> - 2.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +70°C	
Mounting	DIN rail 35mm	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3	
ETIM Class	EC 001625	
Weight	35g (nett), 60g (gross)	

### Dimensions and wiring diagram



KM-DMG-024/1-RB

## Two-stage surge current arrester for RS485 signal lines



Coarse and fine surge protection for 2 core signalling networks.

### Features

- Screwless terminals
- Coupling impedance (resistance)
- Use on systems up to 24 volts

### Benefits

Coarse and fine surge protection in differential mode (core - core) and common mode (core - PE).

### Application

Install close to equipment for protection of communication interfaces.

### Standards

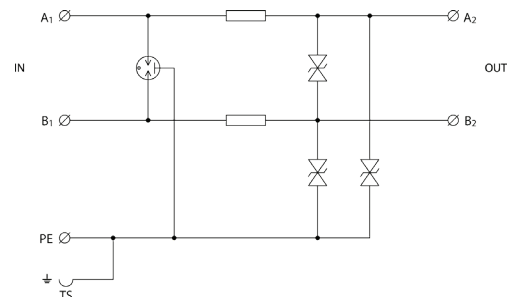
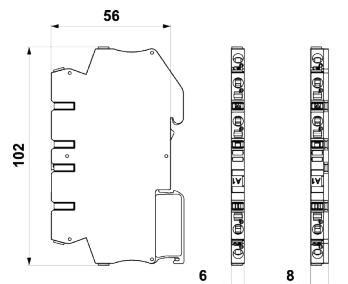
EN 61643-11 (for surge protection devices).

## Electrical specification

Order number	KM-DM-006/1-RB	
Location	ST 2+3	
Connection (input - output)	screwless terminals - screwless terminals	
Nominal voltage	$U_n$	6V DC
Maximum operating voltage (AC/DC)	$U_c$	6V AC/8.5V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	5kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	10kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	18V
C2 Voltage protection level mode core-PE at $I_n$	$U_p$	30V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	12V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	15V
Response time core-core/core-PE	$t_a$	1ns
Serial resistance per core	$R$	1.6 $\Omega$
Threshold frequency core-core	$f$	1MHz
Cross-section of connected conductors (solid) (min - max)	0.08mm <sup>2</sup> - 4mm <sup>2</sup>	
Cross-section of connected conductors (stranded) (min - max)	0.08mm <sup>2</sup> - 2.5mm <sup>2</sup>	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +70°C	
Mounting	DIN rail 35mm	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3	
ETIM Class	EC 001625	
Weight	35g (nett), 60g (gross)	

## Dimensions and wiring diagram

### KM-DM-006/1-RB





## KRONE™ LSA-Plus® Telephone Signal Protection

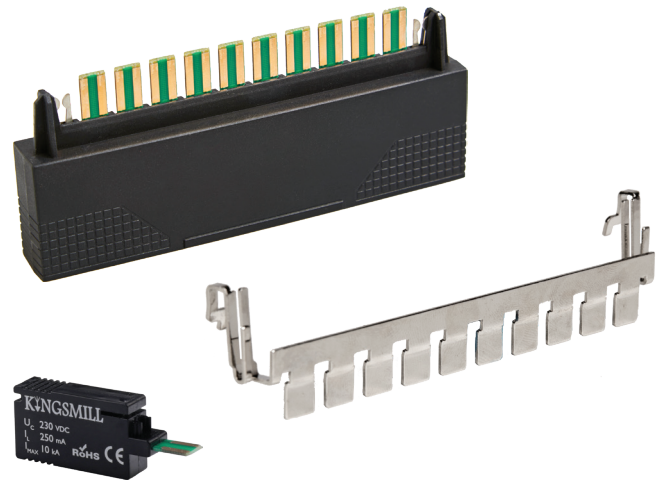
Use the Kingsmill KP series of products for telephone and signal line protection for signals utilising the KRONE™ LSA-PLUS® 10-way connection blocks.

### Two stages of protection

Standard KRONE™ surge arresters only provide a single stage of protection which cannot prevent equipment from being exposed to excessive voltages during a surge event. The KP series of products utilise a two stage protection approach that keeps the voltage let through to an absolute minimum.

### Telephone and Signal protection

The KMKP-10 devices are designed for protecting PSTN and digital PABX signals with a maximum line voltage of up to 200V. They protect all common signalling systems.



### Ordering Information

Model	Signal Type		Ordering Codes	
KMKP-x	PSTN	PABX	KMKP-1 (1 pair)	KMKP-10 (10 pairs)

*The KMKP-1 must be used in conjunction with the Earth Bar KM-KP-EB.*

### Electrical specification

Order number	KMKP-1		KMKP-10
Connection type	in series		
Modes of protection	transverse and common mode		
Number of lines	1 pair	10 pairs	
Maximum continuous voltage (AC/DC)	$U_c$	140V AC/200V DC	
Maximum discharge current (8/20µs)	$I_{max}$	5kA per line (10kA common mode)	
Impulse durability	C2 10 x 5kA 8/20µs		
Maximum load current	$I_L$	250mA	
L-L Voltage protection level at 1kV/µs	$U_p$	220V	
L-L Voltage protection level at 100V/s		235V	
L-PE Voltage protection level at 1kV/µs	$U_p$	350V	
L-PE Voltage protection level at 3kA 8/20µs	$U_p$	600V	
L-PE Voltage protection level at 100V/s		230V	
AC durability	5 x 1s, 1A rms		
Overstressed fault mode	Mode 3 (open circuit)		
Response time	$t_a$	<5ns	
Line resistance	2.7Ω		
L-L capacitance	18pF		
L-PE capacitance	4.5pF		
Insertion loss @ 150Ω	<0.5dB (<1MHz)		
3dB frequency @ 150Ω	70MHz		

## KRONE™ LSA-Plus® Telephone Signal Protection

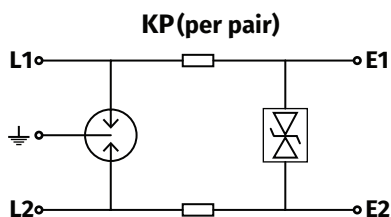
### Mechanical specification

Order number	KMKP-1	KMKP-10
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +85°C	
Humidity range	5% to 95% non-condensing	
Mounting	KRONE LSA-PLUS®	
Earthing	Additional earth bar for KMKP-1 (KM-KP-EB)	-
According to standard	EN 61643-21:2012, AS/NZS 1768:2007, UL 1449 3rd edition & UL 497B, ITU-T K.44:2012, AS/CA S008:2010, AS/NZS 4117:1999	
Weight	6.5g	150g

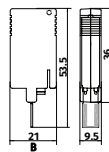
### Standards

Order number	KMKP-1	KMKP-10
EN 61643-21:2012	SPD connected to telecommunications and signalling networks - Cat C2, D1	
AS/NZS 1768:2007	Signalling/telecommunications surge protection	
UL 1449 3rd edition & UL 497B	Protectors for data communications and fire-alarm circuits	
ITU-T K.44:2012	Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents	
AS/CA S008:2010	Requirements for Customer Cabling Products	
AS/NZS 4117:1999	Surge Protective Devices for Telecommunications Applications	

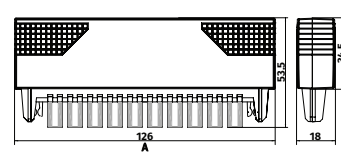
### Dimensions and wiring diagram



**KMKP-1**



**KMKP-10**



## Surge arrester for Power over Ethernet

Combination of coarse and fine protection of ethernet lines with Power over Ethernet (PoE). For protection of ethernet line Cat 6 with PoE Mode A, B against surge voltages.

### Features

- RJ45 sockets
- Suitable for use on 10 Gbits/s Ethernet (Cat 6A) lines

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND2 holder



### Application

Install at the entry into the building and close to protected equipment, at the boundary of LPZ0 and LPZ1 or higher.

### Standards

EN 61643-11 (for surge protection devices).

**Type:** D1, C2, C3

**Location:** ST 1+2+3

### Electrical specification

<b>Order number</b>	<b>KM-DL-1G-RJ45-PoE-AB</b>
Degree of protection	IP20
Range of operating temperatures (min - max)	-40°C - +80°C
Mounting	DIN rail 35mm and GND2 holder
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / D1, C2, C3
ETIM Class	EC 001473
Weight	135g (nett), 155g (gross)

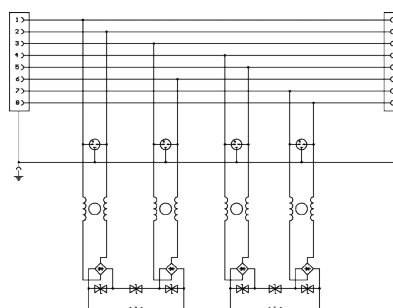
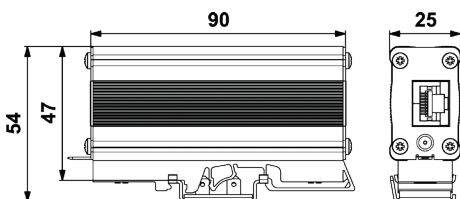
### Line part

Maximum operating voltage	$U_c$	8.5V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	0.15kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	10kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	60V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	22V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	500V
D1 total discharge current (10/350 $\mu$ s) cores P-E	$I_{Total}$	2kA
Response time core-core	$t_a$	1ns
Response time core-PE	$t_a$	100ns
Insert attenuation at 250MHz		1.20dB
Connection (input - output)		RJ45/RJ45

### Power part

Maximum operating voltage	$U_c$	58V DC
Nominal load current	$I_L$	1.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	0.15kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	10kA
C2 Voltage protection level mode (POE) at $I_n$		90V
C3 Voltage protection level mode (POE) at 1kV/ $\mu$ s		80V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	500V
Response time core-core	$t_a$	1ns
Response time core-PE	$t_a$	100ns

### Dimensions and wiring diagram



**KM-DL-1G-RJ45-PoE-AB**

## Surge arrester for Ethernet



**Type:** C2, C3  
**Location:** ST 3

Combination of coarse and fine protection of ethernet lines with Power over Ethernet (PoE). For protection of ethernet line Cat 6 with PoE Mode A, B against surge voltages.

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND 2 holder

### Features

- RJ45 sockets
- Suitable for use on 10 Gbits/s Ethernet (Cat 6A) lines

### Standards

EN 61643-11 (for surge protection devices).

### Application

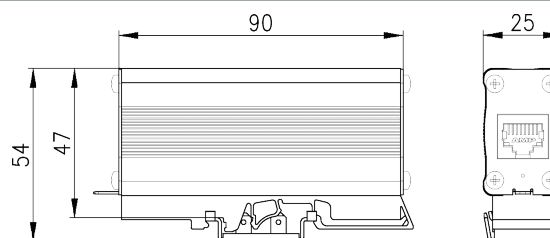
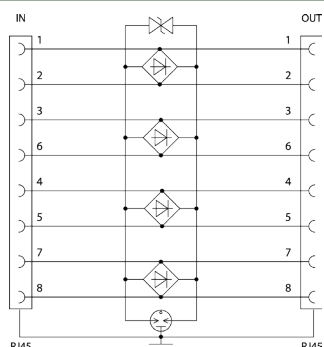
Install close to protected equipment.

## Electrical specification

Order number	KM-DL-CAT.6-60V	
Maximum operating voltage	$U_c$	60V DC
Nominal load current	$I_L$	0.5A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	0.2kA
C2 Nominal discharge current (8/20 $\mu$ s) cores-PE	$I_{Total}$	1.6kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	130V
C3 Voltage protection level mode core-PE at $I_n$	$U_p$	350V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	130V
Response time core-core	$t_a$	1ns
Insert attenuation at 250MHz		2dB
Connection (input - output)		RJ45/RJ45
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm and GND2 holder
According to standard		EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3
Weight		125g (nett), 150g (gross)

## Dimensions and wiring diagram

### KM-DL-CAT.6-60V



## Surge arrester for telephone lines - RJ11 sockets

Protect a single pair of high-speed analogue lines in telecommunication equipment (eg VDSL2).

### Features

- Provides “coarse” and “fine” protection
- Simple installation
- Protect AC and DC systems

### Application

Install inline for protection of telecommunication equipment on high-speed analogue lines.

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND 2 holder

### Standards

EN 61643-11 (for surge protection devices).

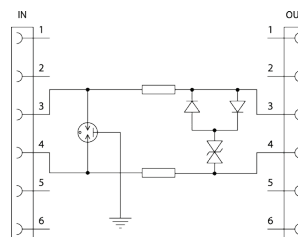
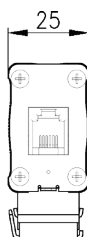
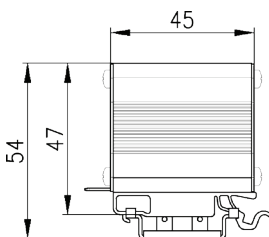


**Type:** C2, C3  
**Location:** ST 2+3

### Electrical specification

Order number	KM-DL-TLF-HF	
Maximum operating voltage (AC/DC)	$U_c$	114V AC/162V DC
Nominal load current	$I_L$	0.06A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	2.5kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	260V
C2 Voltage protection level mode core-PE at $I_n$	$U_p$	300V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	240V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	400V
Response time core-core	$t_a$	1ns
Response time core-PE	$t_a$	100ns
Serial resistance per core	R	6.8 $\Omega$
Threshold frequency core-core	f	40MHz
Connection (input - output)	RJ11 sockets	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +80°C	
Mounting	DIN rail 35mm and GND2 holder	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3	
ETIM Class	EC001625	
Weight	85g (nett), 100g (gross)	

### Dimensions and wiring diagram



KM-DL-TLF-HF



## Surge arrester for telephone lines - RJ45 sockets



Protect a single pair of ISDN lines in telecommunication equipment.

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND 2 holder

### Features

- Provides “coarse” and “fine” protection
- Protect AC and DC systems

### Standards

EN 61643-11 (for surge protection devices).

### Application

Install in front of NT for protection of telecommunication equipment on ISDN lines.

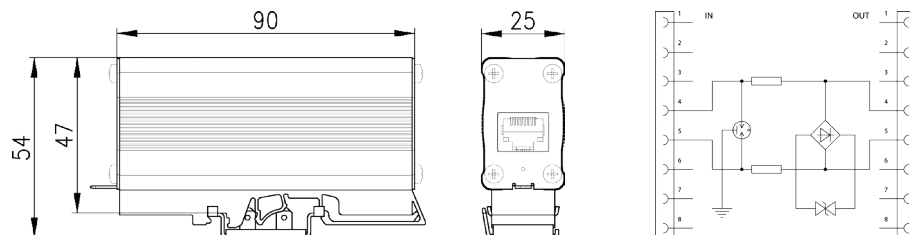
Type: C2, C3  
Location: ST 2+3

## Electrical specification

Order number	KM-DL-ISDN-RJ45	
Maximum operating voltage (AC/DC)	$U_c$	86V AC/121V DC
Nominal load current	$I_L$	0.06A
C2 Nominal discharge current (8/20 $\mu$ s) per core	$I_n$	2.5kA
C2 Voltage protection level mode core-core at $I_n$	$U_p$	270V
C2 Voltage protection level mode core-PE at $I_n$	$U_p$	300V
C3 Voltage protection level mode core-core at 1kV/ $\mu$ s	$U_p$	180V
C3 Voltage protection level mode core-PE at 1kV/ $\mu$ s	$U_p$	400V
Response time core-core	$t_a$	1ns
Response time core-PE	$t_a$	100ns
Serial resistance per core	R	6.8 $\Omega$
Threshold frequency core-core	f	80MHz
Connection (input - output)	RJ45 sockets	
Degree of protection	IP20	
Range of operating temperatures (min - max)	-40°C - +80°C	
Mounting	DIN rail 35mm and GND2 holder	
According to standard	EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / C2, C3	
ETIM Class	EC000943	
Weight	125g (nett), 150g (gross)	

## Dimensions and wiring diagram

### KM-DL-ISDN-RJ45



## Lightning current arrester for coaxial lines (F Connector)

Lightning current arrester with floating shielding (separated with GDT) for TV and CCTV coaxial line systems.

### Features

- F Connectors
- Use on systems up to 70 volts

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND 2 holder

### Application

Install at the boundary of LPZ0 and LPZ1 zones at the line entry into the building.

### Standards

EN 61643-11 (for surge protection devices).

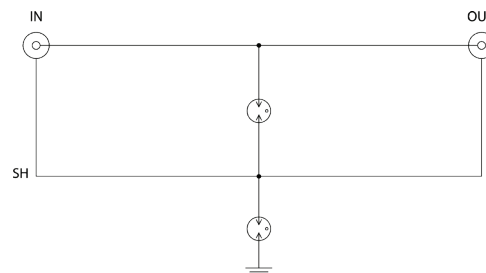
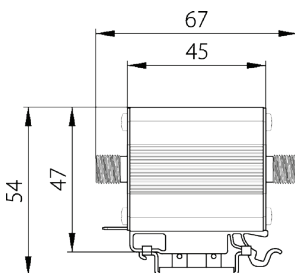


Type: D1, C2  
Location: ST 1

### Electrical specification

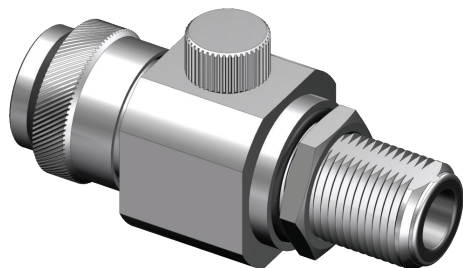
Order number	KM-FX-090 F75 T F/F	
Maximum operating voltage	$U_c$	70V DC
Nominal load current	$I_L$	4A
C2 Nominal discharge current (8/20 $\mu$ s) core-SH/SH-PE	$I_n$	10kA
D1 Impulse discharge current (10/350 $\mu$ s) core-SH/SH-PE	$I_{imp}$	2.5kA
C3 Voltage protection level mode core-SH/SH-PE at 1kV/ $\mu$ s	$U_p$	600V
Wave impedance	Z	75 $\Omega$
Insertion attenuation		0.2dB
SWR	SWR	1.3
Bandwidth (min - max)	f	0MHz - 2150MHz
Response time core-SH/SH-PE	$t_a$	100ns
Connection (input - output)		F75
Degree of protection		IP20
Range of operating temperatures (min - max)		-40°C - +80°C
Mounting		DIN rail 35mm and GND2 holder
According to standard		EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / D1, C2
ETIM Class		EC001466
Weight		120g (nett), 140g (gross)

### Dimensions and wiring diagram



KM-FX-090 F75 T F/F

## Lightning current arrester for coaxial lines (N Connector)



Lightning current arrester for the protection of coaxial lines and telecommunication equipment against the impact of direct or indirect lightning strikes. Suitable for combined and power supply installations.

### Benefits

- Simple installation
- Universal plastic adapter for mounting on DIN rail and GND 2 holder

### Features

- N Connectors
- Use on systems up to 70 volts
- 50Ω wave impedance

### Standards

EN 61643-11 (for surge protection devices).

### Application

Install at the boundary of LPZ0 and LPZ1 zones at the line entry into the building.

**Type:** D1, C2

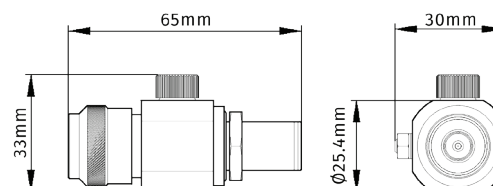
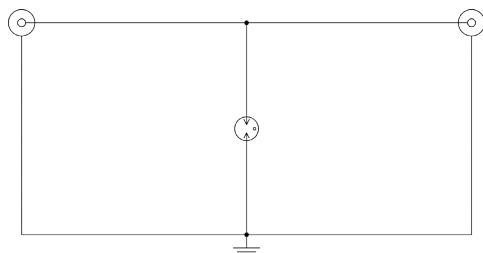
**Location:** ST 1+2

## Electrical specification

Order number	KM-HX-090 N50 F/M	
Maximum operating voltage	$U_c$	70V DC
Nominal load current	$I_L$	6A
C2 Nominal discharge current (8/20μs) core-PE	$I_n$	10kA
D1 Impulse discharge current (10/350μs) core-PE	$I_{imp}$	2.5kA
C3 Voltage protection level mode core-PE at 1kV/μs	$U_p$	600V
Response time core-PE	$t_a$	100ns
Power	P	95W
Wave impedance	Z	50Ω
Bandwidth (min - max)	f	0MHz - 3500MHz
Insertion attenuation		0.1dB
SWR	SWR	1.2
Connection (input - output)		N50
Degree of protection		IP66
Range of operating temperatures (min - max)		-40°C - +80°C
According to standard		EN 61643-21+A1,A2:2013, IEC 61643-21+A1,A2:2012 / D1, C2
ETIM Class		EC001466
Weight		155g (nett), 175g (gross)

## Dimensions and wiring diagram

KM-HX-090 N50 F/M



## Enclosures

**IP65 rated insulated distribution enclosures for use with Kingsmill Surge Protection Devices.**

ABS enclosures with a polycarbonate window. Includes DIN rail. Complete with earth and neutral terminal blocks.

**Fixings**

Fixings for attaching the enclosure to the wall (not included) - 4 x stainless steel countersunk screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic plug (PP12).

**Modules for use with enclosures**

SPD-ENC		SPD-ENC-LARGE
<b>25kA Type 1+2</b>	<b>Type 1+2 PV</b>	<b>25kA Type 1+2</b>
KM1+2-25-1+0 SC	KM-FLP-PV550 V/U S	KM1+2-25-3+0 SC
KM1+2-25-1+1 SC	<b>Type 2 PV</b>	KM1+2-25-3+1 SC
KM1+2-25-2+0 SC	KM-SLP-PV170 V/U S	KM1+2-25-4+0 SC
<b>12.5kA Type 1+2</b>	KM-SLP-PV500 V/U S	<b>Type 1+2 PV</b>
KM1+2-12.5-1+0 SC	KM-SLP-PV700 V/Y S	KM-FLP-PV550 V/U S
KM1+2-12.5-1+1 SC	KM-SLP-PV1000 V/Y S	KM-FLP-PV1000 VS/Y
KM1+2-12.5-2+0 SC	KM- SLP-PV1500 V/Y S	
KM1+2-12.5-3+0 SC	<b>Type 3 RFI</b>	
KM1+2-12.5-3+1 SC	KM-DA-275-DF-16-S	
KM1+2-12.5-4+0 SC	<b>Screw Terminals</b>	
<b>20kA Type 2</b>	KM-DP-048-V/1-F16	
KM2-20-1+0 SC	KM-BDG-230-V/1-FR1	
KM2-20-1+1 SC		
KM2-20-2+0 SC		
KM2-20-3+0 SC		
KM2-20-3+1 SC		
KM2-20-4+0 SC		
<b>10kA Type 3</b>		
KM3-10-1+1 SC		
KM3-10-3+1 SC		

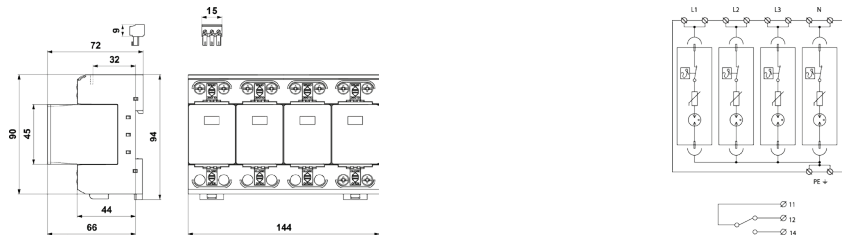
**Specification**

Order number	SPD-ENC	SPD-ENC-LARGE
DIN rail length (mm)	70	160
Useable window opening (mm)	70 x 45	160 x 45
Suitable for maximum product width (mm)	70	160
Height (mm)	215	210
Width (mm)	125	215
Maximum depth (to top of window) (mm)	110	100
Minimum depth (mm)	80	94
Cable knockouts (total all sides)	8	10
Fixing centres (mm)	145 x 52	145 x 143
Weight (kg)	0.51	0.69

## 25kA combined Type 1 & 2 lightning current and surge arresters

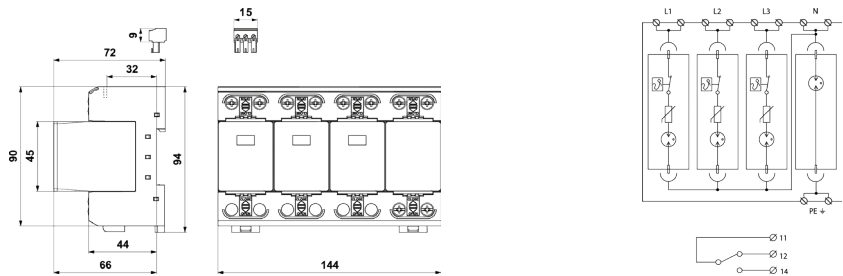
### KM1+2-25-4+0 SC

PAGE SPD:29

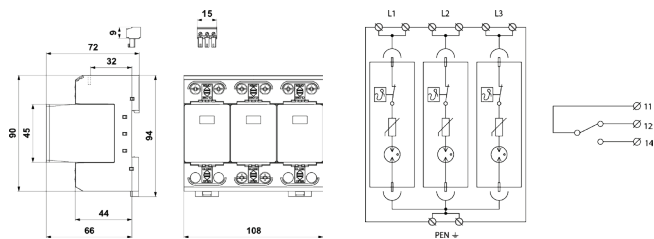


### KM1+2-25-3+1 SC

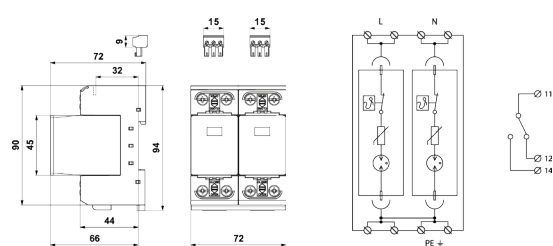
PAGE SPD:30



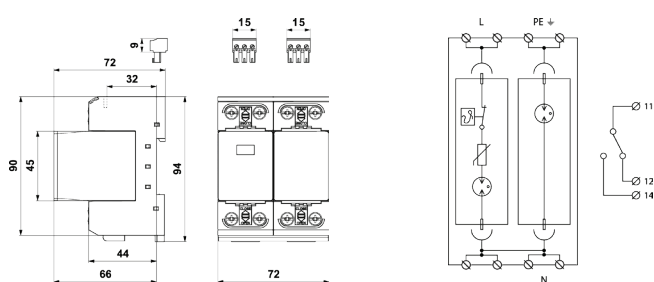
### KM1+2-25-3+0 SC PAGE SPD:31



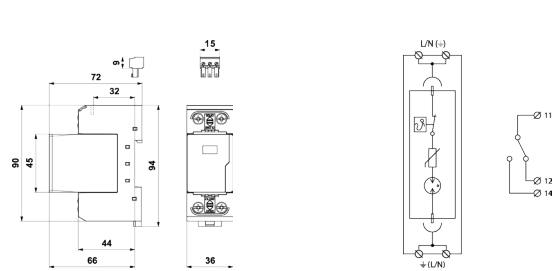
### KM1+2-25-2+0 SC PAGE SPD:32



### KM1+2-25-1+1 SC PAGE SPD:33

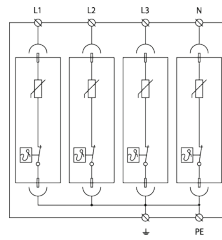
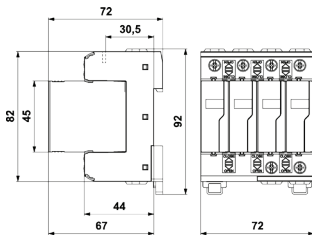


### KM1+2-25-1+0 SC PAGE SPD:34

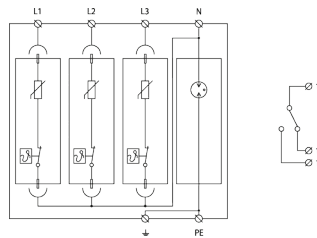
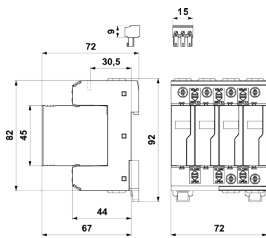




**12.5kA combined Type 1 & 2 lightning current and surge arresters**

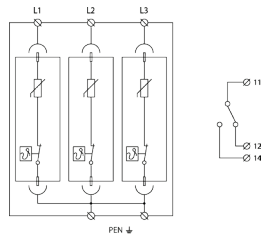
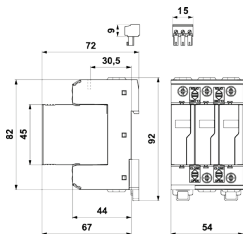


**KM1+2-12.5-4+0 SC**  
PAGE SPD:35

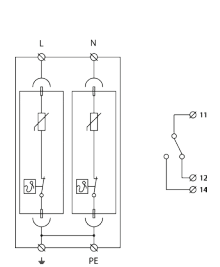
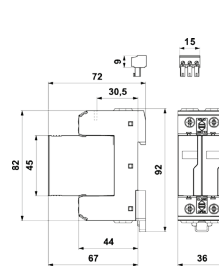


**KM1+2-12.5-3+1 SC**  
PAGE SPD:36

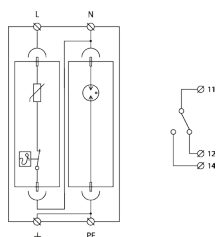
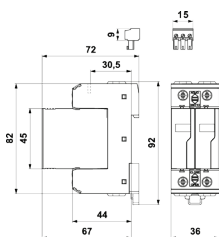
**KM1+2-12.5-3+0 SC** PAGE SPD:37



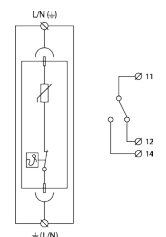
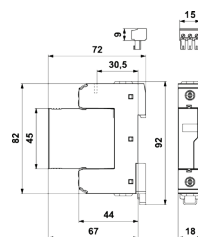
**KM1+2-12.5-2+0 SC** PAGE SPD:38



**KM1+2-12.5-1+1 SC** PAGE SPD:39



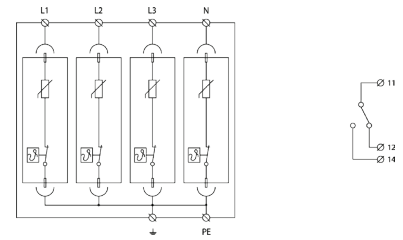
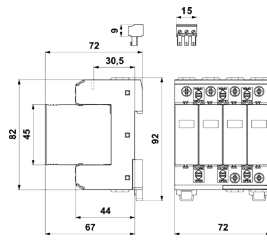
**KM1+2-12.5-1+0 SC** PAGE SPD:40



## 20kA Type 2 surge arresters

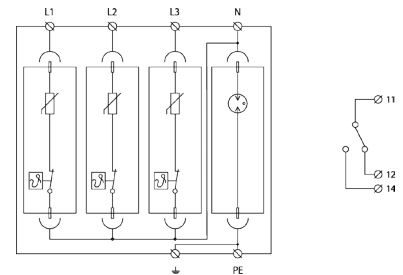
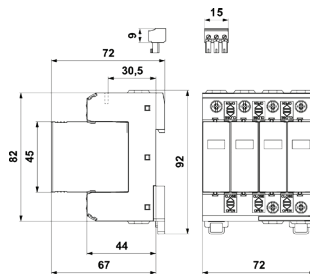
### KM2-20-4+0 SC

PAGE SPD:41



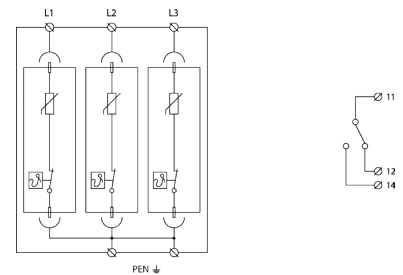
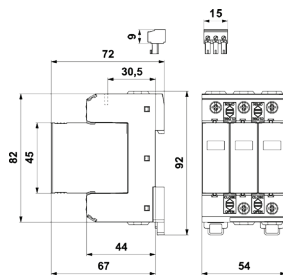
### KM2-20-3+1 SC

PAGE SPD:42



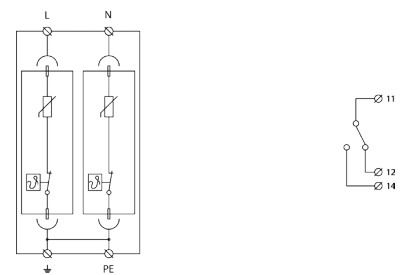
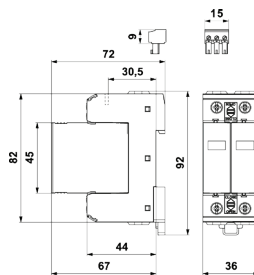
### KM2-20-3+0 SC

PAGE SPD:43



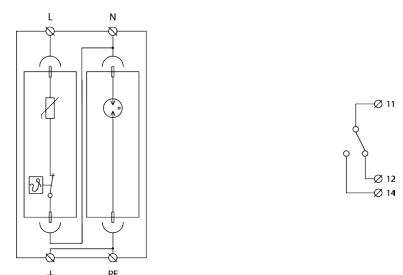
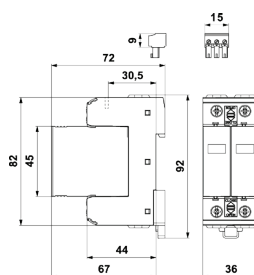
### KM2-20-2+0 SC

PAGE SPD:44

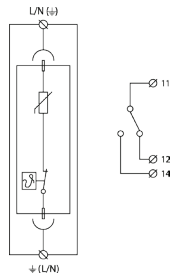
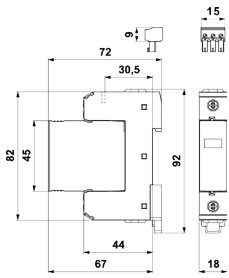


### KM2-20-1+1 SC

PAGE SPD:45

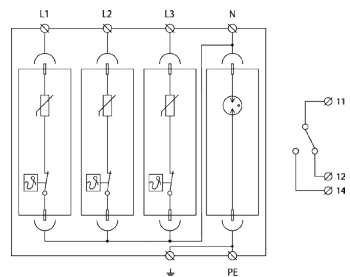
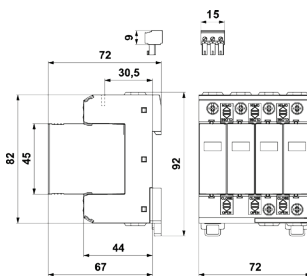


**20kA Type 2 surge arresters**

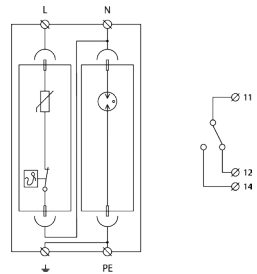
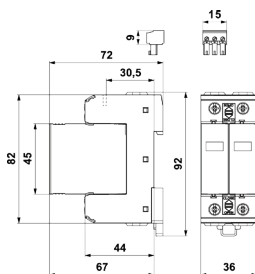


**KM2-20-1+0 SC**  
PAGE SPD:46

**10kA Type 3 surge arresters**

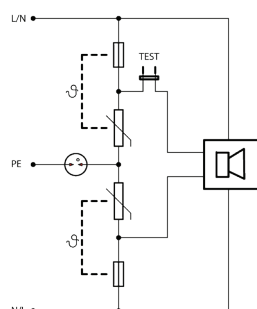
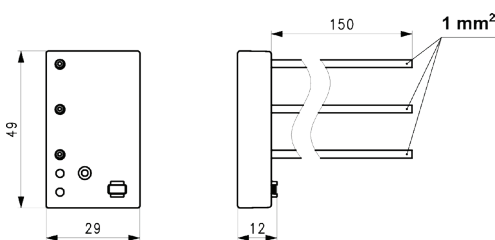


**KM3-10-3+1 SC**  
PAGE SPD:47



**KM3-10-1+1 SC**  
PAGE SPD:48

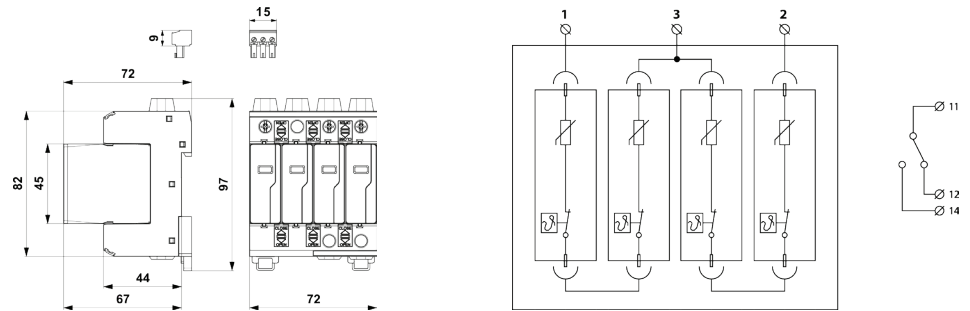
**2kA Type 3 surge protection module**



**KM3-275-A**  
PAGE SPD:49

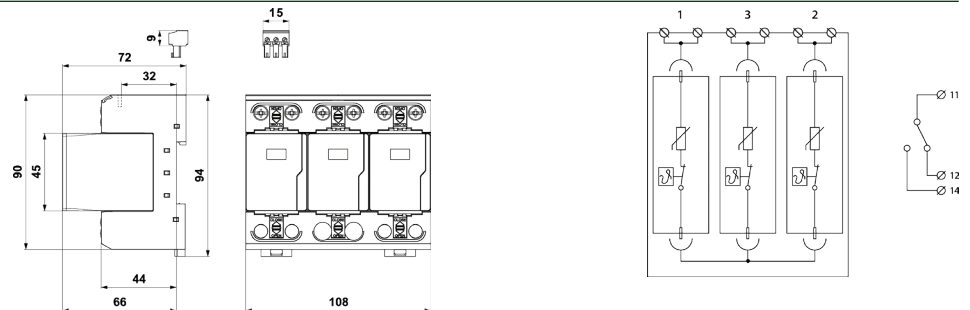
## Type 1+2 surge arrester - 'U' connection

**KM-FLP-PV500 V/U S**  
PAGE SPD:57



## Type 1+2 surge arrester - 'Y' connection

**KM-FLP-PV1000 VS/Y**  
PAGE SPD:58



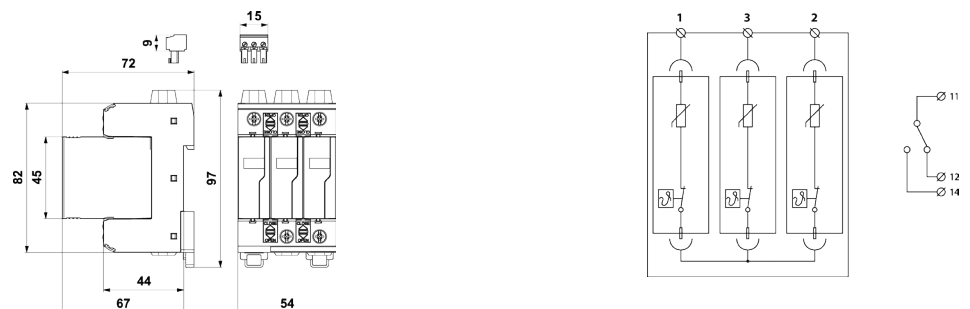
## Type 2 surge arrester 'U' connection

**KM-SLP-PV170 V/U S**  
**KM-SLP-PV500 V/U S**  
PAGE SPD:59

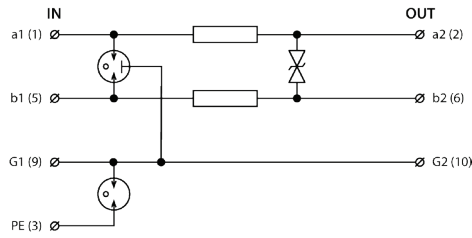
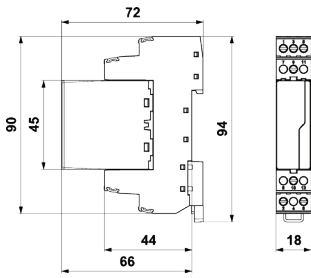


## Type 2 surge arrester 'Y' connection

**KM-SLP-PV700 V/Y S**  
**KM-SLP-PV1000 V/Y S**  
**KM-SLP-PV1500 V/Y S**  
PAGE SPD:60

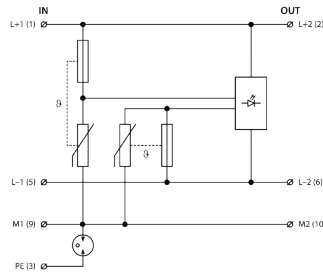
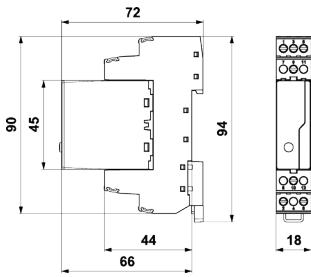


**Surge arrester for data, signal and telecomms (screw terminals)**



**KM-BDG-230-V/1-FR1**  
PAGE SPD:72

**Surge arrester for low voltage AC/DC power supplies (screw terminals)**



**KM-DP-048-V/1-F16**  
PAGE SPD:73

# Declaration of SPDs coordination

<b>Type 1+2</b>	co-ordinated with	<b>Type 2</b>	co-ordinated with	<b>Type 3</b>
KM1+2-25-1 SC		KM2-20-1 SC		KM3-10-1+1 SC
KM1+2-25-3 SC		KM2-20-3 SC		KM3-10-1+1 SC
KM1+2-25-1 SC				KM3-10-1+1 SC
KM1+2-25-3 SC				KM3-10-1+1 SC
KM1+2-25-1 SC		KM2-20-2+0 SC		KM3-10-1+1 SC
KM1+2-25-3 SC		KM2-20-4+0 SC		KM3-10-3+1 SC
KM1+2-25-1 SC		KM2-20-1+1 SC		KM3-10-1+1 SC
KM1+2-25-3 SC		KM2-20-4+0 SC		KM3-10-3+1 SC
KM1+2-25-2+0 SC		KM2-20-2+0 SC		KM3-10-1+1 SC
KM1+2-25-4+0 SC		KM2-20-4+0 SC		KM3-10-3+1 SC
KM1+2-25-1+1 SC				KM3-10-1+1 SC
KM1+2-25-3+1 SC				KM3-10-3+1 SC
KM1+2-25-1+1 SC		KM2-20-2+0 SC		KM3-10-1+1 SC
KM1+2-25-3+1 SC		KM2-20-4+0 SC		KM3-10-3+1 SC
KM1+2-25-1+1 SC		KM2-20-1+1 SC		KM3-10-1+1 SC
KM1+2-25-3+1 SC		KM2-20-3+1 SC		KM3-10-3+1 SC
KM1+2-25-1 SC		KM2-20-1 SC		
KM1+2-25-3 SC		KM2-20-3 SC		
		KM2-20-1 SC		KM3-10-1+1 SC
		KM2-20-3 SC		KM3-10-1+1 SC
		KM2-20-2+0 SC		KM3-10-1+1 SC
		KM2-20-4+0 SC		KM3-10-3+1 SC
KM1+2-25-1+1 SC		KM2-20-2+0 SC		
KM1+2-25-3+1 SC		KM2-20-4+0 SC		
KM1+2-25-1+1 SC		KM2-20-1+1 SC		
KM1+2-25-3+1 SC		KM2-20-3+1 SC		
		KM2-20-1+1 SC		KM3-10-1+1 SC
		KM2-20-4+0 SC		KM3-10-3+1 SC



<b>Introduction</b>	<b>AT:2 - 3</b>
The Air Termination network is a vital part of any structural Lightning Protection System	
<b>Air Termination Systems</b>	<b>AT:4 - 7</b>
Detailed explanations of the available Air Termination Systems	
<b>Product Choice</b>	<b>AT:8 - 10</b>
Which is the correct system for your application?	
<b>Separation Distance</b>	<b>AT:11</b>
Adequate separation distances considerably reduce instances of side-flashing	
<b>Wind Loading</b>	<b>AT:12 - 13</b>
It is important to consider local wind conditions when designing a Lightning Protection System	
<b>Conventional Air Terminals</b>	<b>AT:14 - 21</b>
The Kingsmill range includes Air Terminals, Multi-Points and Strike Pads	
<b>Heavy Duty GRP Air Terminal Masts</b>	<b>AT:22 - 23</b>
Special masts for applications where resilience to mechanical damage and vandalism is paramount	
<b>Lightweight Lightning Mast</b>	<b>AT:24 - 25</b>
innovation through the easy to install, aesthetically pleasing Lightweight Lightning Mast	
<b>Free-Standing Interception Masts/Air Terminals</b>	<b>AT:26 - 33</b>
Suited to the protection of roof mounted plant eg chillers, solar panels etc	
<b>Insulated Lightning Conductor</b>	<b>AT:34 - 49</b>
Interception Masts/Air Terminals specially designed for use with Kingsmill Insulated Lightning Conductor	
<b>Catenary Wire Systems</b>	<b>AT:50</b>
A range of products to form Catenary Wire Protection Systems	
<b>Isolated Systems</b>	<b>AT:51 - 52</b>
Utilising Insulated Spacer Bars in conjunction with Air Terminals and Conductor Supports	

**The Air Termination Network (ATN) is a vital part of any structural Lightning Protection System.**

The ATN is the part that arrests the lightning strike. An ATN can be designed through multiple methods: the “mesh”, the “protective angle method” and/or the “rolling sphere” or a combination. The adoption of which method(s) to use is very much determined by the nature of the structure to be protected.

An ATN may consist of:

- Conductors laid in a mesh over the structure
- Vertical Air Terminals (or Lightning Masts)
- A combination of the two (particularly useful when protecting roof mounted plant)

**Kingsmill offer a complete range of Air Termination Network materials:**

**AT:14** Conventional Small Air Terminals

**AT:22** Lightweight Lightning Masts

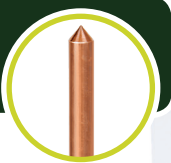
**AT:27** Free-Standing Air Terminals

**AT:32** Insulated Lightning Conductor Cable used in conjunction with associated Air Terminals and supports

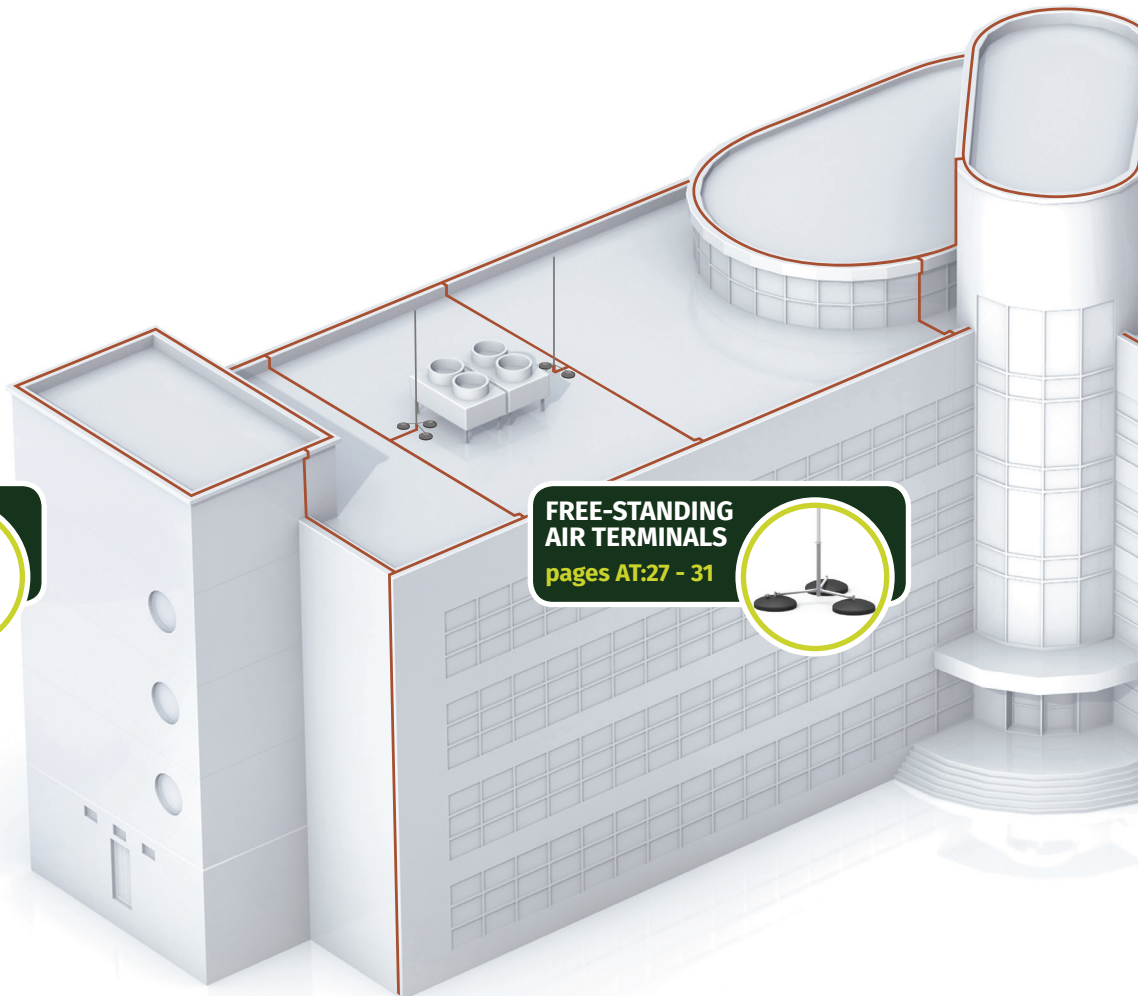
**AT:50** Catenary Wire Systems

**AT:51** Isolated Systems using Insulated Spacer Bars and Masts

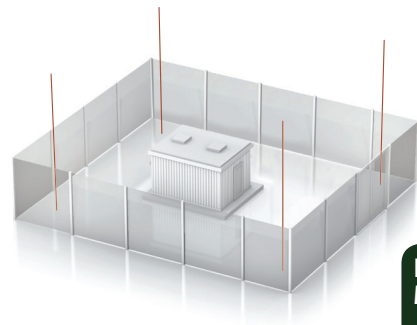
**CONVENTIONAL  
AIR TERMINALS**  
pages AT:14 - 21



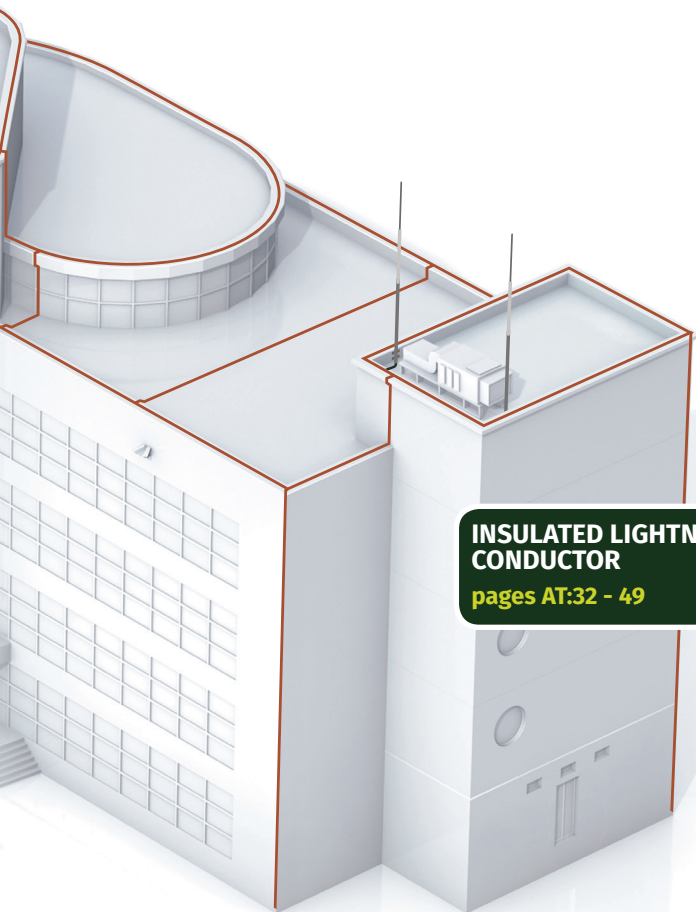
**FREE-STANDING  
AIR TERMINALS**  
pages AT:27 - 31



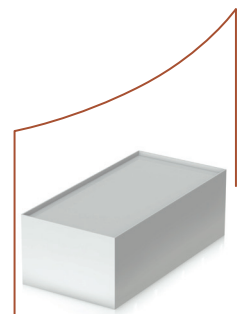
The ATN can be fixed to the building - this is the most common form. Alternatively, it can use elements of the structure to conduct lightning, eg Reinforcing Bar or steelwork. However, special conditions relate to the use of such “fortuitous conductors” in BS:EN 62305. Finally, it can be an Isolated System where separation distances need to be maintained between the Lightning Protection System and the structure being protected, in order to avoid “flashover” to that structure (for example, stores containing explosive material).



**LIGHTNING MASTS**  
pages AT:22 - 25



**INSULATED LIGHTNING CONDUCTOR**  
pages AT:32 - 49



**CATENARY WIRE SYSTEMS**  
page AT:50

**ISOLATED SYSTEMS**  
pages AT:51 - 52

## Roof Mesh Conductor Systems

***Kingsmill offer a choice of conductors and fittings for use in the construction of a roof mesh.***

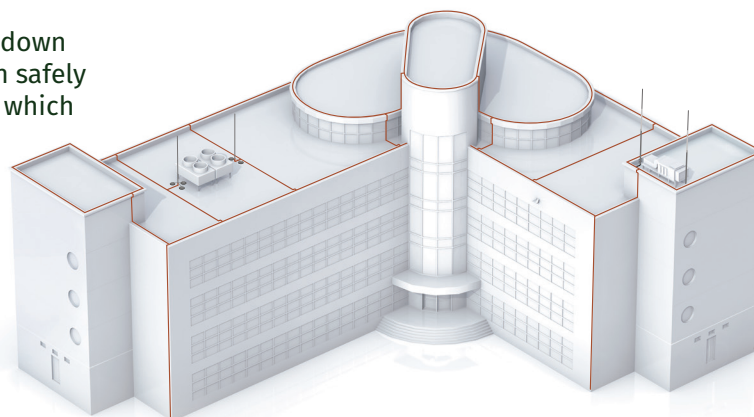
These are shown in the sections - CONDUCTORS and FITTINGS.

Our range includes solid circular, rectangular tape and stranded conductors, as well as PVC coated. Thus giving the designer the flexibility to blend the Lightning Protection network into the building facade.

Conductors are an important element of a Lightning Protection System. They can be used by themselves in a mesh or in combination with Air Terminals.

Conductors are also the main element in both down conductor (the path by which lightning is taken safely to the earth system) and earthing (the path by which the lightning current is discharged to earth).

Given the importance of conductors (and their fittings) to the three elements of an effective lightning protection scheme, we have dedicated two sections to these products: CONDUCTORS and FITTINGS.

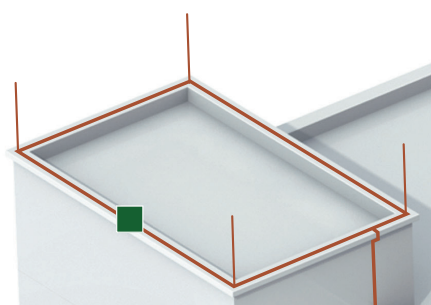


## Conventional Small Air Terminals

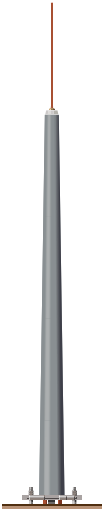
Available in both copper and aluminium, Conventional Small Air Terminals offer a quick and easy solution for Air Terminals of 0.5m to 3.0m in height.

They are suitable for use with flat and circular conductors.

Flat parapet, ridge saddle and wall-mounting bases are available.



## Lightweight Lightning Mast



The Lightweight Lightning Mast is our premier product, offering height combinations from 5m to 20m. Its conical shape adds considerable strength and thus resistance to deflection/whipping in the wind.

It is easy to fix. In fact, the building itself can become the foundation for the mast, alleviating the need for heavy and unsightly concrete blocks and tripods.

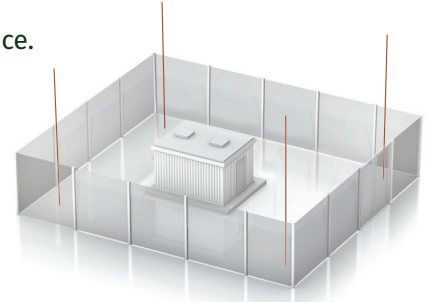
The hinged base design allows easy inspection and maintenance.

The mast can be supplied in different colours and graphics to blend in with building architecture and landscaping designs.

When aesthetics are important - this is the product for you.

Due to its composite material the Lightweight Lightning Mast is non-corrosive. This allows for a longer life than conventional metal masts. It is also an insulator, reducing touch potential problems.

The mast can also be combined with aerial wires to form part of a catenary wire system.



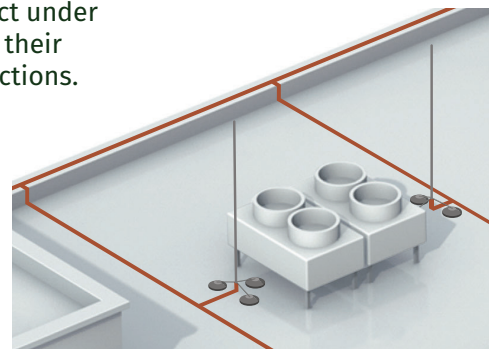
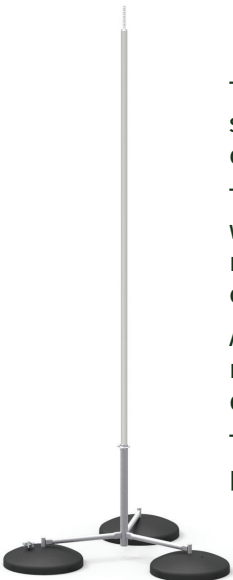
## Free-Standing Air Terminals

The top of Free-Standing Air Terminals could deflect under some wind conditions. This is due to the nature of their construction and having smaller diameter mast sections.

These terminals require to be weighted down with concrete blocks and tripod structures. This may be problematic in terms of weight loading on some roofs, particularly when retro-fitting.

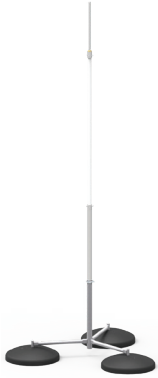
A reasonable amount of clear roof space is required to accommodate both the separation distance and tripod base.

These terminals are a simple solution to protecting roof mounted plant, when aesthetics are of less importance.



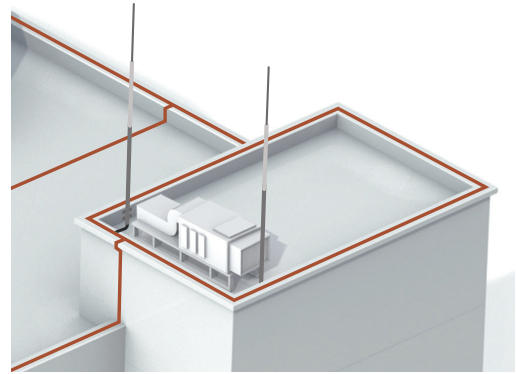
# Insulated Lightning Conductor

Insulated Lightning Conductor is ideal for use where there is insufficient roof space to install Conventional and Free-Standing Masts/Air Terminals while maintaining the required separation distance from the object being protected.



Insulated Lightning Conductor Air Terminals are constructed from:

- Aluminium interception Air Terminal/ Rod 0.5m to 1m
- GRP mast section varying from 2m to 3m for wall fixing installations and 1.5m when used with a stainless steel Mast and Base
- Stainless steel Mast section to give mast height and supporting strength
- Stainless steel Base



When used in conjunction with Kingsmill Insulated Lightning Conductor cable, the Air Terminal can be placed closer to objects that require protection. The cable simulates a separation distance of  $\leq 0.75\text{m}$  in air and  $\geq 1.5\text{m}$  in solid material.

Kingsmill Insulated Lightning Conductor cable is used for maintaining separation distance between the electrically conductive parts of the structure (to be protected) and the Lightning Protection System.

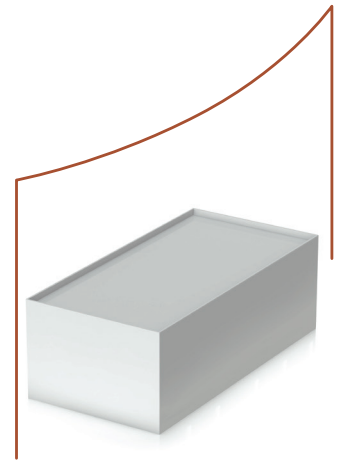


## Catenary Wire Systems

Kingsmill can offer Catenary Wire Systems and application designs.

Each system tends to be unique in terms of both material selection and protection area.

**Please contact Kingsmill sales support staff with your project requirements.**



## Isolated Systems

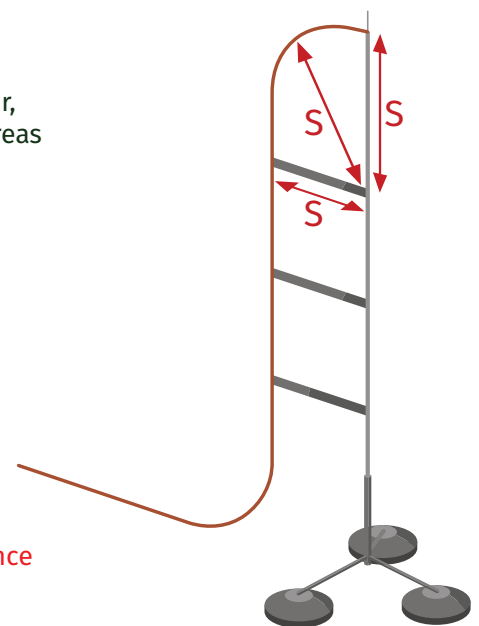
### Isolated Systems using Insulated Spacer Bars and Masts

Kingsmill can offer bespoke Isolated Lightning Protection Systems, where the Lightning Protection Conductor Network is installed in such a way that the lightning current does not come into contact with the object/structure being protected.

NOTE: such systems are designed for use with 8mm diameter conductor, due to the ability to bend such material through 360° (all planes) whereas a tape can only be bent through one plane.

*Example of an isolated system using mast and insulated bars to maintain the separation distance from the object being protected.*

S = separation distance



## Product Choice

The choice over whether a mesh of roof conductors, vertical air terminals, or fortuitous elements of the building etc are used, is dependent on the Lightning Protection Designer and the nature of the structure itself. There is no such thing as a standard Lightning Protection Kit. Each building needs to be examined in its own right and a system designed to suit that particular structure and its use or purpose.

The type of conductor used - aluminium, copper, composite or PVC covered - has a bearing on which fittings to use, as does the shape and size of the conductor. Conductors can be supplied in a rectangular and solid circular section.

### Air Terminals/Masts

Kingsmill offer a comprehensive range of Air Terminals:

- Lightweight Lightning Mast (5m to 20m in height)
- Free-standing Air Terminals (1m to 10m in height)
- Conventional Small Air Terminals (0.5m to 3m in height)
- Air terminals for use with Insulated Lightning Conductor cable (3m to 7m in height)

This give the architect, designer, contractor and client flexibility over height, as well as installed aesthetics of the system.

Each system has its features and benefits which are summarised below:

Product	Height	Aesthetics	Life span	Corrosion resistance	Ease of installation	Foundation type	Issues to consider on roof	Stability in wind	Installation / maintenance
 <p><b>Lightweight Mast</b></p>	5m - 20m	Excellent/can be customised to blend into architectural or landscape setting  ★★★★★	45+ years	Excellent  ★★★★★	Simple, quick, lightweight  ★★★★★	Direct fix to structure Direct burial Fix to foundation block	Civil contractor to cast in foundation bolts	Excellent - conical design improves strength Resists wind deflection  ★★★★★	Lowers to ground on hinged base
 <p><b>Free-standing Air Terminal</b></p>	3m - 10m	Average aesthetics  ★★★	30 - 40 years	Good  ★★★★★	Heavy, requires concrete blocks and guy wires for tall versions  ★★★	Free-standing base	Weight of concrete blocks/ tripod base and guys take up space	Subject to deflection in wind and storm conditions  ★★★	
 <p><b>Conventional small air terminals</b></p>	0.5m - 3m	Average aesthetics  ★★★★	30 - 40 years	Good  ★★★★★	Lightweight, easy fixing  ★★★★★	Small base		Can be broken if hit by an object  ★★★	
 <p><b>Air Terminals used with Insulated Lightning Conductor cable</b></p>	3m - 7m	Average aesthetics  ★★★	30 - 40 years	Good  ★★★★★	Heavy, requires concrete blocks and guys for tall versions  ★★★	Free-standing base/wall bracket mounting	Weight of concrete blocks/ tripod base takes up space	Subject to deflection in wind and storm conditions  ★★★	Reduces separation distance/useful where roof space is limited

Table AT:1. Air Terminals/Masts features comparison

**From BS:EN 62305 . . .**

The Lightning Protection Designer may need to consider the following when designing a system . . .

**Roof mesh conductor system**

BS:EN 62305 recommends the use of a protective mesh of conductors laid over the structure to be protected. This mesh can be supplemented with the use of Air Terminals. The risk assessment carried out from BS:EN 62305-2 determines both the Lightning Protection Level (LPL) and Lightning Protection Class (LPC) for a structure.

**Roof mesh spacing**

The roof mesh is spaced in accordance with guidelines contained within BS:EN 62305-3. This can be summarised below:

**Example of a roof mesh system**

Perimeter conductors should be placed close to the edge of the structure. If possible, place down conductors at each corner as well as spacing them equally around the structure.

A minimum of two down conductors is required, whether an Air Terminal, Mesh or Rolling Sphere concept is used.

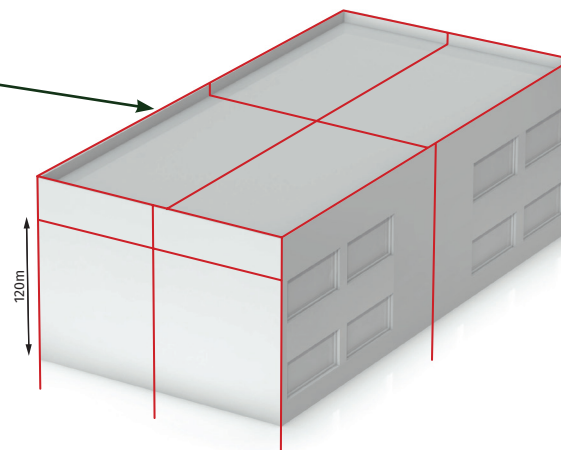
LPC	Maximum mesh size (m)	Down conductor spacing (m)
I	5 x 5	10
II	10 x 10	10
III	15 x 15	15
IV	20 x 20	20

LPC	Maximum mesh size (m)
I	5 x 5
II	10 x 10
III	15 x 15
IV	20 x 20

LPC	Down conductor spacing (m)
I	10
II	10
III	15
IV	20

LPC	Lateral conductor spacing (m)*
I + II	10
III	15
IV	20

\*Buildings over 120m height



Conductors are equally spaced - it is important to protect all exposed corners of the building.

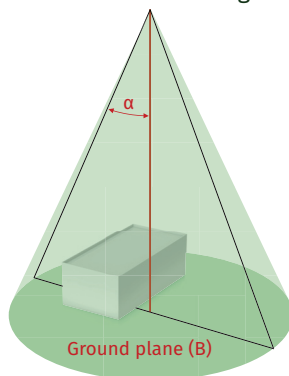
Minimum of two down conductors.

**Protective angle/zone of protection**

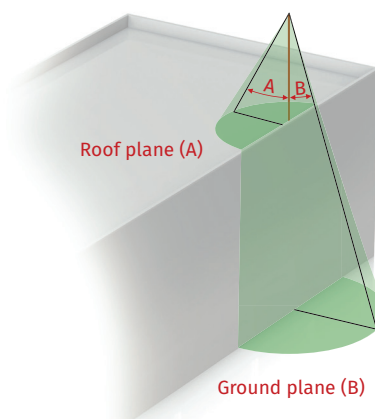
The protective angle differs according to the class of Lightning Protection System (ie I, II, III or IV) and the height of the Air Terminal above the reference plane.

Examples of how the protective angle changes with height and LPS class are shown to the right.

Height of Air Terminal above reference plane (h)	Class I		Class II		Class III		Class IV	
	Angle (deg)	Radius (m)	Angle (deg)	Radius (m)	Angle (deg)	Radius (m)	Angle (deg)	Radius (m)
3m	66.3	6.8	70.1	8.2	74.1	10.3	76.7	12.6
6m	55.9	5.9	62	11.4	67.9	15	71	17.5
12m	40.4	10.2	50.3	14.4	58.2	19.4	62.1	22.6
18m	27.1	9.3	40.6	15.4	50.3	21.5	55.2	25.9



Simple ground mounted terminal



**Roof mounted terminal**

In this circumstance there are two reference planes and angles:

**A** Roof to tip of Air Terminal

**B** Ground to tip of Air Terminal

*From BS:EN 62305 . . .*

## Rolling Sphere

The Rolling Sphere can also be used to determine protective area.

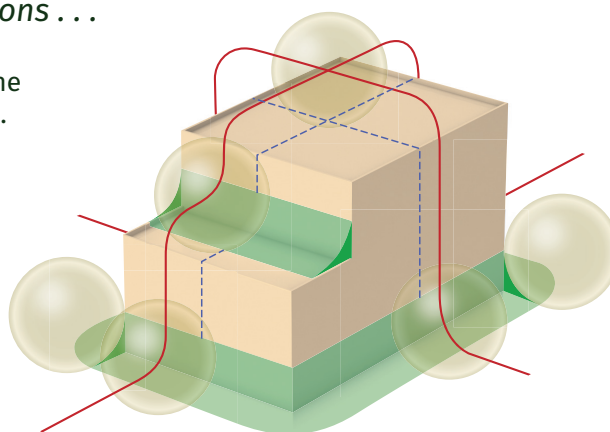
Lightning Protection Class	Radius of rolling sphere
I	20m
II	30m
III	45m
IV	60m

*Some examples of Rolling Sphere applications . . .*

The sphere is rolled all over the structure. Where the sphere touches the building, protection is required.

This protection is usually in the form of a mesh system of conductors.

- Centre line of sphere
- - - Protection required where the sphere touches the structure

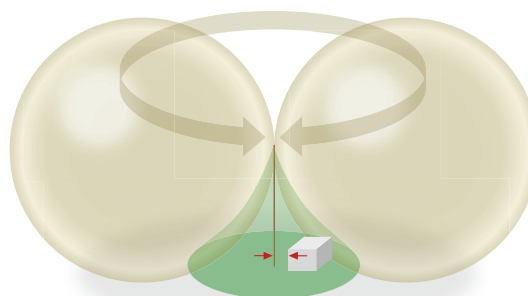


Buildings over 60m in height should have both lateral (side) and roof conductors installed.

Spacing of conductors would still conform to the tables on page AT:9.

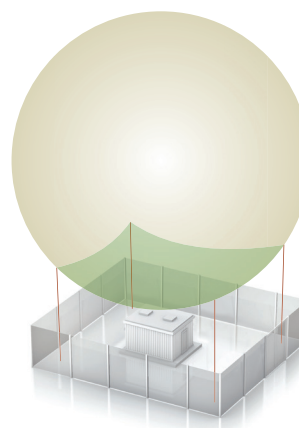
**When used in conjunction with a Lightning Mast . . .**

*The object being protected must be contained within the green protected area.*



**When used in conjunction with several Lightning Masts . . .**

*A separation distance needs to be maintained between the top of the object being protected and the bottom of the sphere.*



*From BS:EN 62305 . . .*

## Separation Distance

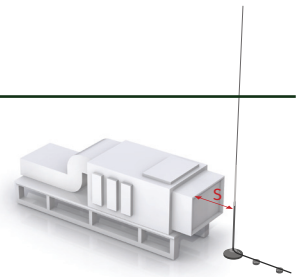
All metallic parts of a structure, electrical equipment and their supply cables should be incorporated into the Lightning Protection Design. This prevents dangerous 'side flashing' (or sparking) between the Lightning Protection Network and the conductive parts of the structure/building to be protected.

Where adequate separation exists between the Lightning Protection System and the conductive parts of the structure, side-flashing is considerably reduced.

*Some examples of achieving separation distance using Air Terminals are:*

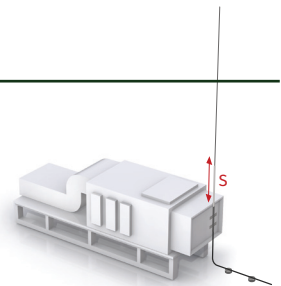
### Fixed or Free-Standing Masts

Maintaining the appropriate separation distance when there is plenty of roof space available to site masts.



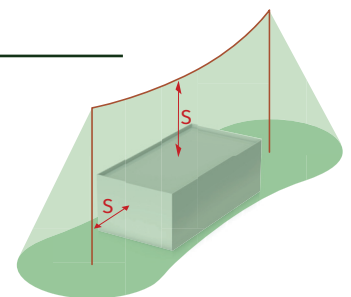
### Insulated Lightning Conductor

Using the Insulated Lightning Conductor system to simulate separation distance where the lack of space dictates that the Lightning Protection system must pass close to, or be connected to, the object to be protected.



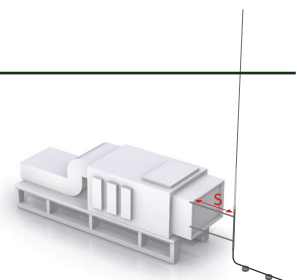
### Suspended Catenary Wires

Where space allows the use of an isolated system, for example a series of masts and catenary wires.



### Insulated Separation Bars

Where it is not possible, due to space constraints, to use a tripod mast, but it is possible to connect one end of an insulated spacer bar to the object to be protected, and the other to the lightning conductor/mast.



**S = separation distance**

# Wind Loading

It is important that the Interception Mast/Air Terminal has minimum wind deflection and that the mast can withstand both constant and gusting winds.

## UK Wind Speed Map

The following map approximately indicates mean hourly wind speeds and actual velocity. However, it must be noted that wind speeds change with altitude, location and height above ground.

With this in mind, it is important to consider local wind conditions when designing a Lightning Protection System.

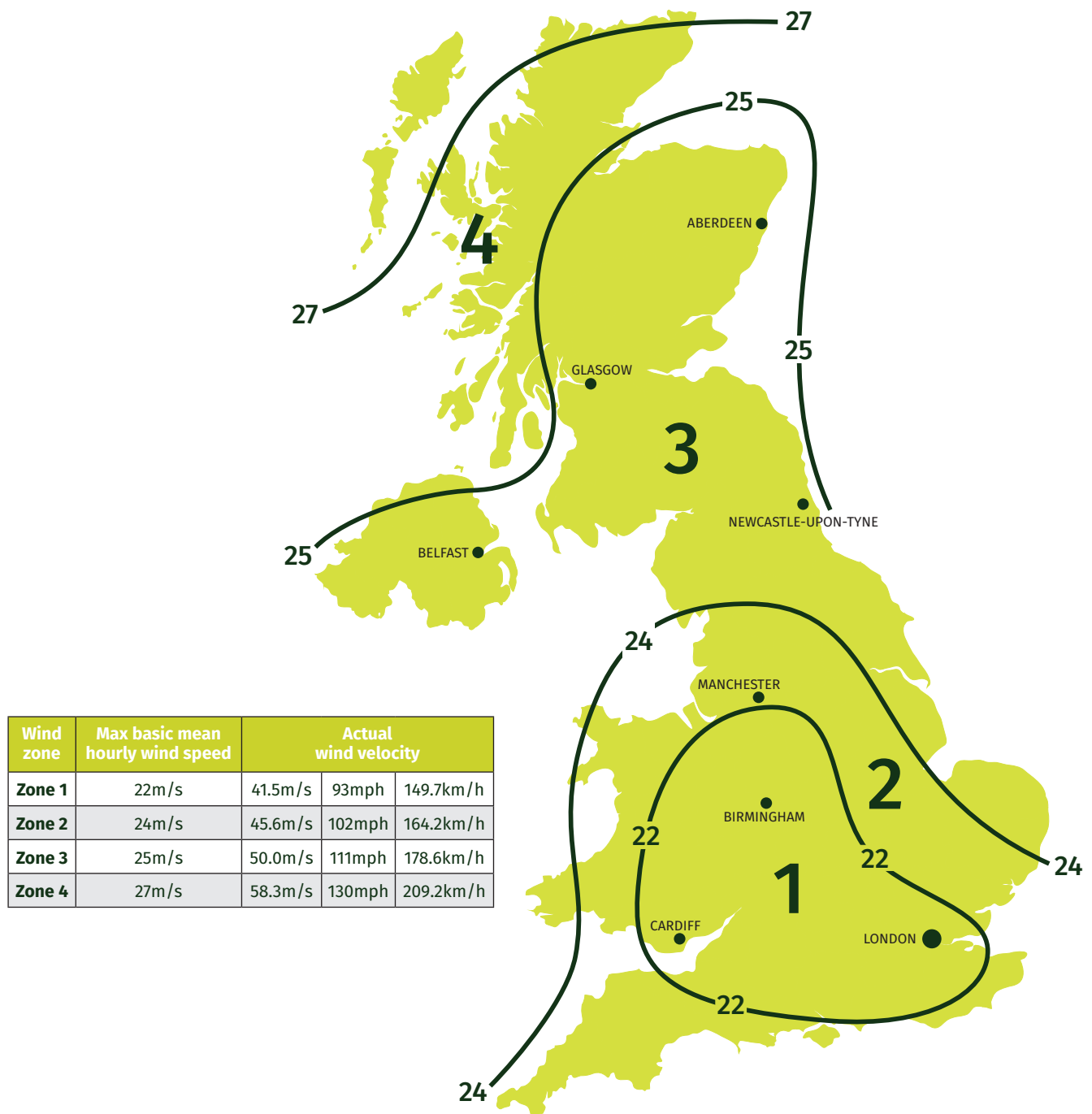


Figure AT:1 - UK wind speed map



## Wind Loading (continued)

Lightning Interception Mast selection must take into account wind loading. Air Terminals are often installed in exposed places - tops of buildings and open terrain. Therefore they must be capable of withstanding local wind conditions.

In order to calculate wind loading conditions, the following information is required:

- Location and/or coordinates
- Average wind speed
- Gusting wind speed
- Terrain category

On the right is a copy of our questionnaire relating to calculating wind loading conditions for our Lightweight Lightning Masts.

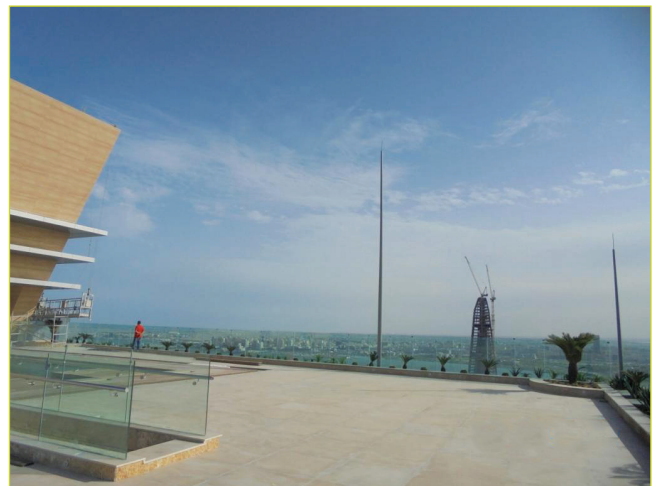


Figure AT:2 - Lightweight Lightning Mast installation in Qatar

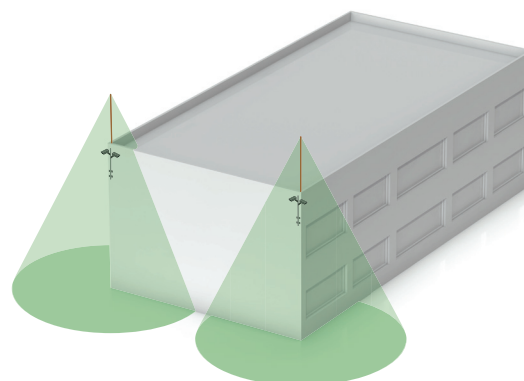
# Conventional Air Terminals

The Kingsmill range covers:

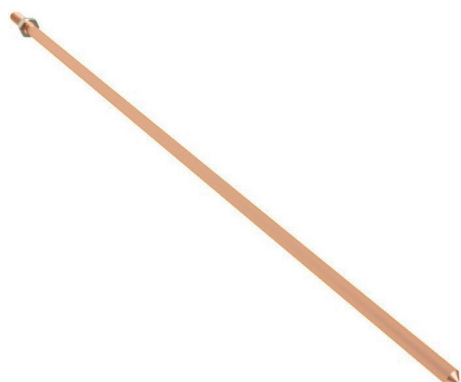
- Air Terminals
- Multi-Points
- Strike Pads
- Heavy duty wall mounting and hinged base masts

The products are available in copper and aluminium.

Air Terminals are used by the designer to solve protection problems for equipment such as cameras, roof mounted plant etc.



## Air Terminals



Kingsmill **Copper Air Terminals** are designed to be used with either the standard Air Terminal Base, Multi-Purpose Base or the Side Mounted Brackets. Threads are rolled for high strength.

### Copper

ROD LENGTH (mm)	SHANK DIA (mm)	THREAD DIA (mm)	MATERIAL	WEIGHT (kg)	PART NO.
500	8.9	10	Copper	0.33	ATCR1005
1000	8.9	10	Copper	0.65	ATCR1010
500	14.2	16	Copper	0.75	ATCR1605
1000	14.2	16	Copper	1.50	ATCR1610
1500	14.2	16	Copper	2.25	ATCR1615
2000	14.2	16	Copper	3.00	ATCR1620
2500	14.2	16	Copper	3.75	ATCR1625
3000	14.2	16	Copper	4.50	ATCR1630

**Material:** Copper

**Standard:** BS:EN 62561-2

Kingsmill **Aluminium Air Terminals** are designed to be used with either the standard Air Terminal Base, Multi-Purpose Base or the Side Mounted Brackets. Threads are cut.

### Aluminium

ROD LENGTH (mm)	SHANK DIA (mm)	THREAD DIA (mm)	MATERIAL	WEIGHT (kg)	PART NO.
500	10	10	Aluminium	0.11	ATAR1005
1000	10	10	Aluminium	0.20	ATAR1010
500	16	16	Aluminium	0.29	ATAR1605
1000	16	16	Aluminium	0.58	ATAR1610
1500	16	16	Aluminium	0.87	ATAR1615
2000	16	16	Aluminium	1.16	ATAR1620
2500	16	16	Aluminium	1.45	ATAR1625
3000	16	16	Aluminium	1.74	ATAR1630

**Material:** Aluminium

**Standard:** BS:EN 62561-2

**APPLICATION**

**COMPONENT ASSEMBLY:**

Kingsmill **Air Terminals** can be used with a selection of bases.  
*Never mix aluminium and copper parts.*

## Elevation Rods

Kingsmill **Copper Elevation Rods** are designed to be used with either the standard Air Terminal Base, Multi-Purpose Base or the Side Mounted Brackets and the Multi-Point Air Terminal. Threads are rolled for high strength.

### Copper

ROD LENGTH (mm)	SHANK DIA (mm)	THREAD DIA (mm)	MATERIAL	WEIGHT (kg)	PART No.
500	14.2	16	Copper	0.75	CELV1605
1000	14.2	16	Copper	1.50	CELV1610
1500	14.2	16	Copper	2.25	CELV1615
2000	14.2	16	Copper	3.0	CELV1620
2500	14.2	16	Copper	3.75	CELV1625
3000	14.2	16	Copper	4.50	CELV1630

**Material:** Copper

**Standard:** BS:EN 62561-2



Kingsmill **Aluminium Elevation Rods** are designed to be used with either the standard Air Terminal Base, Multi-Purpose Base or the Side Mounted Brackets and the Multi-Point Air Terminal. Threads are cut.

### Aluminium

ROD LENGTH (mm)	SHANK DIA (mm)	THREAD DIA (mm)	MATERIAL	WEIGHT (kg)	PART No.
500	16	16	Aluminium	0.30	AELV1605
1000	16	16	Aluminium	0.59	AELV1610
1500	16	16	Aluminium	0.88	AELV1615
2000	16	16	Aluminium	1.17	AELV1620
2500	16	16	Aluminium	1.46	AELV1625
3000	16	16	Aluminium	1.74	AELV1630

**Material:** Aluminium

**Standard:** BS:EN 62561-2

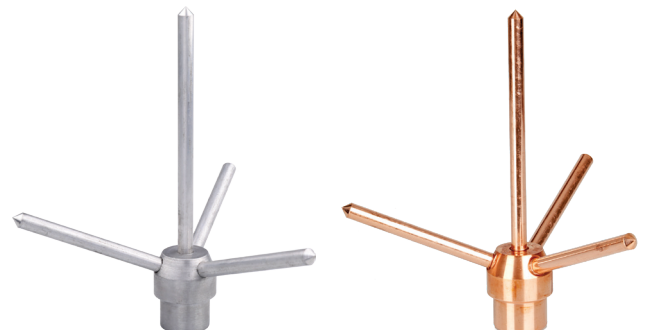
## Multi Points

Kingsmill **Multi Points** are designed to be used with the Kingsmill **Elevation Rod**.

THREAD DIAMETER (mm)	MATERIAL	WEIGHT (kg)	PART No.
16	Copper	0.54	MPAT
16	Aluminium	0.14	MPATA

**Material:** Copper/aluminium

**Standard:** BS:EN 62561-2

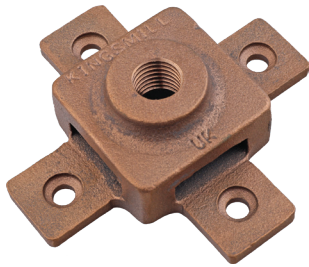


**APPLICATION**

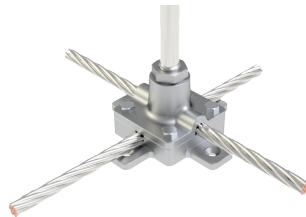
**COMPONENT ASSEMBLY:** Multi Points + Elevation Rod (page AT:15) + Air Terminal Base (page AT:16) = Multi Point Air Terminal

Kingsmill **Multi Points** can be used with a variety of base/material options but must be used in conjunction with **Threaded Elevation Rods**.

## Air Terminal Bases



CATBxx - Tape



Kingsmill **Air Terminal Bases** are designed to be used with the Kingsmill **Air Terminals** and **Elevation Rods**.

THREAD DIA (mm)	CONDUCTOR SIZE (mm)	MATERIAL	WEIGHT (kg)	PART NO.
16	25	Copper	0.50	CATB16
16	25	Aluminium	0.17	AATB16
10	8 or 25 x 3	Aluminium	0.15	AATB10
16	31 x 6	Copper	0.50	CATB316
16	50mm <sup>2</sup>	Copper	0.80	CATB50
16	70mm <sup>2</sup>	Copper	0.75	CATB70
16	95mm <sup>2</sup>	Copper	0.90	CATB95

**Material:** Gunmetal/aluminium

**Standard:** BS:EN 62561-1, Class H



### FIXINGS

4 x CSK 1½ x No.10 woodscrew  
(BCSW1.5-10 brass for copper/  
A2CSKSLT1.5-10 stainless steel for  
aluminium) + plug (PP10) not included



SEE FIXINGS

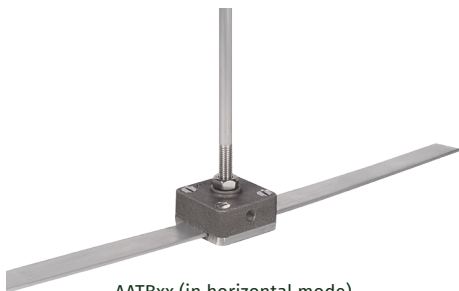
SECTION - PAGE FIX:4



CATBxx - Stranded Conductor



CATBxx - Stranded Conductor



AATBxx (in horizontal mode)  
- Solid Circular or Tape



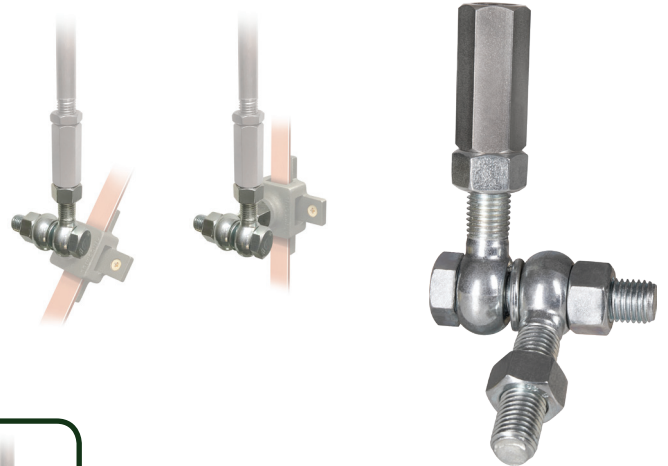
AATBxx (in vertical mode)  
- Solid Circular or Tape

### Air Terminal Pivoting Adapter

Kingsmill **Air Terminal Pivoting Adapters** can move through 180° to align the Air Terminal into the desired plane. They are suitable for M16 thread copper and aluminium Air Terminals.

THREAD DIAMETER	MATERIAL	WEIGHT (kg)	PART No.
M16	Stainless Steel	0.611	ATPBA16

**Material:** Stainless Steel  
**Standard:** BS:EN 62561-1, Class H



**APPLICATION**

**COMPONENT ASSEMBLY:**  
 Air Terminal (page AT:14) + Air Terminal Base (page AT:16) + Rod to Tape Coupling = Air Terminal Pivoting Adapter

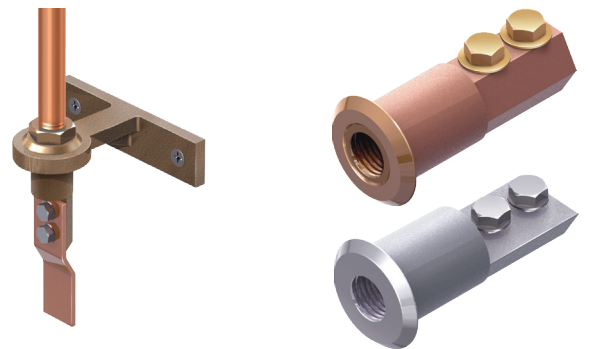
**Air Terminal Pivoting Adapters** are to be used in conjunction with Air Terminals and Air Terminal Bases. They can move through 180°.

### Rod to Tape Couplers

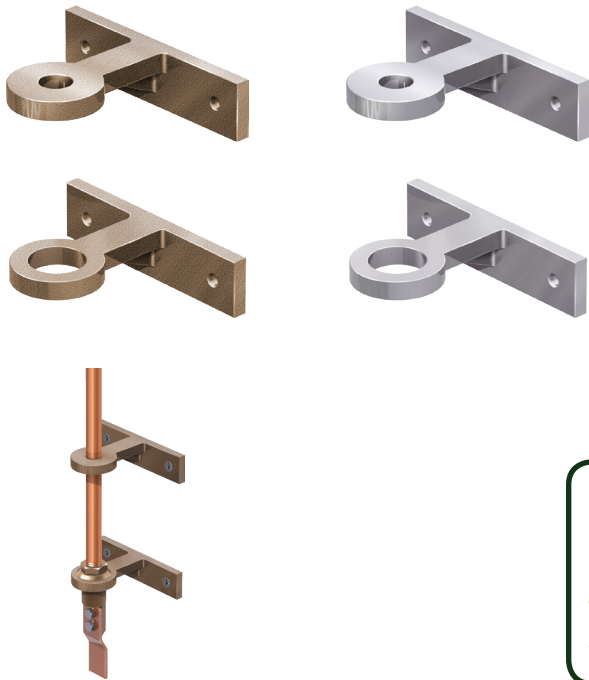
Kingsmill **Rod To Tape Couplers** are used in conjunction with **Side Mounted Brackets**.

THREAD DIA (mm)	CONDUCTOR SIZE (mm)	MATERIAL	WEIGHT (kg)	PART No.
16	25 x 3	Gunmetal	0.23	RBCC16
16	25 x 3	Aluminium	0.08	RBCA16
16	8	Gunmetal	0.25	RBCC08

**Material:** Gunmetal/aluminium  
**Standard:** BS:EN 62561-1, Class H



## Side Mounted Rod Brackets



Kingsmill **Side Mounted Rod Brackets** are designed to be installed to the side of the building where it is not possible to fit a conventional Air Terminal Base. **Side Mounted Rod Brackets** are sold as a set of two.

ROD DIAMETER (mm)	MATERIAL	QUANTITY	WEIGHT (kg)	PART NO.
16	Gunmetal	2	0.91	RBC16
16	Aluminium	2	0.29	RBA16

**Material:** Gunmetal/aluminium



### FIXINGS

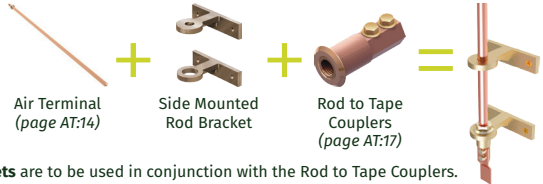
4 x CSK 1½ x No.10 woodscrew  
(BCSW1.5-10 brass for copper/  
A2CSKSLT1.5-10 stainless steel for  
aluminium) + plug (PP10) not included



**SEE FIXINGS SECTION - PAGE FIX:4**

### APPLICATION

#### COMPONENT ASSEMBLY:



**Side Mounted Rod Brackets** are to be used in conjunction with the Rod to Tape Couplers. Never mix aluminium and copper parts.

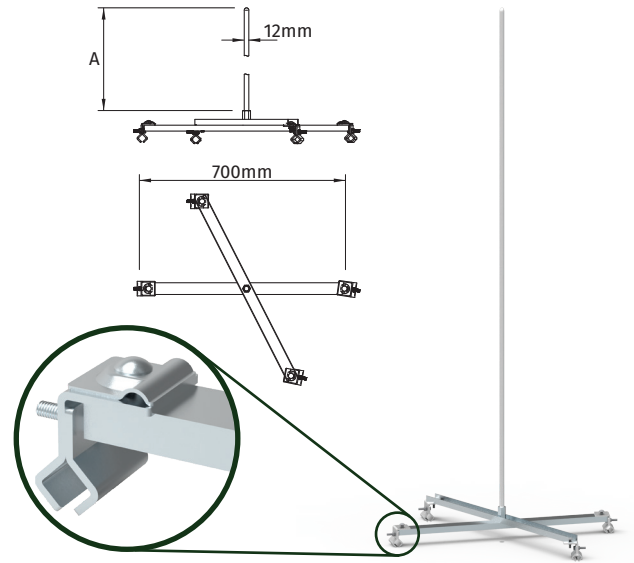


### Standing Seam Roof Air Terminal and Base

Kingsmill **Standing Seam Roof Air Terminals and Bases** are used with Standing Seam type roofing sheets. They are suitable for use with 8mm diameter aluminium conductors. Connection is by means of a clamp on the mast leg (*shown below*).

ROD LENGTH (A) (mm)	ROD DIAMETER (mm)	CONDUCTOR DIA + MATERIAL	WEIGHT (kg)	PART No.
1000	12	8mm Aluminium	0.23	KM97121009
2000	12	8mm Aluminium	0.08	KM97122009

**Material:** Aluminium Air Terminal/Zinc Plated Steel Base



## Ridge Tile Air Terminal (single bracket)

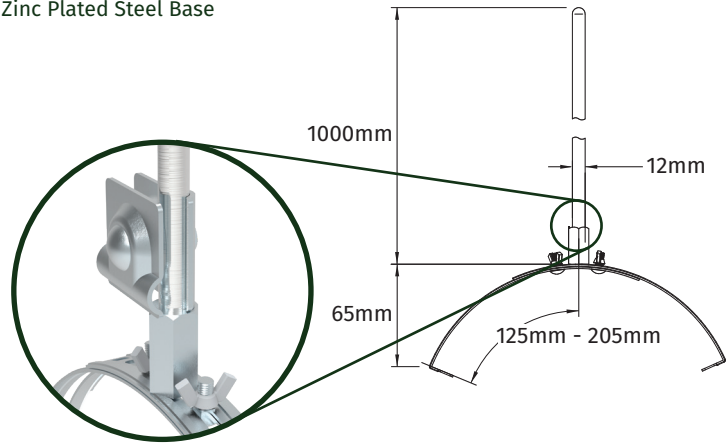


Kingsmill **Ridge Tile Air Terminals (single bracket)** are for use with 8mm diameter aluminium conductors.

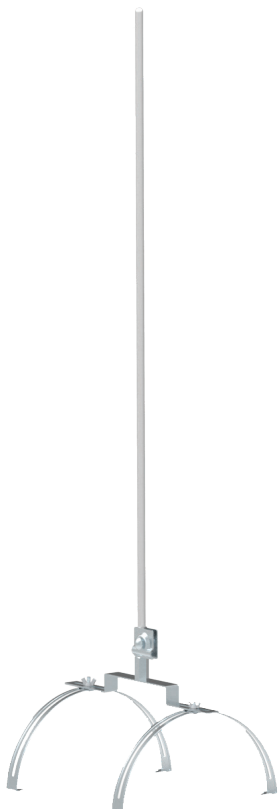
Connection of Conductor to Air Terminal is by means of a galvanised steel clamp (*shown below*).

ROD DIAMETER (mm)	TERMINAL HEIGHT (mm)	CONDUCTOR DIAMETER + MATERIAL	DEPTH (mm)	TILE DIAMETER (mm)	WEIGHT (kg)	PART NO.
12	1000	8mm Aluminium	65	125 - 205	0.6	KM97111009

**Material:** Aluminium/Zinc Plated Steel Base



## Ridge Tile Air Terminal (double bracket)

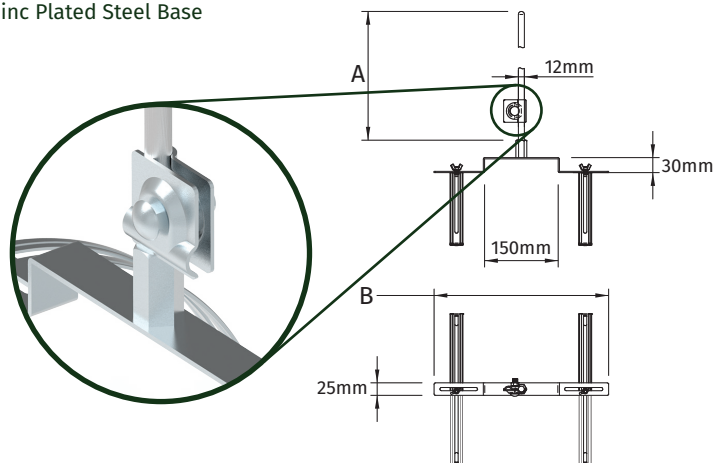


Kingsmill **Ridge Tile Air Terminals (double bracket)** are for use with 8mm diameter aluminium conductors.

Connection of Conductor to Air Terminal is by means of a galvanised steel clamp (*shown below*).

ROD DIAMETER (mm)	TERMINAL HEIGHT (A) (mm)	CONDUCTOR	TILE WIDTH (mm)	WEIGHT (kg)	PART NO.
12	1000	8mm Aluminium	36	0.9	KM97101009
12	1500	8mm Aluminium	350	KM97101509	

**Material:** Aluminium/Zinc Plated Steel Base

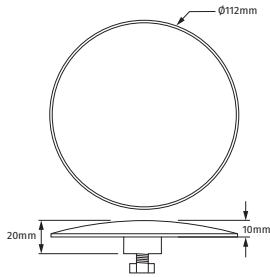


### Strike Pads

Kingsmill **Strike Pads** are ideal for use at roof level in car parks or for protection of building sides on structures over 60m high.

MATERIAL	WEIGHT (kg)	PART No.
Copper	0.41	CSP1
Aluminium	0.13	ASP1
Stand-off bracket (copper to suit CSP1)	0.08	CSP1B
Stand-off bracket (stainless steel to suit ASP1)	0.07	ASP1B

**Material:** Copper/Aluminium

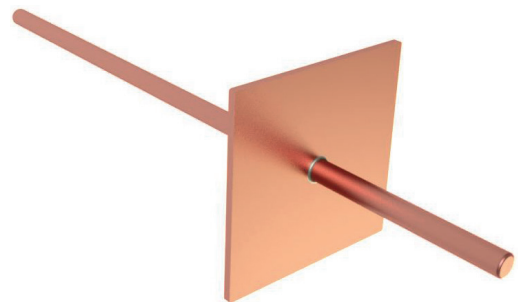
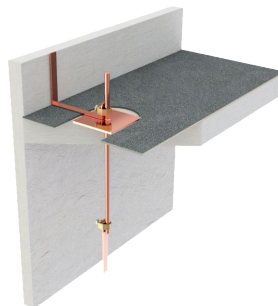


### Puddle Flanges

Kingsmill **Puddle Flanges** are designed to take lightning conductors through surfaces such as roofing.

NOMINAL DIMENSIONS (mm)	MATERIAL	WEIGHT (kg)	PART No.
150 x 150 x 625	Copper	1.54	CPF
150 x 150 x 625	Aluminium	0.50	APF

**Material:** Copper to BS:EN 13601  
Aluminium to BS:EN 755-5

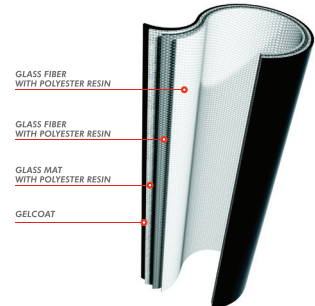


# Heavy Duty GRP Air Terminal Masts

Kingsmill can manufacture special masts for applications where resilience to mechanical damage and vandalism is paramount, whilst still maintaining a pleasant aesthetic appearance.

Kingsmill bring innovation to lightning protection through the introduction of easy to install Heavy Duty GRP Air Terminal Masts.

Suited to projects using the “protective angle” or “rolling sphere” methods for determining zones of protection.



## Wall Mounted Heavy Duty GRP Air Terminal Masts



Kingsmill **Heavy Duty Wall Mounted GRP Air Terminal Masts** are manufactured from white GRP and are supplied with brackets. They are suitable for use with aluminium or copper **Air Terminals** of 0.5m and 1.0m heights. Standard Air Terminal height = 0.5m.

**Air Terminals and conductors are not included. These must be specified at the time of quotation/order.**

MAST HEIGHT (excluding Air Terminal) (mm)	MAST DIA. (mm)	WEIGHT (kg)	PART NO.
1000	65	1.92	KMHDATM10
2000	65	3.84	KMHDATM20
3000	65	5.76	KMHDATM30
4000	65	7.68	KMHDATM40
5000	65	9.60	KMHDATM50

**Material:** Mast - GRP / Bracket - Galvanised Steel

**APPLICATION**

**COMPONENT ASSEMBLY:** GRP Air Terminal Mast + Air Terminal Assembly + Conductor = Final Product

Combine Kingsmill **Wall Mounted Heavy Duty GRP Air Terminal Masts** with 500mm copper or aluminium **Air Terminals** (see above) and any compatible **Conductors** from our extensive range (see *Conductor* section).

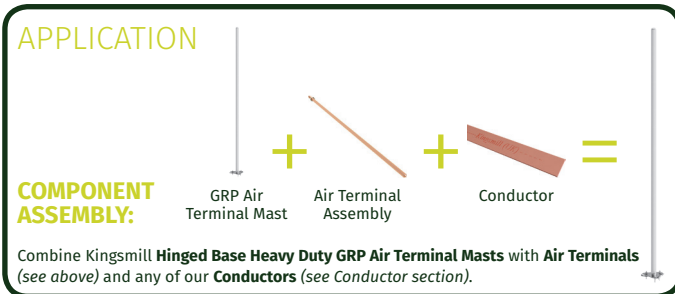
## Hinged Base Heavy Duty GRP Air Terminal Masts

Kingsmill **Flange Base Heavy Duty GRP Air Terminal Masts** are suitable for use with 14.2mm diameter Air Terminals. They are white and suitable for use with aluminium or copper Air Terminals of 0.5m and 1.0m heights. Standard Air Terminal height = 0.5m.

**Air Terminals and conductors are not included. These must be specified at the time of quotation/order.**

MAST HEIGHT (excluding Air Terminal) (mm)	MAST DIA. (mm)	WEIGHT (kg)	PART NO.
1000	65	6.92	KMFBHDATM10
2000	65	8.84	KMFBHDATM20
3000	65	10.76	KMFBHDATM30
4000	65	12.68	KMFBHDATM40
5000	65	14.60	KMFBHDATM50

**Material:** Mast - GRP / Bracket - Galvanised Steel

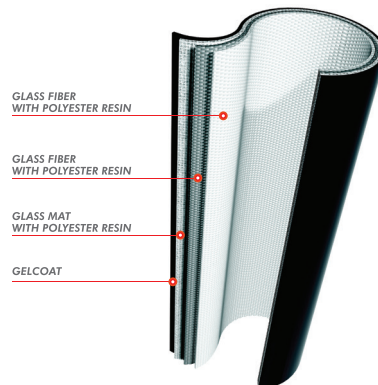


# Lightweight Lightning Mast

Kingsmill bring innovation to lightning protection through the introduction of an easy to install, aesthetically pleasing Lightweight Lightning Mast.

Suited to projects using the “protective angle” or “rolling sphere” methods for determining zones of protection.

The conical design brings greater strength, wind loading capability and minimal wind deflection.



## Aesthetics

### Single mast:

No unsightly guy wires or supports.

### Colours:

Three standard colours (see below). Other colours available subject to RAL code.

### Patterns:

It is possible to add a pattern to the mast, for example camouflage.

## Ease of installation

- Lightweight
- Quick and easy to install
- Reduced installation time
- Hinged base option to facilitate easy testing and inspection
- Three mounting options:
  - direct burial
  - hinged
  - free-standing base

## Durability

- Composite high strength material
- Corrosion resistant
- UV protected
- Vandal resistant (mechanical damage and graffiti)
- The composite mast itself does not cause interference for radio, microwaves etc.

## Safety

- Glass-polyester composite construction - an insulating material that helps reduce touch potential
- The mast does not absorb energy in the event of a vehicular collision

## Product Selection

Wind loading and location of the masts are key elements in determining the type and size of foundation/base that can be used. Therefore it is important that Kingsmill carry out calculations to verify the correct foundation selection.

## Flexibility of Selection

Our Lightweight Lightning Mast can be customised to customer requirements.

It allows the user flexibility to choose either aluminium or copper Air Terminals and Conductor. Users can also select one or two down-conductors as well as vary the cross-sectional area.

There are three standard colours to choose from:

- White
- Pebble Grey (RAL 7032)
- Kingsmill Grey (RAL 7042)



... but we can offer other colours as well as customer specific pattern and graphic effects.





## Range and Part Number Selection

The standard mast is designed for a basic wind speed of  $v = 22\text{m/s}$ . Stronger masts are available on request.

Ordering codes are made up from combinations of the following data:

Basic mast part number + Colour code + Foundation code + Conductor material + Number and type of conductors + Height and material of air terminal

Kingsmill **Lightweight Lightning Masts** are supplied with 16mm x 500mm copper Air Terminals and one or two 25mm x 3mm copper or aluminium Down Conductors (can supply 8mm conductor on request).

**Standard mast sizes are outlined in the tables below:**

*NOTE: Air Terminals and Conductors are not included. Please specify these for quotation/order. Standard Air Terminal height = 0.5m. Available in copper and aluminium.*

**Root mounting/Direct burial in ground Masts** (part no. without Conductor and Air Terminal assembly)

BASIC MAST PART NUMBER	HEIGHT ABOVE GROUND (m)	HEIGHT INCLUDING AIR TERMINAL (m)	POLE DIAMETER AT BASE (mm)	NO. OF MAST SECTIONS	WEIGHT (kg)
KMLM5500	5	5.5	120	1	9
KMLM6500	6	6.5	120	1	10
KMLM7500	7	7.5	120	1	11
KMLM8500	8	8.5	120	1	14
KMLM9500	9	9.5	120	1	16
KMLM10500	10	10.5	140	1	23
KMLM11500	11	11.5	140	1	26
KMLM12500	12	12.5	140	1	29
KMLM13500	13	13.5	175	2	70
KMLM14500	14	14.5	175	2	85
KMLM15500	15	15.5	175	2	100
KMLM16500	16	16.5	175	2	115
KMLM17500	17	17.5	175	2	123
KMLM18500	18	18.5	175	2	138
KMLM19500	19	19.5	200	2	148
KMLM20500	20	20.5	200	2	154

**Hinged base Masts** (part no. without Conductor and Air Terminal assembly)

BASIC MAST PART NUMBER	HEIGHT ABOVE GROUND (m)	HEIGHT INCLUDING AIR TERMINAL (m)	POLE DIAMETER AT BASE (mm)	NO. OF MAST SECTIONS	HINGE BASE TYPE	WEIGHT (kg)
KMLMHB5500	5	5.5	120	1	Triangular	22
KMLMHB6500	6	6.5	120	1	Triangular	23
KMLMHB7500	7	7.5	120	1	Triangular	25
KMLMHB8500	8	8.5	120	1	Triangular	26
KMLMHB9500	9	9.5	120	1	Triangular	27
KMLMHB10500	10	10.5	140	1	Triangular	34
KMLMHB11500	11	11.5	140	1	Triangular	38
KMLMHB12500	12	12.5	140	1	Triangular	40
KMLMHB13500	13	13.5	175	2	Square	112
KMLMHB14500	14	14.5	175	2	Square	127
KMLMHB15500	15	15.5	175	2	Square	139
KMLMHB16500	16	16.5	175	2	Square	150
KMLMHB17500	17	17.5	175	2	Square	162
KMLMHB18500	18	18.5	175	2	Square	175
KMLMHB19500	19	19.5	200	2	Circular	203
KMLMHB20500	20	20.5	200	2	Circular	209
KMLMHB21500	21	21.5	200	2	Circular	222
KMLMHB22500	22	22.5	200	2	Circular	236

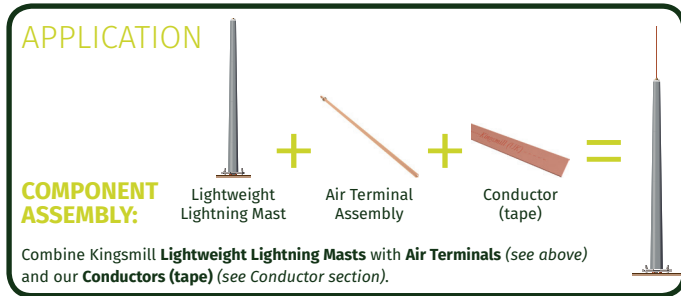


## Foundation Types

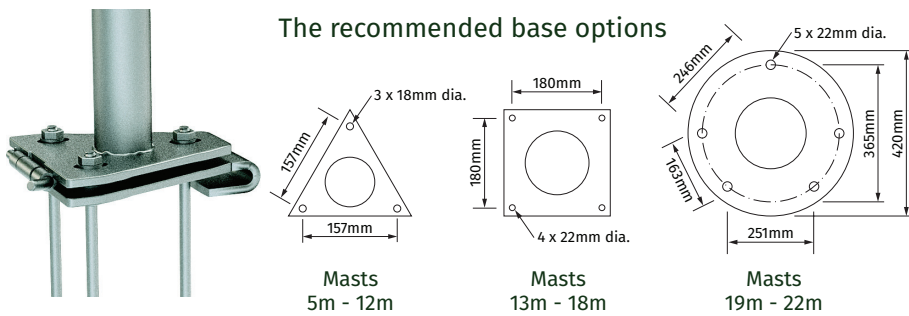
Dependent upon wind-loading and location, the Kingsmill Lightning Mast can be fixed to a concrete foundation, fixed to structural steelwork or set into the ground.

**The type of base offered is dependent on wind-loading and other operational conditions.**

*The recommended base option is hinged and used in conjunction with a concrete foundation or directly fixed/incorporated to the structure.*



## Hinged Bases



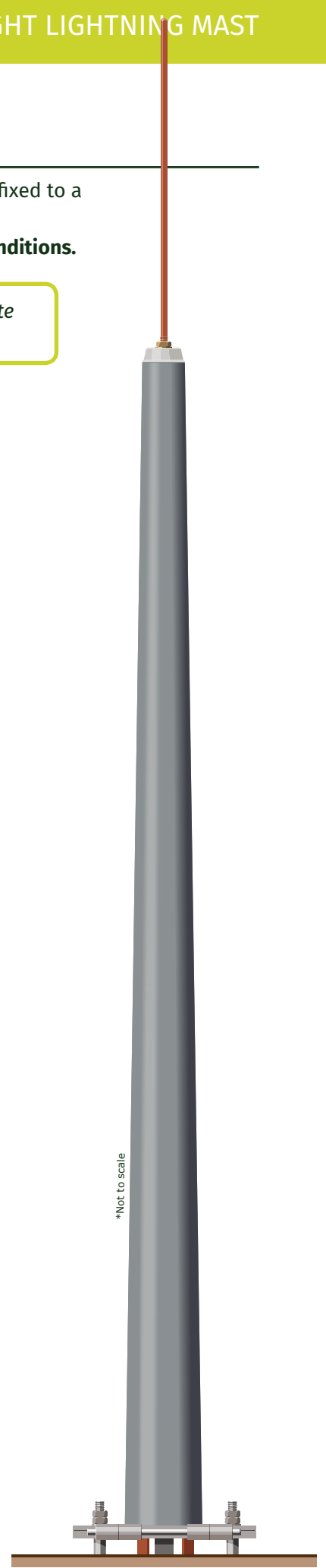
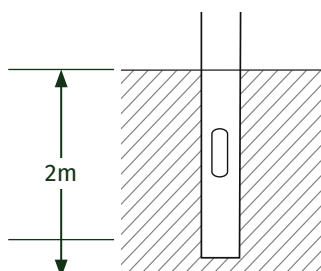
## Free-Standing

Free-Standing Bases are not available for all mast height/wind loading conditions - please contact Kingsmill for advice.



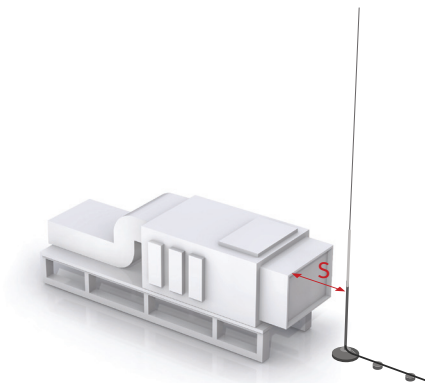
## Direct Burial (root mounted/direct in the ground)

When the foundation required is by direct burial in the ground, please refer to the part number where the foundation type is "Direct In Ground".



# Free-Standing Interception Masts/Air Terminals

The Kingsmill range of Free-Standing Interception Masts/Air Terminals are suited to the protection of roof mounted plant, for example chillers, solar panels etc.



Used where there is sufficient roof space to maintain the appropriate separation distance between the mast and the object being protected.

S = separation distance



Figure AT:3 - Free-standing Air Terminals installed with 8mm diameter aluminium conductor

## Free-Standing Air Terminals (1m - 4m)

Free-Standing Air Terminals (1m - 4m) are suitable for wind speeds of 24-27m/s, 86.4-169.2km/h, 53.7-105.1mph

TOTAL HEIGHT (A) (mm)	MOUNTING BLOCK DIAMETER (B) (mm)	MOUNTING BLOCKS WEIGHT (kg)	ASSEMBLY WEIGHT (kg)	PART NO.
1000	345	20.0	22.0	KM94341009
2000	345	20.0	22.6	KM94342009
3000	500	40.0	43.6	KM94343009
4000	500	40.0	44.0	KM94344009

Each **Free-Standing Air Terminal (1m - 4m)** is manufactured from 16mm diameter aluminium and supplied with a **Stainless Steel Stabiliser** and a **Concrete Mounting Block** incorporating a **Mast to Roof Conductor Connector**.

### Concrete Mounting Block

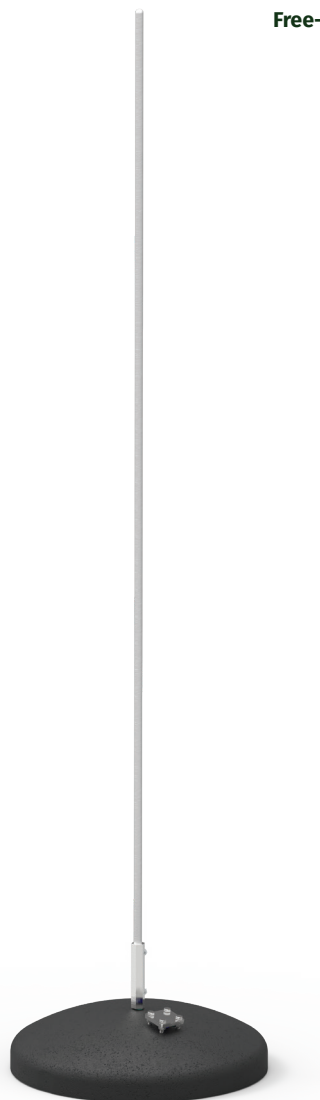
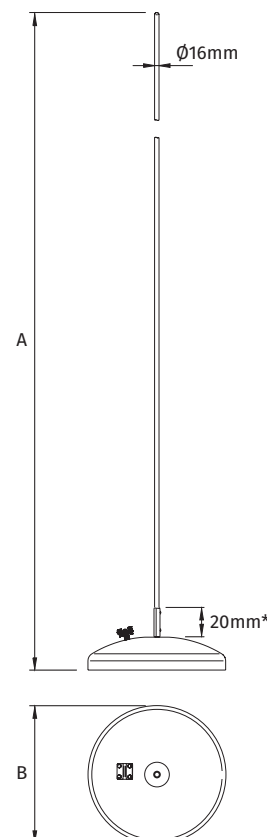
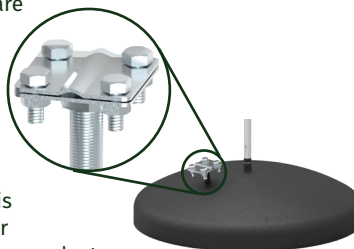
The Air Terminal is supplied complete with a round **Concrete Mounting Block** incorporating the **Mast to Roof Conductor Connector** for connection from the Air Terminal to the roof Conductor.

**Concrete Mounting Blocks** are a combination of concrete and a bitumastic compound to protect against wet weather conditions.

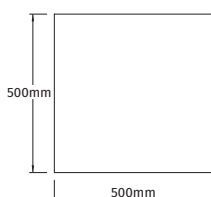
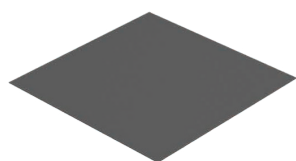
The stainless steel **Mast to Roof Conductor Connector** is suitable for either copper or aluminium 8mm or 25 x 3mm conductors.

*\*Optional stabiliser, 2500mm to 4000mm Air Terminals only.*

Kingsmill recommend the use of a square membrane **Roof Protection Pad** under each concrete block (*not included in the above set – see part number KM94308221, below*). The membrane helps protect the waterproof roof covering from mechanical damage.



## Roof Protection Pad



Roof Protection Pads fit underneath the mast mounting blocks to prevent damage to the roof surface from the bare Concrete Mounting Block.

DESCRIPTION	WEIGHT (kg)	PART NO.
Membrane Support Square Plate for Concrete Base	0.30	KM94308221

**Material:** Polymer Membrane

## Free-Standing Air Terminals (4m - 8m)

Free-Standing Air Terminals (4m - 8m) are suitable for wind speeds of 24-27m/s, 86.4-169.2km/h, 53.7-105.1mph

TOTAL MAST HEIGHT (A) (mm)	ALUMINIUM AIR TERMINAL LENGTH (mm)	STAINLESS STEEL MAST AND TRIPOD BASE HEIGHT (B) (mm)	ASSEMBLY WEIGHT (kg)	PART NO.
4000	200	640	138	KM96504005
5000	200	640	139	KM96505005
6000	200	640	140	KM96506005
7000	200	640	141	KM96507005
8000	2000	6000	145	KM96538005

Each Free-Standing Air Terminal (4m - 8m) comprises:

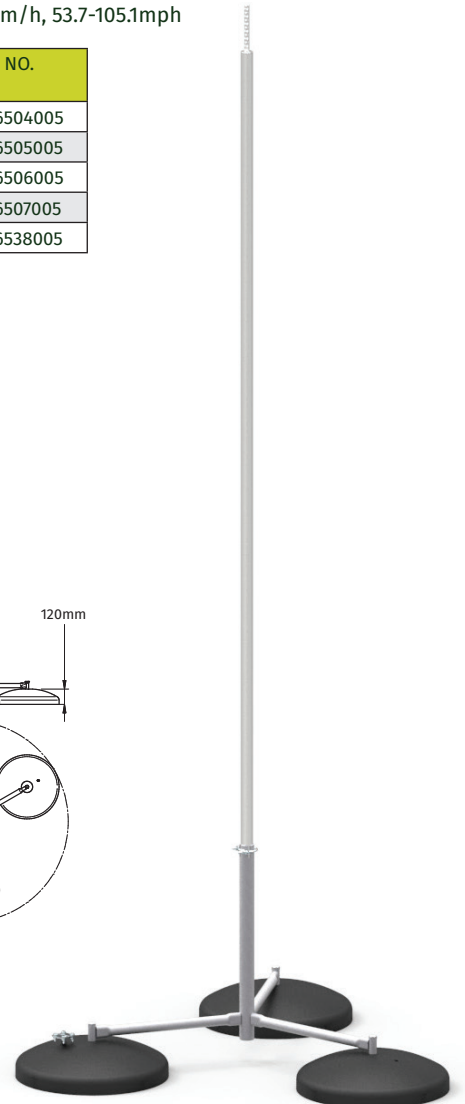
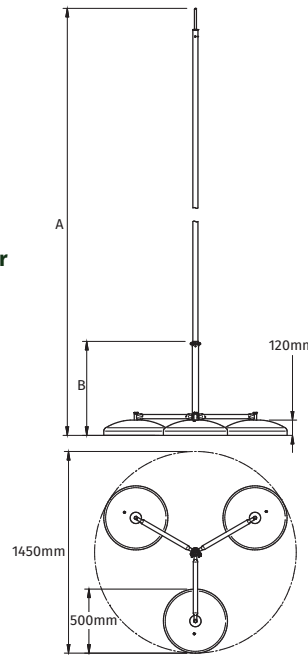
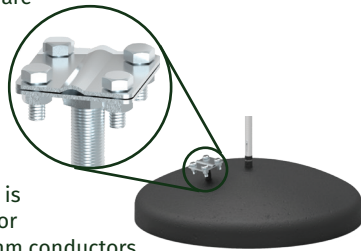
- 1 x 16mm diameter aluminium Air Terminal
- 2 x 40mm diameter stainless steel Mast and Tripod Bases
- 3 x 40kg Concrete Mounting Blocks and
- 1 x Mast to Roof Conductor Connector.

### Concrete Mounting Block

The Air Terminal is supplied complete with three round Concrete Mounting Blocks incorporating a Mast to Roof Conductor Connector for connection from the Air Terminal to the roof Conductor.

Concrete Mounting Blocks are a combination of concrete and a bitumastic compound to protect against wet weather conditions.

The stainless steel Mast to Roof Conductor Connector is suitable for either copper or aluminium 8mm or 25 x 3mm conductors.



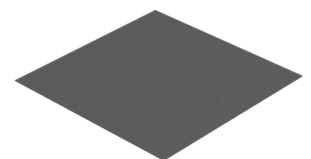
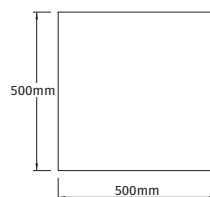
Kingsmill recommend the use of a square membrane Roof Protection Pad under each concrete block (not included in the above set – see part number KM94308221, below). The membrane helps protect the waterproof roof covering from mechanical damage.

## Roof Protection Pad

Roof Protection Pads fit underneath the mast mounting blocks to prevent damage to the roof surface from the bare Concrete Mounting Block.

DESCRIPTION	WEIGHT (kg)	PART NO.
Membrane Support Square Plate for Concrete Base	0.30	KM94308221

Material: Polymer Membrane



## Free-Standing Air Terminals (8m - 10m)

**Free-Standing Air Terminals (8m - 10m)** are suitable for wind speeds of 24-27m/s, 86.4-169.2km/h, 53.7-105.1mph

TOTAL MAST HEIGHT (mm)	ALUMINIUM AIR TERMINAL LENGTH (A) (mm)	STAINLESS STEEL SECTION HEIGHTS		ASSEMBLY WEIGHT (kg)	PART NO.
		(B) (mm)	(C) (mm)		
8000	1765	6235	4280	220kg	KM96508005
9000	2265	6735	4280	230kg	KM96509005
10000	2700	7300	5000	240kg	KM96501005

Each **Free-Standing Air Terminal (8m - 10m)** comprises:

- 1 x 16mm diameter aluminium **Air Terminal**
- 1 x 25mm diameter stainless steel guyed **Mast**
- 1 x 40mm diameter stainless steel guyed **Mast**
- 1 x Stainless steel **Fivepod Base**
- 5 x 40kg **Concrete Mounting Blocks** and
- 1 x **Mast to Roof Conductor Connector**.

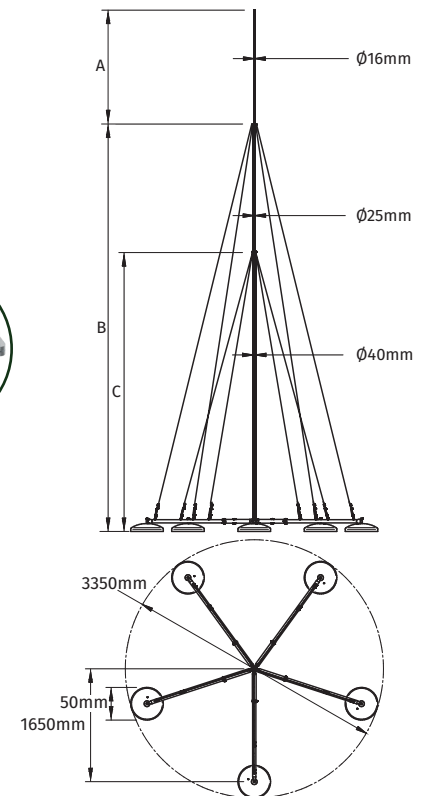
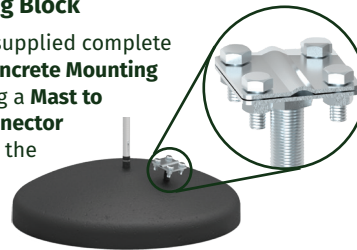
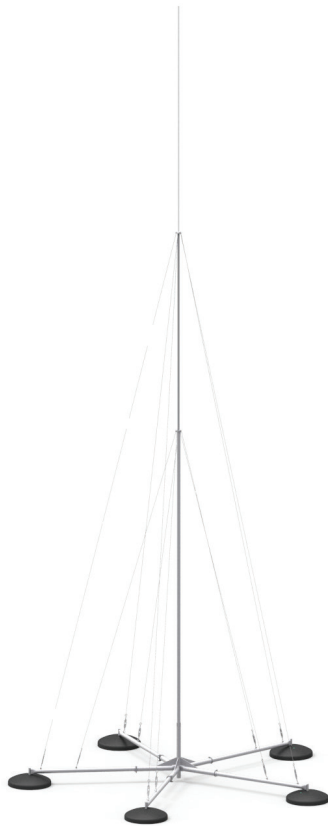
### Concrete Mounting Block

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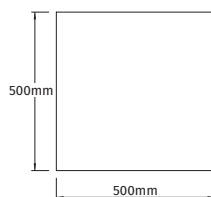
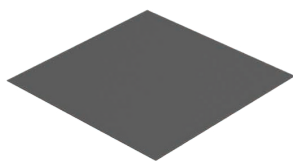
**Concrete Mounting Blocks** are a combination of concrete and a bitumastic compound to protect against wet weather conditions.

The stainless steel **Mast to Roof Conductor Connector** is suitable for either copper or aluminium 8mm or 25 x 3mm conductors.

Kingsmill recommend the use of a square membrane **Roof Protection Pad** under each concrete block (not included in the above set – see part number KM94308221, below). The membrane helps protect the waterproof roof covering from mechanical damage.



## Roof Protection Pad



Roof Protection Pads fit underneath the mast mounting blocks to prevent damage to the roof surface from the bare Concrete Mounting Block.

DESCRIPTION	WEIGHT (kg)	PART NO.
Membrane Support Square Plate for Concrete Base	0.30	KM94308221

**Material:** Polymer Membrane

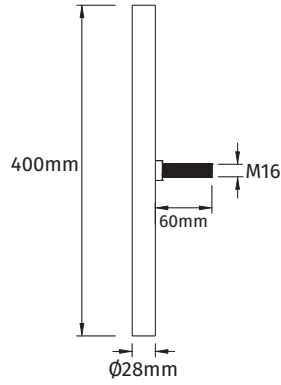


### Concrete Base Carrying Handle

For use by two operatives for the safe lifting of 40kg blocks.

DESCRIPTION	WEIGHT (kg)	PART NO.
Carrying Handle for safe handling of Concrete Mounting Blocks	0.60	KM98500101

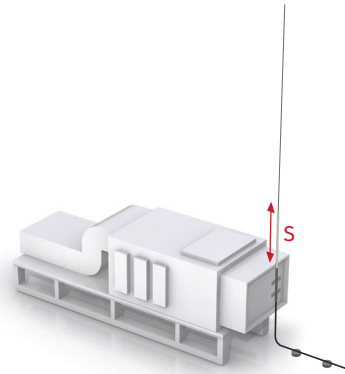
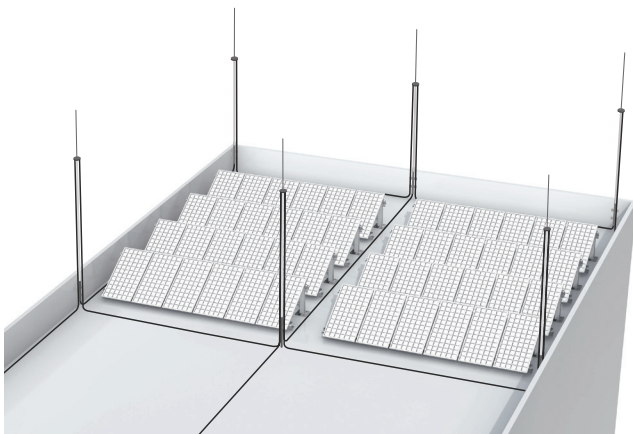
**Material:** Galvanised Steel



## Interception Masts/Air Terminals used with Insulated Lightning Conductor Cable

The Interception Masts/Air Terminals in this section are specially designed to be used with the Kingsmill Insulated Lightning Conductor.

This system is ideal where space is in limited supply. Through using Insulated Lightning Conductor, the Air Terminal can be placed closer to the object to be protected - for example, roof-mounted plant or solar PV panels.



S = separation distance

Used with objects where there is no possibility to maintain separation distance, due either to lack of sufficient space or simply for aesthetic reasons.

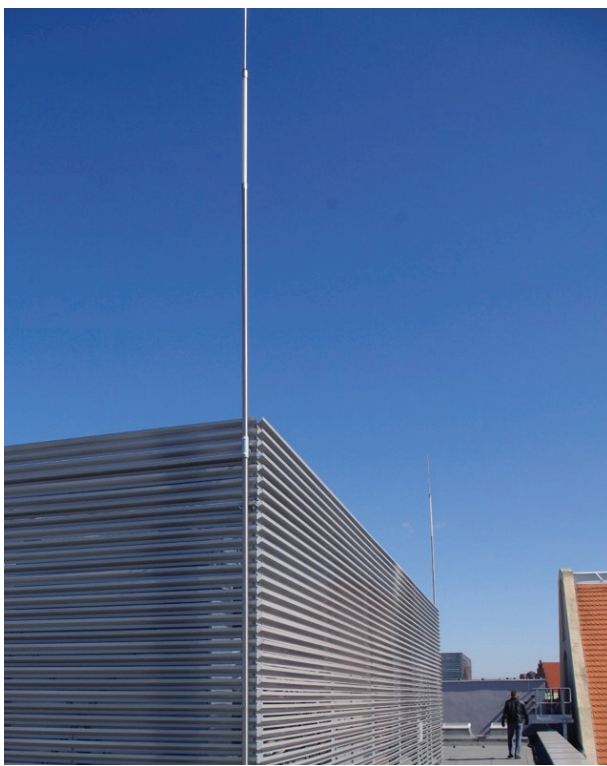


Figure AT:4 - Ideal for use with plant screens

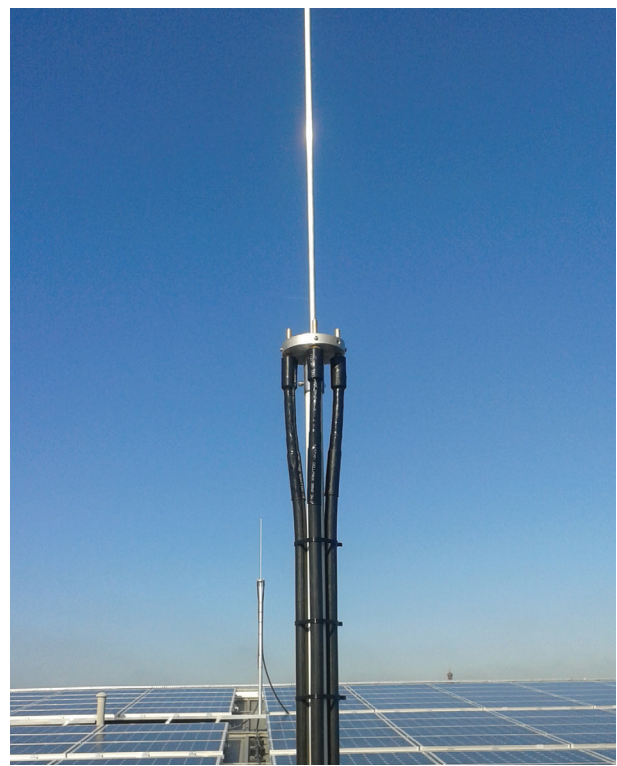
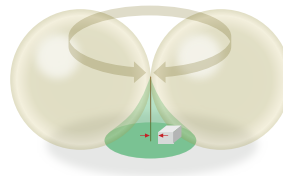


Figure AT:5 - Can be used with solar arrays

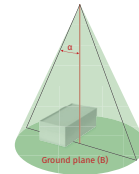
The cable simulates a separation distance of  $\leq 0.75\text{m}$  in air and  $\geq 1.5\text{m}$  in solid material and is used for maintaining the separation distance between the electrically conductive parts of the structure (to be protected) and the lightning protection system. Thus reducing flash over from the lightning protection system to exposed metallic and electrical structures - for example, air handling units, solar PV arrays, etc.

### Protective Angle

The protective area of the air terminal is determined by the rules contained within BS:EN 62305 part 3 – “protective angle” method of protection.



Example 1



Example 2

The minimum separation distance between the object being protected and the Lightning Protection System, is calculated according to the formulae for separation distances, given in BS:EN 62305 part 3.

The insulated cable does not have to replace the entire Lightning Protection down conductor, it can be connected to the conventional Lightning Protection System (Air Termination and Down Conductor network).

The cable should be connected to the rest of the roof mesh (bare or PVC covered conductor) not less than 1.5m away from the object being protected.

The separation distance (where there is sufficient space to permit) can be increased by installing the Air Terminal on a free-standing mast and moving it further away from the object being protected. If 1m (in air) is required, move the mast 0.25m away ( $0.25\text{m} + 0.75\text{m}$  simulated separation distance = 1.0m).

*(The cable can also be run adjacent to conductive parts of the structure, as illustrated below.)*

The cable has a tested arresting capacity of 100kA lightning surge current (1.2/50 $\mu\text{s}$ ).

The cable is flexible and thus ideally suited for routing in external or confined areas, roofs, walls or embedded in concrete.

Bending radius of the cable is 280mm.

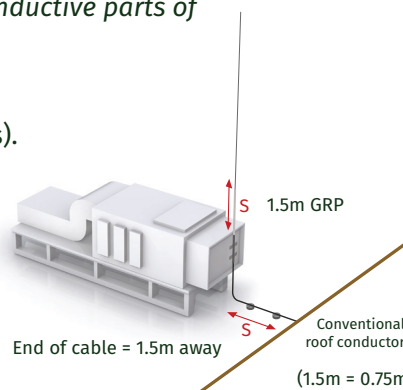


Figure AT:6 - Pitched roof with PV arrays

S = separation distance

### Notes on maximum conductor length

In cases where the separation distance required is greater than 0.75m, the use of additional cables is recommended to effectively reduce the separation distance. Such reduction (utilising additional cables) can only take place when the distance between the cables is not less than 0.2m. This distance (0.2m), minimises the interaction between the magnetic fields of the cables.

If however, the cables are run next to each other and less than 0.2m apart, the addition of an extra cable does not reduce either the separation distance or the maximum length of cable.

The values expressed in the table (right), are valid for all types of A and B electrodes, provided that the difference in resistance of an individual electrode is less than or equal to 2.

Should the installation require longer cables than indicated in the table, then we recommend that you contact us to provide detailed design advice and options.

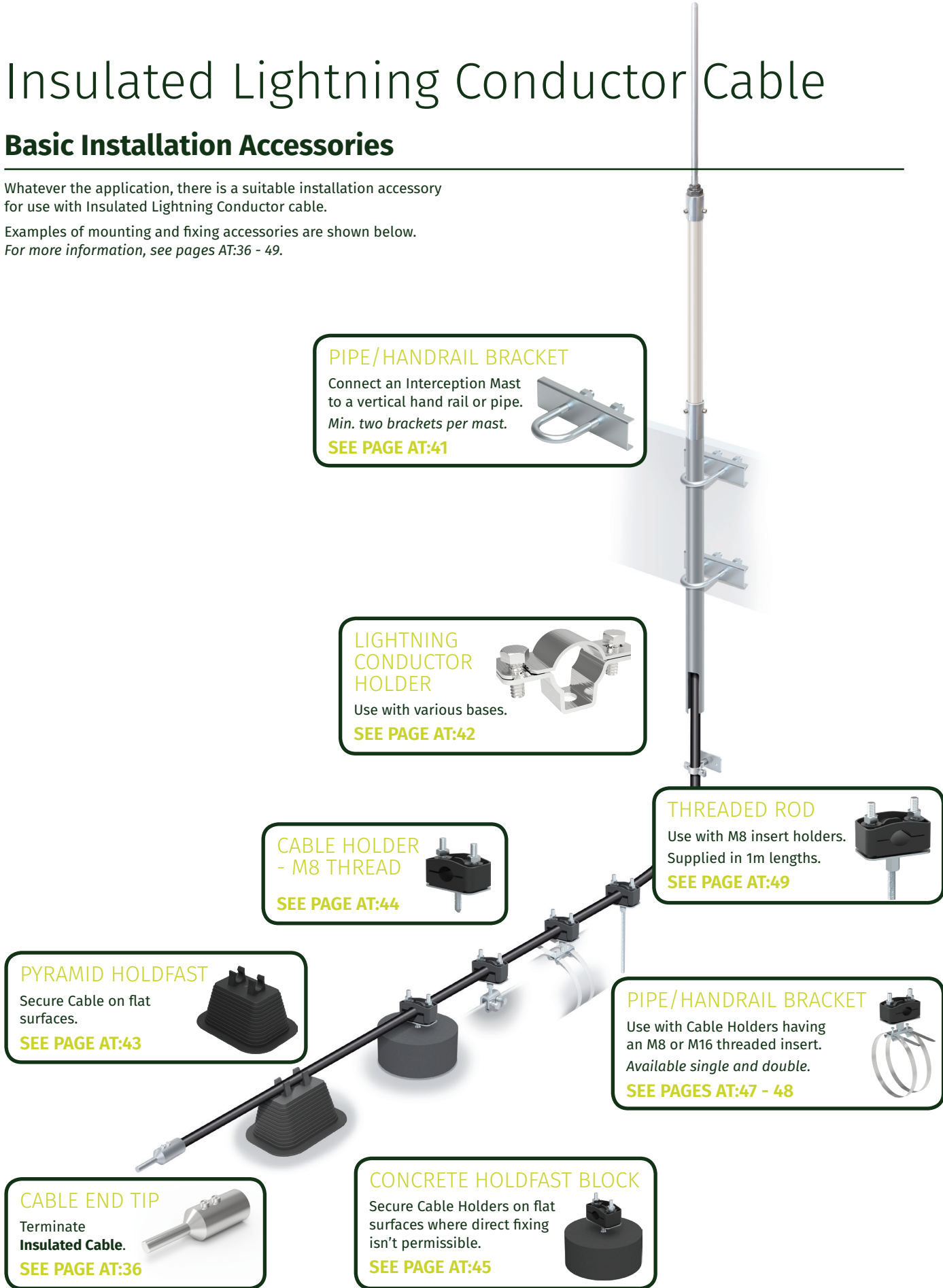
NUMBER OF CABLES	LIGHTNING PROTECTION CLASS		
	I	II	III + IV
1	-	12.50m	18.75m
2	14.20m	18.94m	28.40m
3 and more	21.30m	28.40m	42.61m

# Insulated Lightning Conductor Cable

## Basic Installation Accessories

Whatever the application, there is a suitable installation accessory for use with Insulated Lightning Conductor cable.

Examples of mounting and fixing accessories are shown below.  
For more information, see pages AT:36 - 49.



**PIPE/HANDRAIL BRACKET**  
Connect an Interception Mast to a vertical hand rail or pipe.  
*Min. two brackets per mast.*  
**SEE PAGE AT:41**

**LIGHTNING CONDUCTOR HOLDER**  
Use with various bases.  
**SEE PAGE AT:42**

**CABLE HOLDER - M8 THREAD**  
**SEE PAGE AT:44**

**THREADED ROD**  
Use with M8 insert holders.  
Supplied in 1m lengths.  
**SEE PAGE AT:49**

**PYRAMID HOLDFAST**  
Secure Cable on flat surfaces.  
**SEE PAGE AT:43**

**PIPE/HANDRAIL BRACKET**  
Use with Cable Holders having an M8 or M16 threaded insert.  
*Available single and double.*  
**SEE PAGES AT:47 - 48**

**CABLE END TIP**  
Terminate Insulated Cable.  
**SEE PAGE AT:36**

**CONCRETE HOLDFAST BLOCK**  
Secure Cable Holders on flat surfaces where direct fixing isn't permissible.  
**SEE PAGE AT:45**

Figure AT:6 - Example of an Insulated Lightning Conductor Cable installation showing various accessories

# Insulated Lightning Conductor Cable

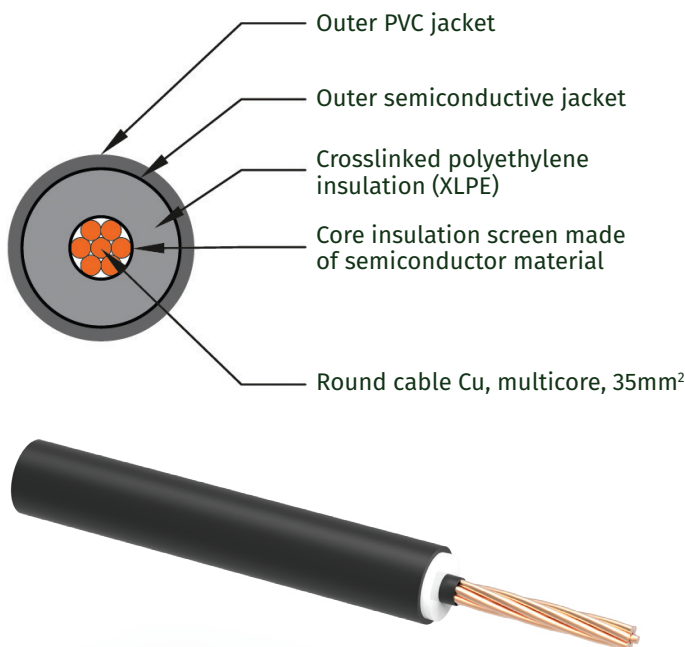
Kingsmill **Insulated Lightning Conductor Cable** is used for maintaining the separation distance between electrically conductive parts of the structure to be protected and the Lightning Protection System and is in accordance with IEC EN 62305-3.

Used for equivalent separation distances of  $\leq 0.75\text{m}$  in air and  $\leq 1.5\text{m}$  in solid material.

**Insulated Lightning Conductor Cable** is flame-resistant in accordance with IEC EN 60332-1-2, its twisted copper core, is surrounded by insulation layers of meshed cross-linked polyethylene (XLPE) and the ageing-resistant polyvinyl chloride (PVC) sheath. The cable is flexible and ideally suited for routing in external areas, roofs, walls and embedding in concrete.

Kingsmill **Insulated Lightning Conductor Cable** system has a tested arresting capacity of 100kA lightning surge current (1.2/50 $\mu\text{s}$ ).

The cable meets the requirements of IEC EN 62561-1.



Insulated Lightning Conductor Cable	
Part Number	KM30000199
Colour	Black
The outer diameter	23.4mm
Cross-section of the cable core	35mm <sup>2</sup>
Maximum conductor resistance at 20°C	0.524 $\Omega$ /km
Equivalent of separation distance for air	750mm
Equivalent of separation distance for regular building materials	1500mm
Cable weight	0.735kg/m
Operating temperature range	From -30°C to 70°C
Assembly temperature range	From -5°C to 40°C
Minimum bending radius	About 280mm
Cable flammability	Not spreading flame
Flammability test	PN-EN 60332-1-2; IEC 60332-1
Bending radius	280mm

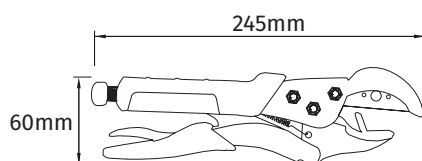
Can be used with standard connection accessories for 8mm size conductor.

**Insulated Lightning Conductor Cable** can be used in conjunction with the **Air Terminals** outlined on pages AT:38 - 40. It can also be used in applications where it is not possible to maintain the separation distance between down conductors and the structure being protected, for example, running close to photovoltaic array panels.

## Insulated Lightning Conductor Cable Scissors

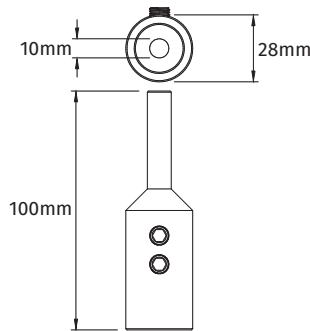
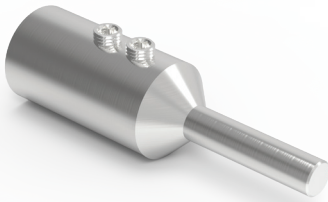
Use Kingsmill **Insulated Lightning Conductor Cable Scissors** to strip insulation from the cable to enable installation of **Insulated Lightning Conductor Cable End Tips**.

DESCRIPTION	PART NO.
Cable Scissors	KM31400101





## Insulated Lightning Conductor Cable End Tip



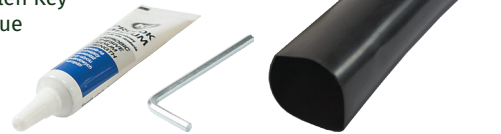
Use to terminate **Insulated Lightning Conductor Cable** for secure installation in **Cable Connectors** (below) and **Clamps** (see *Fittings* section).

SOCKET SCREWS	WEIGHT (kg)	PART NO.
2 x M8 x 8	0.30	KM30100105

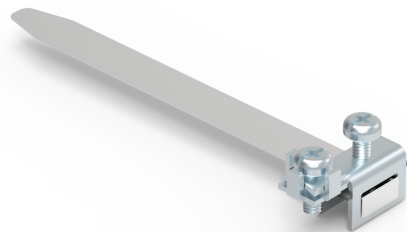
**Material:** Stainless Steel

Sold as a kit comprising:

- Cable End Tip
- Heat Shrink Tubing
- Allen Key
- Glue

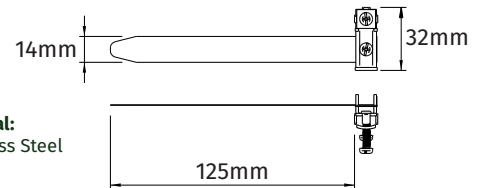


## Equipotential Bonding Strap



For equipotential connections to pipe work.

DESCRIPTION	WEIGHT (kg)	PART NO.
Equipotential bonding strap	0.04	KM96440105



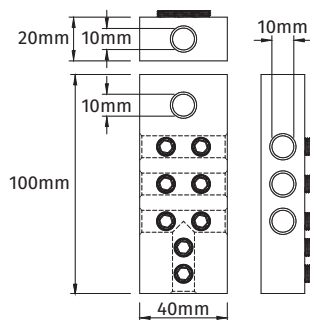
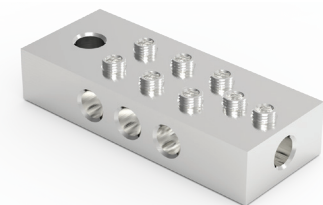
**Material:** Stainless Steel

**There can be an electromagnetic field around the cable despite its insulation.**

Although the cable is insulated, the electromagnetic field cannot be completely isolated. By using the Equipotential Bonding Strap we ensure that the voltage charge is kept within tolerable limits.

The connection from equipotential bond to earth should be by the shortest route, preferably connected to an equipotential bonding bar, building reinforcing (if connected to a foundation electrode) or to the housings of securely earthed metal elements. This connection can be via 3.5mm<sup>2</sup> cable.

## Insulated Lightning Conductor Cable Connector



For connecting several Insulated Lightning Conductor cables together at the end of the cable run.

Used outside the separation distance area.

MATERIAL	SOCKET SCREWS	WEIGHT (kg)	PART NO.
Stainless steel	8 x M8 x 8	0.54	KM31300105

**Material:** Stainless Steel



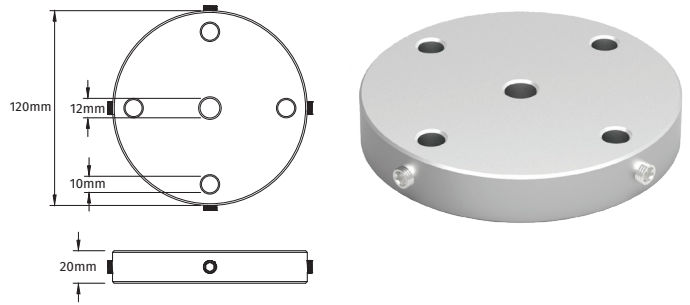


## Insulated Lightning Conductor Cable Connection Ring

The **Connection Ring** connects several cables to the Air Terminal Mast, where more than one cable is required to meet separation distance requirements. The **Connection Ring** is fixed at the top of the Interception Mast (over the aluminium Air Rod section).

SOCKET SCREWS	WEIGHT (kg)	PART NO.
4 x M8 x 8mm	0.60	KM31500109

**Material:** Aluminium



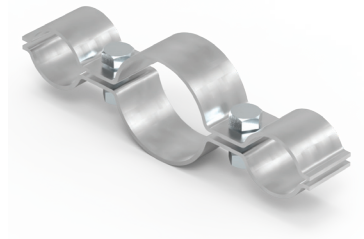
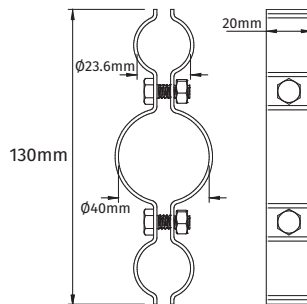
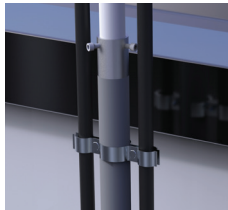
## Insulated Lightning Conductor Cable Holder

For use with multiple cables on a mast.

The Kingsmill **Interception Air Rod Cable Holder** holds two Insulated Lightning Conductor cables on either side of the Interception Mast - in cases where more than one conductor is used.

SOCKET SCREWS	WEIGHT (kg)	PART NO.
2 x M6 x 16	0.10	KM30900105

**Material:** Stainless Steel

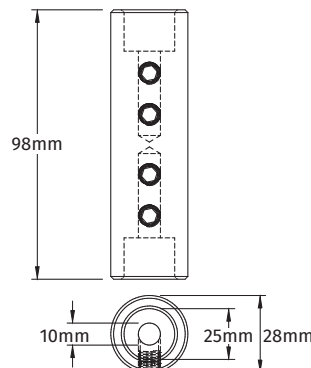


## Insulated Lightning Conductor Cable Connector

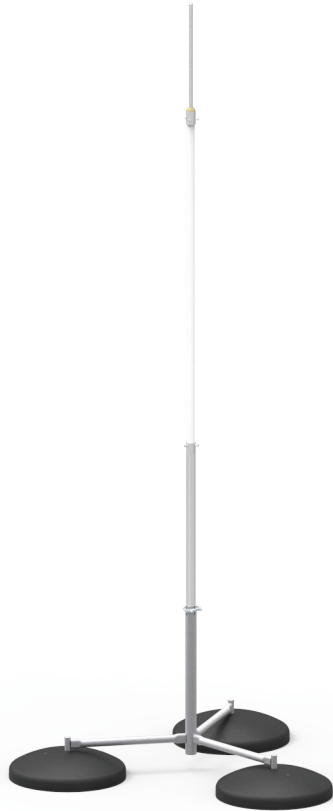
Used to connect cables outside the separation distance area.

SOCKET SCREWS	WEIGHT (kg)	PART NO.
4 x M8 x 8	0.39	KM31100105

**Material:** Stainless Steel



## Insulated Lightning Conductor Free-Standing Tripod Interception Mast - 3m to 7m high



**Insulated Lightning Conductor Free-Standing Tripod Interception Masts** are suitable for wind speeds of up to 24 to 27m/s, 86.4 to 169.2km/h, 53.7 to 105.1mph

TOTAL MAST HEIGHT (A) (mm)	ALUMINIUM AIR TERMINAL LENGTH (B) (mm)	BASE HEIGHT (C) (mm)	ASSEMBLY WEIGHT (kg)	PART NO.
3000	500	1000	135.00	KM96573005
4000	1000	1500	138.00	KM96574005
5000	1000	2500	139.00	KM96575005
6000	1000	3500	140.00	KM96576005
7000	1000	4500	141.00	KM96577005

Each mast is supplied as a complete assembly, comprising of the following:

- Stainless steel **Tripod Base and Mast**
- 1500mm glass fibre **Insulation Section**
- Aluminium **Air Terminal**

The **Tripod Base and Mast** includes 3 x 40kg **Concrete Mounting Blocks**.

### Concrete Mounting Block

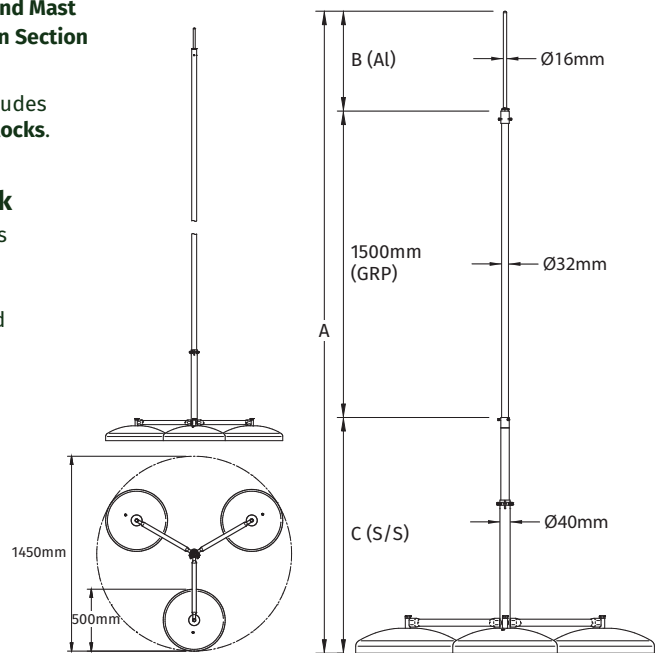
The Interception Mast includes 3 x **Concrete Mounting Blocks**.

**Concrete Mounting Blocks** are a combination of concrete and a bitumastic compound to protect against wet weather.

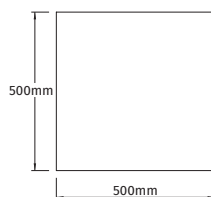
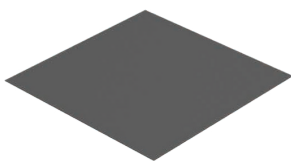
### Roof Protection Pad

We recommend the use of a square membrane **Roof Protection Pad** under each concrete block (*not included in the above set - see part number KM94308221, below*).

The membrane helps protect the waterproof roof covering from mechanical damage.



## Roof Protection Pad



**Roof Protection Pads** fit underneath the mast mounting blocks to prevent damage to the roof surface from the bare Concrete Mounting Block.

DESCRIPTION	WEIGHT (kg)	PART NO.
Membrane Support Square Plate for Concrete Base	0.30	KM94308221

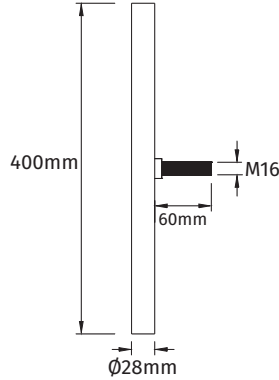
**Material:** Polymer Membrane

### Concrete Base Carrying Handle

For use by two operatives for the safe lifting of 40kg blocks.

DESCRIPTION	WEIGHT (kg)	PART NO.
Carrying Handle for safe handling of Concrete Mounting Blocks	0.60	KM98500101

**Material:** Galvanised Steel



### Insulated Lightning Conductor Wall Mounted Interception Mast - 3m to 4m high

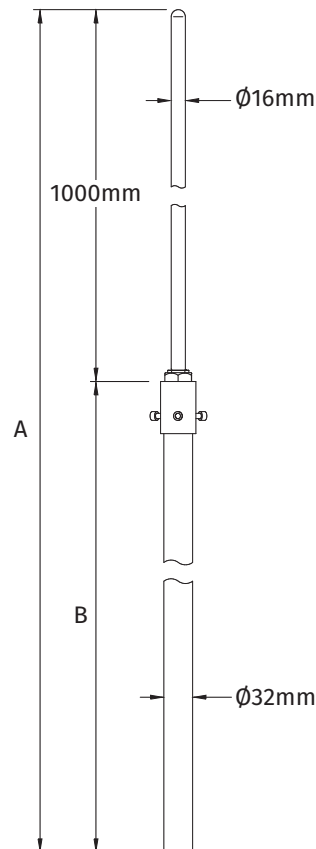
**Insulated Lightning Conductor Wall Mounted Interception Mast** comprises the following:

- 1000mm Aluminium **Air Terminal**
- GRP **Supporting Mast**

OVERALL HEIGHT (A) (mm)	SUPPORTING MAST HEIGHT (B) (mm)	WEIGHT (kg)	PART NO.
3000	2000	1.60	KM96213005
4000	3000	1.90	KM96214005

**Material:** Aluminium Air Terminal  
GRP Supporting Mast

**FIXINGS**  
 KM96000202 (page AT:41) for fixing to the wall  
 KM96000401 (page AT:41) for fixing to pipes/handrails



## Insulated Lightning Conductor Wall Mounted Interception Mast - 3m to 7m high



OVERALL HEIGHT (A) (mm)	AIR TERMINAL HEIGHT (B) (mm)	SUPPORTING MAST HEIGHT (C) (mm)	WEIGHT (kg)	PART NO.
3000	500	1000	2.70	KM96223005
4000	1000	1500	3.70	KM96224005
5000	1000	2500	5.10	KM96225005
6000	1000	3500	6.50	KM96226005
7000	1000	4500	7.70	KM96227005

The **Wall Mounted Interception Mast** is supplied in three sections:

- Stainless steel **Supporting Mast**
- 1500mm glass fibre **Insulation Section**
- Aluminium **Air Terminal**

When mounting against a wall or flat vertical structure, it is recommended that a minimum of 1000mm of the mast assembly is below the top of the wall/vertical surface.

It is recommended that two **Mast Holders** are used for each mast, spaced at a distance of 800mm apart.

The mast can be fixed to the wall using two of our KM96000102 **Wall Mounted Brackets** (page AT:41).

Alternatively, when fixing to handrails or tubular structures, the mast can be secured using two each of the following items:

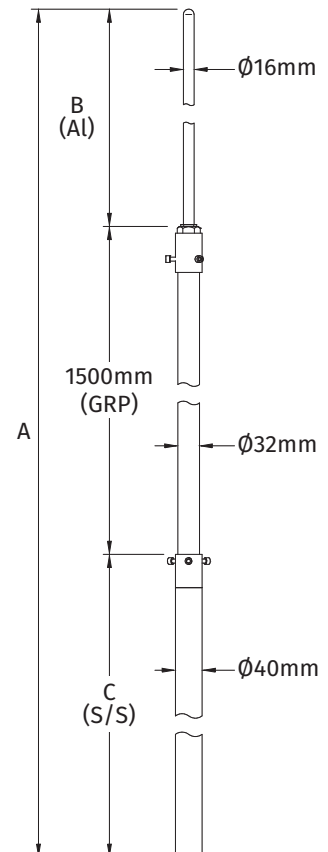
- Mast Holder KM96000701 (page AT:44)
- Pipe/Handrail Brackets (suitably sized) (pages AT:47 - 48)

**Material:** Aluminium Air Terminal  
GRP Insulation Section  
Stainless Steel Supporting Mast



### FIXINGS

KM96000202 (page AT:41) for fixing to the wall  
KM96000401 (page AT:41) for fixing to pipes/handrails

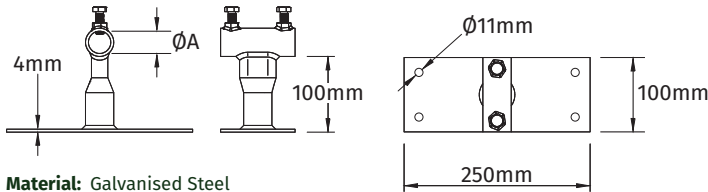


## Wall Mounted Bracket for Air Terminal Interception Mast

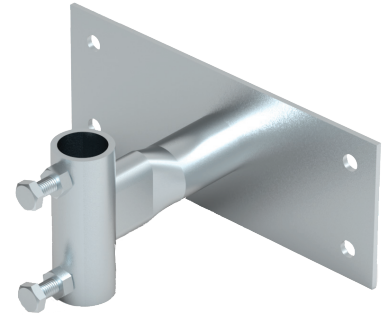
The Kingsmill **Wall Mounted Bracket for Air Terminal Interception Mast** is manufactured from hot dipped galvanised steel.

Use a minimum of two brackets per **Interception Mast** (maximum distance apart 0.8m).

AIR TERMINAL DIAMETER (A) (mm)	SECURING BOLTS	WEIGHT (kg)	PART NO.
31	2 x M10 x 30	1.50	KM96000102
42	2 x M10 x 30	2.70	KM96000202



**Material:** Galvanised Steel



## Pipe/Handrail Bracket for Air Terminal Interception Mast

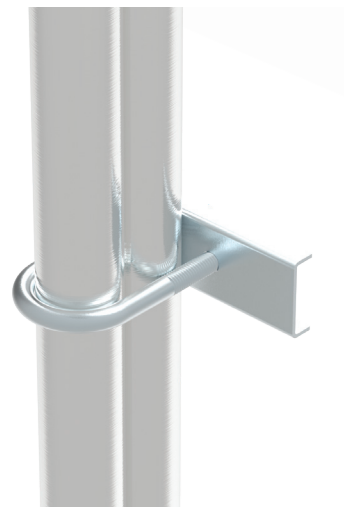
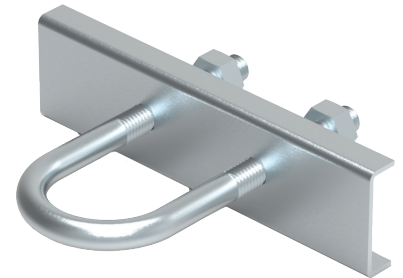
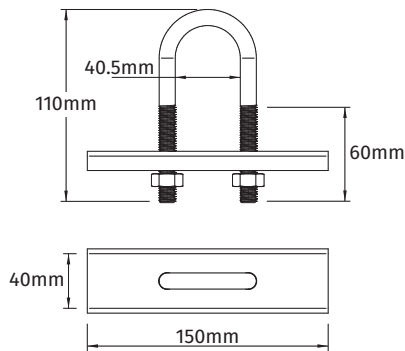
The Kingsmill **Pipe/Handrail Bracket for Air Terminal Interception Mast** connects an **Interception Mast** to a vertical hand rail or pipe.

Use a minimum of two brackets per mast.

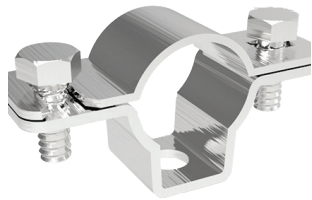
DESCRIPTION	THREAD	WEIGHT (kg)	PART NO.
Pipe/Handrail Bracket	M10	0.30	KM96000401



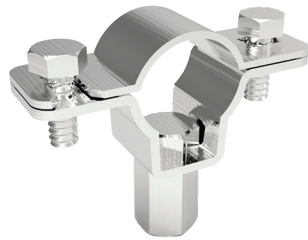
**Material:** Galvanised Steel



## Stainless Steel Insulated Lightning Conductor Holder



KM31600105

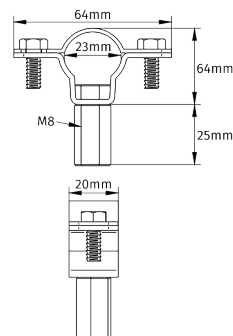
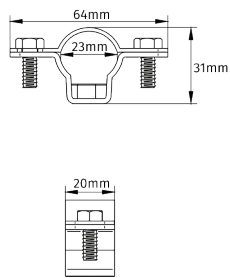


KM31600205

Corrosion resistant **Stainless Steel Insulated Lightning Conductor Holders** are used for fixing an insulated lightning conductor to various surfaces (when used with different adapters).

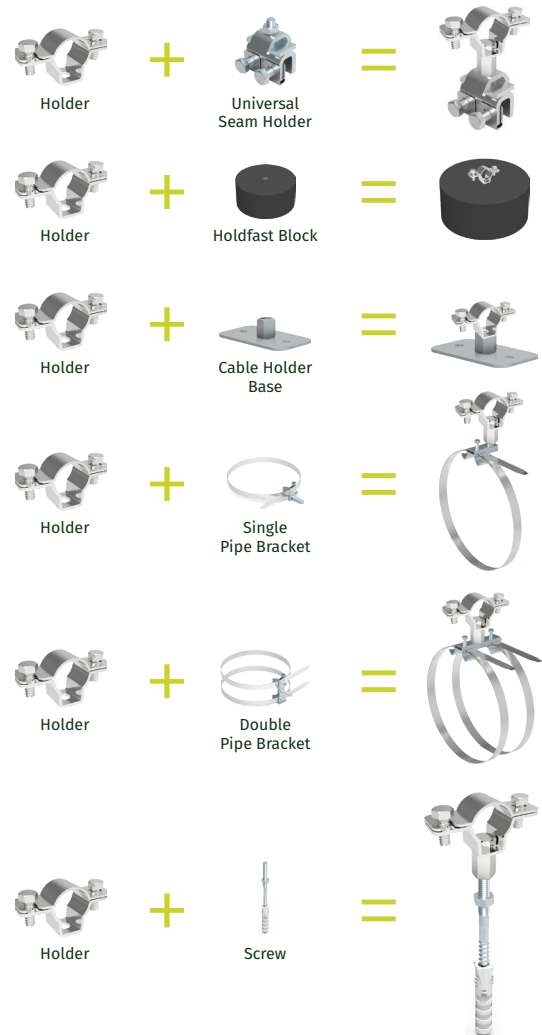
DESCRIPTION	WEIGHT (kg)	PART NO.
Cable Holder	0.04	KM31600105
Cable Holder with M8 internal thread adapter	0.08	KM31600205

**Material:** Stainless Steel



### APPLICATION

#### COMPONENT ASSEMBLY:



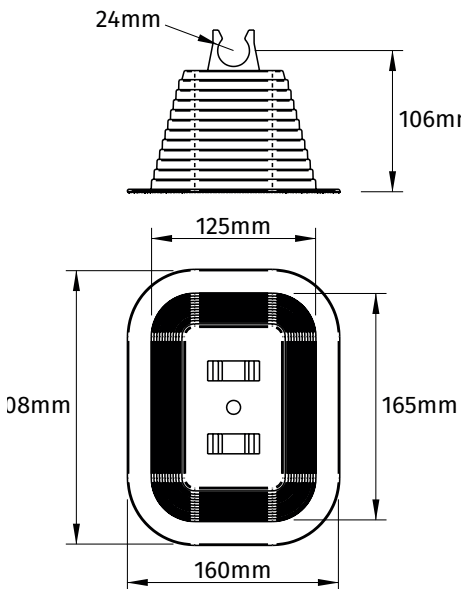
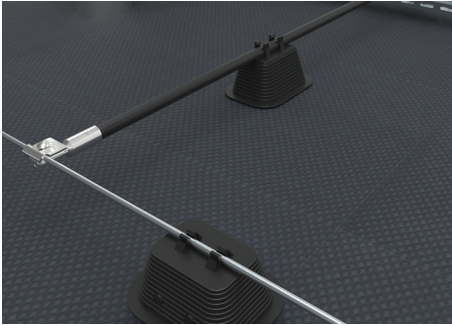
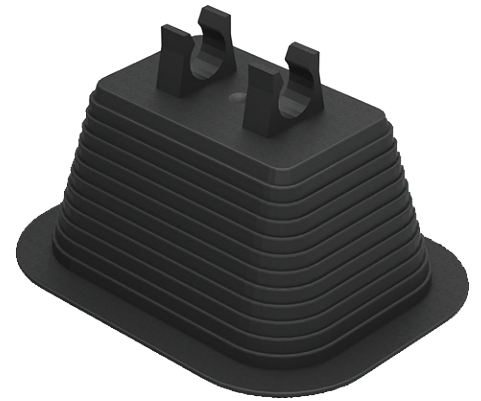


### Pyramid Holdfast

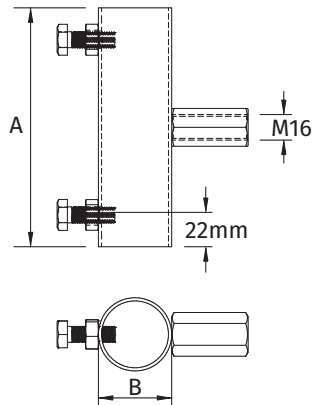
The **Pyramid Holdfast** is designed to hold the insulated cable on flat roofs where it is not possible to drill holes for fixing clips.

CONDUCTOR DIAMETER	CONDUCTOR TYPE	NUMBER OF CLIPS	WEIGHT (kg)	PART NO.
Cable Holder	Insulated	2	2.20	KM31000111

**Material:** PVC filled with concrete



## Air Terminal Mast Holder with Threaded Insert



The **Air Terminal Mast Holders with Threaded Insert** are designed for use with our insulated and steel/insulated Air Terminal Masts.

Use with **Pipe Fixing Brackets:**  
 KM97701105 - page AT:47 (*single*) and  
 KM96701105 - page AT:48 (*double*).

A	B	MAST TIGHTENING SCREWS	WEIGHT (kg)	PART NO.
100	30	2 x M10 x 30	0.50	KM96000701
130	42	2 x M10 x 30	0.70	KM96000801

**Material:** Galvanised Steel

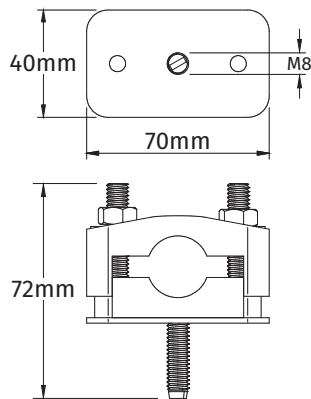
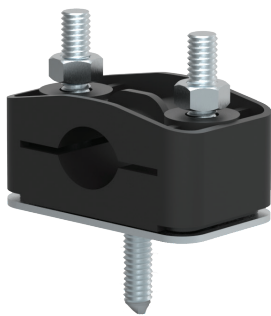
### APPLICATION

#### COMPONENT ASSEMBLY:



The Kingsmill **Air Terminal Mast Holder with Threaded Insert** is designed for use with clamps/brackets having an M16 threaded stud.

## Insulated Lightning Conductor Cable Holder - M8 Thread



The **Insulated Lightning Conductor Cable Holder** is supplied with an M8 threaded stud.

DESCRIPTION	WEIGHT (kg)	PART NO.
Cable Holder with M8 threaded stud	0.14	KM30500101

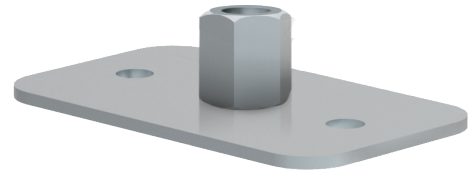
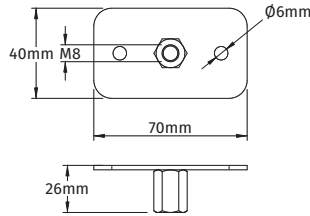
**Material:** Galvanised Steel Insulated Saddle

## Insulated Lightning Conductor Cable Holder Base

The **Cable Holder Base** is used to fix **Cable Holders** with an M8 threaded insert to a flat surface. It is supplied with 2 x 6mm diameter holes for self-tapping screws or bolts.

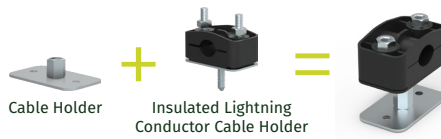
DESCRIPTION	WEIGHT (kg)	PART NO.
Cable Holder Base with M8 threaded stud	0.10	KM30600101

**Material:** Galvanised Steel



### APPLICATION

#### COMPONENT ASSEMBLY:



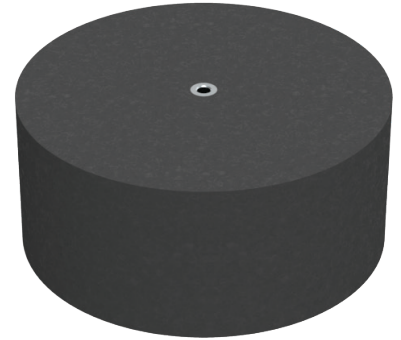
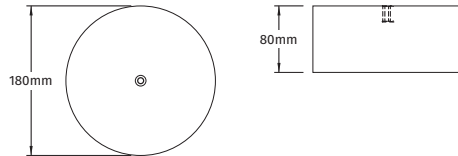
The Kingsmill **Insulated Lightning Conductor Cable Holder Base** is designed for use with Cable Holders having an M8 stud

## Concrete Holdfast Block

The **Concrete Holdfast Block** is used for securing Cable Holders in place on flat surfaces where direct fixing isn't possible.

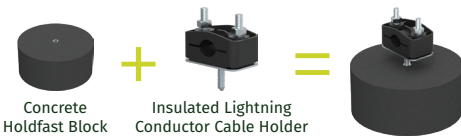
DESCRIPTION	WEIGHT (kg)	PART NO.
Concrete Holdfast Block complete with M8 threaded insert	5.00	KM92910101

**Material:** Concrete



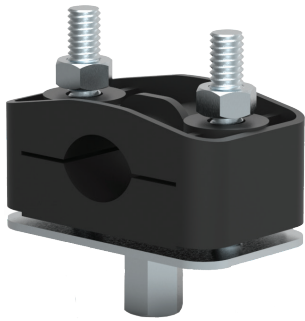
### APPLICATION

#### COMPONENT ASSEMBLY:



The Kingsmill **Concrete Holdfast Block** is designed for use with bracketry having an M8 threaded rod.

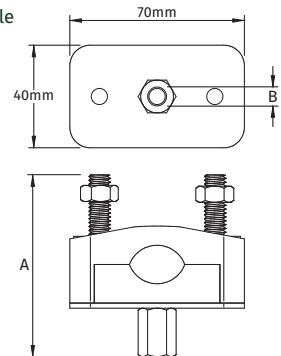
## Insulated Lightning Conductor Cable Holder with Connector



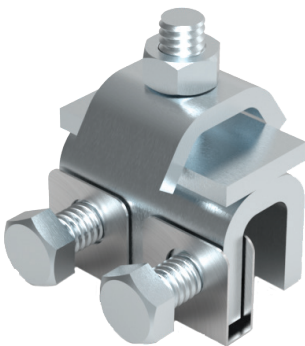
The **Insulated Lightning Conductor Cable Holder with Connector** is supplied with either M8 or M16 threaded inserts.

DESCRIPTION	HEIGHT (A) (mm)	THREADED INSERT (B)	WEIGHT (kg)	PART NO.
Cable Holder with M8 internal thread	70	M8	0.16	KM30400101
Cable Holder with M16 internal thread	94	M16	0.20	KM30400201

**Material:** Galvanised Steel Insulated Saddle



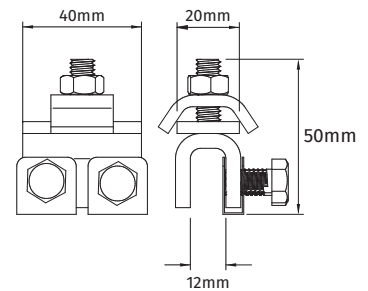
## Universal Seam Holder



The **Universal Seam Holder** is used for fixing Cable Holders to standing seam roofs.

MATERIAL	BOLTS	WEIGHT (kg)	PART NO.
Galvanised Steel	3 x M8 x 25mm	0.18	KM99600101
Hot Dip Galvanised	3 x M8 x 25mm	0.19	KM99600102
Stainless Steel	3 x M8 x 25mm	0.17	KM99600105

**Material:** Galvanised Steel, Hot Dip Galvanised or Stainless Steel



### APPLICATION

#### COMPONENT ASSEMBLY:



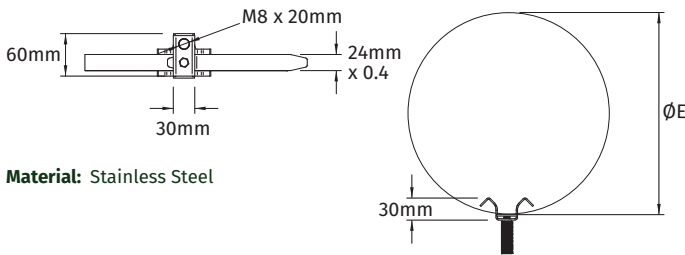
The **Universal Seam Holder** is designed for Cable Holders with an M8 threaded insert (two M10 versions are also available).

## Single Pipe/Handrail Bracket

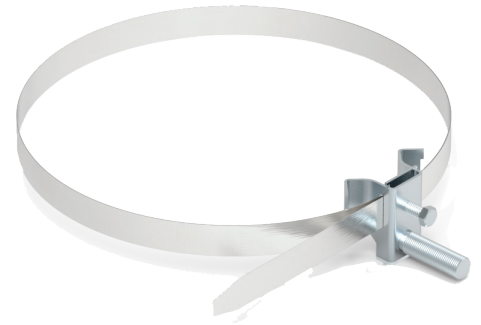
The **Single Pipe/Handrail Bracket** is manufactured from stainless steel and is used in conjunction with **Cable Holders** having an M8 or M16 threaded insert and **Mast Holders** having M16 threaded inserts.

### Brackets for use with Cable Holders and accessories with M8 fixings

BAND DIAMETER (ØE) (mm)	THREADED STUD	WEIGHT (kg)	PART NO.
150 - 300	M8 x 25mm	0.18	KM97700105
≤150	M8 x 25mm	0.16	KM97700205
300 - 500	M8 x 25mm	0.21	KM97700305

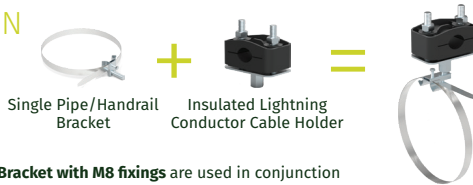


Material: Stainless Steel



### APPLICATION

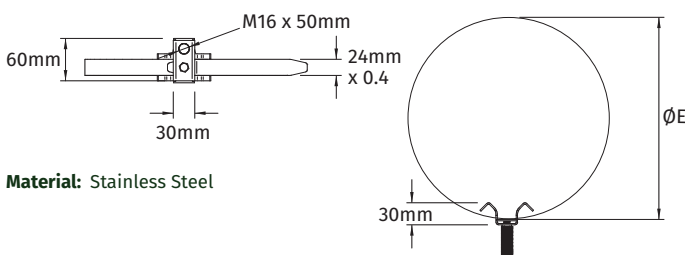
#### COMPONENT ASSEMBLY:



**Single Pipe/Handrail Bracket with M8 fixings** are used in conjunction with Insulated Lightning Conductor Cable Holders having an M8 threaded insert.

### Brackets for use with Mast Holders and accessories with M16 fixings

BAND DIAMETER (ØE) (mm)	THREADED STUD	WEIGHT (kg)	PART NO.
150 - 300	M16 x 50mm	0.23	KM97701105
≤150	M16 x 50mm	0.21	KM97701205
300 - 500	M16 x 50mm	0.26	KM97701305



Material: Stainless Steel

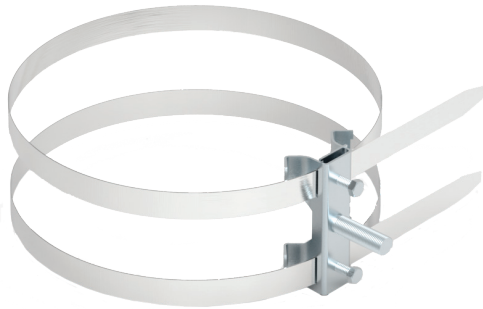
### APPLICATION

#### COMPONENT ASSEMBLY:



**Single Pipe/Handrail Bracket with M16 fixings** are used in conjunction with Insulated Lightning Conductor Mast Holders having an M16 threaded insert.

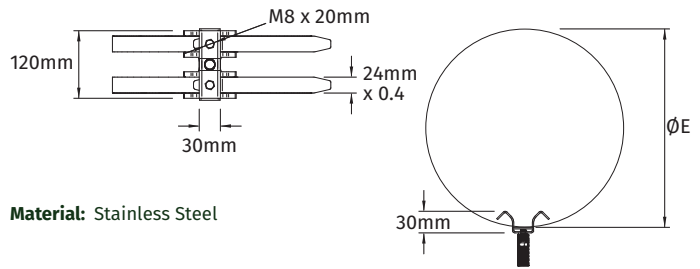
## Double Pipe/Handrail Bracket



The **Double Pipe/Handrail Bracket** is manufactured from stainless steel and is used in conjunction with **Cable Holders** having an M8 or M16 threaded insert and **Mast Holders** having M16 threaded inserts.

### Brackets for use with Cable Holders and accessories with M8 fixings

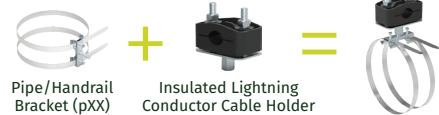
BAND DIAMETER (ØE) (mm)	THREADED STUD	WEIGHT (kg)	PART NO.
150 - 300	M8 x 25mm	0.36	KM96700105
≤150	M8 x 25mm	0.32	KM96700205
300 - 500	M8 x 25mm	0.42	KM96700305



**Material:** Stainless Steel

### APPLICATION

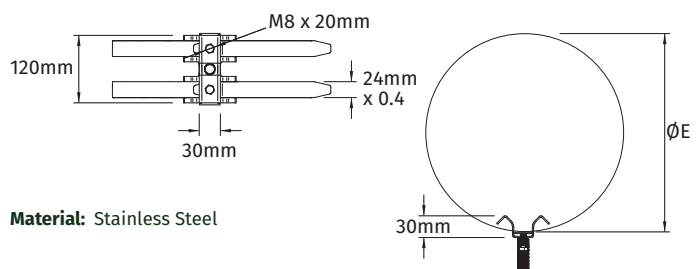
#### COMPONENT ASSEMBLY:



**Double Pipe/Handrail Bracket for Cable holders** are used in conjunction with Insulated Lightning Conductor Cable Holders having an M8 threaded insert.

### Brackets for use with Mast Holders and accessories with M16 fixings

BAND DIAMETER (ØE) (mm)	THREADED STUD	WEIGHT (kg)	PART NO.
150 - 300	M16 x 50mm	0.41	KM96701105
≤150	M16 x 50mm	0.38	KM96701205
300 - 500	M16 x 50mm	0.47	KM96701305



**Material:** Stainless Steel

### APPLICATION

#### COMPONENT ASSEMBLY:



**Double Pipe/Handrail Bracket for Mast holders** are used in conjunction with Insulated Lightning Conductor Cable Holders having an M16 threaded insert.



### Double-Threaded Screw

**Double-Threaded Screws** can be used with holders having an M8 insert. For example, KM30400101 (page AT:46).

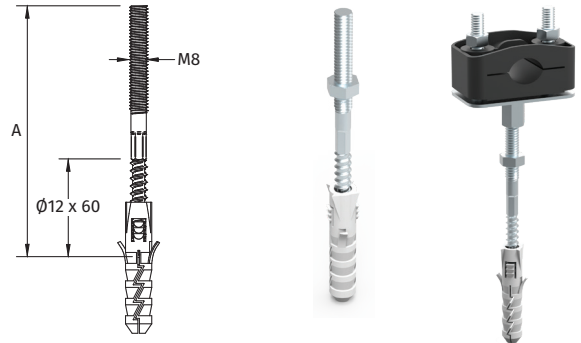
SCREW LENGTH (A) (mm)	WEIGHT (kg)	PART NO.
80	0.18	KM31208001
120	0.29	KM31212001
200	0.53	KM31220001

**Material:** Galvanised Steel

**APPLICATION**

**COMPONENT ASSEMBLY:** Double-Threaded Screw + Insulated Lightning Conductor Cable Holder =

The **Double-Threaded Screw** is designed for use where a large stand-off space is required.



### Threaded Rod

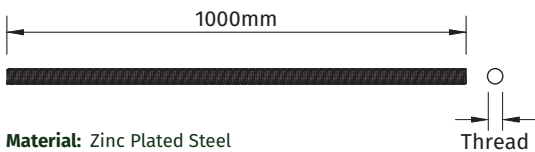
**Threaded Rods** can be used with holders having an M8 insert for example, KM30400101 (page AT:46). Supplied in 1m lengths for cutting to size at site.

**Zinc Plated Threaded Rod**

THREAD	WEIGHT (kg)	PART NO.
M8	0.40	KM30800101
M10	0.50	KM30800201
M12	0.60	KM30800301
M16	1.20	KM30800401

**Stainless Steel Nuts**

THREAD	WEIGHT (kg)	PART NO.
M8	0.004	A2FN08
M10	0.001	A2FN10
M12	0.016	A2FN12
M16	0.020	A2FN16



**APPLICATION**

**COMPONENT ASSEMBLY:** Threaded Rod + Insulated Lightning Conductor Cable Holder =

The **Threaded Rod** is designed for use where a large stand-off space is required.

# Catenary Wire Systems

Kingsmill can offer a range of products to form catenary wire protection systems.

**These products encompass:**

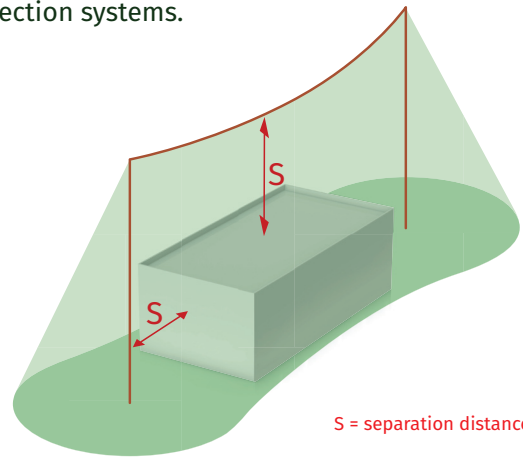
- Wire
- Turnbuckles
- Masts

Such systems are used where an Isolated Lightning Protection System is required.

Designs are project specific since differing wind loading, separation distances and protective angles may apply.

**Factors that must be taken into account when designing such a system are:**

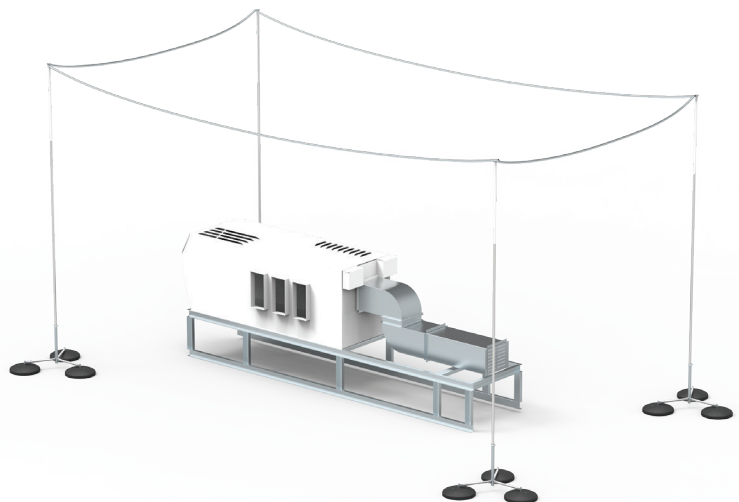
- Wire (cable) type, size and weight
- Length of span, amount of wire (cable) sag
- Wind loading factors
- Ice loading factors
- Protective angles



## Free-Standing Masts

A catenary wire system is ideally constructed using our strong, lightweight mast.

However, smaller systems could utilise free-standing masts.

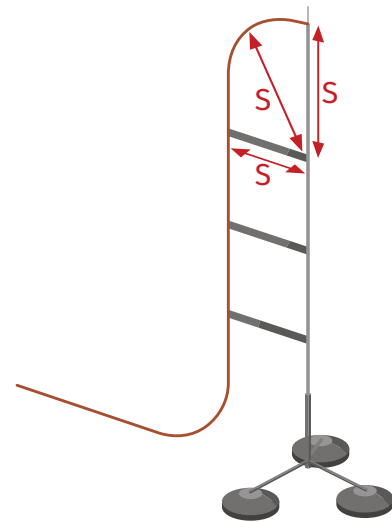
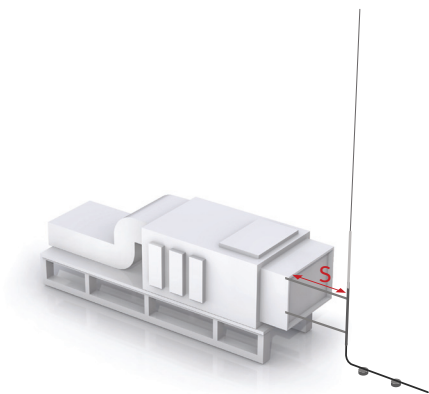


# Isolated Systems

Kingsmill can also supply Isolated Lightning Protection Systems, utilising Insulated Spacer Bars in conjunction with Air Terminals and Conductor Supports.

*Such systems are project specific and better options might be available. Please contact Kingsmill for advice.*

Can be used where roof space is limited but space permits their use. Otherwise, we recommend the use of the Insulated Lightning Conductor Cable system.



Maintains separation distance using **Insulated Separation Bars**.

Used where there is sufficient space to mount one end of an insulated spacer bar to the equipment being protected, and clamp the mast or conductor into the other end of the insulated spacer bar.

S = separation distance

Isolated System using Mast and Insulated Bars to maintain the separation distance from the object being protected.

**NOTE:** Such systems are designed for use with 8mm diameter conductor, due to the ability to bend such material through 360° (all planes). Whereas, a tape can only be bent through one plane.

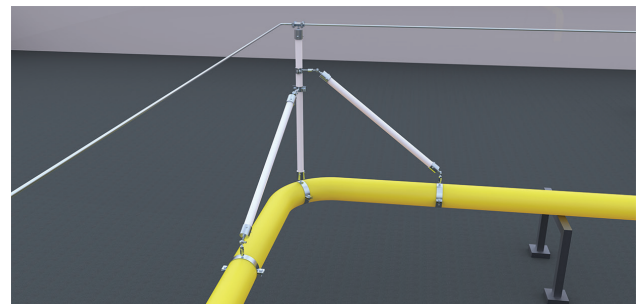
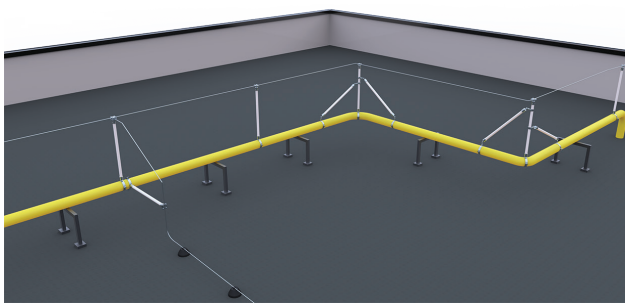


Figure AT:7 - Isolation bars used to protect a pipeline

## Insulated Separation Bars

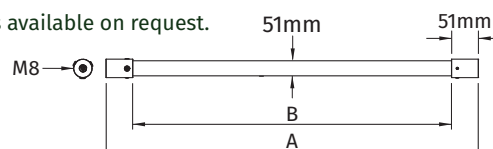


**Insulated Separation Bars** maintain the separation distance between the lightning protection conductor and the object being protected.

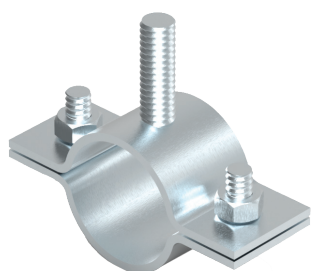
DESCRIPTION	DIMENSIONS (mm)		WEIGHT (kg)	PART NO.
	A	B		
750mm Separation Bar	750	638	0.48	KM97900729
1000mm Separation Bar	1000	888	0.57	KM97900029
1500mm Separation Bar	1500	1388	0.60	KM97901529
2000mm Separation Bar	2000	1888	0.80	KM97920029

M16 threaded bars available on request.

**Material:** GRP



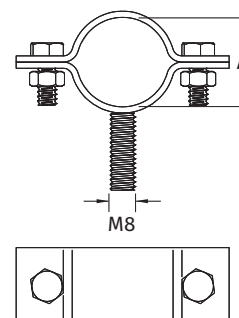
## Mast or Pipe to Insulated Separation Bar Clamp



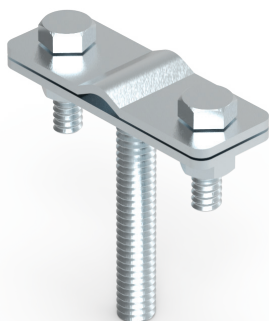
**Mast or Pipe to Insulated Separation Bar Clamp** for connecting to an Interception Mast or Pipe.

PIPE DIAMETER (A) (mm)	STUD	SCREW	WEIGHT (kg)	PART NO.
32	M8	2 x M8 x 20	0.10	KM98300401
40	M8	2 x M8 x 20	0.12	KM98300601

**Material:** Galvanised Steel



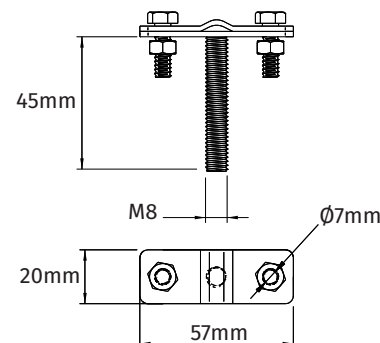
## Wire Conductor Holder



**Wire Conductor Holder** secures the Lightning Conductor to the end of the Insulated Separation Bar.

DESCRIPTION	STUD	WEIGHT (kg)	PART NO.
Wire Conductor Holder for 8mm diameter circular conductor and flat tape up to 30mm x 4mm	M8	0.06	KM98400201

**Material:** Galvanised Steel



<b>Introduction</b>	<b>COND:2 - 3</b>
<b>Guide to conductor selection</b>	<b>COND:4 - 6</b>
<b>Copper conductor ratings</b>	<b>COND:7</b>
<b>STRIKEBAND</b> Lightweight, cost effective above ground lightning conductor that combines the advantages of copper and aluminium	<b>COND:8 - 9</b>
<b>Copper Tape</b> For Earthing and Lightning Protection applications	<b>COND:9 - 12</b>
<b>Steel Tape</b> For foundation earthing	<b>COND:12</b>
<b>Insulated Lightning Conductor</b> A lightning conductor resolving design issues where space is limited	<b>COND:13</b>
<b>Aluminium Tape</b> Lightweight, easy to install above ground lightning conductor, including an aesthetically pleasing PVC covered range	<b>COND:14</b>
<b>Solid Circular</b> 50mm <sup>2</sup> BS:EN 62305 range of lightning conductors	<b>COND:15</b>
<b>Copper Cable</b> Bare, tinned and insulated for use in earthing systems	<b>COND:16</b>
<b>Conductor Guards</b> To protect and conceal lightning down conductors from theft	<b>COND:18</b>

Conductors are an essential component of a Lightning Protection System.

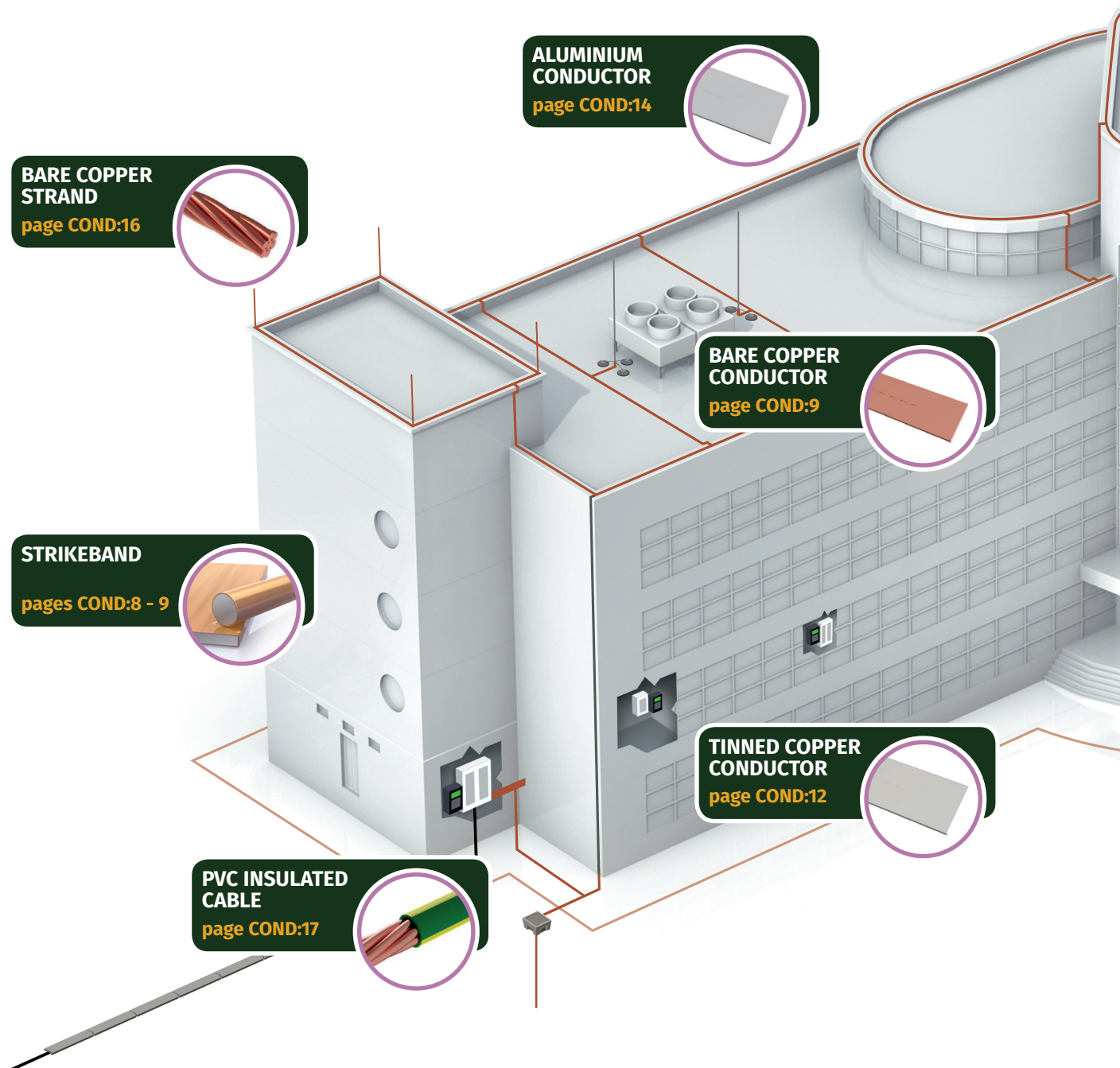
They form part of:

- The Air Termination Network - arresting the lightning strike
- The Down Conductor System - taking the lightning discharge to ground
- The Earth Termination/Network - safely dissipating the lightning discharge into the ground

Conductors are also an integral and important component of an earthing system, whether this be for a power station, sub-station, cell site, solar PV array etc.

Conductors provide a low impedance path and they must be:

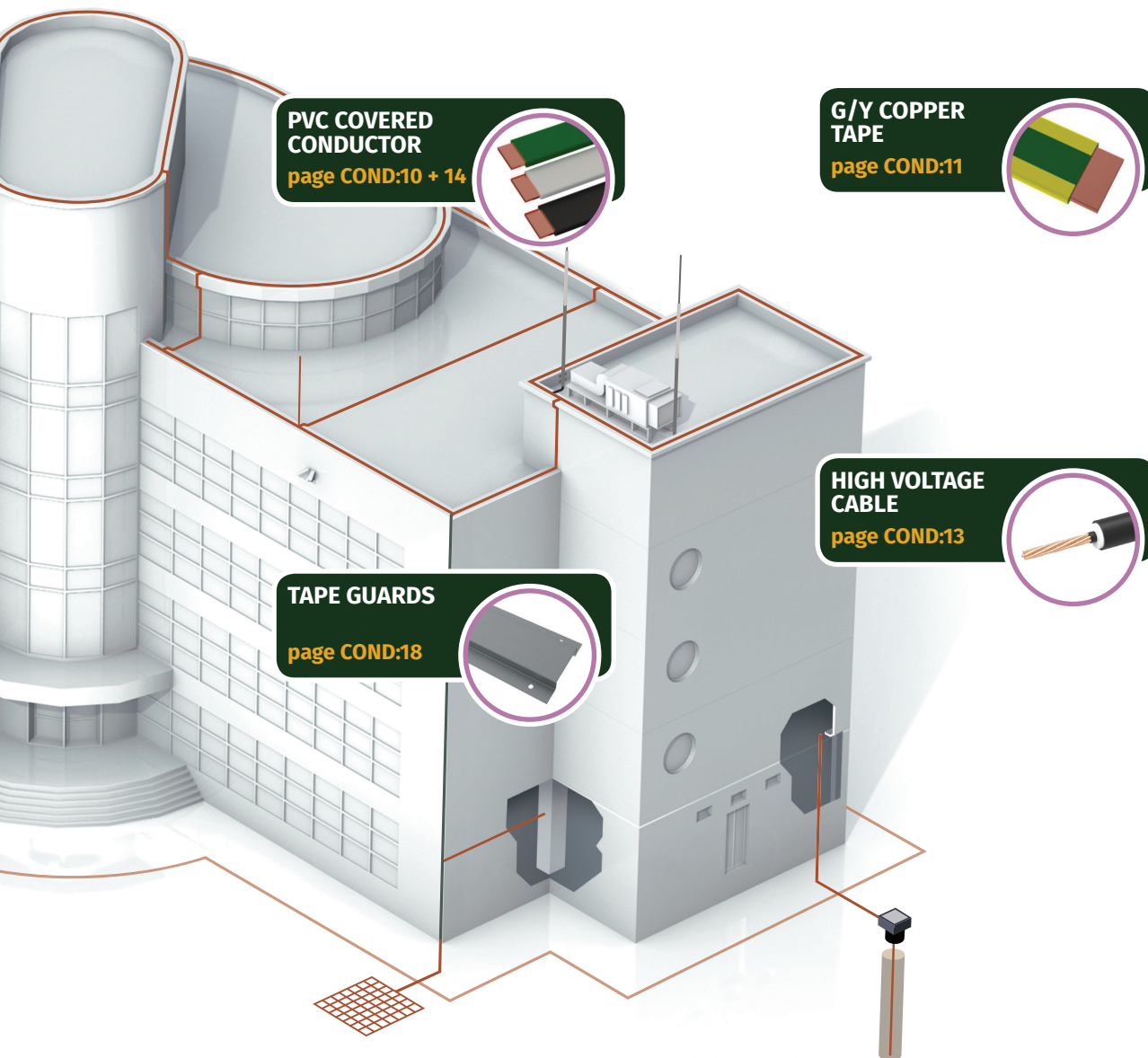
- Correctly sized for fault current
- Sufficiently robust to resist mechanical damage
- Able to resist the effects of corrosion





Kingsmill are proud to offer a comprehensive range of conductors. Thus enabling the Lightning Protection Designer greater freedom to: conceal conductors, aesthetically blend conductors into the building facade, as well as offering lower cost alternatives - Strikeband and aluminium etc.

Our Insulated Lightning Conductor also allows the designer to resolve spacing problems when there is insufficient room to install a “conventional” conductor whilst maintaining the required separation distance between it and the electrically conductive parts of the structure that require protection. The Kingsmill Insulated Lightning Conductor effectively simulates an equivalent separation distance of  $\leq 0.75\text{m}$  in air and  $\leq 1.5\text{m}$  in solid material.



## Guide to conductor selection

Conductors are the most important part of a Lightning Protection and Earthing system. They:

- Intercept the lightning current
- Carry and safely dissipate the lightning current/earth fault to earth

It is important, therefore, that they:

- Are corrosion resistant
- Carry the current required
- Are mechanically robust
- Provide a low resistivity path to earth

**From BS:EN 62305 . . .**

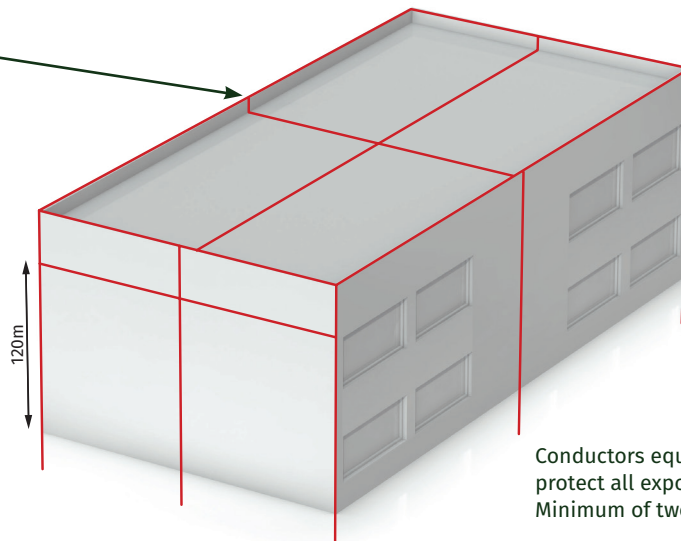
### Roof mesh conductor system

LPC	Maximum mesh size (m)
I	5 x 5
II	10 x 10
III	15 x 15
IV	20 x 20

LPC	Down conductor spacing (m)
I	10
II	10
III	15
IV	20

LPC	Lateral conductor spacing (m)*
I + II	10
III	15
IV	20

\*Buildings over 120m height



Conductors equally spaced - important to protect all exposed corners of the building. Minimum of two down conductors.

The most common cross-section areas for above ground lightning protection conductors are 8mm dia (50mm<sup>2</sup> - BS:EN 62305 min) and 25 x 3mm (75mm<sup>2</sup>) rectangular section.

## Selecting the best conductor for the application

SECTION	MATERIAL	COVERING	EARTHING			LIGHTNING PROTECTION				
			Power Earthing	Lightning Protection Earthing	Below ground	Lightning Protection above ground	Above ground	Best for ease of installation	Best for aesthetics	Best for cost above ground
<b>STRIKEBAND</b>	Cu/Al	-	✗	✗	✗	✓	✓	✓	-	✓
<b>Rectangular Tape</b>	Cu	Bare	✓	✓	✓	✓	✓	-	-	-
	Cu	PVC	✓	✓	✗	✓	✓	-	✓	-
	Cu	Tinned	✓	✓	✓	✓	✓	-	-	-
	Cu	Lead	-	-	✓	Chimneys	✓	-	-	-
	Cu	LSOH	✓	✓	✓	Tunnels	✓	-	-	-
	Al	Bare	✗	✗	✗	✓	✓	✓	-	✓
<b>Solid Circular</b>	Al	PVC	✗	✗	✗	✓	✓	✓	✓	✓
	Cu	Bare	✓	✓	✓	✓	✓	-	-	-
	Cu	PVC	✓	✓	✗	✓	✓	-	✓	-
	Cu	Tinned	✓	✓	✓	✓	✓	-	-	-
	Cu	Lead	-	-	✓	Chimneys	✓	-	-	-
	Al	Bare	✗	✗	✗	✓	✓	✓	-	✓
<b>Stranded</b>	Al	PVC	✗	✗	✗	✓	✓	✓	✓	✓
	Cu	Bare	✓	✓	✓	✓	✓	-	-	-
	Cu	PVC	✓	✓	✗	✓	✓	-	-	-
	Cu	Tinned	✓	✓	✓	✓	✓	-	-	-
<b>Insulated Lightning Conductor</b>	Cu	Lead	✓	-	✓	Chimneys	✓	-	-	-
	Cu	Insulated	✗	✗	✗	✓	✓	-	-	-

When choosing the material for “above ground” Lightning Conductors, it is important to take into account the avoidance of any bimetallic corrosion. For example, one should avoid the installation of copper conductors over aluminium or steel cladding.

- Galvanic corrosion - happens when there is a potential difference between dissimilar metals
  - When the materials are in contact in the presence of an electrolyte, corrosion occurs. One metal becomes the anode, the other the cathode. The anode will tend to go into solution and therefore corrode. The electrolyte can be water with impurities from the air.
  - In the instance of water run-off from copper - the water carries fine copper corrosion particles which, when they drip on to aluminium or zinc, may result in corrosion. The direct contact of the dissimilar metals is not required for corrosion to occur in such a case.

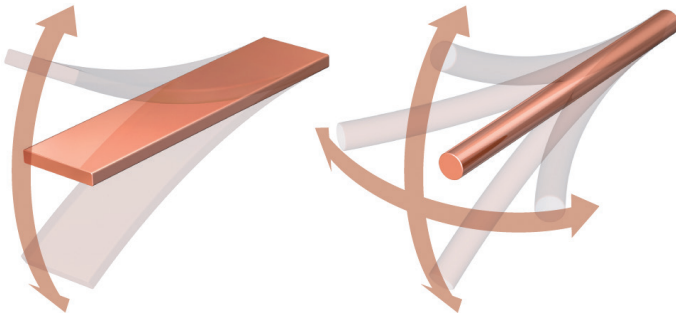
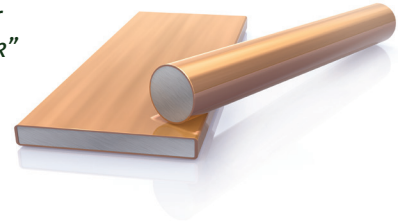
Whilst there are cautions with respect to the use of aluminium, these can generally be overcome with the use of PVC covered aluminium conductor, in an above ground Lightning Conductor setting.

### Conductor section options

**STRIKEBAND and aluminium conductors** combine the benefits to the installer of light weight and easy installation (such materials exhibit little “spring back” and so are easier to dress to the contours and shapes of the structure).

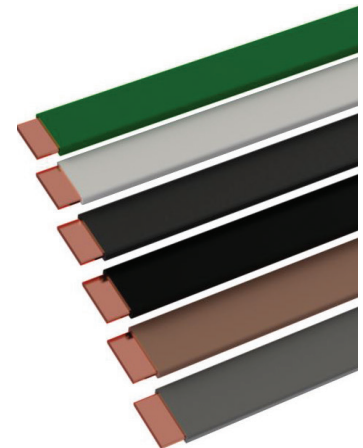
**Solid circular section conductors** are the easiest to install since they can be bent through any plane (360°) whereas tape can only be bent in two directions.

360° overcomes problems that are presented by complex geometry buildings.



### PVC covered conductor

PVC covering is often used as a decorative cover when blending in external conductors to building aesthetics. Thought must be given however, to using such conductors in areas of high UV, due to colour bleaching and the life of modern UV stabilisation compounds.



### Conductor colour chart

The decision to be made on the colour of PVC covered conductor is governed by the aesthetics of the building to be protected.

To reduce the impact of an external system, Kingsmill offer a range of colours designed to match the colours of common building materials.

COLOUR	STANDARDS	COLOUR
Black	18B29*	
Green	BS 6746C	
Grey	00A07*	
Stone	08B23*	
White	10B15*	
Brown	06C39*	
Green/Yellow	N/A	

OTHER COLOURS ARE AVAILABLE UPON REQUEST - PLEASE SPEAK TO A MEMBER OF THE SALES OFFICE.

**\*PVC colours to BS 5252, green to BS 6746C**

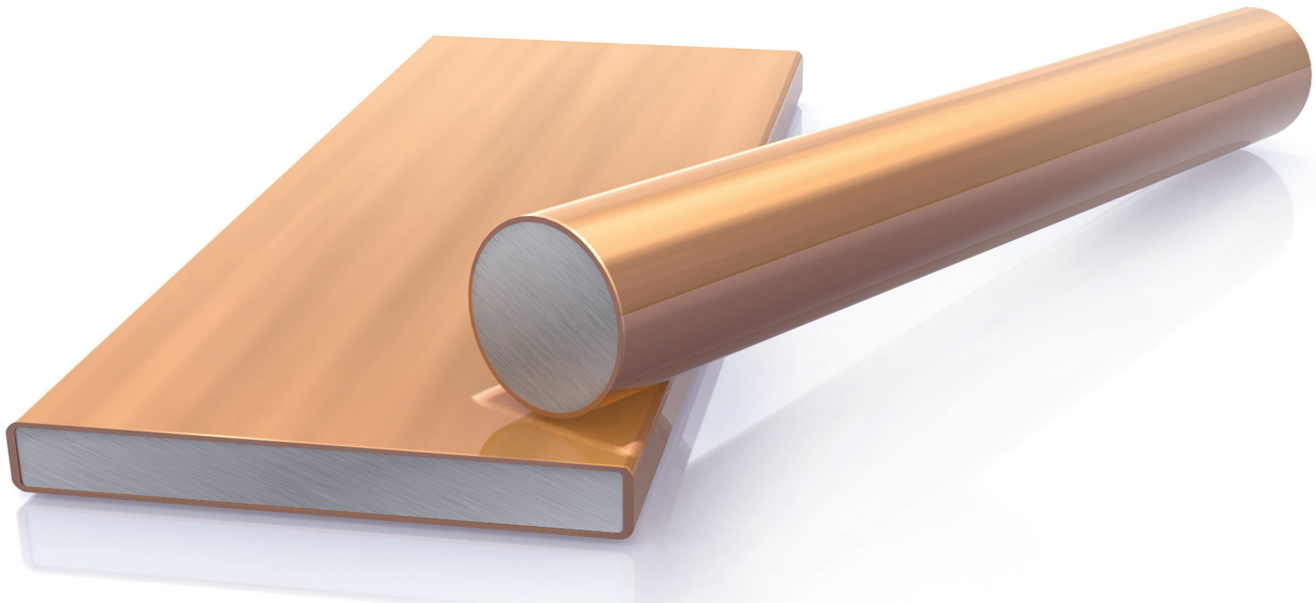
### Conductor sizing

Earth conductors are sized according to the maximum fault that they are to carry. When carrying out this calculation, it is important to take into account the type of connectors used - exothermic joints will take 100% of the fault current, whereas bolted, braided and crimp connections do not (a chain is only as good as its weakest link).

## Copper conductor ratings: fault current

CONDUCTOR SIZE	CSA (mm <sup>2</sup> )	kA for 1 sec	kA for 3 sec
12.5 x 1.5	18.75	3.3	1.9
12.5 x 3	37.5	6.6	3.8
20 x 1.5	30	5.3	3.0
20 x 3	60	10.6	6.1
25 x 1.5	37.5	6.6	3.8
25 x 3	75	13.2	7.6
25 x 4	100	17.6	10.2
25 x 6	150	26.4	15.2
30 x 2	60	10.6	6.1
30 x 3	90	15.8	9.1
30 x 4	120	21.1	12.2
30 x 5	150	26.4	15.2
31 x 3	93	16.4	9.5
31 x 6	186	32.7	18.9
38 x 3	114	20.1	11.6
38 x 5	190	33.4	19.3
38 x 6	228	40.1	23.2
40 x 3	120	21.1	12.2
40 x 4	160	28.2	16.3
40 x 5	200	35.2	20.3
40 x 6	240	42.2	24.4
50 x 3	150	26.4	15.2
50 x 4	200	35.2	20.3
50 x 5	250	44.0	25.4
50 x 6	300	52.8	30.5

The following conductor ratings are based upon the recommendations of BS 7430 with an initial conductor temperature of 30°C and a maximum temperature of 250°C.



## STRIKEBAND - a bimetallic lightning conductor for above ground applications

**STRIKEBAND combines the corrosion resistance and inherent low resistivity of copper, with the lightness and flexibility of aluminium, providing a low cost, easy to use alternative to solid copper.**

Seamless, high conductivity copper is bonded (through high pressure) to a solid core of electrical grade aluminium. The copper thickness used is 15% by volume of the cross-sectional area. The resultant material is easier to bend, having less spring-back than copper. This is a distinct advantage to the Lightning Protection installer when “dressing” the conductor to the contours of the building. Combining longer coil lengths and a light weight makes this product an ideal choice where the advantages of copper above ground are required, but with cost reductions.

**STRIKEBAND** is offered in two sizes and has passed testing to IEC/BS:EN 62561-2.

**For Flat Tape see page COND:9. For Circular Conductor see page COND:15.**

### Benefits

- **Reduce labour costs**  
Due to its reduced weight and ease of handling **STRIKEBAND** can save labour costs when compared with installing a copper conductor of equal dimensions
- **Reduce weight by up to 60%**  
The relative density of **STRIKEBAND** vs copper results in the mass of **STRIKEBAND** conductors being only 41% of that of a solid copper bar of equal dimensions
- **Reduce material costs**  
1 metre of **STRIKEBAND** costs less than 1 metre of copper, therefore the same stock provides lower inventory values, meaning lower financing costs
- **Uses standard Lightning Protection components**
- **Longer coil lengths**  
When compared to equivalent solid copper section

### Characteristics

**STRIKEBAND** is easy to bend, having less spring-back than copper. The relevant datasheet should be consulted for recommended bending radii. **STRIKEBAND** is also easy to drill, cut and punch.

### Tested to BS:EN 62561-2

**STRIKEBAND** is tested to ensure it fully complies with the requirements of BS:EN 62561-2.





## STRIKEBAND Copper Covered Aluminium

**STRIKEBAND Copper Covered Aluminium** is sold in the specified coil length only. Copper thickness is 15% by volume, giving a radial thickness of 0.25mm.

DESCRIPTION	DIMENSION (mm)	COIL LENGTH (m)	WEIGHT (per m) (kg)	PART NO.
Copper/aluminium bimetallic conductor	25 x 3	74	0.27	CCAT2530

**Material:** 99.9% purity copper and 99.7% purity aluminium



## Copper Tape (Bare)

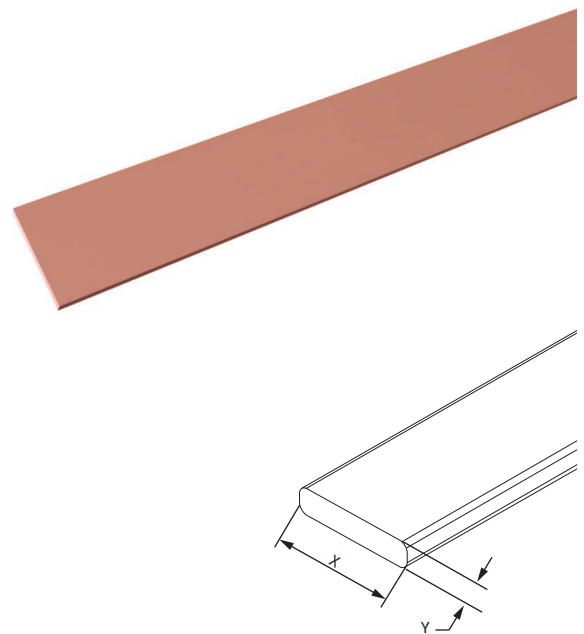
Kingsmill **Copper Tape** is embossed 'Kingsmill (UK)' for identification and is manufactured from high conductivity annealed copper.

All **Bare Copper Tape** sold in the specified coil lengths only. However, **CTBA2530** can be cut to desired length. Please speak to the sales office for further details referencing part no. **CTBA2530/DRUM**.

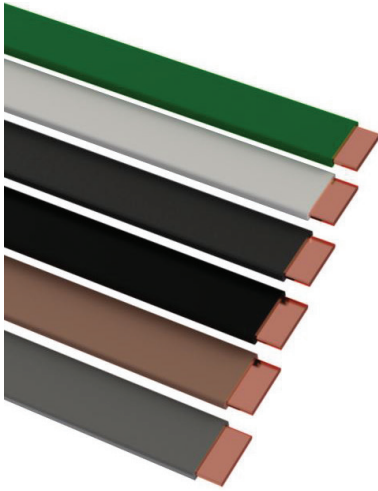
CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
12.5 x 1.5	18.75	100	0.17	CTBA1215
12.5 x 3	37.5	100	0.33	CTBA1230
20 x 1.5	30	100	0.27	CTBA2015
20 x 3	60	100	0.53	CTBA2030
25 x 1.5	37.5	100	0.33	CTBA2515
25 x 3	75	25	0.67	CTBA2530/25
25 x 3	75	50	0.67	CTBA2530
25 x 4	100	50	0.89	CTBA2540
25 x 6	150	40	1.34	CTBA2560
30 x 2	60	50	0.53	CTBA3020
30 x 3	90	50	0.80	CTBA3030
30 x 4	120	40	1.07	CTBA3040
30 x 5	150	40	1.33	CTBA3050
31 x 3	93	50	0.83	CTBA3130
31 x 6	186	30	1.65	CTBA3160
38 x 3	114	50	1.01	CTBA3830
38 x 5	190	30	1.69	CTBA3850
38 x 6	228	25	2.03	CTBA3860
40 x 3	120	40	1.06	CTBA4030
40 x 4	160	30	1.42	CTBA4040
40 x 5	200	25	1.78	CTBA4050
40 x 6	240	25	2.13	CTBA4060
50 x 3	150	40	1.33	CTBA5030
50 x 4	200	30	1.78	CTBA5040
50 x 5	250	20	2.22	CTBA5050
50 x 6	300	20	2.68	CTBA5060

**Material:** Copper to BS:EN 13601 (formerly BS 1432)

**Standard:** BS:EN 62561-2 : 2012



## Copper Tape (PVC covered)



Kingsmill offers a wide range of UV-stabilised **PVC Covered Copper Tapes** in a range of colours.

These colours have been chosen to match the most common structural materials and will reduce the visual impact of Lightning Protection conductor.

All **PVC Covered Copper Tape** is sold in the specified coil lengths only.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COLOUR (to BS 5252*)		COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
25 x 3	75	BLACK	18B29*	25	0.78	TCBL253
25 x 3	75	BROWN	06C39*	25	0.78	TCBN253
25 x 3	75	GREEN	BS 6746C	25	0.78	TCGN253
25 x 3	75	GREY	00A07*	25	0.78	TCGY253
25 x 3	75	STONE	08B23*	25	0.78	TCST253
25 x 3	75	WHITE	10B15*	25	0.78	TCWH253
25 x 6	150	GREEN	BS 6746C	40	1.53	TCGN256
31 X 6	186	GREY	RAL 7037	25	1.91	TC3160
31 X 6	186	IVORY	RAL 1015	25	1.91	TCIV316
31 X 6	186	OYSTER	RAL 1013	25	1.91	TCOW316
31 X 6	186	WHITE	RAL 9003	25	1.91	TCW316
50 x 6	300	GREEN	BS 6746C	20	2.96	TCGN506

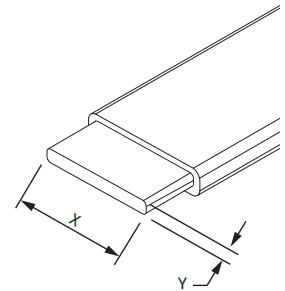
**Material:** Copper

**Standard:** BS:EN 13601 (formerly BS 1432)

**PVC Colour:** BS 5252, except green BS 6746C

### SPECIAL COLOURS

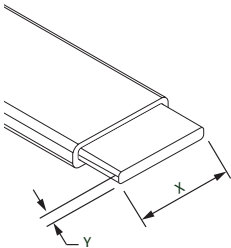
Special colours are available upon request but are subject to minimum quantity and higher set-up costs. Please contact our sales team with details of your requirements.



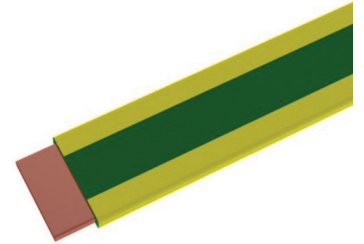
### Copper Tape (Green/yellow covered)

Kingsmill **Copper Tape (Green/yellow covered)** visually indicates it is for earthing purposes. It is sold in the specified coil lengths only.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
25 X 3	75	25	0.78	TCGN/Y253



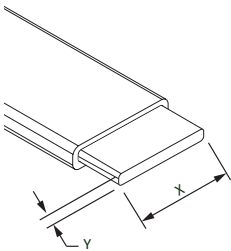
**Material:** Copper  
**Standard:** BS:EN 13601 (formerly BS 1432)  
**PVC Colour:** BS 6746C



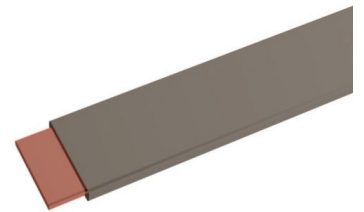
### Copper Tape (Lead covered)

Kingsmill **Copper Tape (Lead covered)** is used in special applications where corrosion is an issue eg at the top of chimneys. It is sold in the specified coil lengths only.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
25 x 3	75	25	2.56	TCLD253



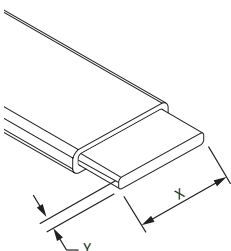
**Material:** Copper  
**Standard:** BS:EN 13601 (formerly BS 1432)  
**Covering:** Type 'B' Lead Alloy (2mm thick coating)



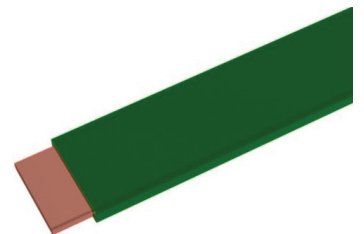
### Copper Tape LSOH (Low smoke, zero halogen covered)

Kingsmill **Copper Tape LSOH** is used in tunnel situations eg underground railways and road tunnels. It is sold in the specified coil lengths only.

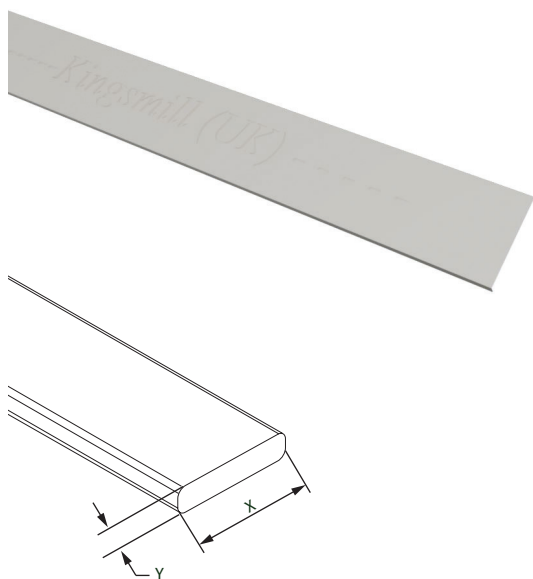
CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
25 x 3	75	25	0.77	TCGN253LS
25 x 3	75	50	0.77	TCGN253LS/50
25 x 6	75	40	1.53	TCGN256LS
50 x 6	300	20	2.95	TCGN506LS



**Material:** Copper  
**Standard:** BS:EN 13601 (formerly BS 1432)  
**PVC Colour:** BS 6746C



## Tinned Copper Tape



Kingsmill **Tinned Copper Tape** is embossed 'Kingsmill (UK)' for identification purposes and is manufactured from high conductivity annealed copper.

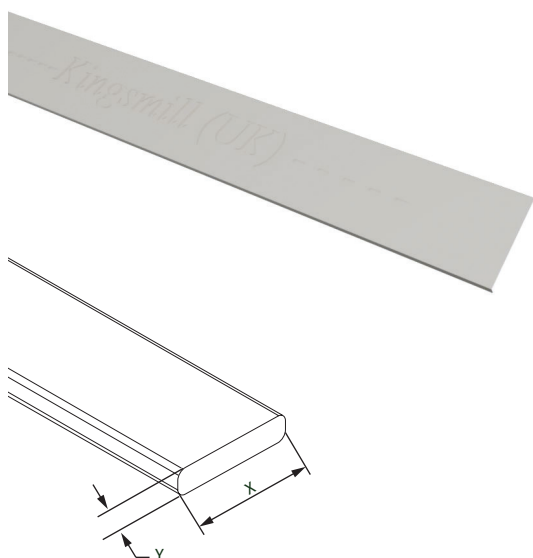
**Tinned Copper Tape** is sold in the specified coil lengths only.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
12.5 x 1.5	18.75	100	0.17	TCTD1215
12.5 x 3	37.5	100	0.33	TCTD1230
20 x 1.5	30	100	0.27	TCTD2015
20 x 3	60	100	0.53	TCTD2030
25 x 1.5	37.5	100	0.33	TCTD2515
25 x 3	75	50	0.67	TCTD2530
25 x 4	100	50	0.89	TCTD2540
25 x 6	150	40	1.34	TCTD2560
30 x 2	60	50	0.53	TCTD3020
30 x 3	90	50	0.80	TCTD3030
30 x 4	120	40	1.07	TCTD3040
30 x 5	150	40	1.33	TCTD3050
31 x 3	93	50	0.83	TCTD3130
31 x 6	186	30	1.65	TCTD3160
38 x 3	114	50	1.01	TCTD3830
38 x 5	190	30	1.69	TCTD3850
38 x 6	228	25	2.03	TCTD3860
40 x 3	120	40	1.06	TCTD4030
40 x 4	160	30	1.42	TCTD4040
40 x 5	200	25	1.78	TCTD4050
40 x 6	240	25	2.13	TCTD4060
50 x 3	150	40	1.33	TCTD5030
50 x 4	200	30	1.78	TCTD5040
50 x 5	250	20	2.22	TCTD5050
50 x 6	300	20	2.68	TCTD5060

**Material:** Tinned Copper

**Standard:** BS:EN 13601 (formerly BS 1432)

## Galvanised Steel Tape



Kingsmill **Galvanised Steel Tape** is suitable for BS:EN 62305 internal foundation earthing rings.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
30 x 3.5	105	30	0.84	GST3035

**Material:** Galvanised Steel

**Standard:** BS:EN 62561-2

## Insulated Lightning Conductor

**Insulated Lightning Conductor** can be used with standard connection accessories for 8mm size conductor.

The **Insulated Lightning conductor** can be used in conjunction with the **Air Terminals** outlined on pages AT:38 - 40, but it can also be used in applications where it is not possible to maintain the separation distance between down conductors and the structure being protected, eg running close to photovoltaic array panels.

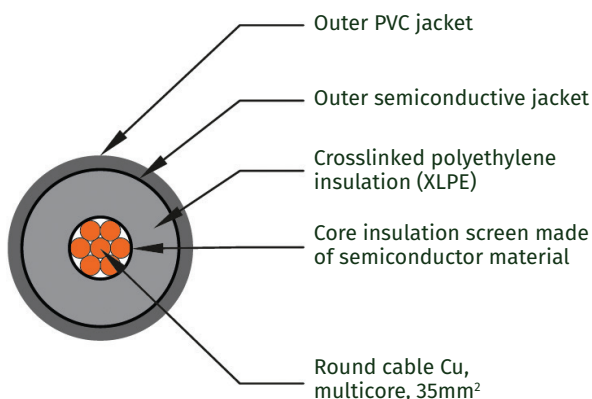


<b>Part Number</b>	KM30000199
<b>Colour</b>	Black
<b>The outer diameter</b>	23.4mm
<b>Cross-section of the cable core</b>	35mm <sup>2</sup>
<b>Maximum conductor resistance at 20°C</b>	0.524 Ω/km
<b>Equivalent of separation distance for air</b>	750mm
<b>Equivalent of separation distance for regular building materials</b>	1500mm
<b>Cable weight</b>	0.735kg/m
<b>Operating temperature range</b>	From -30°C to 70°C
<b>Assembly temperature range</b>	From -5°C to 40°C
<b>Minimum bending radius</b>	About 280mm
<b>Cable flammability</b>	Not spreading flame
<b>Flammability test</b>	PN-EN 60332-1-2; IEC 60332-1
<b>Bending radius</b>	280mm

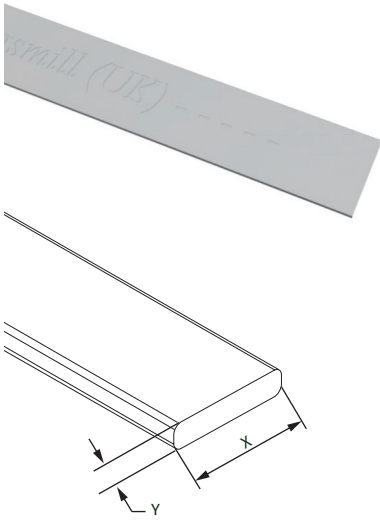
Used for equivalent separation distances of  $\leq 0.75\text{m}$  in air and  $\leq 1.5\text{m}$  in solid material.

The **Insulated Lightning Conductor** is flame-resistant in accordance with IEC EN 60332-1-2, its twisted copper core is surrounded by insulation layers of meshed cross-linked polyethylene (XLPE) and the ageing-resistant polyvinyl chloride (PVC) sheath. The cable is flexible and ideally suited for routing in external areas, roofs, walls and embedding in concrete.

Kingsmill **Insulated Lightning conductor** has a tested arresting capacity of 100kA lightning surge current (1.2/50 $\mu\text{s}$ ) and it meets the requirements of IEC EN 62561-1.



## Aluminium Tape



Kingsmill **Aluminium Tape** is sold in the specified coil lengths only.

OVERALL NOMINAL SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
12.5 x 1.5	18.75	50	0.05	ATBA12515
20 x 3	60	50	0.17	ATBA2030
25 x 3	75	50	0.21	ATBA2530
30 x 3	90	50	0.25	ATBA3030
25 x 6	150	50	0.42	ATBA2560
40 x 6	240	50	0.67	ATBA4060
50 x 6	300	50	0.85	ATBA5060

**Material:** Aluminium

**Standard:** BS:EN 755-5

## PVC Covered Aluminium Tape



Kingsmill offers UV-stabilised **PVC Covered Aluminium Tape** in a range of colours. Colours match the most common structural materials and will reduce the visual impact of a Lightning Protection conductor.

PVC covering of aluminium provides an aesthetically pleasing product and it also protects the product from corrosion.

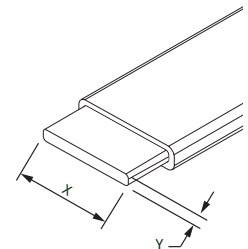
Sold in the specified coil lengths only.

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	COLOUR (to BS 5252*)		COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
12.5 x 1.5	18.75	BLACK	18B29*	50	0.09	TABL12515
20 x 3	60	BLACK	18B29*	50	0.25	TABL2030
25 x 3	75	BLACK	18B29*	50	0.31	TABL253
25 x 3	75	BROWN	06C39*	50	0.31	TABN253
25 x 3	75	GREEN	BS 6746C	50	0.31	TAGN253
25 x 3	75	GREY	00A07*	50	0.31	TAGY253
25 x 3	75	STONE	08B23*	50	0.31	TAST253
25 x 3	75	WHITE	10B15*	50	0.31	TAWH253

**Material:** Aluminium, PVC

**Standard:** BS:EN 755-5

**PVC Colour:** BS 5252 (green to BS 6746C)





## Solid Circular Copper

**Solid Circular Copper** is sold in the specified coil lengths only.

DIAMETER (X) (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
8.0	50	50	0.44	CC08

**Material:** Copper

**Standard:** BS:EN 13601 (formerly BS 1432)

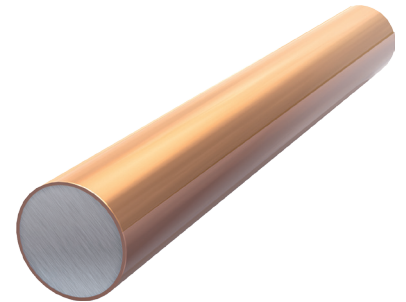


## STRIKEBAND Copper Covered Aluminium

**STRIKEBAND Copper Covered Aluminium** is sold in the specified coil length only. Copper thickness is 15% by volume, giving a radial thickness of 0.31mm.

DESCRIPTION	CSA (mm <sup>2</sup> )	DIAMETER (mm)	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
Copper/aluminium bimetallic conductor	50	8.0	110	0.18	CCA08

**Material:** 99.9% purity copper and 99.7% purity aluminium



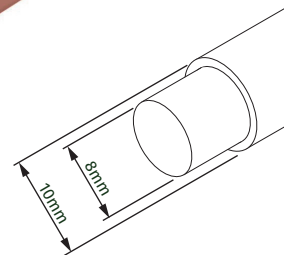
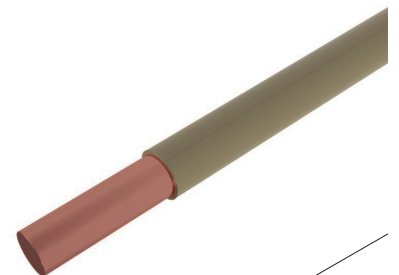
## PVC Covered Solid Circular Copper

Kingsmill offers UV-stabilised **PVC Covered Solid Circular Copper** in a range of colours\*. Colours match the most common structural materials to reduce visual impact of a Lightning Protection conductor. Outer diameter (10mm) includes the PVC sheathing. Sold in the specified coil lengths only. **Use with 10mm clips.**

COLOUR	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	BS 5252 COLOUR	PART NO.
Black	50	50	0.49	18B29*	CCBL
Brown	50	50	0.49	06C39*	CCBN
Grey	50	50	0.49	00A07*	CCGY
Stone	50	50	0.49	08B23*	CCST
White	50	50	0.49	10B15*	CCWH

**Material:** Copper

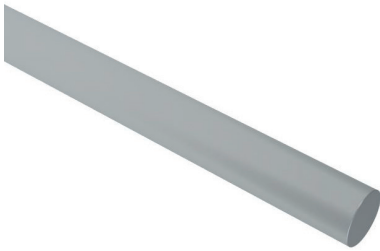
**Standard:** BS:EN 13601 (formerly BS 1432) (conductor)  
BS 5252 (\*PVC colours)



### SPECIAL COLOURS

Special colours are available upon request but are subject to minimum quantity and higher set-up costs. Please contact our sales team with details of your requirements.

## Solid Circular Aluminium

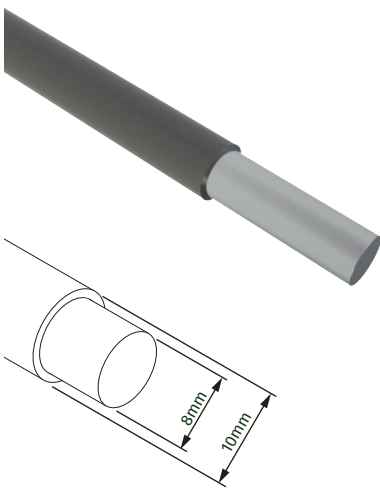


Kingsmill **Solid Circular Aluminium** is easy to install. It is sold in the specified coil length only.

DIAMETER (mm)	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	PART NO.
8.0	50	50	0.12	CA08

**Material:** Aluminium  
**Standard:** BS:EN 755-5

## PVC Covered Solid Circular Aluminium



Kingsmill offers UV-stabilised **PVC Covered Solid Circular Aluminium** in a range of colours\*. Colours match the most common structural materials to reduce visual impact of a Lightning Protection conductor. Outer diameter (10mm) includes the PVC sheathing. Sold in the specified coil lengths only. **Use with 10mm clips.**

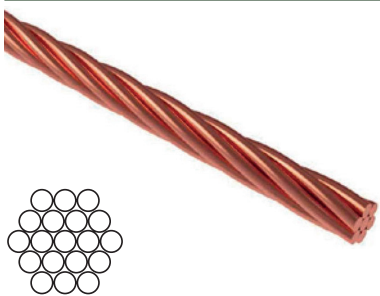
COLOUR	CSA (mm <sup>2</sup> )	COIL SIZE (m)	WEIGHT (kg/m)	COLOUR (to BS 5252*)	PART NO.
Black	50	50	0.18	18B29*	CABL
Brown	50	50	0.18	06C39*	CABN
Grey	50	50	0.18	00A07*	CAGY
Stone	50	50	0.18	08B23*	CAST
White	50	50	0.18	10B15*	CAWH

**Material:** Aluminium  
**Standard:** BS:EN 755-5 (formerly BS 1432) (conductor)  
 BS 5252 (\*PVC colours)

### SPECIAL COLOURS

Special colours are available upon request but are subject to minimum quantity and higher set-up costs. Please contact our sales team with details of your requirements.

## Copper Cable (Bare stranded)



Kingsmill **Copper Cable (Bare stranded)** is suitable for earthing applications.

CSA (mm <sup>2</sup> )	STRANDING No./DIA (mm)**	NOMINAL DIAMETER (mm)	WEIGHT (kg/m)	PART NO.
6.0	7 / 1.04	3.12	0.05	BSCW006
16	7 / 1.70	5.10	0.15	BSCW016
25	7 / 2.14	6.42	0.23	BSCW025
35	7 / 2.52	7.56	0.32	BSCW035
50	19 / 1.78	8.90	0.43	BSCW050
70	19 / 2.14	10.70	0.62	BSCW070
95	19 / 2.52	12.60	0.86	BSCW095
120	37 / 2.03	14.21	1.09	BSCW120
150	37 / 2.25	15.75	1.33	BSCW150
185	37 / 2.52	17.64	1.67	BSCW185
240	61 / 2.25	20.25	2.20	BSCW240
300	61 / 2.52	22.68	2.76	BSCW300
400	61 / 2.85	25.65	3.53	BSCW400

**Material:** Soft drawn stranded copper cable to BS:EN 60228 (can supply hard drawn on request to BS 7884)

**Standard:** BS:EN 60228

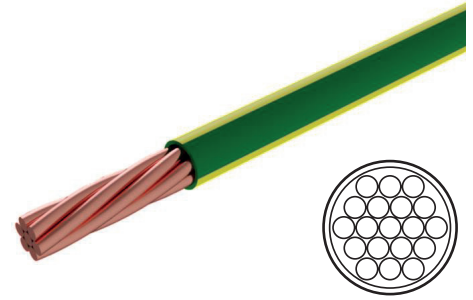
## Stranded Copper Cable (Green/yellow PVC covered)

Kingsmill **Stranded Copper Cable (Green/yellow PVC covered)** for use as earth continuity conductors, equipment tails etc.

STRANDING No./DIA (mm)**	NOMINAL DIAMETER (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg/m)	PART NO.
7 / 1.70	7.10	16	0.15	CCGY016
7 / 2.14	8.90	25	0.23	CCGY025
7 / 2.52	9.95	35	0.32	CCGY035
19 / 1.78	11.70	50	0.43	CCGY050
19 / 2.14	13.35	70	0.62	CCGY070
19 / 2.52	15.60	95	0.86	CCGY095
37 / 2.03	17.20	120	1.09	CCGY120
37 / 2.25	19.10	150	1.33	CCGY150
37 / 2.52	21.30	185	1.67	CCGY185
61 / 2.25	24.30	240	2.20	CCGY240
61 / 2.52	27.05	300	2.76	CCGY300
61 / 2.85	30.35	400	3.53	CCGY400

**Material:** Soft drawn stranded copper cable \*\*Stranding may vary  
**Standard:** BS:EN 60228 (conductor), BS 6746C (PVC colour)  
**Temp range:** 0°C to 70°C

Such conductors are generally referred to in the industry as 6491X, voltage rating 450/750V (designated suitable 600/1000V).



## Stranded Copper Cable (Tinned)

Kingsmill **Stranded Copper Cable (Tinned)** is used where extra corrosion protection is required.

STRANDING No./DIA (mm)**	NOMINAL DIAMETER (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg/m)	PART NO.
7 / 1.70	5.10	16	0.15	BSCW016/T
7 / 2.14	6.42	25	0.23	BSCW025/T
7 / 2.52	7.56	35	0.32	BSCW035/T
19 / 1.78	8.90	50	0.43	BSCW050/T
19 / 2.14	10.70	70	0.62	BSCW070/T
19 / 2.52	12.60	95	0.86	BSCW095/T
37 / 2.03	14.21	120	1.09	BSCW120/T
37 / 2.25	15.75	150	1.33	BSCW150/T
37 / 2.52	17.64	185	1.67	BSCW185/T
61 / 2.25	20.25	240	2.20	BSCW240/T
61 / 2.52	22.68	300	2.76	BSCW300/T
61 / 2.85	25.65	400	3.53	BSCW400/T

**Material:** Tinned soft drawn stranded copper cable \*\*Stranding may vary  
**Standard:** BS:EN 60228



## Galvanised Stranded Conductor

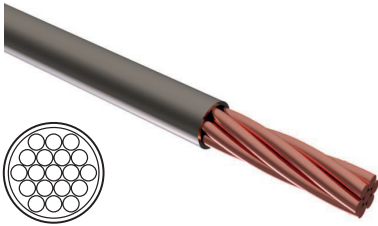
Kingsmill **Galvanised Stranded Conductor** is suitable for BS62305 internal foundation earthing rings.

STRANDING NO./DIA (mm)**	NOMINAL DIAMETER (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg/m)	PART NO.
19/2	10.00	78.55	0.50	GSC10

**Material:** Galvanised steel \*\*Stranding may vary  
**Standard:** BS:EN 12385-4:2002 & A1:2008 Steel Wire Ropes DIN 3053



## Copper Cable (Lead covered stranded)



Kingsmill **Copper Cable (Lead covered stranded)** is used in areas where corrosion is an issue.

CSA (mm <sup>2</sup> )	STRANDING NO./DIA. (mm)	NOMINAL DIA. (mm)	WEIGHT (kg/m)	PART NO.
185	37 / 2.52	21.64	1.67	BSCW185/LS
240	61 / 2.25	24.25	2.20	BSCW240/LS
300	61 / 2.52	26.68	2.76	BSCW300/LS
400	61 / 2.85	29.65	3.53	BSCW400/LS

**Material:** Soft drawn stranded copper cable

**Standard:** BS:EN 60228

**Covering:** Type 'B' lead alloy (2mm thick coating)

## Steel Tape Guards/Cable Guards



Kingsmill **Steel Tape Guards** protect against accidental damage, vandalism and theft. Suitable for 25 x 3 tape (including fixing clip). Easy to fix, with a low profile. A galvanised finish gives this product a long lasting resistance to corrosion.

LENGTH (mm)	WIDTH (mm)	DEPTH (mm)	WEIGHT (kg)	PART NO.
2500	90	15	2.68	GAVG

**Material:** Galvanised Steel

**Powder Coated Steel Tape Guards** blend to a building's aesthetics.

COLOUR	LENGTH (mm)	WIDTH (mm)	DEPTH (mm)	WEIGHT (kg)	PART NO.
Black	2400	90	15	2.70	GAVGB
White	2400	90	15	2.70	GAVGW
Grey	2400	90	15	2.70	GAVGG
Brown	2400	90	15	2.70	GAVGBR

Other **Tape Guards** are available. Please contact our sales office with your requirements.

### CAN'T SEE A CONDUCTOR THAT MEETS YOUR REQUIREMENTS . . ?

Kingsmill supply a wide range of conductor, including: copper tape, insulated high voltage cable, aluminium tape, solid circular copper, copper covered aluminium, solid circular aluminium, copper cable and galvanised stranded conductor. If none of these meet your requirements, Kingsmill can source other types of conductor eg copper covered steel. Please contact us for details.

<b>Introduction</b>	<b>FIT:2 - 3</b>
<b>Metallic DC Clips</b> For securing conductors to walls and roofs etc	<b>FIT:4</b>
<b>Metallic Cable Saddles</b> For use in both Lightning Protection and Earthing Systems	<b>FIT:5</b>
<b>Non-Metallic DC Clips</b> PVC clips for securing conductors to walls and roofs etc. Colours blend with our range of PVC coloured conductors	<b>FIT:6</b>
<b>Adhesive Clips</b> For securing conductors to surfaces where drilling is not permitted	<b>FIT:7</b>
<b>One Hole Cable Clips</b> Simple solution for fixing circular conductors to flat surfaces	<b>FIT:8</b>
<b>Clip Bases</b> For securing clips to surfaces including bitumen roofing and ridge tiles	<b>FIT:9</b>
<b>Clamps</b> Square and Tee clamps for providing three and four way conductor connections	<b>FIT:10 - 11</b>
<b>Holdfasts</b> Bases for special fixing applications	<b>FIT:12 - 14</b>
<b>Standing Seam Clamps</b> For securing lightning conductors to Standing Seam roofing sheets	<b>FIT:15</b>
<b>Test Links/Clamps</b> Disconnectable clamps to separate lightning conductor from the Earthing System during testing	<b>FIT:16 - 17</b>
<b>Bimetallic Connectors</b> For connecting aluminium conductors to copper conductors	<b>FIT:18</b>
<b>Lightning Strike Counter</b> Counts the number of lightning strikes to a building	<b>FIT:19</b>
<b>Screws and Plugs</b>	<b>FIT:20</b>

# Introduction

Once the type of Conductor has been chosen, it is important to consider how to fix/secure this to the structure to be protected. The Kingsmill range includes fixings for both roof and wall and are designed to suit most applications, as well as materials.

DC Clips, Saddles, Clips, Hold Fast, Adhesive Clips, Bimetallic Connectors, special roofing fixings etc. Materials used include: high copper content alloys, aluminium and UV resistant plastics.



**PYRAMID  
HOLDFASTS**  
page FIT:13



**SQUARE AND  
TEE CLAMPS**  
page FIT:10 - 11



**HOLDFAST AND  
STANDING SEAM  
CLAMPS**  
pages FIT:14 - 15



**TEST LINKS**  
pages FIT:16 - 17



**ADHESIVE  
CLIPS**  
page FIT:7



**METALLIC  
CLIPS**  
page FIT:4



**NON-METALLIC  
CLIPS**  
page FIT:6



**LIGHTNING STRIKE  
COUNTER**  
page FIT:19



**BIMETALLIC  
CONNECTORS**  
pages FIT:18



Kingsmill connection components that have been tested to BS:EN 62561-1 - *Lightning Protection Components - requirements for Connection Components* have passed both environmental ageing and 100kA impulse current testing and are rated H.



# Introduction

When choosing a connector it is important to ensure:

- The connector is mechanically robust.
- The connector is selected according to its application.
- The connector is rated for its application.
- To avoid bimetallic corrosion - use a bimetallic connector (*do not connect bare copper directly to bare aluminium, or have water run-off from copper, fall onto aluminium*).

**Galvanic corrosion - happens when there is a potential difference between dissimilar metals:**

- *When the materials are in contact in the presence of an electrolyte, corrosion occurs. One metal becomes the anode, the other the cathode. The anode will tend to go into solution and therefore corrode. The electrolyte can be water with impurities from the air.*
- *In the instance of water run-off from copper - the water carries fine copper corrosion particles which, when they drip on to aluminium or zinc, may result in corrosion. The direct contact of the dissimilar metals is not required for corrosion to occur in such a case.*

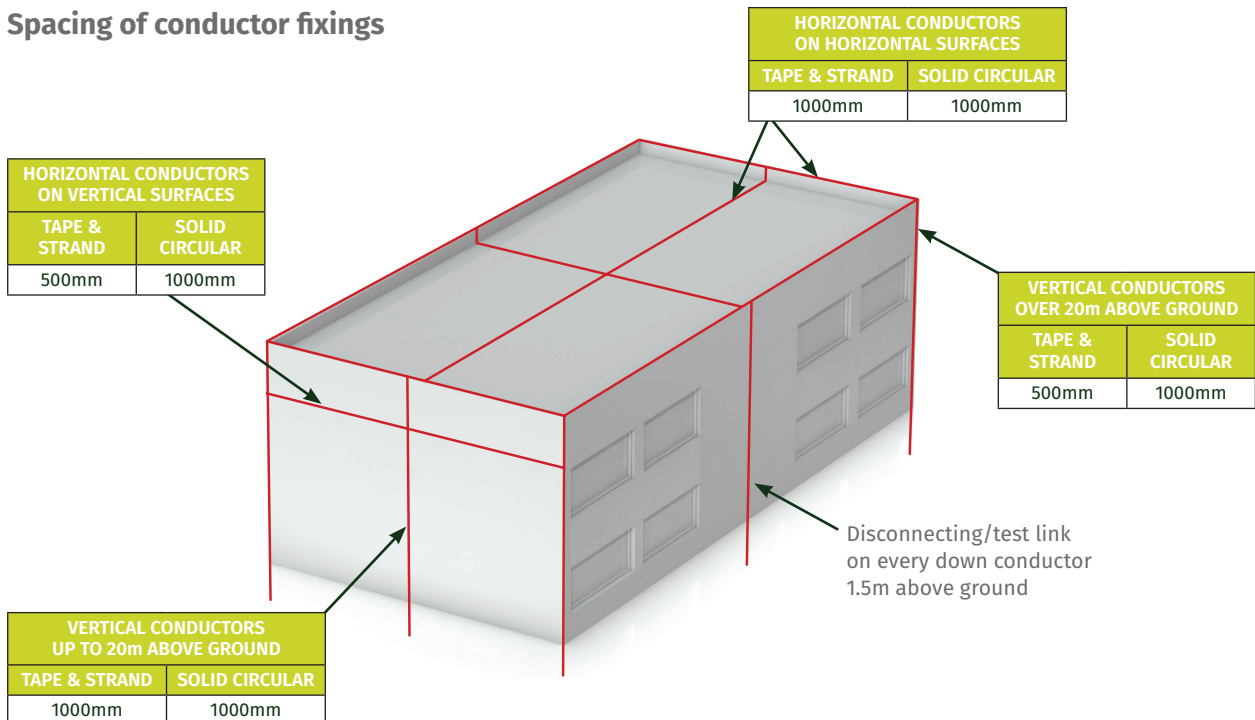
## From BS:EN 62305 . . .

BS:EN 62305-3 contains guidance on the quantity of fixings to be used through specifying minimum distances and usage.

Down conductors should each have the provision of a test or disconnecting link to separate the above and below ground conductor networks during testing.

Conductor fixings should be placed taking into account the minimum spacings recommended within BS:EN 62305, as well as practical considerations associated with building geometry.

### Spacing of conductor fixings



Most Kingsmill connection components have been tested to BS:EN 62561-1 - Lightning Protection Components - requirements for connection components. They have passed both environmental ageing and 100kA impulse current testing and rated H.

## BS:EN 62305 Metallic DC Clips (Flat conductor)



**BS:EN 62305 Metallic DC Clips** for securing lightning conductors to flat surfaces.

CONDUCTOR SIZE (mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
25 x 3	Bare Copper	0.047	MDCF253
25 x 6	Bare Copper	0.057	MDCF256
31 x 6	Bare Copper	0.061	MDCF316
40 x 4	Bare Copper	0.062	MDCF404
50 x 6	Bare Copper	0.077	MDCF506
25 x 3	PVC Copper	0.055	MDCF253P
25 x 6	PVC Copper	0.064	MDCF256P
31 x 6	PVC Copper	0.069	MDCF316P
40 x 4	PVC Copper	0.071	MDCF404P
50 x 6	PVC Copper	0.084	MDCF506P
25 x 3	Aluminium	0.017	MDAF253
25 x 3	PVC Aluminium	0.020	MDAF253P

**MATERIAL:** High Quality Copper Alloy/Aluminium

NEW hot stamped design (part numbers in red) coming soon



**FIXINGS**

1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included



SEE PAGE FIT:20

## Heavy Duty Metallic DC Clips (Flat conductor)



MDC253



MDA253

**Heavy Duty Metallic DC Clips** are suitable for use in Earthing and Lightning Protection applications.

CONDUCTOR SIZE (mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
20 x 3	Bare Copper	0.09	MDC203
25 x 3	Bare Copper	0.07	MDC253
25 x 4	Bare Copper	0.06	MDC254
25 x 6	Bare Copper	0.06	MDC256
31 x 3	Bare Copper	0.09	MDC313
31 x 6	Bare Copper	0.11	MDC316
38 x 3	Bare Copper	0.12	MDC383
38 x 5	Bare Copper	0.12	MDC385
38 x 6	Bare Copper	0.14	MDC386
40 x 4	Bare Copper	0.14	MDC404
40 x 6	Bare Copper	0.14	MDC406
50 x 3	Bare Copper	0.15	MDC503
50 x 4	Bare Copper	0.15	MDC504
50 x 6	Bare Copper	0.17	MDC506
25 x 3	PVC Copper	0.13	MDC253P
25 x 6	PVC Copper	0.10	MDC256P
50 x 6	PVC Copper	0.26	MDC506P
25 x 3	Lead Covered Copper	0.20	MDC253LD
20 x 3	Bare Aluminium	0.02	MDA203
25 x 3	Bare Aluminium	0.03	MDA253
25 x 6	Bare Aluminium	0.04	MDA256
50 x 6	Bare Aluminium	0.05	MDA506
25 x 3	PVC Aluminium	0.04	MDA253P
50 x 6	PVC Aluminium	0.06	MDA506P

**MATERIAL:** High Copper Content Alloy/Gunmetal/Aluminium Alloys

**STANDARD:** BS:EN 62561-4



**FIXINGS**

1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included



SEE PAGE FIT:20

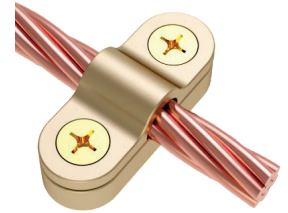
## Heavy Duty Metallic Cable Saddles

**Heavy Duty Metallic Cable Saddles** are suitable for use in both Lightning Protection and Earthing Systems.

### Use with bare solid and stranded copper conductor

CONDUCTOR CSA (mm <sup>2</sup> )	CONDUCTOR DIA (approx mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
50	8	Bare solid copper	0.100	HDSC08
16	5.1	Bare stranded copper	0.105	HDCS16
25	6.42	Bare stranded copper	0.105	HDCS25
35	7.56	Bare stranded copper	0.105	HDCS35
50	8.9	Bare stranded copper	0.100	HDCS50
70	10.7	Bare stranded copper	0.100	HDCS70
95	12.6	Bare stranded copper	0.107	HDCS95
120	14.21	Bare stranded copper	0.107	HDCS120
150	15.75	Bare stranded copper	0.215	HDCS150
185	17.64	Bare stranded copper	0.205	HDCS185
240	20.25	Bare stranded copper	0.300	HDCS240
300	22.68	Bare stranded copper	0.290	HDCS300
400	25.65	Bare stranded copper	0.285	HDCS400

**Material:** High copper content alloy





**FIXINGS**  
1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10) + plug (PP10) not included



[SEE PAGE FIT:20](#)

### Use with PVC insulated copper cable

CONDUCTOR CSA (mm <sup>2</sup> )	CONDUCTOR DIA (approx mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
16	7.10	PVC insulated copper cable	0.105	HDCS16INS
25	8.90	PVC insulated copper cable	0.100	HDCS25INS
35	9.95	PVC insulated copper cable	0.100	HDCS35INS
50	11.70	PVC insulated copper cable	0.110	HDCS50INS
70	13.35	PVC insulated copper cable	0.115	HDCS70INS
95	15.60	PVC insulated copper cable	0.215	HDCS95INS
120	17.20	PVC insulated copper cable	0.205	HDCS120INS
150	19.10	PVC insulated copper cable	0.205	HDCS150INS
185	21.30	PVC insulated copper cable	0.295	HDCS185INS
240	24.30	PVC insulated copper cable	0.285	HDCS240INS
300	27.05	PVC insulated copper cable	0.280	HDCS300INS
400	30.35	PVC insulated copper cable	0.275	HDCS400INS

**Material:** High copper content alloy



**FIXINGS**  
1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10) + plug (PP10) not included



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## Non-Metallic DC Clips (Flat conductor)



**Non-Metallic DC Clips** are available in six colours to match bare and PVC copper and aluminium tapes.

CONDUCTOR SIZE (mm)	CONDUCTOR TYPE	COLOUR	WEIGHT (kg)	PART No.
20 x 3	Bare	Brown	0.01	PCBN203B
20 x 3	Bare	Grey	0.01	PCGY203B
25 x 3	Bare	Brown	0.01	PCBN253B
25 x 3	Bare	Grey	0.01	PCGY253B
50 x 6	Bare	Brown	0.01	PCBN506B
25 x 3	PVC	Brown	0.01	PCBN253P
25 x 3	PVC	Black	0.01	PCBL253P
25 x 3	PVC	Grey	0.01	PCGY253P
25 x 3	PVC	Green	0.01	PCGN253P
25 x 3	PVC	Stone	0.01	PCST253P
25 x 3	PVC	White	0.01	PCWH253P

**Material:** UV Stabilised Polypropylene



### FIXINGS

1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 or AZCSKSLT1.5-10) + plug (PP10) not included



[SEE PAGE FIT:20](#)

## Non-Metallic DC Clips (Circular - push in type)



One-piece **Non-Metallic DC Clips** are designed for ease of installation. They suit 8mm bare and PVC sheathed circular conductors and are UV stabilised to prevent degradation in cold weather conditions.

CONDUCTOR DIA. (mm)	CONDUCTOR TYPE	COLOUR	WEIGHT (kg)	PART No.
8.0	Bare	Brown	0.01	PCBN08B/PUSH
8.0	Bare	Grey	0.01	PCGY08B/PUSH
8.0	PVC	Brown	0.01	PCBN08P/PUSH
8.0	PVC	Grey	0.01	PCGY08P/PUSH
8.0	PVC	Black	0.01	PCBL08P/PUSH
8.0	PVC	Stone	0.01	PCST08P/PUSH
8.0	PVC	White	0.01	PCWH08P/PUSH

**Material:** UV Stabilised Polypropylene



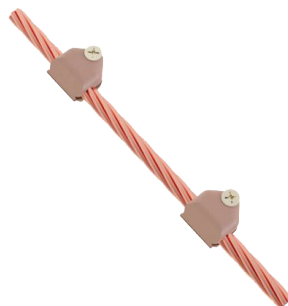
### FIXINGS

1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 or AZCSKSLT1.5-10) + plug (PP10) not included



[SEE PAGE FIT:20](#)

## Non-Metallic DC Clips (Circular - wrap over type)



**Wrap Over Type Clips** are designed for ease of installation. They suit 8mm bare and PVC sheathed circular conductors.

CONDUCTOR DIA. (mm)	CONDUCTOR TYPE	COLOUR	WEIGHT (kg)	PART No.
8.0	Bare	Brown	0.01	PCBN08B/BUTT
8.0	Bare	Grey	0.01	PCGY08B/BUTT
8.0	PVC	Brown	0.01	PCBN08P/BUTT
8.0	PVC	Grey	0.01	PCGY08P/BUTT
8.0	PVC	Black	0.01	PCBL08P/BUTT
8.0	PVC	Stone	0.01	PCST08P/BUTT
8.0	PVC	White	0.01	PCWH08P/BUTT

**Material:** UV Stabilised Polypropylene



### FIXINGS

1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 or AZCSKSLT1.5-10) + plug (PP10) not included



[SEE PAGE FIT:20](#)

## Adhesive Clips (Flat conductor)

**Adhesive Clips** are used where no mechanical fixing method can be achieved or allowed. The base has a threaded hole and is supplied with a fixing screw to suit our **Non-Metallic DC Clip**.

The base is fixed using the adhesive peel off strip and must be applied to a clean and dust free surface. Please use the **Surface Primer** to clean the surface (Part No. SP01).

CONDUCTOR SIZE (mm)	CONDUCTOR	COLOUR	WEIGHT (kg)	PART NO.
25 x 3	Bare	Brown	0.03	PCBN253B/AD
25 x 3	Bare	Grey	0.03	PCGY253B/AD
25 x 3	PVC Covered	Brown	0.03	PCBN253P/AD
25 x 3	PVC Covered	Grey	0.03	PCGY253P/AD
25 x 3	PVC Covered	Black	0.03	PCBL253P/AD
25 x 3	PVC Covered	Stone	0.03	PCST253P/AD
25 x 3	PVC Covered	White	0.03	PCWH253P/AD

**Material:** UV stabilised polypropylene



## Adhesive Clips (Circular conductor)

**Adhesive Clips** are used where no mechanical fixing method can be achieved or allowed. The base has a threaded hole and is supplied with a fixing screw to suit our **Non-Metallic DC Clip**.

The base is fixed using the adhesive peel off strip and must be applied to a clean and dust free surface. Please use the **Surface Primer** to clean the surface (Part No. SP01).

CONDUCTOR SIZE (mm)	CONDUCTOR	COLOUR	WEIGHT (kg)	PART NO.
8.0	Bare	Brown	0.02	PCBN08B/AD
8.0	Bare	Grey	0.02	PCGY08B/AD
8.0	PVC Covered	Brown	0.02	PCBN08P/AD
8.0	PVC Covered	Grey	0.02	PCGY08P/AD
8.0	PVC Covered	Black	0.02	PCBL08P/AD
8.0	PVC Covered	Stone	0.02	PCST08P/AD
8.0	PVC Covered	White	0.02	PCWH08P/AD

**Material:** UV stabilised polypropylene



### SURFACE PRIMER

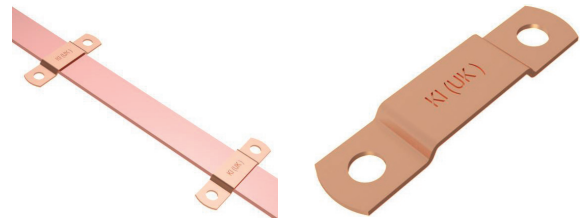
We recommend the use of a suitable **Surface Primer** (such as Norbond N2292) to clean the surface that the **Adhesive Clip** is being adhered to.

## Tape Clips (Flat conductor)

Metal **Tape Clips** hold the tape flush to the surface and are fixed using two screws. They are only suitable for use with bare tape.

CONDUCTOR SIZE (mm)	MATERIAL	WEIGHT (kg)	PART NO.
20 x 3	Copper	0.02	TPC203
25 x 3	Copper	0.02	TPC253
25 x 3	Aluminium	0.02	TPA203
25 x 3	Aluminium	0.02	TPA253
25 x 3	Copper	0.02	TPC253P

**Material:** Copper to BS:EN 13601 (formerly BS 1432)  
Aluminium to BS:EN 755-5



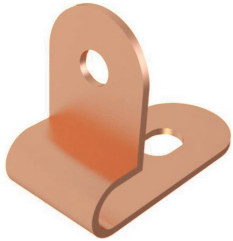
### FIXINGS

2 x CSK 1½ x No:10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included



SEE PAGE FIT:20

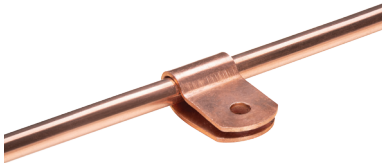
## One Hole Cable Clips (Circular conductor)



**One Hole Cable Clips** are a simple solution for fixing stranded or solid circular conductors to flat surfaces.

CONDUCTOR SIZE (mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
8 Dia	Copper	0.01	OH8C
8 Dia	Aluminium	0.01	OH8A
8 Dia	Copper PVC Covered	0.01	OH10C
8 Dia	Aluminium PVC Covered	0.01	OH10A

**Material:** Copper/Aluminium



A simple, economical clip design for securing cables to flat surfaces.

### Use with bare stranded copper conductor

CONDUCTOR CSA (mm <sup>2</sup> )	CONDUCTOR DIA (approx mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
16	5.1	Bare stranded copper	0.020	OH016
25	6.42	Bare stranded copper	0.020	OH025
35	7.56	Bare stranded copper	0.020	OH035
50	8.9	Bare stranded copper	0.020	OH050
70	10.7	Bare stranded copper	0.020	OH070
95	12.6	Bare stranded copper	0.022	OH095
120	14.21	Bare stranded copper	0.022	OH120
150	15.75	Bare stranded copper	0.025	OH150
185	17.64	Bare stranded copper	0.025	OH185
240	20.25	Bare stranded copper	0.027	OH240
300	22.68	Bare stranded copper	0.027	OH300
400	25.65	Bare stranded copper	0.032	OH400

### Use with PVC insulated copper cable

CONDUCTOR CSA (mm <sup>2</sup> )	CONDUCTOR DIA (approx mm)	CONDUCTOR TYPE	WEIGHT (kg)	PART NO.
16	7.10	PVC insulated copper cable	0.020	OH016INS
25	8.90	PVC insulated copper cable	0.020	OH025INS
35	9.95	PVC insulated copper cable	0.020	OH035INS
50	11.70	PVC insulated copper cable	0.022	OH050INS
70	13.35	PVC insulated copper cable	0.022	OH070INS
95	15.60	PVC insulated copper cable	0.025	OH095INS
120	17.20	PVC insulated copper cable	0.027	OH120INS
150	19.10	PVC insulated copper cable	0.027	OH150INS
185	21.30	PVC insulated copper cable	0.027	OH185INS
240	24.30	PVC insulated copper cable	0.030	OH240INS
300	27.05	PVC insulated copper cable	0.032	OH300INS
400	30.35	PVC insulated copper cable	0.032	OH400INS

**Material:** High Copper Content Alloy

**FIXINGS**  
1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10) + plug (PP10) not included

**SEE PAGE FIT:20**



### Felt Pad Clip Bases

Only use on bitumen roofing felt. Includes clip.

CONDUCTOR SIZE/TYPE (mm)	COLOUR	WEIGHT (kg)	PART NO.
8 Bare	Brown	0.05	PCBN08B/PUSH/FP
8 Bare	Grey	0.05	PCGY08B/PUSH/FP
8 PVC Covered	Brown	0.05	PCBN08P/PUSH/FP
8 PVC Covered	Grey	0.05	PCGY08P/PUSH/FP
8 PVC Covered	Black	0.05	PCBL08P/PUSH/FP
8 PVC Covered	Stone	0.05	PCST08P/PUSH/FP
8 PVC Covered	White	0.05	PCWH08P/PUSH/FP
25 x 3 Bare	Brown	0.05	PCBN253B/FP
25 x 3 Bare	Grey	0.05	PCGY253B/FP
25 x 3 PVC Covered	Brown	0.05	PCBN253P/FP
25 x 3 PVC Covered	Grey	0.05	PCGY253P/FP
25 x 3 PVC Covered	Black	0.05	PCBL253P/FP
25 x 3 PVC Covered	Stone	0.05	PCST253P/FP
25 x 3 PVC Covered	White	0.05	PCWH253P/FP
25 x 3 PVC Covered	Green	0.05	PCGN253P/FP

**Material:** Roofing felt/polypropylene

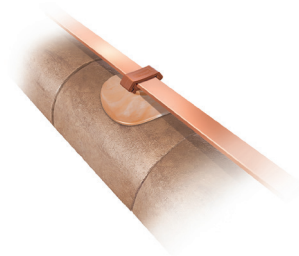


### Flexible DC Clip Bases

Supplied with an M6 CSK screw for attaching the clip. Can be used with our **DC Clip** and **Square Clamp** ranges.

DESCRIPTION	COLOUR	WEIGHT (kg)	PART NO.
Flexible self-adhesive DC Clip Base	Brown	0.037	PCBNFAD/BASE
Flexible self-adhesive DC Clip Base	Grey	0.037	PCGYFAD/BASE
Flexible DC Clip Base	Brown	0.011	PCBNF/BASE
Flexible DC Clip Base	Grey	0.011	PCGYF/BASE

**Material:** Polypropylene



**APPLICATION**

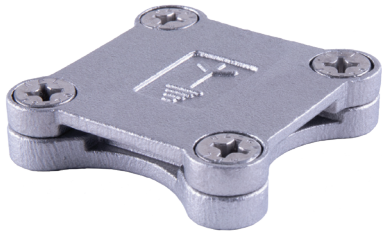
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**COMPONENT ASSEMBLY:**

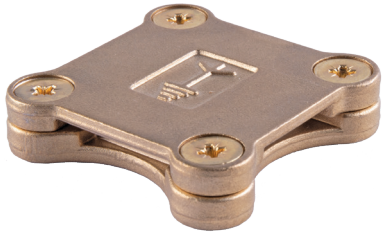
Flexible DC Clip Bases + Non-Metallic DC Clips =

The Kingsmill **Flexible DC Clip Bases** are designed for fixing to curved surfaces such as ridge tiles.

## Square Clamps (Flat conductor)



SQCAF253



SQCCF253

### BS62305 hot stamped design - NEW

**Square Clamps** are designed for a four way connection and are suitable for crossing over tapes, straight through joints or 'T' connections to form a continuous network of tapes.

Countersunk hole in the base for fixing the clamp in place.


CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
25 x 3	Aluminium	0.05	SQCAF253
25 x 3	Copper	0.15	SQCCF253
25 x 6	Copper	0.19	SQCCF256
31 x 3	Copper	0.22	SQCCF313
31 x 6	Copper	0.22	SQCCF316
40 x 6	Copper	0.79	SQCCF406
50 x 6	Copper	0.35	SQCCF506

**Material:** Aluminium/Copper Alloy


**Standard:** BS:EN 62561-1, Class H

**Tightening Torque:** 6Nm

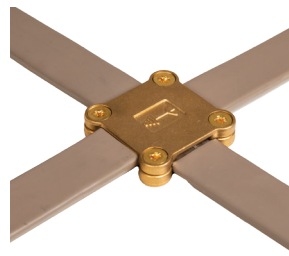
NEW hot stamped design (part numbers in red) coming soon



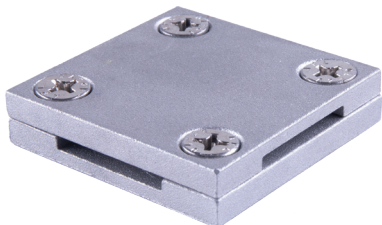
**FIXINGS**  
 1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included



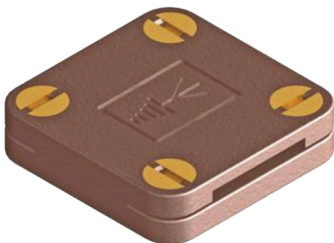
**SEE PAGE FIT:20**



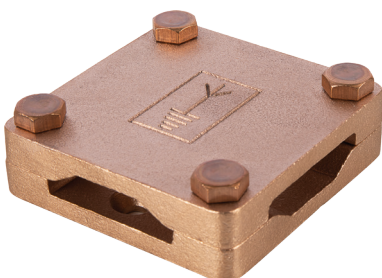
Kingsmill **Square Clamps** permit neat joints on PVC covered conductors due to the recessed lid.



SQCA253



SQCC253



SQCC506


### Earthing Range

CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
25 x 3	Aluminium	0.08	SQCA253
25 x 3	Copper	0.23	SQCC253
25 x 6	Copper	0.44	SQCC256
31 x 3	Copper	0.30	SQCC313
31 x 6	Copper	0.22	SQCC316
40 x 6	Copper	0.79	SQCC406
50 x 6	Copper	1.00	SQCC506


**Material:** Aluminium/High Copper Content Alloy/Gunmetal

**Standard:** BS:EN 62561-1, Class H

**Tightening Torque:** 6Nm



**FIXINGS**  
 1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included



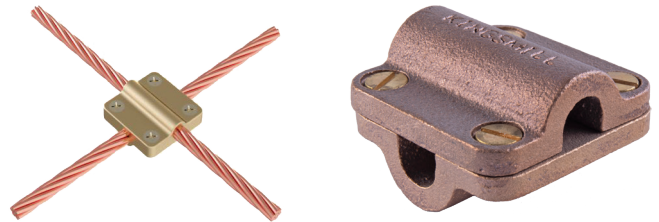
**SEE PAGE FIT:20**

### Square Clamps (Circular conductor)

**Square Clamps** provide four way connection and are suitable for crossing over cable, straight through joints or 'T' connections to form a continuous network of cables. Countersunk hole in the base for fixing the clamp in place.

CONDUCTOR SIZE (mm/mm <sup>2</sup> )	MATERIAL	WEIGHT (kg)	PART NO.
8 Dia	Aluminium	0.23	SQCA08
8 Dia	Copper	0.23	SQCW08
50	Copper	0.30	SQCW50
70	Copper	0.26	SQCW70
95	Copper	0.33	SQCW95

**Material:** Aluminium/copper alloy  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 6Nm

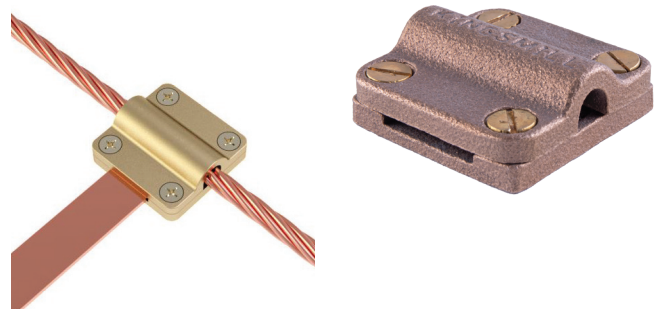


### Square Clamps (Flat to circular conductor)

**Square Clamps** provide four way connection and are suitable for crossing over tapes and cables in straight through joints or 'T' connections to form a continuous cable network. Countersunk hole in the base for fixing the clamp in place.

CONDUCTOR SIZE (mm)	CONDUCTOR RANGE (mm/mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
25 x 3	8 Dia	0.16	SQCC25308
25 x 3	50	0.16	SQCC25350
25 x 3	70	0.14	SQCC25370
25 x 3	95	0.12	SQCC25395

**Material:** Gunmetal  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 6Nm



**FIXINGS**  
 1 x CSK 1½ x No.10 woodscrew (BCSW1.5-10) + plug (PP10) not included

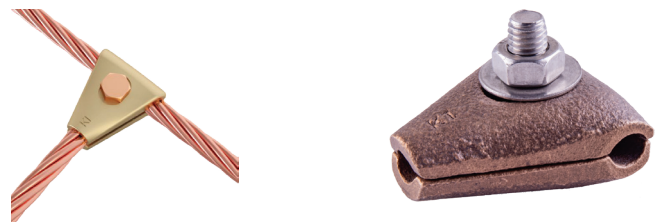
[SEE PAGE FIT:20](#)

### Tee Clamps

Kingsmill **Tee Clamps** are designed for a three way connection.

CONDUCTOR SIZE (mm)	MATERIAL	WEIGHT (kg)	PART NO.
8 Dia	Copper	0.17	TEEC08
8 Dia	Aluminium	0.07	TEEA08

**Material:** Copper alloy/aluminium  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 12Nm



### Circular Conductor Joining and Tee Clamps

**Circular Conductor Joining and Tee clamps** connect 8mm diameter conductor in straight or crossover configurations.

CONDUCTOR SIZE (mm)	MATERIAL	WEIGHT (kg)	PART NO.
8 Dia	Steel	0.05	SQCS08-MV
8 Dia	Copper	0.05	SQCC08-MV
8 Dia	Aluminium	0.01	SQCA08-MV

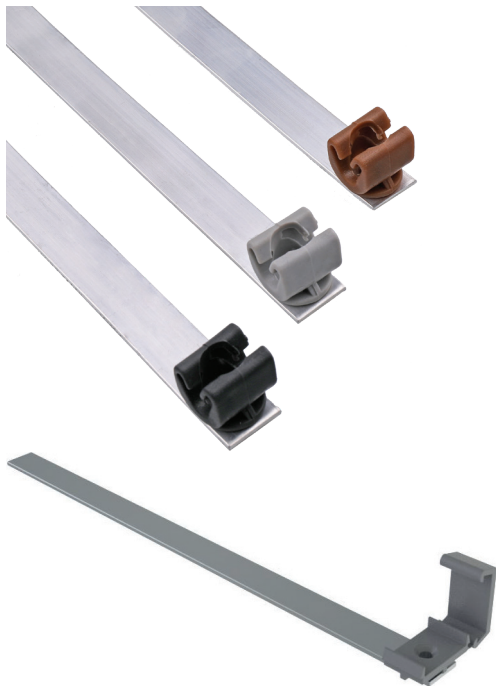
**Material:** Copper/aluminium/zinc plated steel  
**Standard:** BS:EN 62561-1



SQCC08-MV

SQCA08-MV

## Slate Holdfasts (Flat and circular conductor)



**Slate Holdfasts** are used for the installation of circular conductor tape above the roof tiles without the need for drilling holes.

The aluminium tail slides under the roof tile and is fixed to the wooden beam or tile batten using proprietary galvanised nails. The clip then protrudes from the tile and offers a fixing for the tape.

### For use with circular conductor

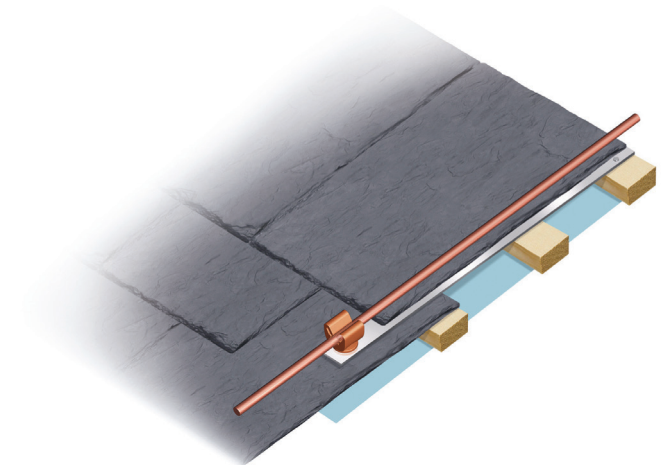
CONDUCTOR DIA (mm)	CONDUCTOR TYPE	COLOUR	WEIGHT (kg)	PART No.
8	Bare	Brown	0.05	SHBN08B/PUSH
8	Bare	Grey	0.05	SHGY08B/PUSH
8	PVC covered	Brown	0.05	SHBN08P/PUSH
8	PVC covered	Grey	0.05	SHGY08P/PUSH
8	PVC covered	Black	0.05	SHBL08P/PUSH
8	PVC covered	Stone	0.05	SHST08P/PUSH
8	PVC covered	White	0.05	SHWH08P/PUSH

### For use with flat conductor

CONDUCTOR SIZE (mm)	CONDUCTOR TYPE	COLOUR	WEIGHT (kg)	PART No.
25 x 3	Bare	Brown	0.05	SHBN253B
25 x 3	Bare	Grey	0.05	SHGY253B
25 x 3	PVC	Brown	0.05	SHBN253P
25 x 3	PVC	Grey	0.05	SHGY253P
25 x 3	PVC	Black	0.05	SHBL253P
25 x 3	PVC	Stone	0.05	SHST253P
25 x 3	PVC	Green	0.05	SHGN253P
25 X 3	PVC	White	0.05	SHWH253P

**Material:** Polypropylene clip/Aluminium tape

**Standard:** Aluminium tape to BS:EN 755-5



Pyramid Holdfasts

Supplied filled with concrete. Lip around the base enables building in to bitumen type roofs.

CONDUCTOR DIA (mm)	CONDUCTOR TYPE	FIXING SCREW	CLIP PROVISION	WEIGHT (kg)	PART NO.
8	Bare	-	x 2	1.00	PHFB08X2
8	Bare	-	x 1	0.98	PHFB08
10	PVC Covered	-	x 1	0.98	PHFB10
Universal	Universal	M6	x 1	0.98	PHFBM6

**Material:** Polyethylene  
**Standard:** BS:EN 62561-1, Class H



PHFB08 + PHFB10



PHFBM6



PHFB8X2



**APPLICATION**

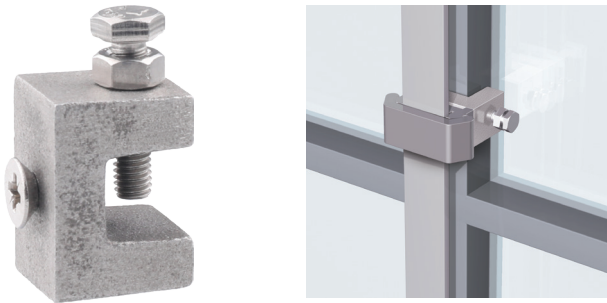
**COMPONENT ASSEMBLY:**

- PHFBM6 + Non-metallic DC Clip = Assembly with copper rod
- PHFBM6 + Metallic DC Clip = Assembly with copper rod
- PHFBM6 + Metallic Cable Saddles = Assembly with copper rod
- PHFBM6 + Square Clamp = Assembly with copper rod
- PHFBM6 + Square Clamp = Assembly with copper rod

Clip/Clamps NOT included - must be ordered separately.



### Glazing Bar Holdfasts



**Glazing Bar holdfast** is used to fix clips to glazing bars. Can be used with both metallic and non-metallic clips.

CONDUCTOR TYPE	MATERIAL	WEIGHT (kg)	PART NO.
Aluminium	Aluminium	0.04	AGBH
Copper	Copper	0.11	GGBH

**Material:** Gunmetal/Aluminium

**APPLICATION**

**COMPONENT ASSEMBLY:** Glazing Bar Holdfast + All Kingsmill DC clips =

### Back Plate Holdfasts



**Back Plate holdfast** maintains a set distance of 75mm between lightning conductor and the surface of the structure being protected (when required).

Supplied with M6 CSK screw for attaching either Tape Clip or Square Clamp.

CONDUCTOR TYPE	MATERIAL	WEIGHT (kg)	PART NO.
Aluminium	Aluminium	0.84	ABPH
Copper	Copper	0.26	BBPH

**Material:** Copper Alloy/Aluminium

**FIXINGS**

2 x CSK 1½ x No.10 woodscrew (BCSW1.5-10 brass for copper/A2CSKSLT1.5-10 stainless steel for aluminium) + plug (PP10) not included **SEE PAGE FIT:20**

**APPLICATION**

**COMPONENT ASSEMBLY:** Back Plate Holdfast + Non-metallic DC clips =

**APPLICATION**

**COMPONENT ASSEMBLY:** Back Plate Holdfast + Metallic DC clips =

**APPLICATION**

**COMPONENT ASSEMBLY:** Back Plate Holdfast + Square clamps =

*Clip/Clamps NOT included - must be ordered separately.*



## Standing Seam Clamps

**Standing Seam Clamps** are designed to allow the installer to secure Lightning Conductors to roofing sheets that use the Standing Seam construction.

### Aluminium Standing Seam Clamps (seam widths 16 - 30mm)

FIXING TYPE	CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	FIXING COLOUR	WEIGHT (kg)	PART NO.
Non-metallic DC Clip	25 x 3	Bare Al	Grey	0.096	KMFBAL-PCGY253B
	25 x 3	PVC Al	Grey	0.096	KMFBAL-PCGY253P
Metallic DC Clip	25 x 3	Bare Al	-	0.098	KMFBAL-MDA253
	25 x 3	PVC Al	-	0.099	KMFBAL-MDA253P
Push-In Clip	8mm dia	Bare Al	Grey	0.096	KMFBAL-PCGY08B/PUSH
	8mm dia	PVC Al	Grey	0.096	KMFBAL-PCGY08P/PUSH
Square Clamp	25 x 3	Aluminium	-	0.168	KMFBAL-SQCA253
	25 x 3	Aluminium	-	0.168	KMFBAL-SQCAF253
Standing Seam only	-	-	-	0.095	KMFBAL

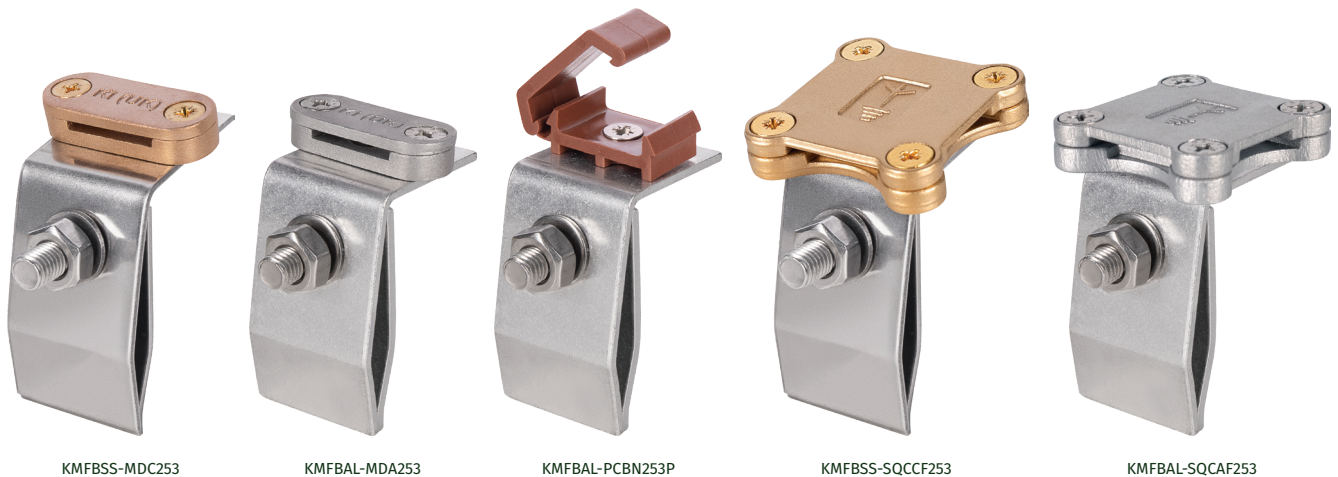
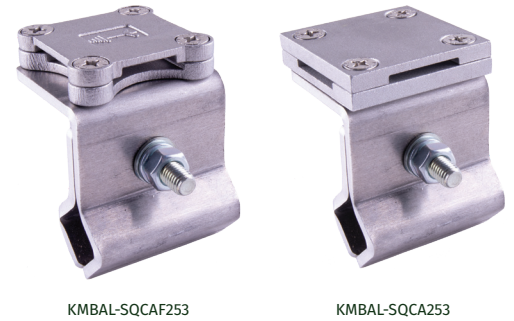
**Material:** Aluminium

### Stainless Steel Standing Seam Clamps (seam widths 16 - 30mm)

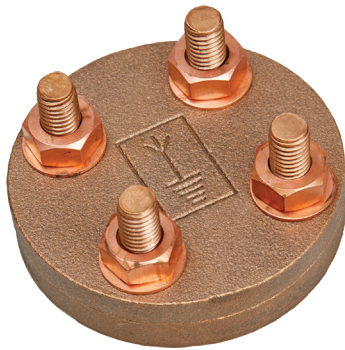
FIXING TYPE	CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	FIXING COLOUR	WEIGHT (kg)	PART NO.
Non-metallic DC Clip	25 x 3	Bare Al	Grey	0.16	KMFBSS-PCGY253B
	25 x 3	PVC Al	Grey	0.16	KMFBSS-PCGY253P
Metallic DC Clip	25 x 3	Bare Al	-	0.18	KMFBSS-MDA253
	25 x 3	PVC Al	-	0.19	KMFBSS-MDA253P
Push-In Clip	8mm dia	Bare Al	Grey	0.16	KMFBSS-PCGY08B/PUSH
	8mm dia	PVC Al	Grey	0.16	KMFBSS-PCGY08P/PUSH
Square Clamp	25 x 3	Aluminium	-	0.23	KMFBSS-SQCA253
	25 x 3	Aluminium	-	0.23	KMFBSS-SQCAF253
Non-metallic DC Clip	25 x 3	Bare Cu	Brown	0.16	KMFBSS-PCBN253B
	25 x 3	PVC Cu	Brown	0.16	KMFBSS-PCBN253P
Metallic DC Clip	25 x 3	Bare Cu	-	0.22	KMFBSS-MDCF253
	25 x 3	PVC Cu	-	0.28	KMFBSS-MDCF253P
Push-In Clip	8mm dia	Bare Cu	Brown	0.16	KMFBSS-PCBN08B/PUSH
	8mm dia	PVC Cu	Brown	0.16	KMFBSS-PCBN08P/PUSH
Square Clamp	25 x 3	Copper	-	0.39	KMFBSS-SQCC253
	25 x 3	Copper	-	0.38	KMFBSS-SQCCF253
Standing Seam only	-	-	-	0.15	KMFBSS

**Material:** Stainless Steel

The **Standing Seam Clamp** only can be used with a range of other fittings and is supplied with an M6 stainless steel bolt and nut for securing the chosen accessory.



### Plate Type Test Clamp



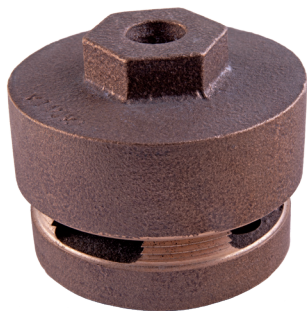
**Plate Type Test Clamps** are used to form a disconnecting joint between the Down Conductor System and the Earthing System. Conductors are secured by the top and bottom plates being clamped together.

CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
25 x 3	Copper	0.90	PTTC253

**Material:** Gunmetal  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 15Nm



### Screw Down Test Clamp



**Screw Down Test Clamps** join 25 x 3 conductor tape to facilitate annual testing of the Lightning Protection System. The heavy duty lid simply screws on and off the threaded base.

CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
25 x 3	Copper	0.84	SDTC253

**Material:** Copper  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 20Nm



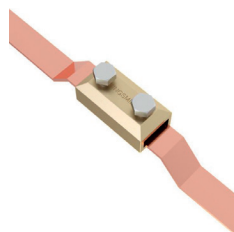
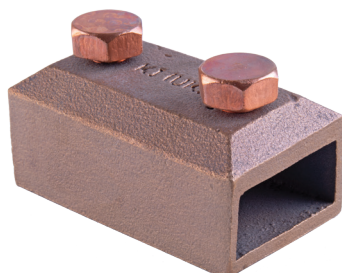
**FIXINGS**

2 x CSK 1½ x No.10 woodscrew (BCSW1.5-10) + plug (PP10) not included



[SEE PAGE FIT:20](#)

### Oblong Test Clamps



**Oblong Test Clamps** are designed to join conductor tape to facilitate in the annual testing of the Lightning Protection System. The clamp is designed to allow the conductor to be overlapped and secured using bolts. *Suitable for use with PVC covered tape.*

CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART No.
25 x 3	Aluminium	0.16	OTCA253
25 x 3	Copper	0.40	OTCC253
31 x 6	Copper	0.38	OTCC316
40 x 5	Copper	0.53	OTCC405
50 x 6	Copper	1.35	OTCC506

**Material:** Aluminium/Copper  
**Standard:** BS:EN 62561-1, Class H  
**Tightening Torque:** 15Nm

### Cable Test Clamps

**Cable Test Clamps** are used to form a disconnecting joint between the Down Conductor System and the Earthing System. The conductors overlap end to end and secure together using two bolts.

CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
50	Copper	0.40	TC50
70	Copper	0.40	TC70
95	Copper	0.40	TC95

**Material:** Gunmetal

**Standard:** BS:EN 62561-1, Class H

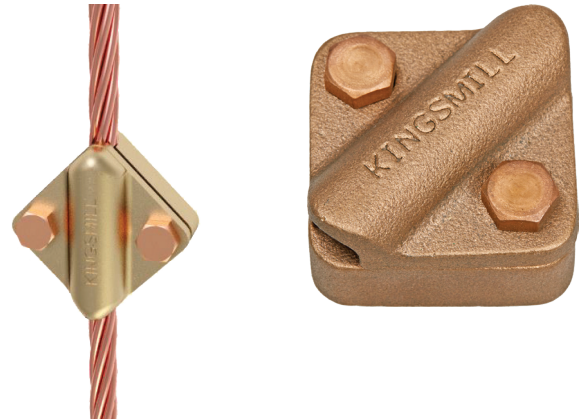
**Tightening Torque:** 6Nm



**FIXINGS**  
1 x CSK 1½ x No.10 woodscrew  
(BCSW1.5-10) + plug (PP10) not included



**SEE PAGE FIT:20**



### Test Clamps (Flat to circular conductor)

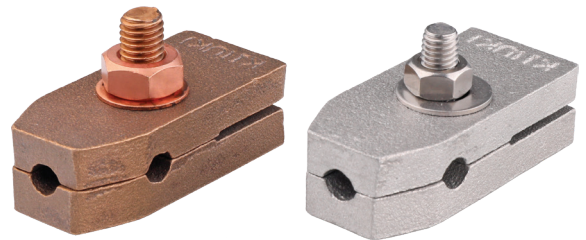
**Test Clamps** form a disconnecting joint between either 8mm and 8mm diameter conductor or 8mm and 25 x 3mm conductor.

CONDUCTOR DIA. (mm)	CONDUCTOR SIZE (mm)	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
8.0	25 x 3	Copper	0.20	TC08
8.0	25 x 3	Aluminium	0.09	TA08

**Material:** Copper/Aluminium

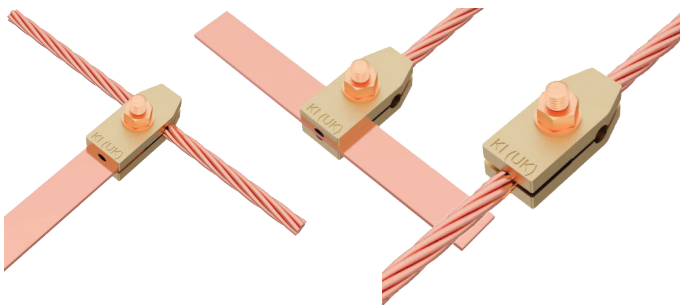
**Standard:** BS:EN 62561-1, Class H

**Tightening Torque:** 12Nm

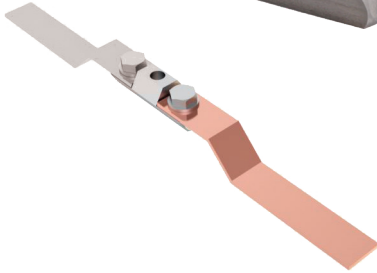


TC08

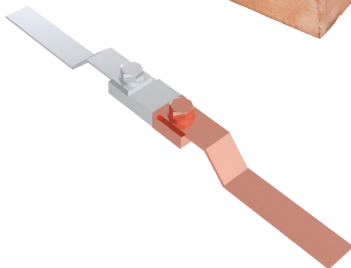
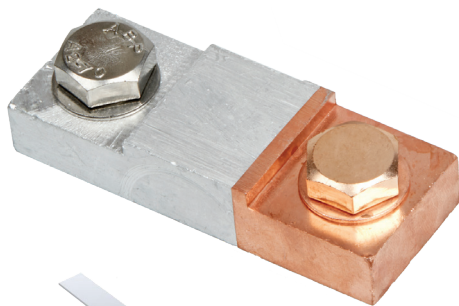
TA08



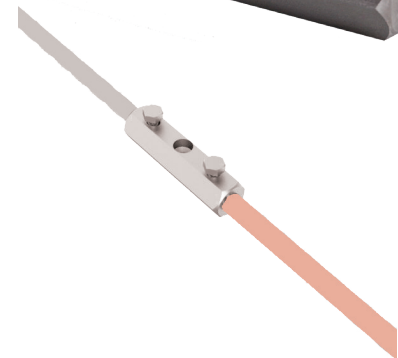
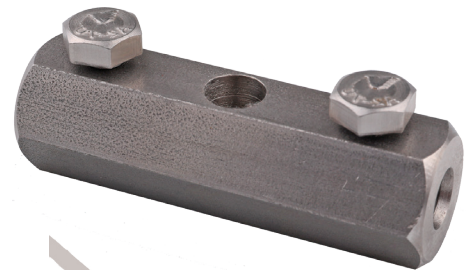
## Bimetallic Connectors



Stainless steel connector for use with 25mm x 3mm conductor



Copper/aluminium connector for use with 25mm x 3mm conductor



Stainless steel connector for use with 25mm x 3mm, 8 dia or 50mm<sup>2</sup> conductor

**Bimetallic Connectors** are designed to connect aluminium conductor to copper earth conductor. They are a practical joining method without the need for tinning, riveting or wrapping around the joint. We recommend the use of oxide inhibiting compound (UNP250) with Bimetallic Connectors.

CONDUCTOR SIZE (mm)	CONNECTOR MATERIAL	WEIGHT (kg)	PART NO.
25 x 3	Stainless Steel	0.18	BM253HS
8 dia or 50mm <sup>2</sup>	Stainless Steel	0.18	BM08HS
25 x 3 to 8 dia or 50mm <sup>2</sup>	Stainless Steel	0.18	BM08253SS
25 x 3	Copper/Aluminium	0.18	BM253FC

**Material:** Stainless Steel grade 303 (BM253HS/BM08HS/BM08253SS)  
Copper/Aluminium fuse welded (BM253FC)

**Standard:** BS:EN 62561-1, Class H

**Tightening Torque:** 12Nm



### FIXINGS

1 x CSK 1½ x No.10 woodscrew  
(A2CSKSLT1.5-10) + plug (PP10) not included




[SEE PAGE FIT:20](#)

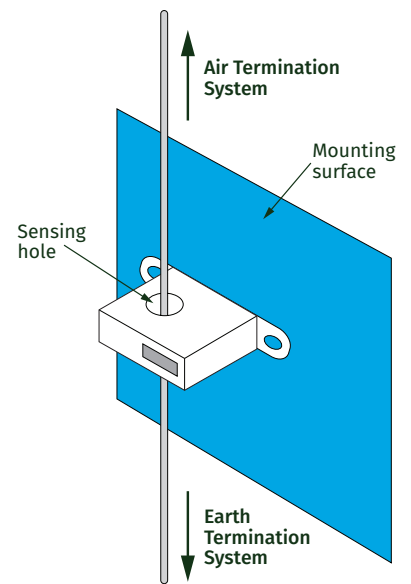
# Lightning Strike Counter

**Lightning Strike Counters** register direct lightning events. They have a long life and do not require a battery or external power.

A sensitive response trigger current of only 500A can register very high lightning strikes up to 150kA 8/20µs. **Lightning Strike Counters** utilise a 6 digit mechanical count display and are IP67 rated for outdoor use. Suitable for use with 8mm dia and 25 x 3mm conductors.

PART NO.	HIT-LEC-D
Counting current (rise time $\geq 8\mu\text{s}$ )	>500A
Impulse sequence	>1s
Display model	Electromechanical digital display
Indicator	Lightning event 0 - 999999
Current sample mode	Inductive probe (built-in)
Working mode	No battery need
Operation temperature	-20°C - +60°C
Window dimension	32mm
Counter dimension	150mm x 80.5mm x 36mm
Enclosure material	Steel
Degree of protection	IP67

**FIXINGS**  
 2 x CSK 1½ x No.10 woodscrew (A2CSKSLT1.5-10) + plug (PP10) not included  **SEE PAGE FIT:20**



## Screws & Plugs



DESCRIPTION	SIZE	WEIGHT (kg)	PART NO.
Brass C/S Woodscrew	1½" x 10g	0.50	BCSW1.5-10
Brass C/S Woodscrew	1½" x 12g	0.60	BCSW1.5-12
CSK SLT ST/ST Screws	1" x 10g	0.60	A2CSKSLT101
CSK SLT ST/ST Screws	1½" x 10g	0.60	A2CSKSLT1.5-10
Plastic Wall Plug (Red) 8 - 10G	No.10	0.06	PP-10
Plastic Wall Plug (Brown) 10 - 12G	No.12	0.06	PP-12
Brass Roundhead Woodscrew	No.12	0.60	BRHW1.5-12
Stainless Steel Roundhead Woodscrew	No.12	0.60	A2RHSL1.5-12

**OTHER MATERIALS ARE AVAILABLE ON REQUEST**



<b>Introduction</b>	<b>BOND:2</b>
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<b>C Crimp Connectors</b>	<b>BOND:16</b>
<b>Isolating Spark Gaps</b> Encapsulated high-performance Isolating Spark Gaps	<b>BOND:17 - 18</b>

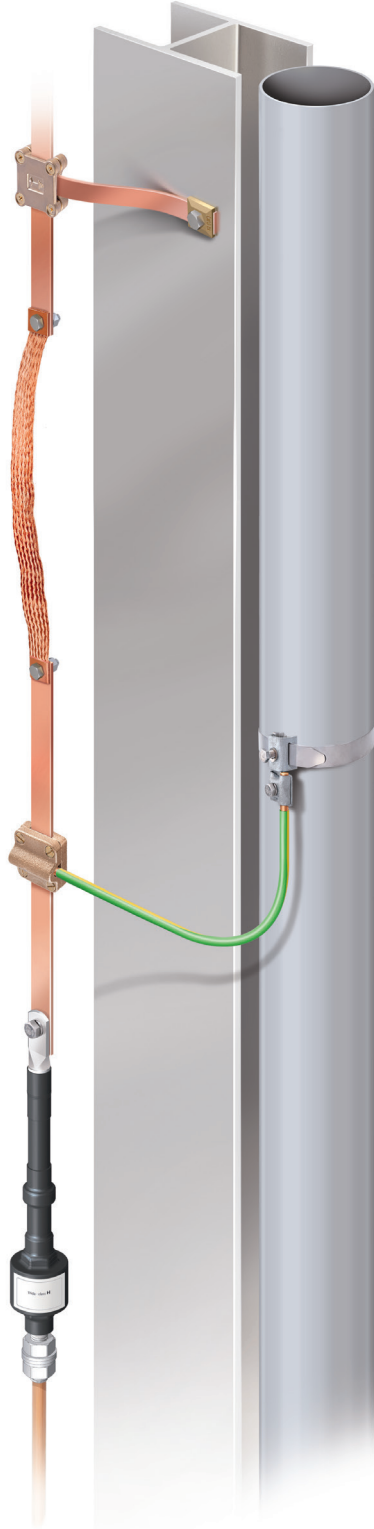
# Introduction

Kingsmill provide a range of products for effective bonding of electrically conductive components to the Lightning Protection System.

**BRAID BONDS**  
pages BOND:10 - 15



**ISOLATING SPARK GAPS**  
pages BOND:17 - 18



**B BONDS**  
page BOND:5



**PIPE BONDS**  
page BOND:5



**REINFORCING BONDS**  
page BOND:6



**STEEL BEAM BONDS**  
page BOND:6

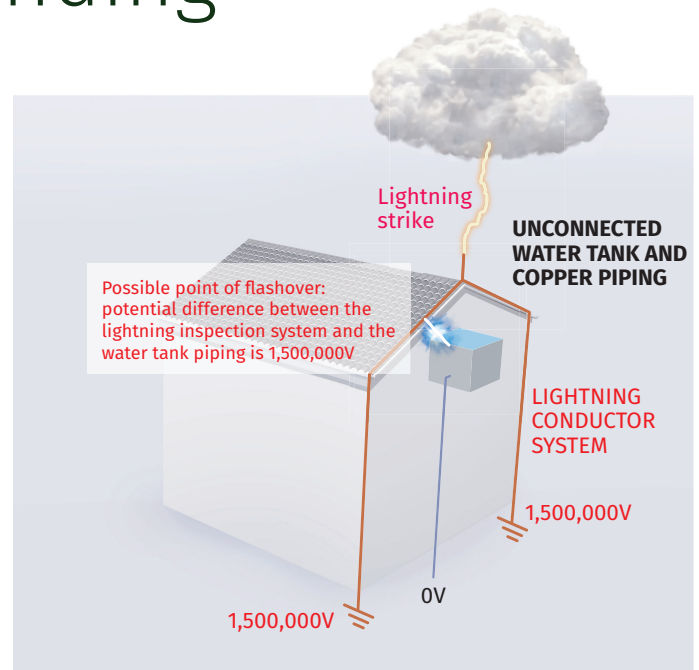


**STATIC EARTH RECEPTACLES**  
page BOND:9



# Equipotential Bonding

An important aspect of a Lightning Protection System (LPS) is that electrically continuous parts of a structure must be bonded into the Lightning Protection network. The purpose of this bonding is to ensure that, in the event of a lightning discharge, any sparking or flashover of the lightning current to conductive parts of the structure, for example water pipes, cables etc is avoided. This is illustrated in the diagram, *to the right*.



## EXPLANATION:

During a lightning strike the lightning conductor system could reach 1,500,000 volts with respect to earth, whilst the copper piping connected to the water tank is at 0 volts to earth. The impedance of the lightning conductor system will determine the “potential difference” between the two systems with respect to earth, as well as the distance that the water tank is away from the lightning conductor. If the potential difference is large enough, it may cause breakdown of the insulation effects of the roof and air, leading to a spark flashing over to the water tank.

Equipotential bonding in this respect, is essentially the connection of conductive metallic parts of the structure such that in the event of a lightning discharge, no potential differences exist between the lightning conductor system and the “other conductive low impedance pathways”.

Materials that can provide a fortuitous low impedance pathway and may require bonding into the lightning protection system are such as:

- Cable screens
- Metallic pipework
- Metallic handrails, stairways, screens
- Structural steelwork
- Reinforcing bar
- Metallic cladding systems for buildings
- Supporting structures for curtain wall systems
- Ductwork etc

The risk of flashover can increase in the presence of:

- Incorrect routeing of conductors
- High impedance lightning protection system - due to the installation of poorly designed components, or inferior/corrosion prone materials

## From BS:EN 62305 . . .

### Some implications for bonding

In a well-designed system, all metallic/conductive services, such as water and gas pipes, power, telecommunications and data cables would enter the building in the same locality and be connected to a single earth bonding bar. Which, in turn, would be connected to the earth termination network, as well as the conductive parts of the building.

However, life isn't that simple and services enter and exit at different places. It is recommended that services are bonded at their point of entry to/exit from the building.

*Equipotential bonding can be achieved through:*

### Direct Connection

Utilising bonds, clamps and conductors which link the various metallic services and parts of the structure to Earth Bars.

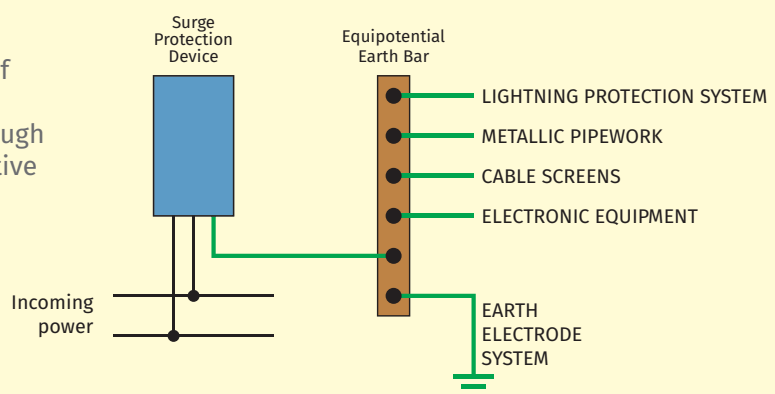
The standard outlines the minimum cross-sectional area of conductors to be used in these applications.

Earth Bars act as collection points for the various bonds and their subsequent connection to the earth termination. Each Earth Bar would be connected to earth. **See Earth Bar section.**

### Surge Protection Devices (SPDs)

It is recommended that the live cores of power, telecommunication and data cables are equipotentially bonded through using appropriately rated Surge Protective Devices.

*A simplified illustration of equipotential bonding using SPDs is demonstrated here . . .*



Guidance for the selection of equipotential bonding or lightning current SPDs can be found on pages SPD:11 - 26.

### Isolating Spark Gaps (ISGs)

Are suitable for use where the direct connection of an external Lightning Protection System and other metallic parts or earthing system is not allowed due to operating reasons. For example, earthing systems for heavy current and telecommunications systems or bridging isolated flanges on pipe connections.

When a difference in potential occurs between these parts, the Isolating Spark Gap (ISG) will provide a temporary conductive connection to earth, thus reducing dangerous potential difference issues (see page EAR:4 for a simple explanation of potential difference).

### Kingsmill offer a wide range of bonding solutions:

- Mechanical Bonds and Clamps
- Earth Bars
- Conductors
- Surge Protection Devices
- Isolating Spark Gaps

**Please contact the Kingsmill sales and technical support team to ensure that you are using high quality products specifically designed for purpose.**

### B Bonds (Flat surfaces)

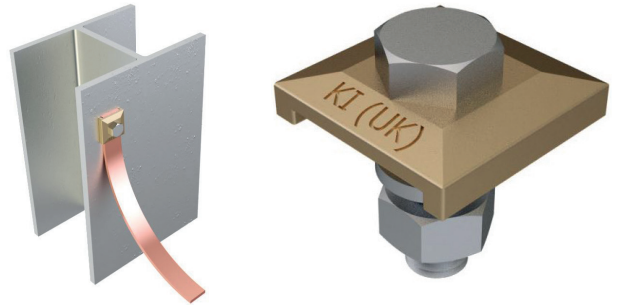
Kingsmill 'B' Type Bond connections are designed to bond either copper or aluminium conductor to flat metal surfaces.

CONDUCTOR MATERIAL	CONDUCTOR SIZE (mm)	MATERIAL	BOLT SIZE	WEIGHT (kg)	PART NO.
Copper	25 x 3	Gunmetal	M10	0.08	BBCB
Aluminium	25 x 3	Aluminium	M10	0.06	BBAB
Copper	31 x 6	Gunmetal	M10	0.14	BBCB316

**Material:** Gunmetal or Aluminium (body)  
Stainless Steel (bolt)

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 17Nm



### RWP Bonds (Pipe work)

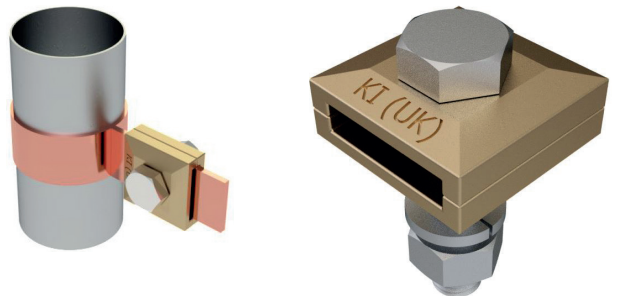
RWP Bonds connect flat conductor to circular objects eg pipework and hand rails etc. RWP Bonds are available in either gunmetal or aluminium to suit your application.

CONDUCTOR MATERIAL	CONDUCTOR SIZE (mm)	MATERIAL	BOLT SIZE	WEIGHT (kg)	PART NO.
Copper	25 x 3	Gunmetal	M10	0.19	CRWB
Aluminium	25 x 3	Aluminium	M10	0.09	ARWB
Copper	31 x 6	Gunmetal	M10	0.25	CRWB316

**Material:** Gunmetal or Aluminium (body), Stainless Steel (bolt)

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 12Nm



### Pipe Bonds

Kingsmill Pipe Bonds are designed for bonding circular stranded copper or aluminium conductor to pipework.

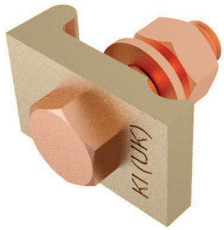
CONDUCTOR SIZE	PIPEWORK SIZE	WEIGHT (kg/m)	PART NO.
10mm <sup>2</sup> - 50mm <sup>2</sup> (up to 8mm dia)	1" - 3" (33.7mm - 88.9mm)	0.073	PBS1-3
10mm <sup>2</sup> - 50mm <sup>2</sup> (up to 8mm dia)	3" - 6" (88.9mm - 168mm)	0.177	PBS1-6

**Material:** Galvanised Steel/Steel

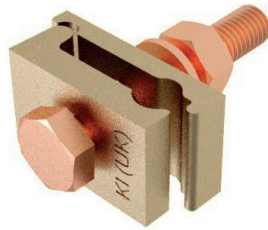
**Standard:** BS:EN 62561-1



### Tower Earth Clamps



TEC2550



TEC1670

Kingsmill **Tower Earth Clamps** are designed to bond either copper or aluminium conductor to flat metal surfaces.

DESCRIPTION	CONDUCTOR SIZE RANGE (mm <sup>2</sup> )	CONDUCTOR MATERIAL	WEIGHT (kg)	PART NO.
Single Plate Clamp	25 - 50	Copper	0.08	TEC2550
Single Plate Clamp	25 - 50	Aluminium	0.06	TEA2550
Double Plate Clamp	16 - 70	Copper	0.13	TEC1670
Double Plate Clamp	70 - 120	Copper	0.23	TEC70120

**Material:** Copper or Aluminium (body), Brass (bolt)

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 12Nm



### Reinforcing Conductor Clamps



KMRC20



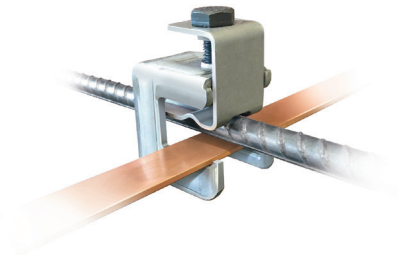
KMRC20-P

Kingsmill **Reinforcing Conductor Clamps** are used to connect flat and circular conductor to reinforcing bar.

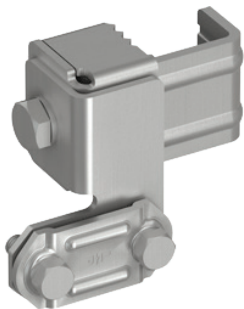
REBAR SIZE (mm <sup>2</sup> )	CIRCULAR CONDUCTOR	FLAT CONDUCTOR (mm)	WEIGHT (kg)	PART NO.
6 - 20	N/A	25 x 3 - 30 x 3.5	0.21	KMRC20
6 - 20	8 - 10mm dia	25 x 3 - 30 x 3.5	0.26	KMRC20-P
25	8 - 10mm dia	25 x 3 - 30 x 3.5	0.20	KMRC25-P
30	N/A	25 x 3 - 30 x 3.5	0.15	KMRC30

**Material:** Zinc Plated Steel

**Standard:** BS:EN 62561-1



### Steel Beam Conductor Clamp

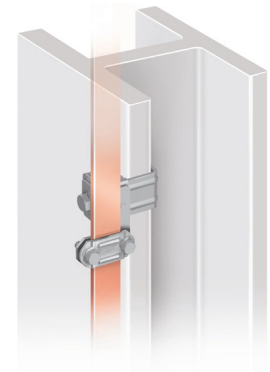


**Steel Beam Conductor Clamps** for fixing conductor to steel beams.

CONDUCTOR RANGE	CLAMPING RANGE (mm)	WEIGHT (kg)	PART NO.
Up to 30 x 3.5mm	36 - 52	0.44	KM111739

**Material:** Stainless Steel

**Standard:** BS:EN 62561-1





### Earth Points (without cover plate)

Kingsmill **Earth Points** (without cover plate) provide a convenient bonding point for bolted connections.

HOLES	FIXING HOLES	MATERIAL	STEM SIZE (φ)	WEIGHT (kg)	PART NO.
1	M8	Gunmetal	10mm	0.170	EBP1-M8
1	M10	Stainless Steel	10mm	0.217	EBP1SS-M10
1	M10	Gunmetal	10mm	0.170	EBP1
2	M10	Gunmetal	10mm	0.300	EBP2
4	M10	Gunmetal	10mm	0.350	EBP4

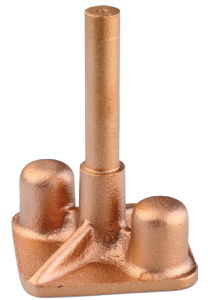
**Material:** Gunmetal/Stainless Steel

**Standard:** BS:EN 62561-1 Class H, BS 7430

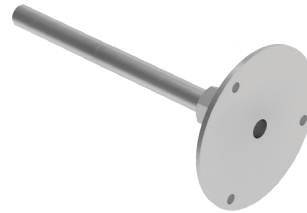
**Tightening torque:** 8Nm



EBP4



EBP2



EBP1SS-M10



EBP1

### Earth Points (with cover plate)

Kingsmill **Earth Points** (with cover plate) provide a convenient bonding point to reinforcing bar.

CONDUCTOR SIZES	MATERIAL	STEM SIZE (φ)	WEIGHT (kg)	PART NO.
25 x 3 / 70mm <sup>2</sup>	Gunmetal	10mm	0.42	EBP2P
25 x 3 / 50mm <sup>2</sup> (8mm φ)	Gunmetal	10mm	0.42	EBP2P-08

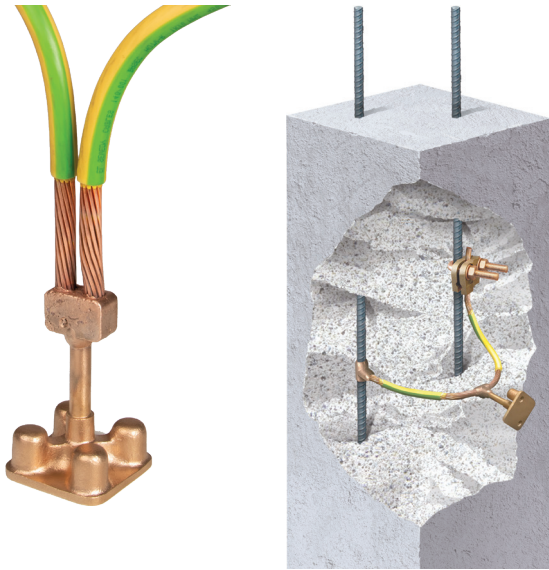
**Material:** Gunmetal

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 8Nm



### Earth Points (with green/yellow tail)



Can be used with bolted clamps or exothermic welds

Kingsmill **Earth Points (with green/yellow tail)** provide bonding points to reinforcing bar.

EARTH POINT	TAIL LENGTH (mm)	NO. OF TAILS	WEIGHT (kg)	PART NO.
EBP1-M8	500	1	0.46	EBP1-M8-T
EBP1	500	1	0.46	EBP1-T
EBP2	500	1	0.63	EBP2-T
EBP2P	500	1	0.75	EBP2P-T
EBP2P-08	500	1	0.75	EBP2P-08-T
EBP2	500	2	0.96	EBP2-2T
EBP2P	500	2	1.08	EBP2P-2T
EBP2P-08	500	2	1.08	EBP2P-08-2T
EBP4	500	1	0.70	EBP4-T
EBP4	500	2	1.05	EBP4-2T

**Material:** Gunmetal, 70mm<sup>2</sup> 6491X green/yellow Copper Cable

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 8Nm

### Single Hole Earth Points (with solid tail)



Kingsmill **Single Hole Earth Points (with solid tail)** provide bonding points to reinforcing bar.

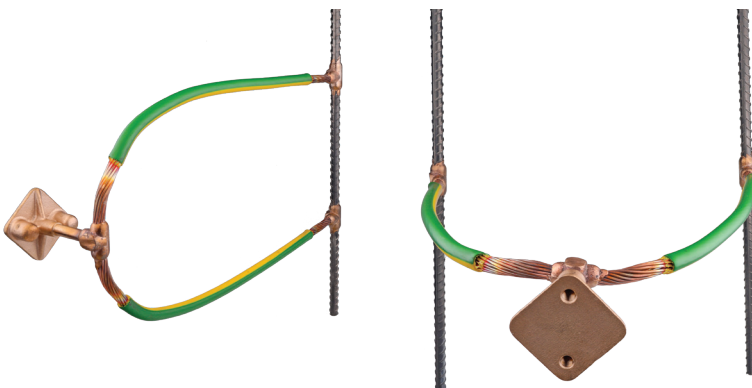
FIXING HOLE SIZE	TAIL DIAMETER (mm)	TAIL LENGTH (mm)	MATERIAL	WEIGHT (kg)	PART NO.
M10	10mm	200mm	Stainless Steel	0.22	EBP1SS-M10
M8	10mm	500mm	Gunmetal/Steel	0.55	EBP1-M8-S
M16	16mm	500mm	Gunmetal/Steel	1.20	EBP1-M16-S

**Material:** Stainless Steel/Gunmetal

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 8Nm

### Pre-Welded Rebar/Earth Points



Kingsmill can prefabricate **pre-welded earth point/conductor/rebar** connections. This saves time on site.

Contact Customer Services for details and quotations.

### Earth Bosses

**Earth Bosses** are used for welding to steel vessels, tanks and structures. Wrap connections with Denso Tape to stop moisture ingress.

Supplied complete with A2 stainless steel dowel, flat washer, spring washer & two nuts. Phosphor bronze fixing assembly is available (add “/PB” suffix to the part number).

DIAMETER (mm)	LENGTH (mm)	THREAD SIZE	WEIGHT (kg)	PART NO.
25	25	M8	0.09	EBOSS2525M08
30	30	M8	0.16	EBOSS3030M08
30	30	M10	0.18	EBOSS3030M10
30	40	M8	0.22	EBOSS3040M08
30	40	M10	0.24	EBOSS3040M10
30	50	M8	0.27	EBOSS3050M08
30	50	M10	0.29	EBOSS3050M10
40	30	M10	0.31	EBOSS4030M10
40	30	M12	0.34	EBOSS4030M12
40	40	M10	0.41	EBOSS4040M10
40	40	M12	0.43	EBOSS4040M12
40	50	M10	0.51	EBOSS4050M10
40	50	M12	0.53	EBOSS4050M12
50	30	M10	0.48	EBOSS5030M10
50	30	M12	0.50	EBOSS5030M12
50	40	M10	0.63	EBOSS5040M10
50	40	M12	0.65	EBOSS5040M12
50	50	M10	0.77	EBOSS5050M10
50	50	M12	0.78	EBOSS5050M12

**Material:** Mild Steel

**Standard:** BS 970 230M07

**OTHER MATERIALS, SIZES AND CONFIGURATIONS AVAILABLE UPON REQUEST.**



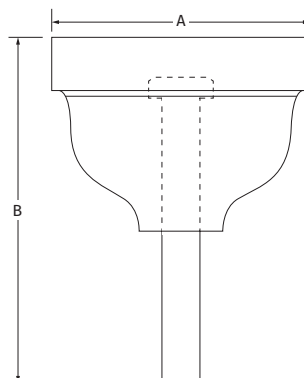
### Static Earth Receptacles

Kingsmill **Static Earth Receptacles** provide a convenient point for attaching portable static discharge wires and clamps to the earth termination, thus safely discharging potentially lethal static voltages.

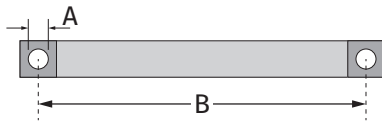
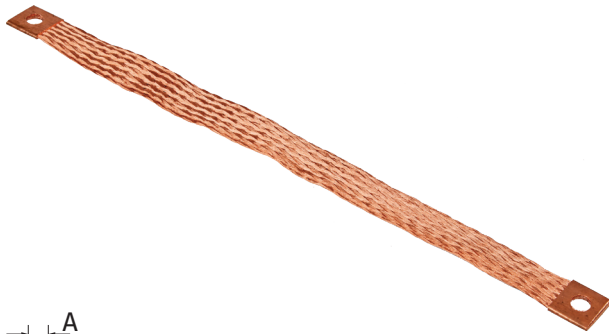
WIDTH (A) (mm)	HEIGHT (B) (mm)	WEIGHT (kg)	PART NO.
68	90	0.58	SER68
130	160	4.25	SER130

**Material:** Gunmetal

**Standard:** BS 7430



## Flexible Flat Copper Braid Bonds



Our pre-terminated **Flexible Flat Copper Braid Bonds** are ideal for bonding of metal doors, gates, fencing etc.

DIMENSIONS (mm)	HOLE DIA. (A) (mm)	LENGTH (B) (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
12 x 1	7.0	200	6.0	0.01	FB200/6/7
12 x 1	7.0	400	6.0	0.02	FB400/6/7
15 x 1.5	7.0	200	10	0.02	FB200/10/7
15 x 1.5	7.0	400	10	0.04	FB400/10/7
19 x 2.5	9.0	200	16	0.03	FB200/16/9
19 x 2.5	9.0	400	16	0.06	FB400/16/9
25 x 3	11	200	25	0.05	FB200/25/11
25 x 3	11	400	25	0.10	FB400/25/11
25 x 3.5	11	200	35	0.09	FB200/35/11
25 x 3.5	11	400	35	0.15	FB400/35/11
30 x 5	11	200	50	0.10	FB200/50/11
30 x 5	11	400	50	0.20	FB400/50/11
32 x 6	13	200	70	0.13	FB200/70/13
32 x 6	13	400	70	0.25	FB400/70/13
37 x 6	13	200	95	0.19	FB200/95/13
37 x 6	13	400	95	0.37	FB400/95/13
45 x 6	17	200	120	0.23	FB200/120/17
45 x 6	17	400	120	0.46	FB400/120/17
50 x 8	17	200	150	0.30	FB200/150/17
50 x 8	17	400	150	0.60	FB400/150/17

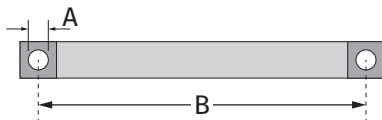
**FIXINGS**  
Use M8 or M10 brass nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

**Material:** Copper  
**Standard:** BS:EN 13602

**OTHER MATERIALS, SIZES AND CONFIGURATIONS AVAILABLE UPON REQUEST.**

## Flexible Flat Copper Braid Bonds (Tinned)



Tinning adds extra corrosion protection to our range of **Flexible Flat Copper Braid Bonds (Tinned)**.

DIMENSIONS (mm)	HOLE DIA. (A) (mm)	LENGTH (B) (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
12 X 1	7.0	200	6.0	0.01	FBT200/6/7
12 X 1	7.0	400	6.0	0.02	FBT400/6/7
15 X 1.5	7.0	200	10	0.02	FBT200/10/7
15 X 1.5	7.0	400	10	0.04	FBT400/10/7
19 X 2.5	9.0	200	16	0.03	FBT200/16/9
19 X 2.5	9.0	400	16	0.06	FBT400/16/9
25 X 3	11	200	25	0.05	FBT200/25/11
25 X 3	11	400	25	0.10	FBT400/25/11
25 X 3.5	11	200	35	0.09	FBT200/35/11
25 X 3.5	11	400	35	0.15	FBT400/35/11
30 X 5	11	200	50	0.10	FBT200/50/11
30 X 5	11	400	50	0.20	FBT400/50/11
32 X 6	13	200	70	0.13	FBT200/70/13
32 X 6	13	400	70	0.25	FBT400/70/13
37 X 6	13	200	95	0.19	FBT200/95/13
37 X 6	13	400	95	0.37	FBT400/95/13
45 X 6	17	200	120	0.23	FBT200/120/17
45 X 6	17	400	120	0.46	FBT400/120/17
50 X 8	17	200	150	0.30	FBT200/150/17
50 X 8	17	400	150	0.60	FBT400/150/17

**FIXINGS**  
Use M8 or M10 stainless steel nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

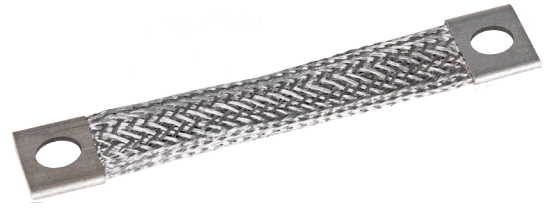
**Material:** Tinned Copper  
**Standard:** BS:EN 13602

**OTHER MATERIALS, SIZES AND CONFIGURATIONS AVAILABLE UPON REQUEST.**

## Flexible Flat Aluminium Braid Bonds

**Flexible Aluminium Braid Bonds** are used for bonding aluminium cladding into the structural Lightning Protection scheme.

DIMENSIONS (mm)	HOLE DIA. (A) (mm)	LENGTH (B) (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
30 x 5	M8	200	50	0.03	FBA200/50/9
30 x 5	M8	300	50	0.04	FBA300/50/9
30 x 5	M8	400	50	0.08	FBA400/50/9
30 x 5	M10	200	50	0.03	FBA200/50/11
30 x 5	M10	300	50	0.04	FBA300/50/11
30 x 5	M10	400	50	0.08	FBA400/50/11
32 x 6	M8	200	75	0.06	FBA200/75/9
32 x 6	M8	300	75	0.09	FBA300/75/9
32 x 6	M8	400	75	0.12	FBA400/75/9
32 x 6	M10	200	75	0.06	FBA200/75/11
32 x 6	M10	300	75	0.09	FBA300/75/11
32 x 6	M10	400	75	0.12	FBA400/75/11



**Material:** Aluminium  
**Standard:** BS:EN 13602

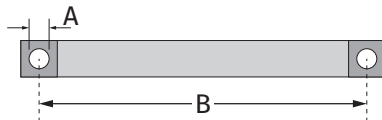


**FIXINGS**  
 Use M8 or M10 galvanised nuts, bolts and washers

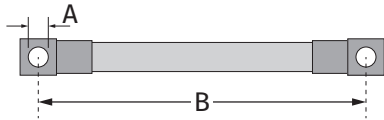


**SEE FIXINGS SECTION PAGE FIX:2**

**OTHER MATERIALS, SIZES AND CONFIGURATIONS AVAILABLE UPON REQUEST.**



### Flexible Circular Copper Braid Bonds



**Flexible Circular Copper Braid Bonds** are terminated with cable lugs at each end. Use to bond gates, doors, fences etc.

BRAID DIA. (mm)	LENGTH (B) (mm)	HOLE DIA. (A) (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
4.2	200	7.0	6.0	0.01	CB200/6/7
4.2	400	7.0	6.0	0.02	CB400/6/7
5.4	200	7.0	10	0.02	CB200/10/7
5.4	400	7.0	10	0.04	CB400/10/7
7.0	200	9.0	16	0.03	CB200/16/9
7.0	400	9.0	16	0.06	CB400/16/9
8.5	200	11	25	0.05	CB200/25/11
8.5	400	11	25	0.10	CB400/25/11
11.5	200	11	50	0.10	CB200/50/11
11.5	400	11	50	0.20	CB400/50/11
14.5	200	13	70	0.13	CB200/70/13
14.5	400	13	70	0.25	CB400/70/13
16.0	200	13	95	0.19	CB200/95/13
16.0	400	13	95	0.37	CB400/95/13

**Material:** Copper

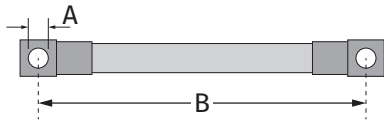
**Standard:** BS:EN 13602

**FIXINGS**  
Use M8 or M10 stainless steel nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**

### Flexible Circular Copper Braid Bonds (Tinned)



**Flexible Circular Copper Braid Bonds (Tinned)** are terminated with cable lugs at each end. Use to bond gates, doors, fences etc.

BRAID DIA. (mm)	LENGTH (B) (mm)	HOLE DIA. (A) (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
4.2	200	7.0	6.0	0.01	CBT200/6/7
4.2	400	7.0	6.0	0.02	CBT400/6/7
5.4	200	7.0	10	0.02	CBT200/10/7
5.4	400	7.0	10	0.04	CBT400/10/7
7.0	200	9.0	16	0.03	CBT200/16/9
7.0	400	9.0	16	0.06	CBT400/16/9
8.5	200	11	25	0.05	CBT200/25/11
8.5	400	11	25	0.10	CBT400/25/11
11.5	200	11	50	0.10	CBT200/50/11
11.5	400	11	50	0.20	CBT400/50/11
14.5	200	13	70	0.13	CBT200/70/13
14.5	400	13	70	0.25	CBT400/70/13
16.0	200	13	95	0.19	CBT200/95/13
16.0	400	13	95	0.37	CBT400/95/13

**Material:** Tinned Copper

**Standard:** BS:EN 13602

**FIXINGS**  
Use M8 or M10 stainless steel nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**



## Flexible Flat Copper Braids

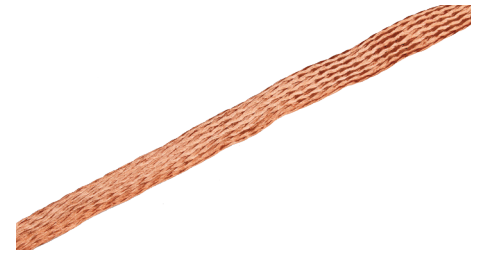
**Flexible Flat Copper Braid (Plain)** is suitable for applications of earth bonding. The braid can also be supplied as standard pre-cut and drilled braid bonds (see page BOND:10).

OVERALL NOMINAL SIZE (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg/m)	PART NO.
12 x 1.0	6	0.055	FCB1201
15 x 1.5	10	0.096	FCB1515
19 x 2.5	16	0.16	FCB1925
25 x 3.0	25	0.25	FCB2530
25 x 3.5	35	0.34	FCB2535
30 x 5.0	50	0.49	FCB3050
32 x 6.0	70	0.63	FCB3260
37 x 6.0	95	0.93	FCB3760
45 x 6.0	120	1.15	FCB4560
50 x 8.0	150	1.45	FCB5080

**Material:** Copper

**Standard:** BS:EN 13602

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**



## Flexible Flat Copper Braids (Tinned)

**Flexible Flat Copper Braid (Tinned)** is suitable for applications of earth bonding. The braid can also be supplied as standard pre-cut and drilled braid bonds (see page BOND:10).

OVERALL NOMINAL SIZE (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg/m)	PART NO.
12 x 1.0	6.0	0.055	FCBT1201
15 x 1.5	10	0.096	FCBT1515
19 x 2.5	16	0.16	FCBT1925
25 x 3.0	25	0.25	FCBT2530
25 x 3.5	35	0.34	FCBT2535
30 x 5.0	50	0.49	FCBT3050
32 x 6.0	70	0.63	FCBT3260
37 x 6.0	95	0.93	FCBT3760
45 x 6.0	120	1.15	FCBT4560
50 x 8.0	150	1.45	FCBT5080

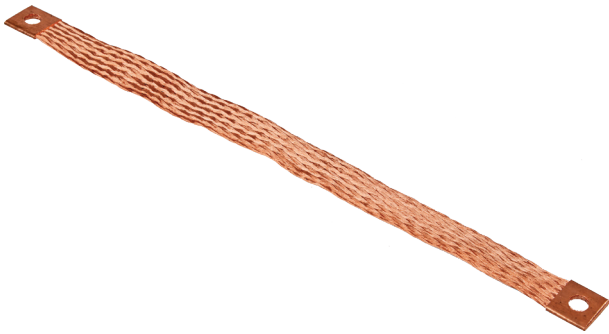
**Material:** Tinned Copper

**Standard:** BS:EN 13602

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**



### Bare Copper Expansion Bonds



**Bare Copper Expansion Bonds** absorb movement caused by the electromechanical effects of a direct lightning strike to the Lightning Protection network. **Expansion Bonds** also absorb movement due to temperature and climate changes.

DIMENSIONS (mm)	HOLE DIA. (mm)	LENGTH (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
30 x 5 x 200	M8	200	50	0.13	FB200/50/9
30 x 5 x 200	M10	200	50	0.13	FB200/50/11
32 x 6 x 200	M8	200	75	0.20	FB200/75/9
32 x 6 x 200	M10	200	75	0.20	FB200/75/11

**Material:** Copper

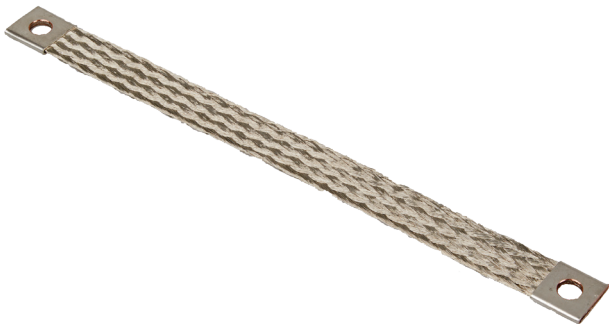
**Standard:** BS:EN 13602

**FIXINGS**  
Use M8 or M10 brass nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**

### Tinned Copper Expansion Bonds



**Tinned Copper Expansion Bonds** absorb movement caused by the electromechanical effects of a direct lightning strike to the Lightning Protection network. **Tinned Copper Expansion Bonds** also absorb movement due to temperature and climate changes.

DIMENSIONS (mm)	HOLE DIA. (mm)	LENGTH (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
30 x 5 x 200	M8	200	50	0.14	FBT200/50/9
30 x 5 x 200	M10	200	50	0.14	FBT200/50/11
32 x 6 x 200	M8	200	75	0.21	FBT200/75/9
32 x 6 x 200	M10	200	75	0.21	FBT200/75/11

**Material:** Tinned Copper

**Standard:** BS:EN 13602

**FIXINGS**  
Use M8 or M10 stainless steel nuts, bolts and washers

**SEE FIXINGS SECTION PAGE FIX:2**

**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**

## Aluminium Expansion Bonds

**Aluminium Expansion Bonds** absorb movement caused by the electromechanical effects of a direct lightning strike to the Lightning Protection network. **Aluminium Expansion Bonds** also absorb movement due to temperature and climate changes.

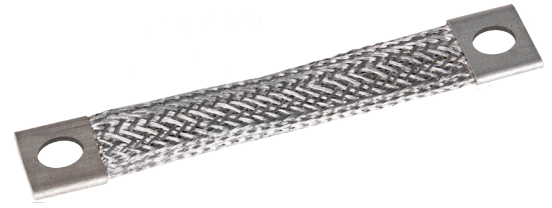
DIMENSIONS (mm)	HOLE DIA. (mm)	LENGTH (mm)	CSA (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
30 x 5 x 200	M8	200	50	0.03	FBA200/50/9
30 x 5 x 200	M10	200	50	0.03	FBA200/50/11
32 x 6 x 200	M8	200	75	0.06	FBA200/75/9
32 x 6 x 200	M10	200	75	0.06	FBA200/75/11

**Material:** Aluminium

**Standard:** BS:EN 13602



**OTHER SIZES, MATERIALS, HOLE SIZES ETC. AVAILABLE ON REQUEST.**



## Split Bolt Connectors

Kingsmill **Split Bolt Connectors** will accept a range of stranded or solid circular conductors. No specialist tools are required for installation.

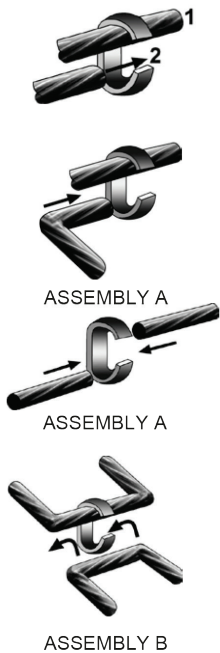
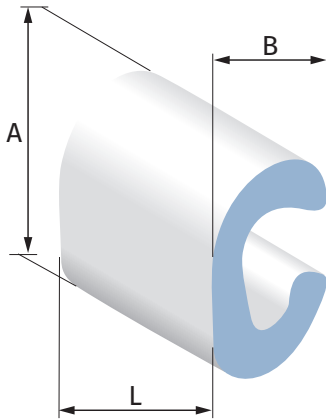
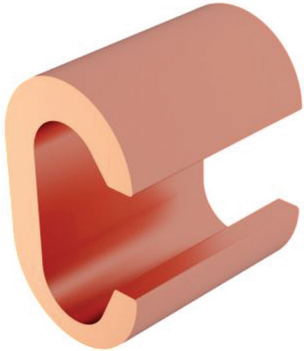
MAIN: Minimum - Maximum (mm <sup>2</sup> )	TAP: Minimum - Maximum (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
4 - 10	2.5 - 10	0.02	SBC8
10 - 16	2.5 - 16	0.03	SBC4
16 - 25	4 - 25	0.04	SBC2
25 - 35	4 - 35	0.06	SBC1
35 - 50	4 - 50	0.09	SBC10
35 - 70	4 - 70	0.14	SBC20
50 - 95	4 - 95	0.17	SBC30
50 - 120	6 - 120	0.18	SBC40
95 - 185	6 - 185	0.35	SBC50

**Material:** High Strength Copper Alloy

**Standard:** BS 7430



## C Crimp Connectors



Kingsmill **C Crimp Connectors** are manufactured from high purity copper profiles and are suitable for a variety of uses, either to create an earthing network or tapping off overhead distribution lines.

Kingsmill **C Crimp Connectors** are designed to allow connections to cable to be formed without the need to cut the main cable.

We also supply a range of sizes in either plain or tinned finish.

CAPACITIES (mm <sup>2</sup> )						ASSEMBLY	PART NO.	
TOTALS		MINIMUM		MAXIMUM			COPPER	TIN PLATED COPPER
Min	Max	Run	Tap	Run	Tap			
3	12	1.5	1.5	6	6	A	C6	C6E
13	20	10	2 x 1.5	10	10	A	C10	C10E
19	32	10	9 2 x 1.5	16	16	A + B	C16	C16E
17	35	16	1.5	25	25	A	C25-10	C25-10E
35	41	25	10	25	25	A + B	C25PM	C25PME
33	56	25	10	29.3	29.3	A	C25	C25E
		27	6	35	35	A + B		
		30	2 x 1.5	50	30	A + B		
53	70	30	25	35	35	A + B	C35	C35E
		50	2 x 1.5	50	50	A + B		
66	100	50	16	50	50	A	C50	C50E
		63	2 x 1.5	70	70	A		
				70	70	A		
				75	75	A		
54	110	50	4	70	70	A	C70-35	C70-35E
85	140	50	35	70	70	A	C70	C70E
105	170	75	30	95	95	A + B	C75	C75E
		70	35	95	95	A + B		
		90	16					
99	140	95	4	100	100	A	C95-35	C95-35E
150	190	75	75	95	95	A	C95	C95E
156	240	120	35	120	120	A	C120	C120E
		150	6	150	150	A		
225	300	150	75	150	150	A + B	C150	C150E
260	300	185	75			A + B	C185-95	C185-95E
210	370	115	95	185	185	A + B	C185	C185E
		150	60	185	185	A + B		
387	480	240	147	240	240	A	C240	C240E

**Material:** Copper

**Standard:** BS:EN 12163

## Isolating Spark Gap (connecting pins)

Encapsulated high-performance Isolating Spark Gap with connecting pins.

### Features

- 100kA
- Class H - heavy duty
- Easy installation

### Benefits

Suitable for use where direct connection is not allowed.

### Application

Use for indirect earthing of isolated conductive parts.

### Standards

EN 61643-11 (for surge protection devices).

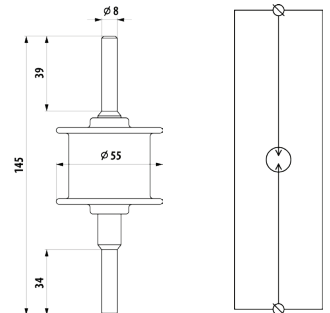


### Electrical specification

Order number	KMSG-A100	
Lightning impulse current	$I_{imp}$	100kA
Rated impulse sparkover voltage	$U_{rimp}$	5kV
Rated power frequency withstand voltage	$U_{WAC}$	2.5kV
Isolation resistance		100M $\Omega$
Classification		Class H - heavy duty
Degree of protection		IP67
Range of operating temperatures (min - max)		-40°C - +80°C
According to standard		EN 62561-3:2012, IEC 62561-3:2012
Weight		195g (nett), 255g (gross)

### Dimensions and wiring diagram

KMSG-A100



## Isolating Spark Gap (M8 bolts)

Encapsulated high-performance Isolating Spark Gap with M8 bolts.

### Features

- 50kA
- Class N - normal duty
- Easy installation

### Benefits

Suitable for use where direct connection is not allowed.

### Application

Use for indirect earthing of isolated conductive parts.

### Standards

EN 61643-11 (for surge protection devices).

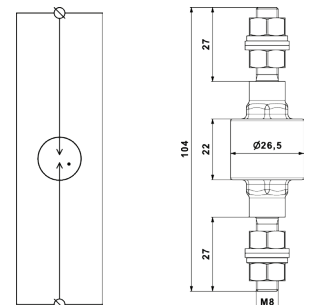


### Electrical specification

Order number	KMSG-100	
Lightning impulse current	$I_{imp}$	50kA
Rated impulse sparkover voltage	$U_{rimp}$	0.95kV
Rated power frequency withstand voltage	$U_{WAC}$	0.07kV
Rated DC withstand voltage	$U_{WDC}$	0.1kV
Isolation resistance		100M $\Omega$
Classification		Class N - normal duty
Degree of protection		IP67
Range of operating temperatures (min - max)		-40°C - +80°C
According to standard		EN 62561-3:2012, IEC 62561-3:2012
Weight		145g (nett), 125g (gross)

### Dimensions and wiring diagram

KMSG-100



## Isolating Spark Gap (connecting cables)



Encapsulated high-performance Isolating Spark Gap with connecting cables.

### Features

- 50kA
- Class N - normal duty
- Easy installation

### Benefits

Suitable for use where direct connection is not allowed.

### Application

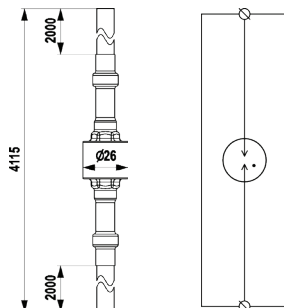
For indirect earthing of isolated conductive parts.

### Standards

EN 61643-11 (for surge protection devices).

### Dimensions and wiring diagram

KMSG-C100



### Electrical specification

Order number	KMSG-C100	
Lightning impulse current	$I_{imp}$	50kA
Rated impulse sparkover voltage	$U_{rimp}$	0.95kV
Rated power frequency withstand voltage	$U_{WAC}$	0.07kV
Rated DC withstand voltage	$U_{WDC}$	0.1kV
Isolation resistance	100MΩ	
Classification	Class N - normal duty	
Degree of protection	IP67	
Range of operating temperatures (min - max)	-40°C - +80°C	
According to standard	EN 62561-3:2012, IEC 62561-3:2012	
Weight	1600g (nett), 1610g (gross)	

## Isolating Spark Gap (M8 bolt and nut)



Encapsulated high-performance Isolating Spark Gap with M8 bolt and nut.

### Features

- 100kA
- Class H - heavy duty
- Easy installation

### Benefits

Suitable for use where direct connection is not allowed.

### Application

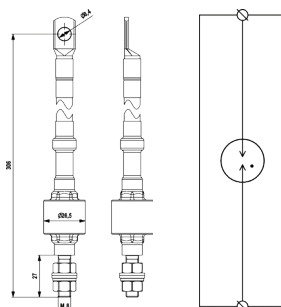
For indirect earthing of isolated conductive parts.

### Standards

EN 61643-11 (for surge protection devices).

### Dimensions and wiring diagram

KMSGO-500



### Electrical specification

Order number	KMSGO-500	
Lightning impulse current	$I_{imp}$	100kA
Rated impulse sparkover voltage	$U_{rimp}$	1.50kV
Rated power frequency withstand voltage	$U_{WAC}$	0.35kV
Rated DC withstand voltage	$U_{WDC}$	0.50kV
Isolation resistance	100MΩ	
Classification	Class H - heavy duty	
Degree of protection	IP67	
Range of operating temperatures (min - max)	-40°C - +80°C	
According to standard	EN 62561-3:2012, IEC 62561-3:2012	
ETIM Class	EC000510	
Weight	235g (nett), 255g (gross)	



<b>Introduction</b>	<b>EB:2 -3</b>
<b>Components of an Earth Bar</b>	<b>EB:4</b>
<b>Standard and Tinned Earth Bars</b>	<b>EB:5 - 7</b>
<b>Earth Bars with single disconnecting links</b>	<b>EB:8 - 9</b>
<b>Earth Bars with twin disconnecting links</b>	<b>EB:10 - 11</b>
<b>Disconnecting Links, Earth Terminals and Insulators</b>	<b>EB:12 - 13</b>
<b>Hard Drawn Copper Bar</b>	<b>EB:13</b>
<b>Cable Lugs</b>	<b>EB:14</b>

**Kingsmill Earth Bars are manufactured using only the highest quality raw materials.**

We offer an extensive range of standard, single-linked and twin-linked Earth Bars and can also manufacture to your own specifications.



# Introduction

Kingsmill can manufacture a range of Earth Bars to suit any telecoms, power and equipotential bonding requirements.

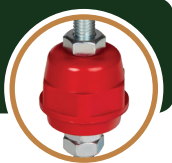
**EARTH BARS**

pages EB:6 - 12



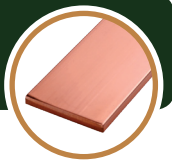
**INSULATORS**

page EB:13



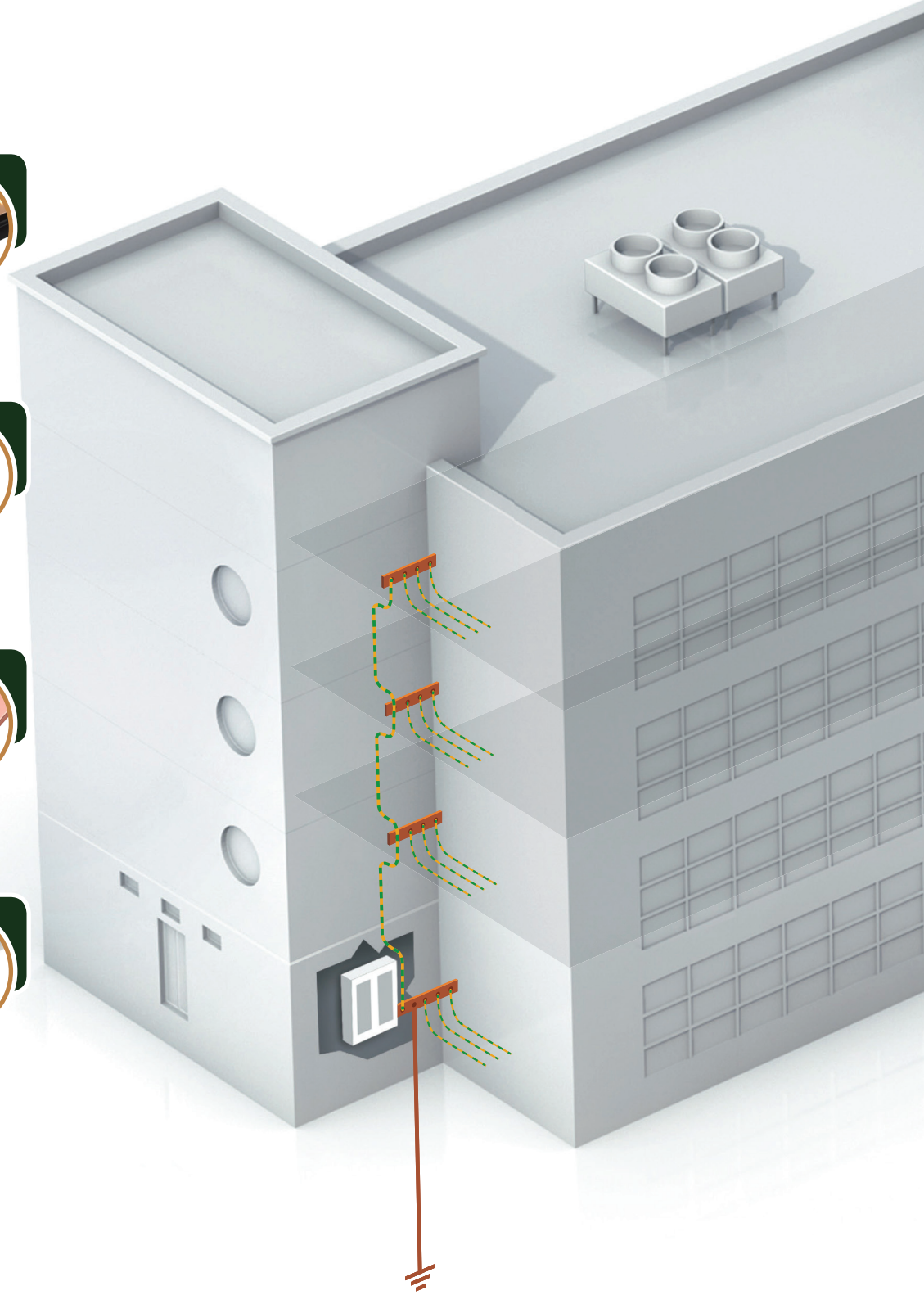
**HARD DRAWN BAR**

page EB:13

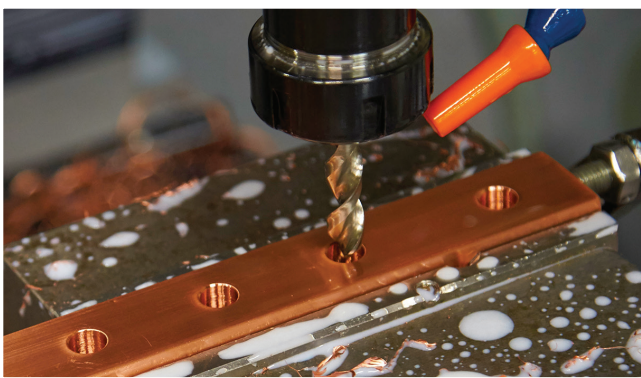


**CABLE LUGS**

page EB:14



# High Quality Earth Bars

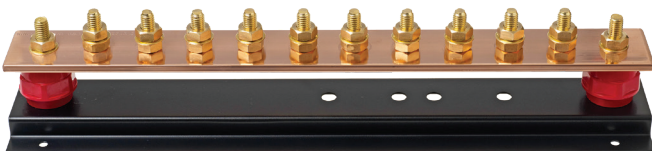


## Manufacturing to Design Specification

Standard Earth Bars meet the requirements of most applications.

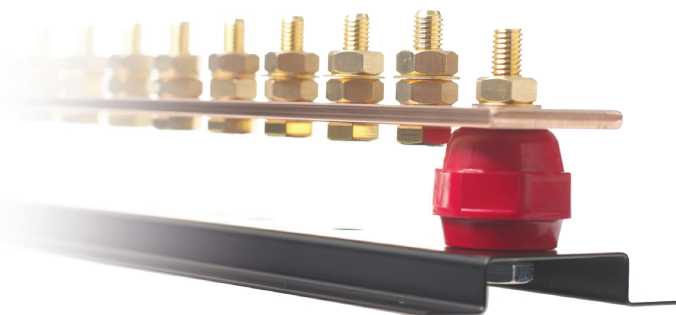
However, we can design and manufacture an Earth Bar to suit special applications.

Send your specification to us and we will design a bespoke Earth Bar. *This design is checked and confirmed by you before work commences.*

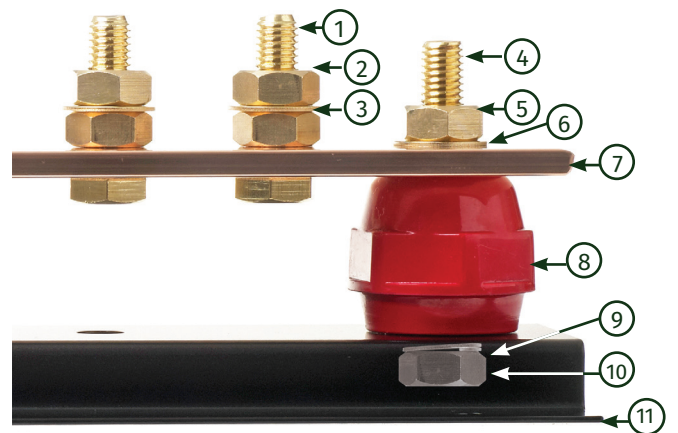


Our standard Earth Bar Bases feature pre-drilled fixing holes for ease of installation and can be supplied powder-coated to reduce the risk of corrosion.

All Earth Bars are manufactured in our dedicated UK factory with a high level of quality control that ensures consistency.



## Common Earth Bar Components



- |   |               |                             |
|---|---------------|-----------------------------|
| ① Brass, Stainless Steel or Phosphor Bronze Hex Set | ⑤ Full Nut    | ⑨ Zinc Plated Spring Washer |
| ② Nut   | ⑥ Flat Washer | ⑩ Zinc Plated Hex Set       |
| ③ Flat Washer                                       | ⑦ Copper Bar  | ⑪ Steel Base                |
| ④ All Thread  | ⑧ Insulator   |                             |

## Bespoke Specification

All components in an Earth Bar can be specified, including:

- Size and material of bolt
- Nut and washer
- Length, width and thickness of bar
- Number of disconnecting links and their position
- The finish of the bar

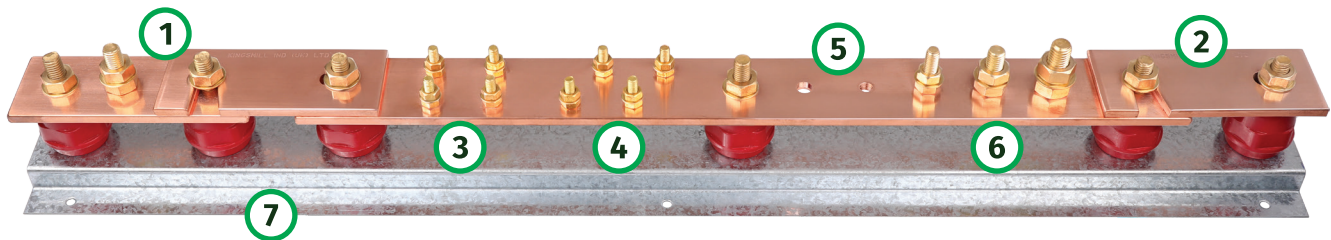
... as well as many other variables.



# Components of an Earth Bar

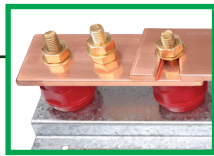
**Understanding and designing Earth Bars should never be a difficult task.**

Kingsmill are on hand to aid you with this design process to cater for any size, configuration or finish of Earth Bar. The sample Earth Bar, below, contains many elements that Kingsmill consider when designing special Earth Bars.



## 1: Outgoing Way

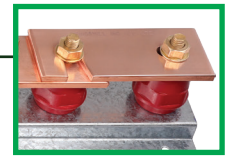
Outgoing ways enable the earth connection to be isolated from the test link.



This enables the test link to operate without the need to loosen the earth connection to the Earth Bar.

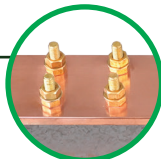
## 2: Standard Link

Standard test links are supplied on all Kingsmill Earth Bars unless outgoing ways are requested.



## 3: Parallel Fixings

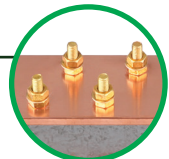
Parallel fixings are typically used when there are space restrictions impacting on the installation of the Earth Bar.



By using parallel fixings, the length of an Earth Bar can be significantly reduced. Also, parallel fixings can be used to accommodate cable lugs with two fixing holes.

## 4: Staggered Fixings

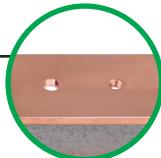
Like parallel fixings, staggered fixings are typically utilised to lower the overall length of an Earth Bar in the event of space restrictions.



Parallel fixings can also be spaced to allow cable lug connections to be made from both sides of the Earth Bar.

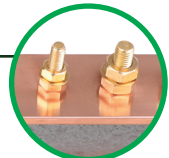
## 5: No Fixings

Earth Bars can also be supplied without fixings. Options include punched holes, tapped holes or plain bar.



## 6: Fixings

Kingsmill Earth Bars are supplied with M10 brass fixings as standard.



We can also supply fixings of different size and material. These include M4 - M16 sizes and stainless steel, phosphor bronze and BZP materials.

## 7: Bases

Kingsmill supply all Earth Bars on metallic bases. All standard stock Earth Bars up to 12 ways (standard, single and twin link) are supplied on powder coated bases. Kingsmill can also supply galvanised and hot-dipped galvanised bases for use in external or more humid environments eg coastal.

## Fixing Centres

Kingsmill Earth Bars are supplied as standard with a minimum 35mm distance between fixing centres. Typically, this allows for up to a 185mm<sup>2</sup> cable lug to be installed on adjacent fixings. Larger cable lugs may require larger fixing centre's to accommodate wider cable lug palms.

# Standard or Tinned Earth Bar?

Standard Earth Bars are manufactured from bare copper bar. In most applications this does not cause any problems since the Earth Bars are located on the inside of a building, usually inside a dry, warm substation/communication room.

When this is not possible or practical, the Earth bar has to be located externally in a location that has higher moisture or humidity. In these cases, we recommend the use of a Tinned Earth Bar.

## Tin

Tin is a soft white metal. It can easily be polished, scratch brushed or flow melted to give a bright finish. It is non-toxic and it is not greatly affected by organic acids. Sulphur compounds do not readily tarnish tin. Neither is it impaired by air or water. Tin is one of the least susceptible metals to corrosion.

## Benefits of a Tinned Earth Bar

Tinning a copper bar protects against atmospheric corrosion and hence provides a longer life when exposed to corrosive atmospheres.

A layer of tin protects the copper in the Earth Bar from the formation of copper oxide, thus preventing oxidation.

Tinned Earth Bars may be used in external applications or where atmospheric conditions are more severe and aggressive than normal ie high moisture content areas, high humidity etc.

A tinned Earth Bar resists corrosion from water.

## Key Features of a Tinned Earth Bar

- Manufactured from 50 x 6mm Tinned Hard Drawn Copper Bar
- M10 x 35 A2 Stainless Steel Connection Bolts
- Zero Halogen, Glass Reinforced Polyester Insulators c/w M10 brass Inserts
- Black powder coated steel base (hot dipped galvanised steel base can also be supplied)
- Pre-drilled base holes for ease of installation



## Standard Earth Bars



**Standard Earth Bars** are an efficient and convenient way of providing a common earth point.

Kingsmill **Standard Earth Bars** are supplied with a powder coated base as standard. The standard connections are M10.

DESCRIPTION	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
4 way Earth Bar	300 x 100 x 90	1.60	EBAR4
6 way Earth Bar	300 x 100 x 90	1.69	EBAR6
8 way Earth Bar	450 x 100 x 90	2.34	EBAR8
10 way Earth Bar	450 x 100 x 90	2.42	EBAR10
12 way Earth Bar	520 x 100 x 90	2.82	EBAR12
14 way Earth Bar	650 x 100 x 90	3.59	EBAR14
16 way Earth Bar	800 x 100 x 90	4.16	EBAR16
18 way Earth Bar	800 x 100 x 90	4.31	EBAR18
20 way Earth Bar	900 x 100 x 90	4.71	EBAR20
22 way Earth Bar	900 x 100 x 90	4.82	EBAR22
24 way Earth Bar	1050 x 100 x 90	5.49	EBAR24
26 way Earth Bar	1050 x 100 x 90	5.59	EBAR26
28 way Earth Bar	1250 x 100 x 90	6.48	EBAR28
30 way Earth Bar	1250 x 100 x 90	6.65	EBAR30

**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

**OTHER SIZES ARE AVAILABLE ON REQUEST**

Brass bolts are provided as standard. See page EB:3 for the full material specification.

*For phosphor bronze add /PB suffix to the part numbers above.*



### FIXINGS

Fixings for attaching the Earth Bar to a wall are not included. We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSL1.5-12) plus plastic wall plug (PP12).



EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

**SEE FIXINGS SECTION - PAGE FIX:4**



## Tinned Earth Bars

**Tinned Earth Bars** are an efficient and convenient way of providing a common earth point.

Kingsmill **Tinned Earth Bars** are supplied with a powder coated base as standard. The standard connections are M10.

DESCRIPTION	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
4 way Tinned Earth Bar	300 x 100 x 90	1.60	EBAR4-T
6 way Tinned Earth Bar	300 x 100 x 90	1.69	EBAR6-T
8 way Tinned Earth Bar	450 x 100 x 90	2.34	EBAR8-T
10 way Tinned Earth Bar	450 x 100 x 90	2.42	EBAR10-T
12 way Tinned Earth Bar	520 x 100 x 90	2.82	EBAR12-T
14 way Tinned Earth Bar	650 x 100 x 90	3.59	EBAR14-T
16 way Tinned Earth Bar	800 x 100 x 90	4.16	EBAR16-T
18 way Tinned Earth Bar	800 x 100 x 90	4.31	EBAR18-T
20 way Tinned Earth Bar	900 x 100 x 90	4.71	EBAR20-T
22 way Tinned Earth Bar	900 x 100 x 90	4.82	EBAR22-T
24 way Tinned Earth Bar	1050 x 100 x 90	5.49	EBAR24-T
26 way Tinned Earth Bar	1050 x 100 x 90	5.59	EBAR26-T
28 way Tinned Earth Bar	1250 x 100 x 90	6.48	EBAR28-T
30 way Tinned Earth Bar	1250 x 100 x 90	6.65	EBAR30-T




**Material:** Tinned Copper (bar), Powder coated steel (base)

**Standard:** BS 7430


**OTHER SIZES ARE AVAILABLE ON REQUEST**

Stainless steel bolts are provided as standard. See page EB:3 for the full material specification.

For phosphor bronze add /PB suffix to the part numbers above.



**FIXINGS**

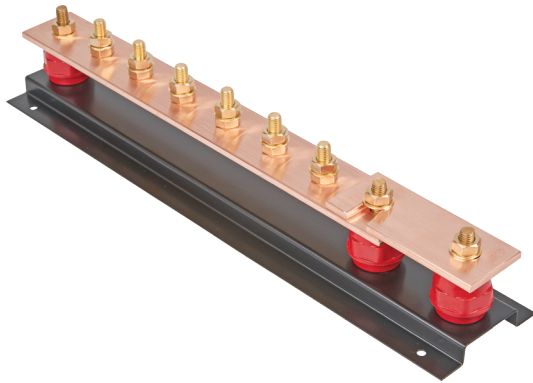


Fixings for attaching the Earth Bar to a wall are not included. We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSL1.5-12) plus plastic wall plug (PP12).

EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

SEE FIXINGS SECTION - PAGE FIX:4

## Earth Bars with Single Disconnecting Link



Earth Bars with Single Disconnecting Link are supplied with a powder coated base and M10 connections as standard.

DESCRIPTION	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
4 Way Earth Bar with Single Disconnecting Link	375 x 100 x 90	2.12	EBAR4-1
6 Way Earth Bar with Single Disconnecting Link	475 x 100 x 90	2.58	EBAR6-1
8 Way Earth Bar with Single Disconnecting Link	575 x 100 x 90	3.12	EBAR8-1
10 Way Earth Bar with Single Disconnecting Link	725 x 100 x 90	3.88	EBAR10-1
12 Way Earth Bar with Single Disconnecting Link	825 x 100 x 90	4.34	EBAR12-1
14 Way Earth Bar with Single Disconnecting Link	925 x 100 x 90	4.74	EBAR14-1
16 Way Earth Bar with Single Disconnecting Link	1025 x 100 x 90	5.18	EBAR16-1
18 Way Earth Bar with Single Disconnecting Link	1125 x 100 x 90	5.58	EBAR18-1
20 Way Earth Bar with Single Disconnecting Link	1275 x 100 x 90	5.71	EBAR20-1
22 Way Earth Bar with Single Disconnecting Link	1375 x 100 x 90	6.65	EBAR22-1
24 Way Earth Bar with Single Disconnecting Link	1475 x 100 x 90	7.46	EBAR24-1
26 Way Earth Bar with Single Disconnecting Link	1575 x 100 x 90	8.00	EBAR26-1
28 Way Earth Bar with Single Disconnecting Link	1675 x 100 x 90	8.51	EBAR28-1
30 Way Earth Bar with Single Disconnecting Link	1775 x 100 x 90	8.90	EBAR30-1

**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

**OTHER SIZES ARE AVAILABLE ON REQUEST**

Brass bolts are provided as standard. See page EB:3 for the full material specification.

For phosphor bronze add /PB suffix to the part numbers above.



### FIXINGS

Fixings for attaching the Earth Bar to a wall are not included.

We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic wall plug (PP12).



EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

**SEE FIXINGS SECTION - PAGE FIX:4**

### DISCONNECTING LINKS

The **Single Disconnecting Link** is mainly used to offer a temporary break in the connection to the earth allowing the inspection and testing of multiple Earth Rods/systems while disconnecting it from the Lightning and Earthing system. See page EB:12 for **Single Disconnecting Link** details.



## Tinned Earth Bars with Single Disconnecting Link

**Tinned Earth Bars with Single Disconnecting Link** are supplied with a powder coated base and M10 connections as standard.

DESCRIPTION	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
4 Way Tinned Earth Bar with Single Disconnecting Link	375 x 100 x 90	2.12	EBAR4-1-T
6 Way Tinned Earth Bar with Single Disconnecting Link	475 x 100 x 90	2.58	EBAR6-1-T
8 Way Tinned Earth Bar with Single Disconnecting Link	575 x 100 x 90	3.12	EBAR8-1-T
10 Way Tinned Earth Bar with Single Disconnecting Link	725 x 100 x 90	3.88	EBAR10-1-T
12 Way Tinned Earth Bar with Single Disconnecting Link	825 x 100 x 90	4.34	EBAR12-1-T
14 Way Tinned Earth Bar with Single Disconnecting Link	925 x 100 x 90	4.74	EBAR14-1-T
16 Way Tinned Earth Bar with Single Disconnecting Link	1025 x 100 x 90	5.18	EBAR16-1-T
18 Way Tinned Earth Bar with Single Disconnecting Link	1125 x 100 x 90	5.58	EBAR18-1-T
20 Way Tinned Earth Bar with Single Disconnecting Link	1275 x 100 x 90	5.71	EBAR20-1-T
22 Way Tinned Earth Bar with Single Disconnecting Link	1375 x 100 x 90	6.65	EBAR22-1-T
24 Way Tinned Earth Bar with Single Disconnecting Link	1475 x 100 x 90	7.46	EBAR24-1-T
26 Way Tinned Earth Bar with Single Disconnecting Link	1575 x 100 x 90	8.00	EBAR26-1-T
28 Way Tinned Earth Bar with Single Disconnecting Link	1675 x 100 x 90	8.51	EBAR28-1-T
30 Way Tinned Earth Bar with Single Disconnecting Link	1775 x 100 x 90	8.90	EBAR30-1-T



**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

### OTHER SIZES ARE AVAILABLE ON REQUEST

Stainless steel bolts are provided as standard. See page EB:3 for the full material specification.

For phosphor bronze add /PB suffix to the part numbers above.

### FIXINGS

Fixings for attaching the Earth Bar to a wall are not included.

We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic wall plug (PP12).

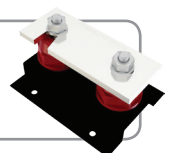
EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

SEE FIXINGS SECTION - PAGE FIX:4

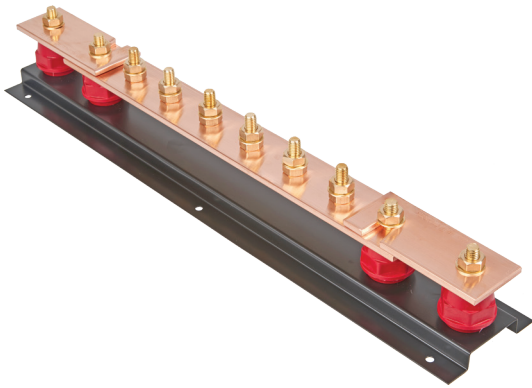
### DISCONNECTING LINKS

The **Single Disconnecting Link** is mainly used to offer a temporary break in the connection to the earth allowing the inspection and testing of multiple Earth Rods/systems while disconnecting it from the Lightning and Earthing system.

See page EB:12 for **Single Disconnecting Link** details.



## Earth Bars with Twin Disconnecting Links



Earth Bars with Twin Disconnecting Link are supplied with a powder coated base and M10 connections as standard.

DESCRIPTION	DIMENSIONS (mm) L x W x H	WEIGHT (kg)	PART NO.
4 Way Earth Bar with Twin Disconnecting Link	450 x 100 x 90	3.90	EBAR4-2
6 Way Earth Bar with Twin Disconnecting Link	550 x 100 x 90	3.12	EBAR6-2
8 Way Earth Bar with Twin Disconnecting Link	650 x 100 x 90	3.63	EBAR8-2
10 Way Earth Bar with Twin Disconnecting Link	800 x 100 x 90	4.40	EBAR10-2
12 Way Earth Bar with Twin Disconnecting Link	900 x 100 x 90	4.84	EBAR12-2
14 Way Earth Bar with Twin Disconnecting Link	1000 x 100 x 90	5.81	EBAR14-2
16 Way Earth Bar with Twin Disconnecting Link	1100 x 100 x 90	6.04	EBAR16-2
18 Way Earth Bar with Twin Disconnecting Link	1200 x 100 x 90	6.28	EBAR18-2
20 Way Earth Bar with Twin Disconnecting Link	1350 x 100 x 90	7.00	EBAR20-2
22 Way Earth Bar with Twin Disconnecting Link	1450 x 100 x 90	7.47	EBAR22-2
24 Way Earth Bar with Twin Disconnecting Link	1550 x 100 x 90	8.18	EBAR24-2
26 Way Earth Bar with Twin Disconnecting Link	1650 x 100 x 90	8.79	EBAR26-2
28 Way Earth Bar with Twin Disconnecting Link	1750 x 100 x 90	9.28	EBAR28-2
30 Way Earth Bar with Twin Disconnecting Link	1850 x 100 x 90	9.48	EBAR30-2

**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

**OTHER SIZES AND CONNECTIONS ARE AVAILABLE ON REQUEST**

Brass bolts are provided as standard. See page EB:3 for the full material specification.

For phosphor bronze add /PB suffix to the part numbers above.



### FIXINGS

Fixings for attaching the Earth Bar to a wall are not included.

We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic wall plug (PP12).



EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

**SEE FIXINGS SECTION - PAGE FIX:4**

### DISCONNECTING LINKS

The **Twin Disconnecting Link** is mainly used to offer a temporary break in the connection to the earth allowing the inspection and testing of multiple Earth Rods/systems while disconnecting it from the Lightning and Earthing system. See page EB:12 for **Twin Disconnecting Link** details.



## Tinned Earth Bars with Twin Disconnecting Links

**Tinned Earth Bars with Twin Disconnecting Link** are supplied with a powder coated base and M10 connections as standard.



DESCRIPTION	DIMENSIONS (mm) L x W x H	WEIGHT (kg)	PART NO.
4 Way Tinned Earth Bar with Twin Disconnecting Link	450 x 100 x 90	3.90	EBAR4-2-T
6 Way Tinned Earth Bar with Twin Disconnecting Link	550 x 100 x 90	3.12	EBAR6-2-T
8 Way Tinned Earth Bar with Twin Disconnecting Link	650 x 100 x 90	3.63	EBAR8-2-T
10 Way Tinned Earth Bar with Twin Disconnecting Link	800 x 100 x 90	4.40	EBAR10-2-T
12 Way Tinned Earth Bar with Twin Disconnecting Link	900 x 100 x 90	4.84	EBAR12-2-T
14 Way Tinned Earth Bar with Twin Disconnecting Link	1000 x 100 x 90	5.81	EBAR14-2-T
16 Way Tinned Earth Bar with Twin Disconnecting Link	1100 x 100 x 90	6.04	EBAR16-2-T
18 Way Tinned Earth Bar with Twin Disconnecting Link	1200 x 100 x 90	6.28	EBAR18-2-T
20 Way Tinned Earth Bar with Twin Disconnecting Link	1350 x 100 x 90	7.00	EBAR20-2-T
22 Way Tinned Earth Bar with Twin Disconnecting Link	1450 x 100 x 90	7.47	EBAR22-2-T
24 Way Tinned Earth Bar with Twin Disconnecting Link	1550 x 100 x 90	8.18	EBAR24-2-T
26 Way Tinned Earth Bar with Twin Disconnecting Link	1650 x 100 x 90	8.79	EBAR26-2-T
28 Way Tinned Earth Bar with Twin Disconnecting Link	1750 x 100 x 90	9.28	EBAR28-2-T
30 Way Tinned Earth Bar with Twin Disconnecting Link	1850 x 100 x 90	9.48	EBAR30-2-T

**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

**OTHER SIZES AND CONNECTIONS ARE AVAILABLE ON REQUEST**

Stainless steel bolts are provided as standard. See page EB:3 for the full material specification.

For phosphor bronze add /PB suffix to the part numbers above.



**FIXINGS**

Fixings for attaching the Earth Bar to a wall are not included.

We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic wall plug (PP12).

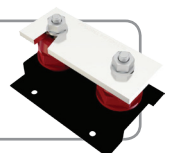


EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

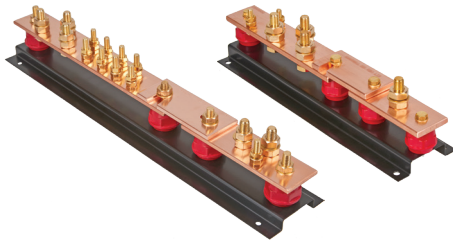
**SEE FIXINGS SECTION - PAGE FIX:4**

### DISCONNECTING LINKS

The **Twin Disconnecting Link** is mainly used to offer a temporary break in the connection to the earth allowing the inspection and testing of multiple Earth Rods/systems while disconnecting it from the Lightning and Earthing system. See page EB:12 for **Twin Disconnecting Link** details.



## Main Earth Terminals



DESCRIPTION	TERMINALS	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
Main Earth Terminal (38 x 6)	2 x M6/4 x M10	285 x 70 x 80	1.30	EBAR600
Main Earth Terminal (50 x 6)	9 x M8/5 x M12	520 x 90 x 90	3.24	EBAR1000

**Material:** Copper (bar), Powder coated steel (base)

**Standard:** BS 7430

**OTHER SIZES ARE AVAILABLE ON REQUEST**

See page EB:3 for the full material specification

For phosphor bronze add /PB suffix to the part numbers above

### Main Earth Terminal (tinned)

DESCRIPTION	TERMINALS	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
Main Earth Terminal (38 x 6)	2 x M6/4 x M10	285 x 70 x 80	1.30	EBAR600-T
Main Earth Terminal (50 x 6)	9 x M8/5 x M12	520 x 90 x 90	3.24	EBAR1000-T

**Material:** Tinned Copper (bar), Powder coated steel (base)

**Standard:** BS 7430



### FIXINGS

Fixings for attaching the Earth Bar to a wall are not included.

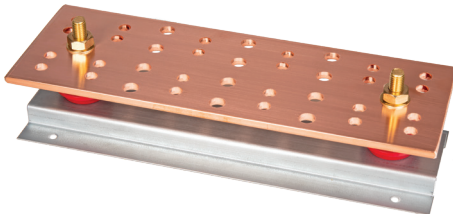
We recommend either brass roundhead screws No.12 x 1.5" (BRHW1.5-12) or stainless steel roundhead screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic wall plug (PP12).



EARTH BAR LENGTH	FIXINGS/BAR
Up to 500mm	4
500mm - 1000mm	6
1001mm - 1500mm	8
1501mm - 1700mm	10
1701mm +	12

**SEE FIXINGS SECTION - PAGE FIX:4**

## Telecom Earth Bars

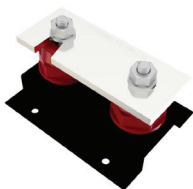


Kingsmill can manufacture Earth Bars for telecommunications bonding. Please ask our sales office for a quote.

## Disconnecting Links (including Tinned)



ELINK



ELINK-T

**Disconnecting Links** offer a temporary break in the connection to earth. This allows testing of an Earth Rod whilst disconnecting it from the Lightning Protection System. **Tinned Disconnecting Links** are resistant to corrosion.

DESCRIPTION	DIMENSIONS L x W x H (mm)	WEIGHT (kg)	PART NO.
Disconnecting Link	125 X 100 X 90	0.71	ELINK
Tinned Disconnecting Link	125 X 100 X 90	0.71	ELINK-T

**Material:** Copper or tinned copper (bar), powder coated steel (base)

**Standard:** BS 7430



### FIXINGS

4 x brass No.12 x 1.5" (BRHW1.5-12) or stainless steel (A2RHSLT1.5-12) roundhead screws + plastic wall plug (PP12)



**SEE FIXINGS SECTION - PAGE FIX:4**



Insulators

DESCRIPTION	SIZE (mm)	WEIGHT (kg)	PART NO.
Stand Off Type c/w 2 studs & 3 nuts	M10 x 35	0.15	INSU1
Stand Off Type	M10 x 35	0.08	INSU2
Stand Off Type	M6 x 25	0.03	INSU3
Stand Off Type	M10 x 51	0.09	INSU4

**Material:** Reinforced polyester/GRP

**Electrical:**  
 Dielectric Strength: >14 Kv/mm  
 Resistance (normal): >10M Ohms  
 Resistance (bolted): >10M Ohms  
 Arc resistance: >180 sec.  
 Tracking index: >600

**Brass inserts:**  
 M6 9Nm Torque  
 M8 18Nm Torque  
 M10 35Nm Torque

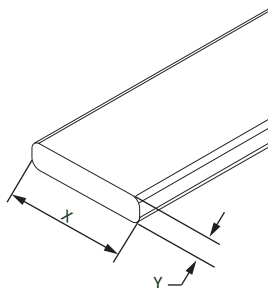


Hard Drawn Copper Bars

CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	BAR LENGTH (m)	WEIGHT (kg/m)	PART NO.
25 x 3	75	2.0	0.67	CBHD2530
25 x 6	150	2.0	1.34	CBHD2560
31 x 3	93	2.0	0.83	CBHD3130
38 x 3	114	2.0	1.01	CBHD3830
38 x 6	228	2.0	2.03	CBHD3860
50 x 6	300	2.0	2.67	CBHD5060
50 x 10	500	2.0	4.45	CBHD5010
60 x 6	600	2.0	3.20	CBHD6060
75 x 6	450	2.0	4.00	CBHD7506
100 x 6	600	2.0	5.34	CBHD1006

**Material:** Copper  
**Standard:** BS:EN 12163

**OTHER SIZES AND LENGTHS ARE AVAILABLE ON REQUEST**

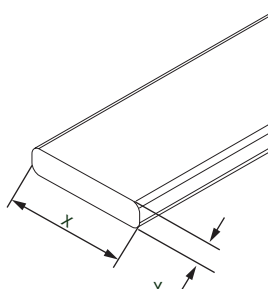


Hard Drawn Tinned Copper Bars

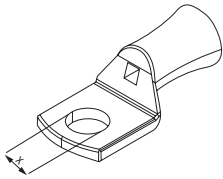
CONDUCTOR SIZE (X x Y) (mm)	CSA (mm <sup>2</sup> )	BAR LENGTH (m)	WEIGHT (kg/m)	PART NO.
25 x 3	75	2.0	0.67	CBHD2530/T
25 x 6	150	2.0	1.34	CBHD2560/T
50 x 6	300	2.0	2.67	CBHD5060/T

**Material:** Tinned copper  
**Standard:** BS:EN 12163

**OTHER SIZES AND LENGTHS ARE AVAILABLE ON REQUEST**



## Tinned Copper Cable Lugs



**Compression Tube Lugs** are manufactured from high conductive electrolytic copper and are tin plated for excellent corrosion resistance. We also supply **Compression Tube Lugs** complete with two stud holes.

CABLE (mm <sup>2</sup> )	STUD (X) (mm)	WEIGHT (kg)	PART NO.
16	6	0.01	LTC16,06
16	8	0.01	LTC16,08
16	10	0.01	LTC16,10
16	12	0.01	LTC16,12
25	6	0.01	LTC25,06
25	8	0.01	LTC25,08
25	10	0.01	LTC25,10
25	12	0.01	LTC25,12
35	6	0.01	LTC35,06
35	8	0.01	LTC35,08
35	10	0.01	LTC35,10
35	12	0.01	LTC35,12
50	6	0.02	LTC50,06
50	8	0.02	LTC50,08
50	10	0.02	LTC50,10
50	12	0.02	LTC50,12

**Material:** Tinned copper  
**Standard:** BS 7430

CABLE (mm <sup>2</sup> )	STUD (X) (mm)	WEIGHT (kg)	PART NO.
70	8	0.04	LTC70,08
70	10	0.04	LTC70,10
70	12	0.04	LTC70,12
70	14	0.04	LTC70,14
70	16	0.04	LTC70,16
95	8	0.06	LTC95,08
95	10	0.06	LTC95,10
95	12	0.06	LTC95,12
95	14	0.06	LTC95,14
95	16	0.06	LTC95,16
120	10	0.06	LTC120,10
120	12	0.06	LTC120,12
120	14	0.06	LTC120,14
120	16	0.06	LTC120,16
150	10	0.09	LTC150,10
150	12	0.09	LTC150,12

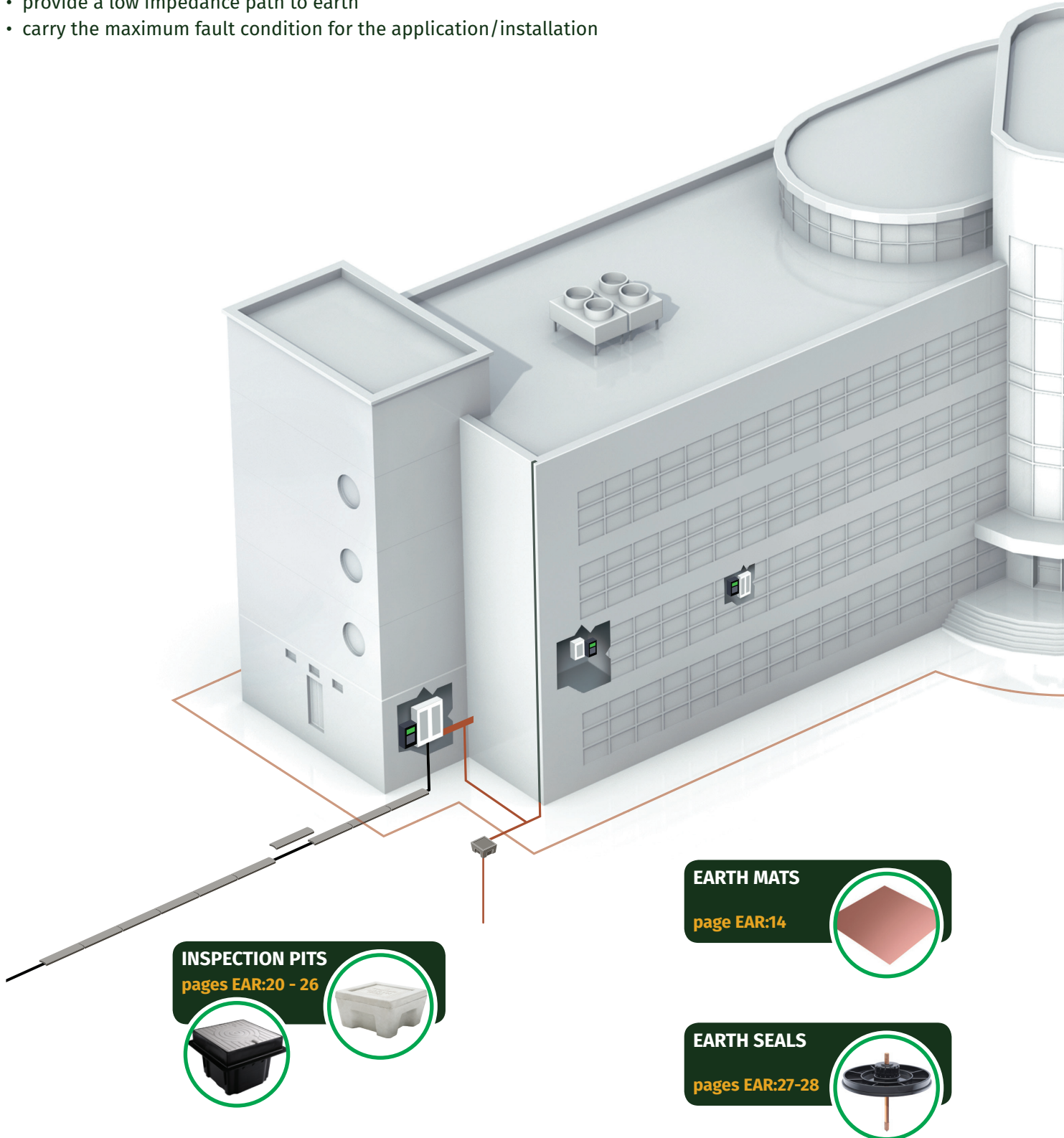
**OTHER SIZES ARE AVAILABLE ON REQUEST**

CABLE (mm <sup>2</sup> )	STUD (X) (mm)	WEIGHT (kg)	PART NO.
150	14	0.09	LTC150,14
150	16	0.09	LTC150,16
185	12	0.11	LTC185,12
185	14	0.11	LTC185,14
185	16	0.11	LTC185,16
240	12	0.14	LTC240,12
240	14	0.14	LTC240,14
240	16	0.14	LTC240,16
300	12	0.17	LTC300,12
300	14	0.17	LTC300,14
300	16	0.17	LTC300,16
400	12	0.21	LTC400,12
400	14	0.21	LTC400,14
400	16	0.21	LTC400,16

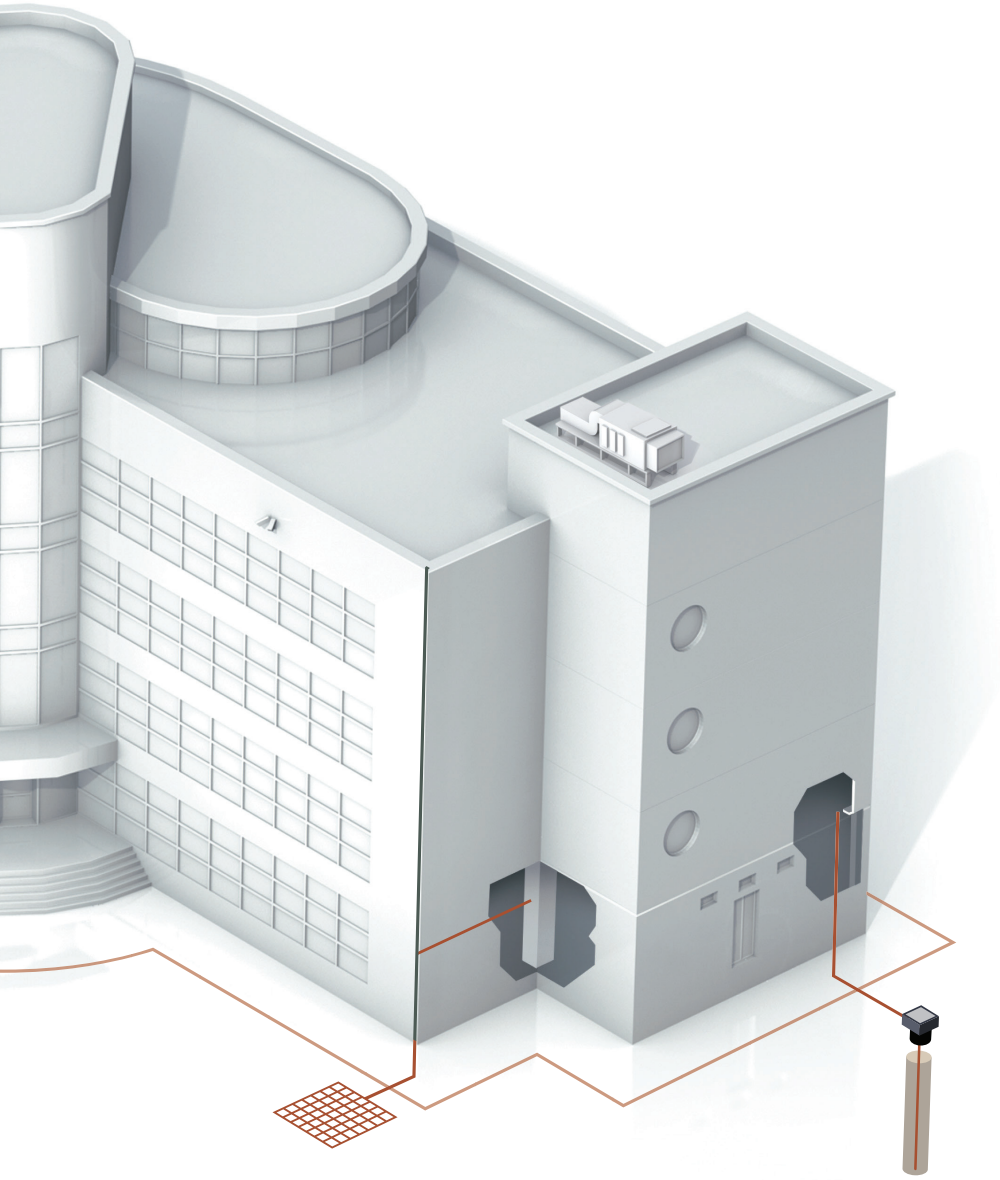
<b>Introduction</b>	<b>EAR:2 - 3</b>
<b>Earth Termination Network</b> The Earth Termination Network is a vital part of any Power or Lightning Protection installation	<b>EAR:4 - 7</b>
<b>Earth Rods and Fittings</b> Copperbond, solid copper and stainless steel Earth Rods and fittings	<b>EAR:8 - 13</b>
<b>Plates and Mats</b> Solid copper Plates and lattice copper Earth Mats	<b>EAR:14</b>
<b>Soil Conditioning Agents</b> Bentonite and Marconite	<b>EAR:15 - 19</b>
<b>Concrete Inspection Pits, Cable Protection Covers, Markers &amp; Posts</b> Concrete Inspection Pits to enable testing of the earth electrode system, cable protection covers and markers to protect cables from damage	<b>EAR:20 - 24</b>
<b>Plastic Inspection Pits</b> Plastic Inspection Pits to enable testing of the earth electrode system	<b>EAR:25 - 26</b>
<b>Earth Rod Seals</b> Single and Double Earth Rod Seals for basement earthing installations	<b>EAR:27 - 28</b>
<b>Clamps</b> Rod to tape, cable and strand clamps for inter-connecting conductors, rods etc	<b>EAR:29 - 31</b>
<b>Accessories</b>	<b>EAR:32</b>

Copper is the recommended material to use in earthing applications, whether below or above ground. Materials used in earthing systems must be able to:

- withstand mechanical damage
- resist corrosion
- provide a low impedance path to earth
- carry the maximum fault condition for the application/installation



Our castings are high quality/high copper content complying to BS 7430 and BS 62561-1. Additional to our range are UL listed copperbond earth rods and exothermic welding.



**EARTH ROD CLAMPS**  
pages EAR:29 - 31

**INSPECTION PITS**  
pages EAR:20 - 26

**EARTH RODS AND ACCESSORIES**  
pages EAR:8 - 13

**EARTH PLATES**  
page EAR:14

**CONDUCTIVE AGGREGATES**  
pages EAR:15 - 19



# Earth Termination Network

It is important that both lightning and electrical fault currents are dispersed into the ground (soil) in a safe manner and that this installation will last in excess of 20 years (in average soil conditions).

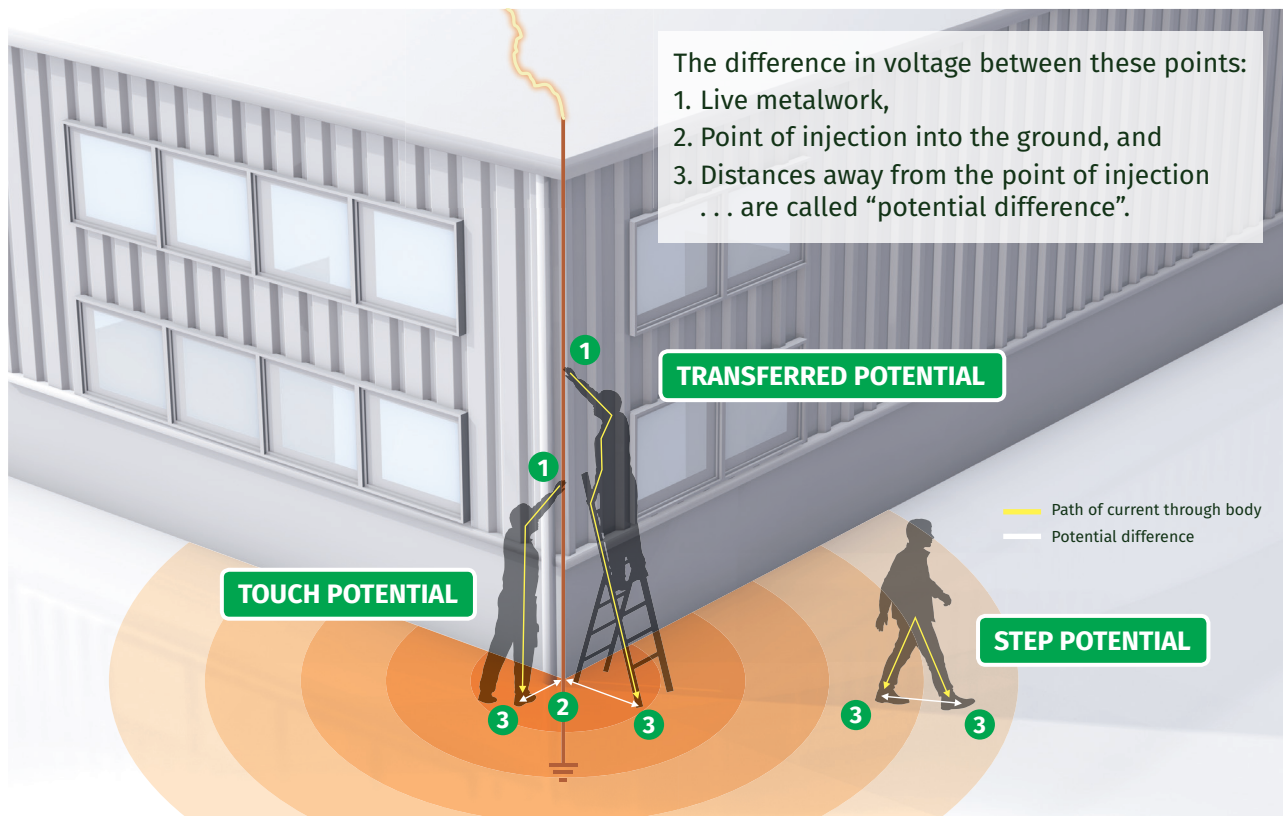
With this in mind, an Earth Termination Network must:

- protect life,
- provide a low resistivity path to earth,
- allow circuit protection devices to operate correctly,
- carry high currents repeatedly,
- have excellent corrosion resistance properties, and
- be mechanically robust.

Moreover, the careful design of an Earth Termination Network will avoid the potentially lethal hazards associated with live metalwork/lightning conductors and the potential difference arising from subsequent voltage gradients in the ground.

## VOLTAGE GRADIENT

When lightning, or a fault current, is injected into the ground the voltage dissipates through the soil, radiating away from the point of entry. The further the distance from the point of entry, the lower the voltage that will present (much like the size of ripples in a pond, as they radiate away from the point where a stone was thrown into the water).



This is significant because a current passing through the heart causes fibrillation and can lead to death.

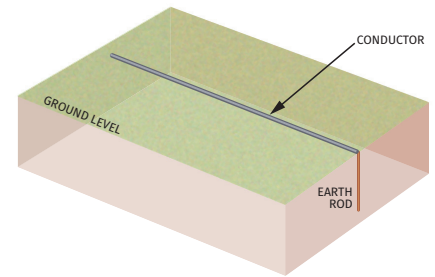
Mitigation of potential differences can be through the use of "equipotential grids" that equalise potential across an area, plus it is good practice to ensure that the conductors and rods are buried at least 1m deep and covered by a thick layer of insulating material eg rock.



An earth termination network can be installed in different ways . . .

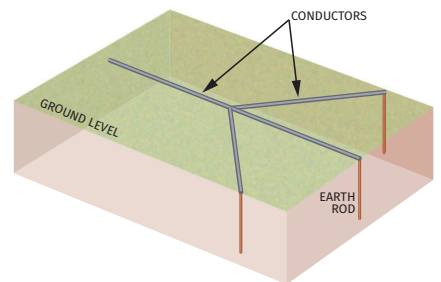
### 1. Simple Earth Electrode

This can be a driven Earth Rod, an Earth Plate, a Mat or a length of buried conductor - or a combination of both.



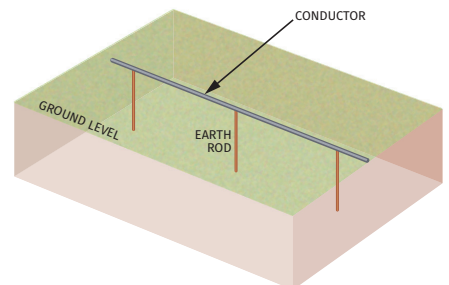
### 2. Crows Foot Electrode

Can incorporate Earth Rods - the rods would be spaced at least twice their driven length apart.



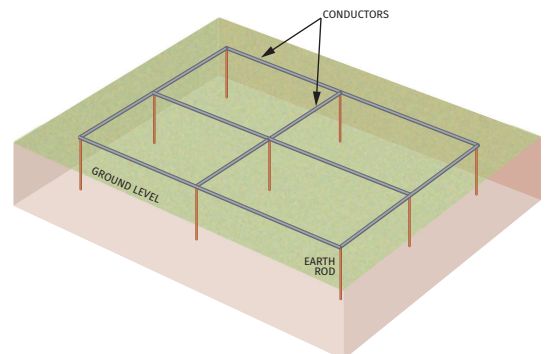
### 3. Counterpoise Conductor

Can incorporate Earth Rods - the rods would be spaced at least twice their driven length apart.



### 4. Grid Conductor

Can incorporate Earth Rods - the rods would be spaced at least twice their driven length apart. For example, in a sub-station or cell site.



### 5. Earth Plates/Mats

For example, for protection of an operator at switch positions.

The choice of Earth Termination layout design depends on multiple factors, but essentially . . .

- The purpose
- The ground conditions

## From BS:EN 62305 . . .

For Lightning Protection, BS:EN 62305:3 advocates two types of Earthing System:

- **TYPE A** - simple earth electrode (*page EAR:5*)
- **TYPE B** - crows foot or counterpoise (*page EAR:5*)  
These are ideally suited to areas of high soil resistivity and structures containing electronic equipment and hazardous materials.
- Foundation electrodes may be employed - these are similar to **TYPE B** and are installed within the building's foundation itself.

## Factors influencing the ability to achieve a satisfactory earth resistivity value

The soil composition also affects the resistivity of the soil itself. The presence of salts can significantly reduce resistivity which also, with some other elements, can become extremely corrosive to the material used in an earthing system.

Corrosion resistance is of paramount importance.

Soil resistivity readings should be taken prior to designing an Earth Termination Network. The reason for this is that the nature of the soil has a major influence over the final resistivity of the Earth Termination network.

*This can be illustrated in the following tables . . .*

### Effects of moisture content on resistivity

Moisture Content % by weight	Resistivity (Ωm)	
	Top soil	Sandy loam
0	10 x 10 <sup>6</sup>	10 x 10 <sup>6</sup>
2.5	2,500	1,500
5	1,650	430
10	530	185
15	310	105
20	120	63
30	64	42

### Effects of temperature on resistivity

Temperature		Resistivity (Ωm)
°C	°F	
20	68	72
10	50	99
0	32 (water)	138
0	32 (ice)	300
-5	23	790
-15	14	3,300

### Confused? Kingsmill are here to help you

Sometimes it is not possible to achieve the desired finished earth electrode resistance, due to the ground conditions being unfavourable - hard rocky ground, mountain tops, dry soil, etc.

For areas where the soil resistivity is very high, Kingsmill offer several “conductive aggregate” solutions to help improve resistivity - these are detailed on pages EAR:15 - 19.

We recommend the use of copper earth electrode systems due to their inherent low resistivity and corrosion resistance.

Our range encompasses:

- Solid copper earth electrodes and conductor
- Solid stainless steel electrodes
- Copperbond (copper covered steel) electrodes and conductor
- Copper conductors
- Earth bars and bonds
- Exothermic welding

Kingsmill do not recommend the use of galvanised, zinc plated or bare mild steel in buried (in direct contact with soil) earth termination networks for two reasons.

1. The high resistivity of steel compared to copper
2. Poor corrosion resistance when compared with solid copper or copperbonded steel

Similarly, the earth connection components must also be able to resist corrosion and carry the nominated fault rating of the conductor.

## Exothermic Welding

It is important that all Earth Terminations can conduct the current that is required by the Earthing design.

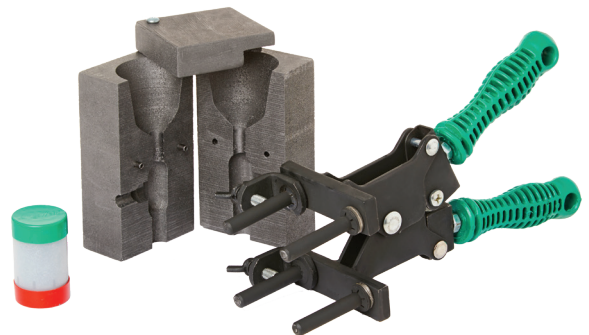
Not only must this apply to the conductor itself, but also to the connectors used within the Earth Termination network. Exothermic joints carry 100% of the conductor fault rating, whereas bolted braided and crimped connections do not. With this in mind, Kingsmill supply a full range of exothermic welding equipment.

Exothermic welds permit the finished joint to carry the full fault rating of the conductors joined, they never loosen and being composed mainly of copper, provide first class corrosion resistance.

The Kingsmill exothermic joint provides:

- Full fault current carrying capacity
- Excellent corrosion resistance
- Ease of installation

*However please note, there are instances where a bolted connection is required. For example, where the earth conductor needs to be disconnected from the earth electrode for testing, or where the installation of an exothermic weld is not possible.*



### **KingsWeld Exothermic Welding**

*KingsWeld products, including applications and methods can be found in the KingsWeld section.*

**A chain is only as good as its weakest link . . .**



**. . . poor component selection can seriously impair a system!**

## Copperbond Earth Rods



**Copperbond Earth Rods**, deep driven, usually provide the most cost effective earth system. They are made from a low carbon, high tensile strength (minimum 600n/mm<sup>2</sup>) steel core with a coating of 99.9% pure electrolytic copper, that has been molecularly bonded to the steel core.

Extendable type rods have a rolled thread (UNC2A) at each end.

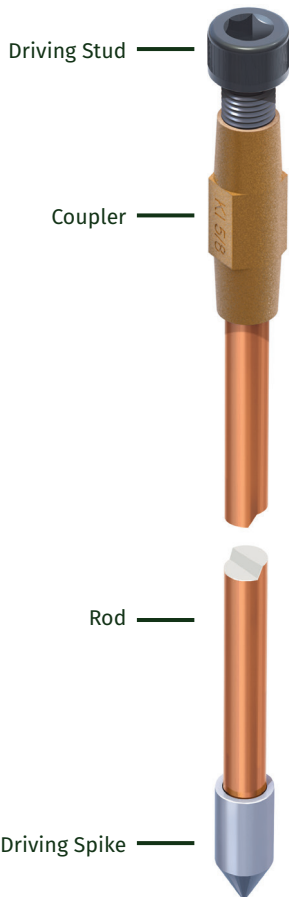
Rolled threads have a higher strength than cut threads. Additionally, they preserve the copper coating over the threaded sections thus improving corrosion resistance.

NOMINAL DIA. (in : mm)	LENGTH (mm)	THREAD SIZE UNC (in)	SHANK DIA. (mm)	WEIGHT (kg)	PART NO.
3/8 : 9	1200	3/8	9.5	0.61	ERCB1004
5/8 : 16	1200	5/8	14.2	1.50	ERCB1604
5/8 : 16	1500	5/8	14.2	1.88	ERCB1605
5/8 : 16	1800	5/8	14.2	2.27	ERCB1606
5/8 : 16	2400	5/8	14.2	2.99	ERCB1608
5/8 : 16	3000	5/8	14.2	3.75	ERCB1610
3/4 : 20	1200	3/4	17.2	2.19	ERCB2004
3/4 : 20	1500	3/4	17.2	2.79	ERCB2005
3/4 : 20	1800	3/4	17.2	3.34	ERCB2006
3/4 : 20	2400	3/4	17.2	4.46	ERCB2008
3/4 : 20	3000	3/4	17.2	5.44	ERCB2010

**Material:** Pure copper molecularly bonded on to a steel core

**Standard:** BS:EN 62561-2, BS 7430

**Copper Thickness:** 254 microns (minimum)



## UL listed Copperbond Earth Rods

NOMINAL DIA. (in)	LENGTH (mm)	THREAD SIZE UNC (in)	SHANK DIA. (mm)	WEIGHT (kg)	PART NO.
5/8	2400	5/8	14.2	2.99	ERCB1608UL
5/8	3000	5/8	14.2	3.75	ERCB1610UL
3/4	2400	3/4	17.2	4.46	ERCB2008UL
3/4	3000	3/4	17.2	5.44	ERCB2010UL

**Copperbond Earth Rods** should have a minimum of 254 microns of copper thickness. This measurement results from research carried out in the USA, that studied the weight loss of copper (corrosion) under differing soil conditions. It was determined that 0.254mm (or 254 microns) will provide a lifetime of 20+ years in average soil conditions.



The thread must be rolled after plating to ensure maximum copper coverage over the threads. Rolled threads are also stronger than cut threads.

**APPLICATION**

Driving Stud + Earth Rod + Coupling + Earth Rod + Driving Spike =

**COMPONENT ASSEMBLY:**

Assemble Kingsmill **Copperbond Earth Rods** to the desired length with **Couplings** and add a **Driving Stud** to the top and a **Driving Spike** to the bottom for safe driving into the ground.

## Couplings (Copperbond Earth Rods)

Kingsmill **Earth Rod Couplings** are counter-bored and of sufficient length to ensure that **Earth Rod** threads are completely enclosed within the coupling. Manufactured from high strength, high copper content alloy to ensure adequate strength and corrosion resistance.

DESCRIPTION	LENGTH (mm)	BODY DIAMETER ACROSS FLATS (mm)	WEIGHT (kg)	PART NO.
Rod Coupling 5/8" UNC	68	22	0.08	COUP16
Rod Coupling 3/4" UNC	79	24	0.14	COUP20

**Material:** High Copper Content Alloy

**Standard:** BS 7430, BS:EN 62561-2: 2012

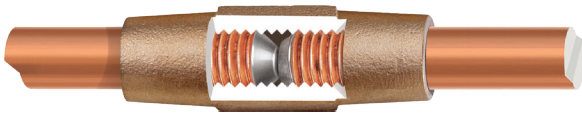
DESCRIPTION	LENGTH (mm)	ACROSS FLATS (mm)	WEIGHT (kg)	PART NO.
16mm Rod Coupling 5/8" UNC (HEX)	68	20	0.11	COUP16HEX
20mm Rod Coupling 3/4" UNC (HEX)	80	25	0.17	COUP20HEX

**Material:** High Copper Content Alloy

**Standard:** BS:EN 62561-2: 2012

DESCRIPTION	LENGTH (mm)	BODY DIA. (mm)	WEIGHT (kg)	PART NO.
5/8" Rod Coupling	80	25	0.20	COUP16S

**Material:** Silicon Aluminium Bronze



## Driving Studs (Copperbond Earth Rods)

High strength **Driving Studs** for repeated use with power hammers.

DESCRIPTION	LENGTH (mm)	HEAD DIA. (mm)	WEIGHT (kg)	PART NO.
16mm Driving Stud 5/8" UNC	54	22	0.09	DRST16
20mm Driving Stud 3/4" UNC	62	25	0.15	DRST20

**Material:** High Tensile Steel with a socket-head cap screw

**Standard:** BS 7430



## Driving Spikes (Copperbond Earth Rods)

**Driving Spikes** for use with our copperbond **Earth Rods**. They enable rods to be driven into hard/compacted ground with ease and are internally threaded for screwing directly onto the **Earth Rod**.

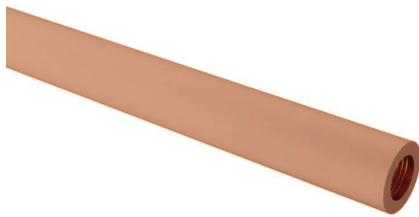
DESCRIPTION	LENGTH (mm)	HEAD DIA. (mm)	WEIGHT (kg)	PART NO.
Driving Spike for 16mm (5/8") copperbond Earth Rod	54	22	0.05	DRSP16-CB
Driving Spike for 20mm (3/4") copperbond Earth Rod	62	25	0.06	DRSP20-CB

**Material:** Case Hardened Steel

**Standard:** BS 7430



### Solid Copper Earth Rods



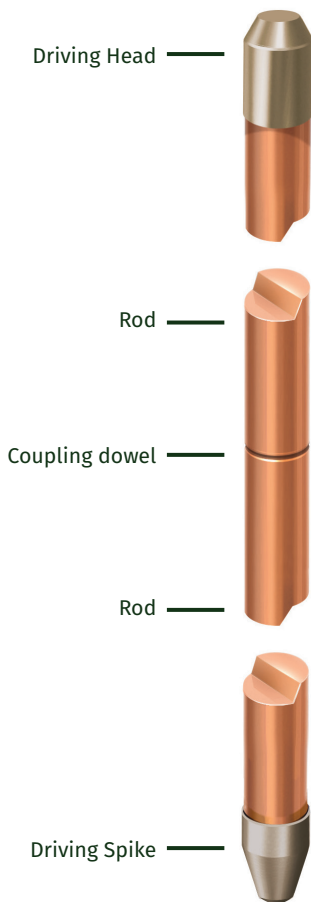
Used where soil conditions are aggressive, ie high salt content.

**Solid Copper Earth Rods** have a tapped hole at each end which allows them to be joined together by means of a coupling dowel.

LENGTH (mm)	DIAMETER (mm)	INTERNAL THREAD (mm)	WEIGHT (kg)	PART No.
1200	15	M10	1.85	ERSC1504
1200	16	M10	2.10	ERSC1604
1500	16	M10	2.49	ERSC1605
1800	16	M10	2.99	ERSC1606
2400	16	M10	3.99	ERSC1608
3000	16	M10	4.99	ERSC1610
1200	20	M10	3.30	ERSC2004
1500	20	M10	4.14	ERSC2005
1800	20	M10	5.02	ERSC2006
2400	20	M10	6.70	ERSC2008
3000	20	M10	8.38	ERSC2010
1200	25	M10	5.18	ERSC2504
1500	25	M10	6.48	ERSC2505
1800	25	M10	7.78	ERSC2506
2400	25	M10	10.37	ERSC2508
3000	25	M10	12.97	ERSC2510

**Material:** 99.9% Hard Drawn Copper

**Standard:** BS:EN 62561-2, BS 7430



#### APPLICATION

+
+
+
+
=

Driving Head    Earth Rod    Coupling Dowel    Earth Rod    Driving Spike

#### COMPONENT ASSEMBLY:

Assemble Kingsmill **Copperbond Earth Rods** to the desired length with **Couplings** and add a **Driving Stud** to the top and a **Driving Spike** to the bottom for safe driving into the ground.



## Driving Heads (Solid Copper Earth Rods)

Kingsmill **Driving Heads** protect both the internal thread and the top of the **Solid Copper Earth Rod** whilst the rods are being driven into the ground.

DESCRIPTION	LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
16mm Rod Driving Head	40	10	0.04	DRHD16
20mm Rod Driving Head	42	10	0.06	DRHD20
25mm Rod Driving Head	45	10	0.09	DRHD25

**Material:** Steel

**Standard:** BS 7430



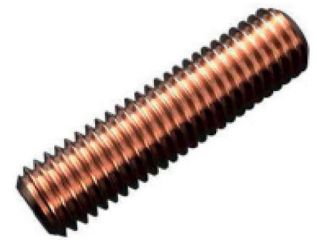
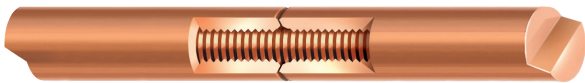
## Coupling Dowel (Solid Copper Earth Rods)

Kingsmill **Coupling Dowels** are used to join solid copper Earth Rods.

DESCRIPTION	LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
M10 Coupling Dowel	40	10	0.02	DWPB10

**Material:** Phosphor Bronze

**Standard:** BS 7430



## Driving Spikes (Solid Copper Earth Rods)

**Driving Spikes** enable the **Solid Copper Earth Rod** to be driven into the ground easily while protecting the end of the rod from damage.

DESCRIPTION	LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
16mm Rod Driving Spike	40	10	0.03	DRSP16
20mm Rod Driving Spike	55	10	0.06	DRSP20
25mm Rod Driving Spike	60	10	0.10	DRSP25

**Material:** Case Hardened Steel

**Standard:** BS 7430



### Stainless Steel Earth Rods



Made from austenitic steel to British standards.

**Stainless Steel Earth Rods** are similar to our **Solid Copper Rods** but are more anodic than copper, and are useful where galvanic corrosion might occur due to buried dissimilar metals being in close proximity to each other. The current carrying capacity of the **Stainless Steel Earth Rod** in relation to copper is poor.

**Stainless Steel Earth Rods** have a tapped hole at each end which allows them to be joined together by means of a coupling dowel.

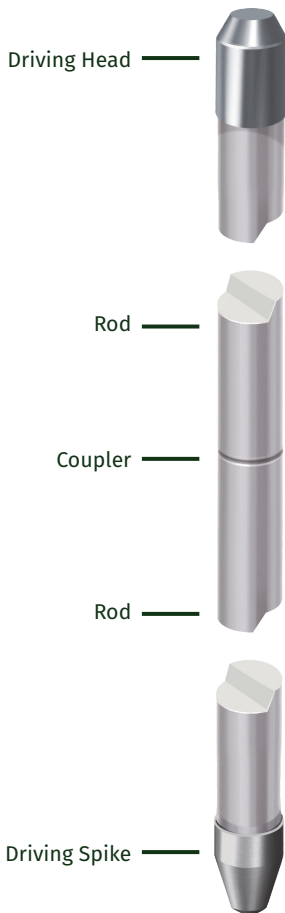
**Stainless Steel Earth Rods** can, if required, be supplied in different grades.

LENGTH (mm)	DIAMETER (mm)	INTERNAL THREAD (mm)	WEIGHT (kg)	PART NO.
1200	16	M10	1.87	ERSS1604
1500	16	M10	2.34	ERSS1605
1800	16	M10	2.81	ERSS1606
2400	16	M10	3.75	ERSS1608
3000	16	M10	4.69	ERSS1610
1200	20	M10	2.96	ERSS2004
1500	20	M10	3.65	ERSS2005
1800	20	M10	4.38	ERSS2006
2400	20	M10	5.84	ERSS2008
3000	20	M10	7.30	ERSS2010
1200	25	M10	4.89	ERSS2504
1500	25	M10	6.12	ERSS2505
1800	25	M10	7.34	ERSS2506
2400	25	M10	9.79	ERSS2508
3000	25	M10	12.24	ERSS2510

**Material:** Stainless steel

**Standard:** BS:EN 62561-2, BS 7430

Recommended for clay soils and marine/shore environments.



#### APPLICATION



#### COMPONENT ASSEMBLY:

Assemble Kingsmill **Stainless Steel Earth Rods** to the desired length with **Couplings** and add a **Driving Stud** to the top and a **Driving Spike** to the bottom for safe driving into the ground.

## Driving Heads (Stainless Steel Earth Rods)

Kingsmill **Driving Heads** are designed to protect both the internal thread and the top of the **Stainless Steel Earth Rod** whilst the rods are being driven into the ground.

DESCRIPTION	LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
16mm Rod Driving Head	40	10	0.04	DRHD16
20mm Rod Driving Head	42	10	0.06	DRHD20
25mm Rod Driving Head	45	10	0.09	DRHD25

**Material:** Steel

**Standard:** BS 7430



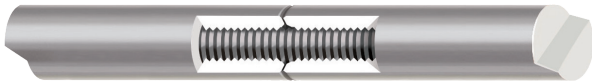
## Coupling Dowel (Stainless Steel Earth Rods)

Kingsmill **Coupling Dowels** are used to join stainless steel earth rods.

LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
40	10	0.02	DWSS10

**Material:** Stainless Steel

**Standard:** BS 7430



## Driving Spikes (Stainless Steel Earth Rods)

**Driving Spikes** enable the **Solid Copper Earth Rod** to be driven into the ground easily while protecting the end of the rod from damage.

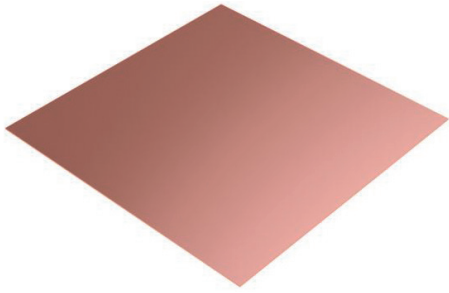
DESCRIPTION	LENGTH (mm)	THREAD DIA. (mm)	WEIGHT (kg)	PART NO.
16mm Rod Driving Spike	40	10	0.03	DRSP16
20mm Rod Driving Spike	55	10	0.06	DRSP20
25mm Rod Driving Spike	60	10	0.10	DRSP25

**Material:** Case Hardened Steel

**Standard:** BS 7430



## Solid Copper Plates



Kingsmill **Solid Copper Earth Plates** are used as part of an earthing network. They provide a long lasting solution where it is not possible to use deep driven **Earth Rods**.

Generally used as an electrode where significant amounts of fault current can be encountered.

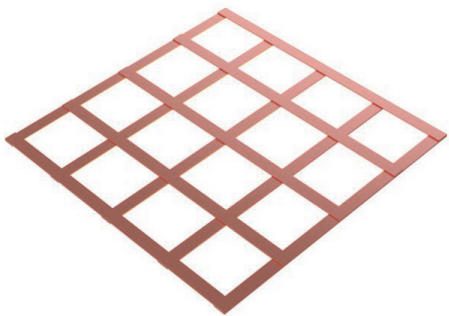
LENGTH x WIDTH (mm)	THICKNESS (mm)	SURFACE AREA (m <sup>2</sup> )	WEIGHT (kg)	PART NO.
600 x 600	1.5	0.73	4.87	SCEP615
600 x 600	3.0	0.73	11.20	SCEP630
900 x 900	1.5	1.63	9.74	SCEP915
900 x 900	3.0	1.63	21.75	SCEP930

**Material:** Copper

**Standard:** BS:EN 12163 (formerly BS 2874)

**OTHER SIZES ARE AVAILABLE UPON REQUEST**

## Lattice Copper Earth Mats



Kingsmill **Lattice Copper Earth Mats** are used where step potential could cause problems.

They are a lower cost option to the solid plates and when used with **Marconite**<sup>®</sup>, they provide a long lasting earth solution.

Generally used as an electrode where significant amounts of fault current can be encountered.

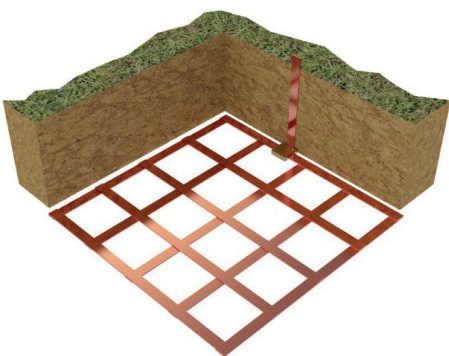
LENGTH x WIDTH (mm)	THICKNESS (mm)	SURFACE AREA (m <sup>2</sup> )	GRID	WEIGHT (kg)	PART NO.
600 x 600	3.0	0.31	5 Bar	4.02	LCEM630
900 x 900	3.0	0.65	5 Bar	5.90	LCEM930

**Material:** Copper

**Standard:** BS:EN 12163 (formerly BS 2874)

**OTHER SIZES ARE AVAILABLE UPON REQUEST**

When buried horizontally, **Earth Mats** can provide an equipotential plane for protecting operators at switching positions.



## Pre-Fabricated Earth Mats

Kingsmill can provide a bespoke service for large **Earth Mats**, which can be rolled-out on site.

Please contact us with your requirements.

## Bentonite - Moisture Retaining Clay

**Bentonite** is used as a backfill to reduce soil resistivity. When mixed with water, it swells to several times its dry volume. This moisture content can be retained for a considerable time and further moisture can be absorbed during rainfall etc. Bentonite can be supplied in either powder or granular form.

Approximately 18 x 25kg bags create a volume of 1m<sup>3</sup> (depending on soil and excavation conditions).

MATERIAL	WEIGHT (kg)	Part NO.
Granulated Moisture Retaining Clay	25	BENT01
Powdered Moisture Retaining Clay	25	BENT02



### Earthing Compound

**Granular:** Granular is the preferred option for filling trenches. The conductor is surrounded with Bentonite and then water poured over and mixed in the trench.

**Powder:** Powder is the preferred product for pouring into bore holes, ensuring the mixture is of a thin enough consistency to reach the bottom of the bore hole.

**Material:** Sodium carbonate activated calcium montmorillonite clay. The product is a naturally occurring substance with no known ecological hazards, and can be disposed of as non-hazardous waste.

## Marconite® - Granulated Conductive Aggregate



**Marconite®** is a granulated conductive medium designed to replace the conventional aggregate in concrete and thereby provide a permanent medium with good electrical conductivity and high strength.

It can provide a permanent solution to problems in electrical/ constructional situations.

**Marconite®** concrete is touch dry within hours, but it will be several days before it is fully cured.

**Marconite®** is chemically inert with very low soluble sulphate content. It can be used with all conventional types of cement, as well as most proprietary resin-based cements, adhesives and gypsum plasters.

MATERIAL	WEIGHT (kg)	Part No.
Marconite Concrete (Pre-Mixed)	25	MARCONITE-01
Marconite Concrete	25	MARCONITE-02

Marconite® is the ideal solution for use in problem earth situations

- a) In areas of poor soil conductivity (high resistivity) - eg rocky areas, sandy soil etc.
- b) In conjunction with lattice mats/plates (where the earth electrodes cannot be deep driven)
- c) Where space is limited

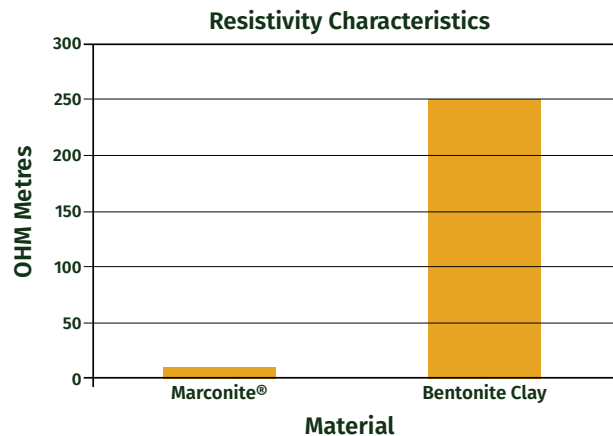
Depending on the surrounding soil conditions Marconite® can reduce electrode resistivity by up to 50%.

Electricity is conducted in much the same way as via metal, through the movement of electrons and direct contact with the carbonaceous particles that compose Marconite®.

This provides a huge advantage over materials such as Bentonite, that rely on conducting electricity through the movement of charged ions. Ions require the presence of an effective electrolyte - water and salts. Such ion type systems can dry out and without water cannot conduct electricity.

Marconite® has a resistivity that is many times lower than that of Bentonite (Marconite 0.001Ωm vs Bentonite 3Ωm) in its natural setting or untamped condition.

Through acting as a backfill, (Marconite® is a highly conductive material), the surface area of the electrode is increased, thus reducing the electrodes' resistance to earth.





## Theft deterrent

When copper conductors are encased in a Marconite®/concrete surround, this acts as a deterrent to those intent on stealing copper from cell sites and substations.

## Advantages

**Marconite®** is a granulated conductive medium designed to replace the conventional aggregate in concrete and thereby provide a permanent medium with good electrical conductivity and strength.

- Low resistivity, especially when compared to Bentonite.
- Does not rely on moisture to conduct electricity.
- No seasonal variation - does not rely on water to conduct, does not shrink.
- Does not require maintenance.
- Chemically inert and non-polluting - non-corrosive to steel and copper, it does not attack cement structures. Its PH is within the neutral range.
- Environmentally safe - it does not dissolve or dissipate like other chemical enhancers such as caustic soda, salt and acid based products.
- Easy to use - forms a concrete like material that can be poured as a slurry and in some situations, used dry.
- Acts as a theft deterrent.
- High strength - can be used as part of the building structure and achieve strengths of grade 25 concrete.
- Synthetic material manufactured specifically for earthing applications.

## Mixing instructions

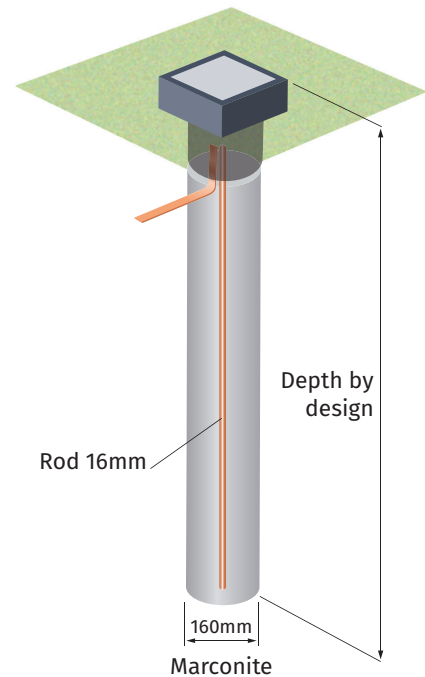
<b>Plain Marconite®</b>	3:1 mix Marconite®/cement by weight plus 1 litre of water per 4kg. (ie 3 x 25kg bags of Marconite®, 1 x 25kg bag of cement, 6 litres of water.)  It is possible to vary the ordinary portland cement and water content to suit local conditions, but this will affect the performance of the finished concrete.
<b>Marconite® Premix</b>	Cement and Marconite® have already been mixed, simply add 6 litres of water per 25kg bag of Marconite® Premix.  When mixed as above, a relatively dry material is formed. Water content can be adjusted as the application requires, but this will affect drying times and resultant compressive strength. Typically, the mix is touch dry within hours but not fully cured until after several days.
<b>Density</b>	<ul style="list-style-type: none"> <li>• Pure dry Marconite® (Marconite-01) is approximately 1,000kg/m<sup>3</sup> (40 x 25kg bag per one cubic metre)</li> <li>• Dry Marconite® pre-mix (Marconite-02) is approximately 1,250kg/m<sup>3</sup> (50 x 25kg bags per one cubic metre)</li> <li>• The fully hardened density of Marconite® concrete, mixed as per instructions, is 1,500kg/m<sup>3</sup></li> </ul>

***We recommend plain Marconite for export markets.***

## Application

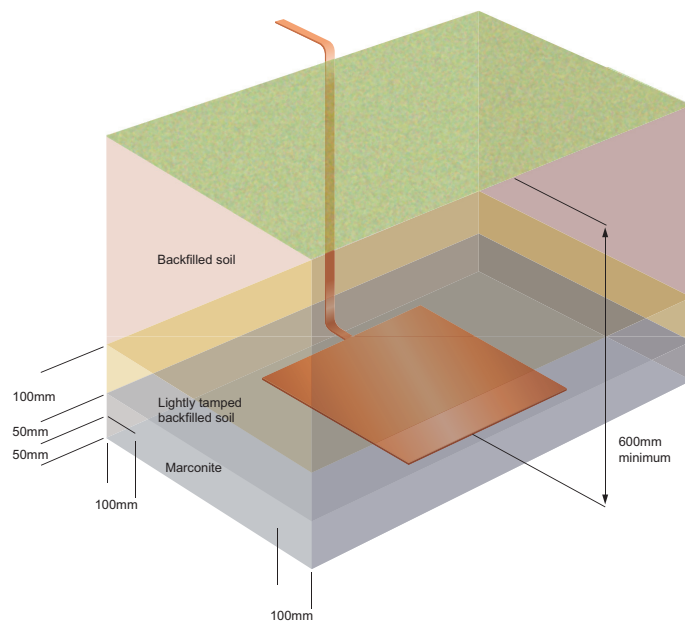
### Earth Rod installation

- Drill a hole 10 x the diameter of the earth rod (16mm diameter rod = 160mm diameter hole)
- Centre the earth rod in the hole and lower it to the bottom
- Mix Marconite® into a slurry and pour into the hole
- Tamp down the mix during pouring to exclude air pockets
- Keep the earth rod central to the hole
- Take a resistivity reading immediately after installation and again 14 days later



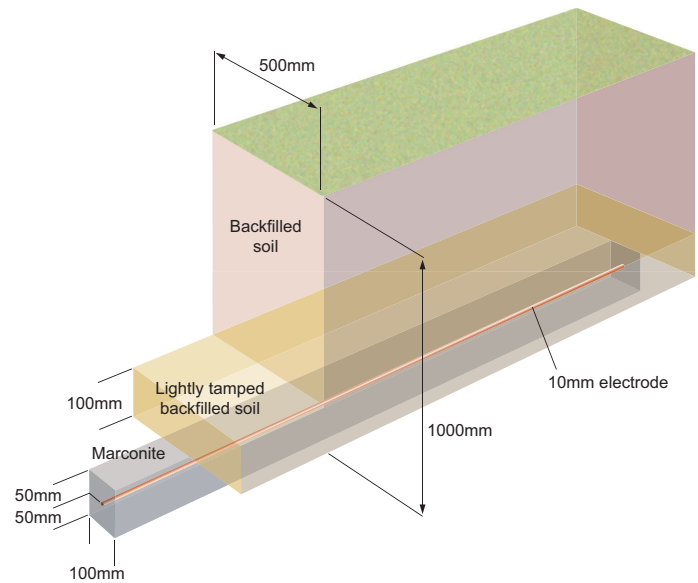
### Trench installation (plate/mat)

- Excavate a trench to approximately 200mm larger, all round than the plate dimensions. The trench should typically be 1,000m deep (minimum 600mm)
- Mix the Marconite® into a slurry and pour into the trench to a depth of 50mm
- Connect the earth plate/mat to the connecting conductors
- Place the earth plate/mat on top of the first layer of Marconite® mix
- Cover the earth plate/mat with a second layer of Marconite® mix to a depth of 50mm
- Backfill the trench with native soil to a depth of 100mm and lightly tamp down
- Then backfill the trench according to the clients requirement
- The use of marker tape or tiles might be required
- Take a resistivity reading immediately after installation and again 14 days later



## Trench installation (conductor)

- Excavate a trench, typically 1m deep and 0.5m wide. The length of the trench is determined by the resistivity of the native soil and the system requirement
- At the bottom of the trench excavate a small channel minimum dimensions 100mm wide and 100mm deep
- Mix the Marconite® into a slurry and pour into the channel to a depth of 50mm
- Lay the conductor on top of the first layer of Marconite® mix
- Cover the conductor with a second layer of Marconite® mix to a depth of 50mm
- Backfill the trench with native soil to a depth of 100mm and lightly tamp down
- Then backfill the trench according to the clients requirement
- The use of marker tape or tiles might be required
- Take a resistivity reading immediately after installation and again 14 days later



## Concrete Inspection Pit



Kingsmill **Concrete Inspection Pits** are suitable for load rating to 4,500kg and are suitable for most types of Earthing and Lightning Protection installations.

The **Concrete Inspection Pit** protects the Earth Rod connection and makes it available for inspection. The **Concrete Inspection Pit** can have an Earth Bar fitted diagonally in slots provided for multiple conductor connections.

DESCRIPTION	DIMENSIONS (mm)	WEIGHT (kg)	PART NO.
Concrete Inspection Pit	315 x 315 x 165	25	CPIT

**Material:** Concrete

**Standard:** BS:EN 62561-5:2011



## Inspection Pit Earth Bars (for Concrete Inspection Pit)



Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

The **Earth Bar** can be fitted into slots, to provide for multiple conductor connections.

DESCRIPTION	SIZE (mm) L x W x T	HOLE SIZE (mm)	WEIGHT (kg)	PART NO.
5 hole pit Earth Bar	300 x 25 x 6	11	0.37	PBAR5
7 hole pit Earth Bar	300 x 25 x 6	11	0.36	PBAR7

**Material:** Copper

**Standard:** BS:EN 13601



## Inspection Pit Earth Bars (tinned)

DESCRIPTION	SIZE (mm) L x W x T	HOLE SIZE (mm)	WEIGHT (kg)	PART NO.
3 hole pit Tinned Earth Bar	290 x 31 x 6	11	0.50	PBAR290
5 hole pit Tinned Earth Bar	290 x 31 x 6	11	0.49	PBAR316

**Material:** Tinned Copper

**Standard:** BS:EN 13601

## Lightweight Concrete Inspection Pit

Kingsmill **Lightweight Concrete Inspection Pits** are suitable for load rating to 4,500kg and are suitable for most types of Earthing and Lightning Protection installations.

The **Lightweight Concrete Inspection Pit** protects the **Earth Rod** connection and makes it available for inspection. The Inspection Pit can have an **Earth Bar** fitted diagonally in slots provided. These **Earth Bars** (see below) allow for multiple conductor connections.

DESCRIPTION	DIMENSIONS (mm)	WEIGHT (kg)	PART NO.
Lightweight Concrete Inspection Pit		16	CPIT/LW

**Material:** Concrete  
**Standard:** BS:EN 62561-8:2011



## Inspection Pit Earth Bars (for Lightweight Concrete Inspection Pit)

Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

The **Inspection Pit Earth Bar** can be fitted diagonally in slots provided in the **Lightweight Concrete Inspection Pit**. They are suitable for multiple - 5 or 7 - conductor connections.

DESCRIPTION	OVERALL SIZE (mm)	HOLE SIZE (mm)	WEIGHT (kg)	PART NO.
5 hole Earth Bar	230 x 25 x 6	11	0.29	PBAR5/LW
7 hole Earth Bar	230 x 25 x 6	11	0.28	PBAR7/LW

**Material:** Copper  
**Standard:** BS:EN 13601



## Concrete Inspection Pit - 500 x 500



Kingsmill **Concrete Inspection Pits - 500 x 500** are designed for use where more space is required in the chamber.

DESCRIPTION	WEIGHT (kg)	PART NO.
Concrete Inspection Pit 500 x 500 x 500	185	CPIT500

**Material:** Concrete

## Inspection Pit Earth Bars (for 500 x 500 Concrete Inspection Pit)



Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

**Inspection Pit Earth Bars** can be fitted diagonally in slots provided in the **Concrete Inspection Pits**. These allow for multiple conductor connections.

DESCRIPTION	OVERALL SIZE L x W x T (mm)	HOLE DIA. (mm)	FINISH	WEIGHT (kg)	PART NO.
5 hole bar for CPIT500	490 x 50 x 6	11	Bare	0.81	PBAR5CBP500
5 hole bar for CPIT500	490 x 50 x 6	11	Tinned	0.81	PBAR5CTP500
7 hole bar for CPIT500	490 x 50 x 6	11	Bare	0.80	PBAR7CBP500
7 hole bar for CPIT500	490 x 50 x 6	11	Tinned	0.80	PBAR7CTP500

**Material:** Copper

**Standard:** BS:EN 13601



## Concrete Inspection Pits (with lifting eye/brass plate)

Kingsmill enhanced **Concrete Inspection Pits with lifting eye/brass plate** can be customised to your exact requirements.

The **lifting eye** makes it easy to remove the pit lid for applications where regular inspection is required.

Inlaid **brass plates** can be engraved as required. Typical engraving includes identification and safety notices and these can be produced in any language.

DESCRIPTION	WEIGHT (kg)	PART NO.
Concrete Inspection Pit c/w lifting eye	25	CPIT-LE
Concrete Inspection Pit c/w brass plate	25	CPIT-BP
Concrete Inspection Pit c/w lifting eye & brass plate	25	CPIT-LE-BP

**Dimensions:** 315mm x 315mm x 165mm  
(W x D x H)

**Material:** Concrete



## Inspection Pit Earth Bars (for Concrete Inspection Pit with lifting eye/brass plate)

Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

The **Earth Bar** can be fitted diagonally in slots provided for multiple conductor connections.

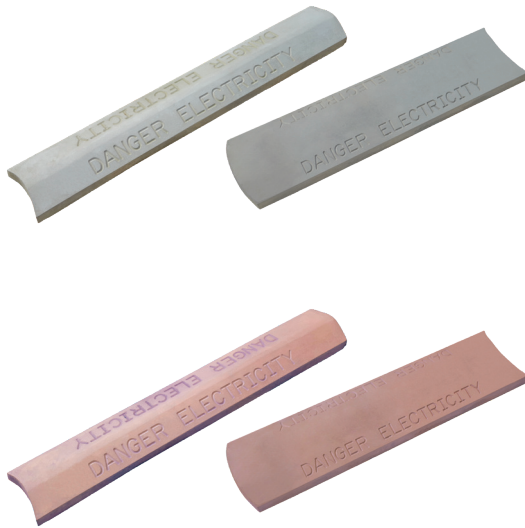
DESCRIPTION	OVERALL SIZE (mm) L x W x T	HOLE DIA. (mm)	WEIGHT (kg)	PART NO.
5 hole Earth Bar	300 x 25 x 6	11	0.37	PBAR5
7 hole Earth Bar	300 x 25 x 6	11	0.36	PBAR7

**Material:** Copper

**Standard:** BS:EN 13601, BS:EN 62561-5:2011



## Cable Protection Covers



**Cable Protection Covers** are wet cast concrete impressed with a warning of 'DANGER ELECTRICITY'.

Available in 3 standard lengths: 150mm, 230mm and 305mm.

WIDTH (mm)	LENGTH (mm)	WEIGHT (kg)	PART NO.
150	914	15	CCP6
230	914	23	CCP9
305	914	29	CCP12

**Material:** Concrete

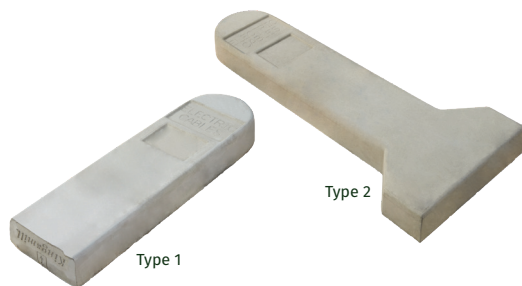
*Care should be taken in selecting the cover size as the cover should be wider than the service line over which it is to be placed.*

**Cable Protection Covers** can be supplied in red coloured concrete:

WIDTH (mm)	LENGTH (mm)	WEIGHT (kg)	PART NO.
150	914	15	CCP6R
230	914	23	CCP9R
305	914	29	CCP12R

**Material:** Concrete

## Marker Posts



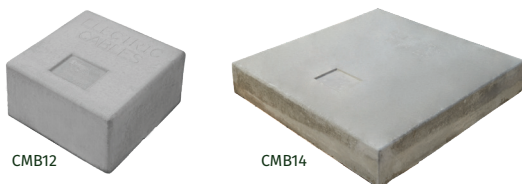
**Marker Posts** for the indication of electric cable junctions and field markers.

- Impressed with the words 'ELECTRIC CABLES'
- Manufactured using wet cast concrete
- 100 x 76mm recess for supplementary identification plates

TYPE	LENGTH (mm)	DEPTH (mm)	WEIGHT (kg)	QUANTITY (per pallet)	PART NO.
1	610	80	14	30	CMPT1
2	762	80	24	30	CMPT2

**Material:** Concrete

## Marker Blocks



**Marker Blocks** for the marking of underground buried electrical services and junctions.

- Concrete blocks impressed with 'ELECTRIC CABLES'
- Manufactured using wet cast concrete
- 100mm x 76mm recess for supplementary identification plates

LENGTH (mm)	WIDTH (mm)	DEPTH (mm)	WEIGHT (kg)	QUANTITY (per pallet)	PART NO.
305	305	150	33	18	CMB12
610	610	100	87	10	CMB24

**Material:** Concrete

## Plastic Inspection Pit

The **Plastic Inspection Pit** protects the **Earth Rod** connection and makes it available for inspection. The **Plastic Inspection Pit** can have up to 3 **Earth Bars** fitted in the slots provided for multiple connections.

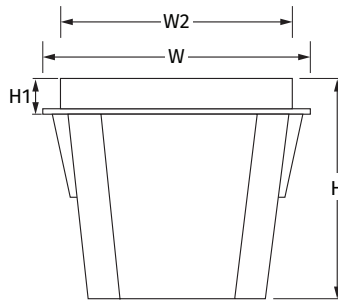
DESCRIPTION	W	W2	H	H1	WEIGHT (kg)	PART NO.
Plastic Inspection Pit	306	260	216	55	3.00	PPIT-K

Paving can be laid up to the lid edge without an unsightly concrete filler surround. Installation instructions are printed on the side. Will withstand 6000kg load when installed correctly.

Lockable lid, using a screwdriver or special key to release the locking mechanism.

**Material:** Polypropylene (body)  
GRP (lid)

**Standard:** BS:EN 62561-5:2011



## Earth Bars (for Plastic Inspection Pit)

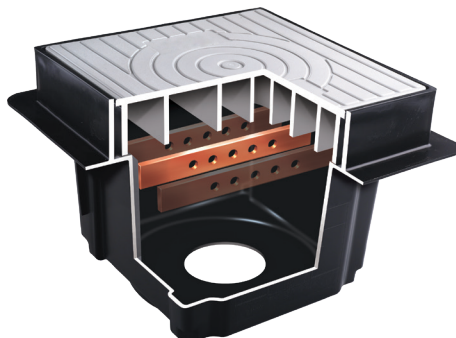
Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

The **Inspection Pit Earth Bar** can be fitted width ways in slots provided in the base of the **Plastic Inspection Pit** (three slots per pit).

DESCRIPTION	OVERALL SIZE (mm) L x W x T	HOLE SIZE (mm)	WEIGHT (kg)	PART NO.
5 hole Earth Bar	203 x 25 x 6	11	0.24	PBAR5PPK
7 hole Earth Bar	203 x 25 x 6	11	0.22	PBAR7PPK

**Material:** Copper

**Standard:** BS:EN 13601



## Light Duty Plastic Inspection Pit



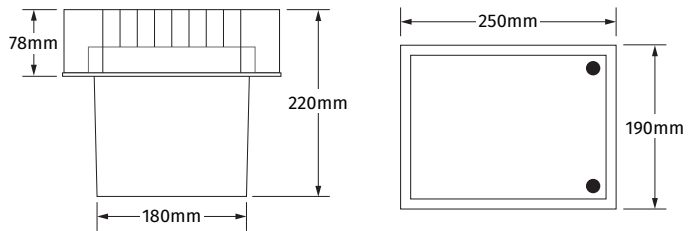
Kingsmill **Light Duty Plastic Inspection Pits** are suitable for load rating to 500kg and is suitable for most types of Earthing and Lightning Protection installations.

The **Light Duty Plastic Inspection Pit** protects the **Earth Rod** connection and makes it available for inspection. The pit can have an **Earth Bar** fitted width ways in slots provided for multiple connections.

DESCRIPTION	WEIGHT (kg)	PART NO.
Light Duty Plastic Inspection Pit	1.28	PPIT-G

**Material:** Polypropylene

**Standard:** BS:EN 62561-5:2011



## Earth Bars (for Light Duty Plastic Inspection Pit)



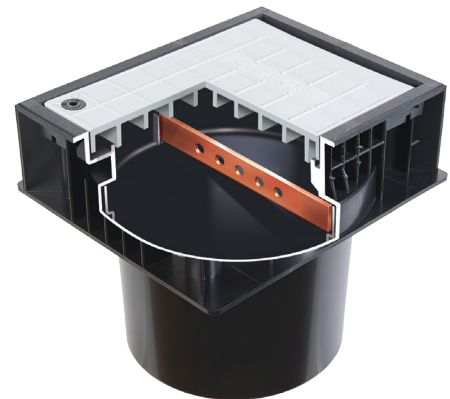
Kingsmill **Inspection Pit Earth Bars** are used to facilitate testing of the earth electrode or earthing system.

The **Earth Bar** can be fitted width ways in a slot (one) provided. The **Earth Bar** allows for multiple conductor connections.

DESCRIPTION	OVERALL SIZE (mm) L x W x T	HOLE SIZE (mm)	WEIGHT (kg)	PART NO.
5 hole Pit Bar	200 x 25 x 6	11	0.24	PBAR5/PP
7 hole Pit Bar	200 x 25 x 6	11	0.23	PBAR7/PP

**Material:** Copper

**Standard:** BS:EN 13601



## Single Flange Earth Rod Seals

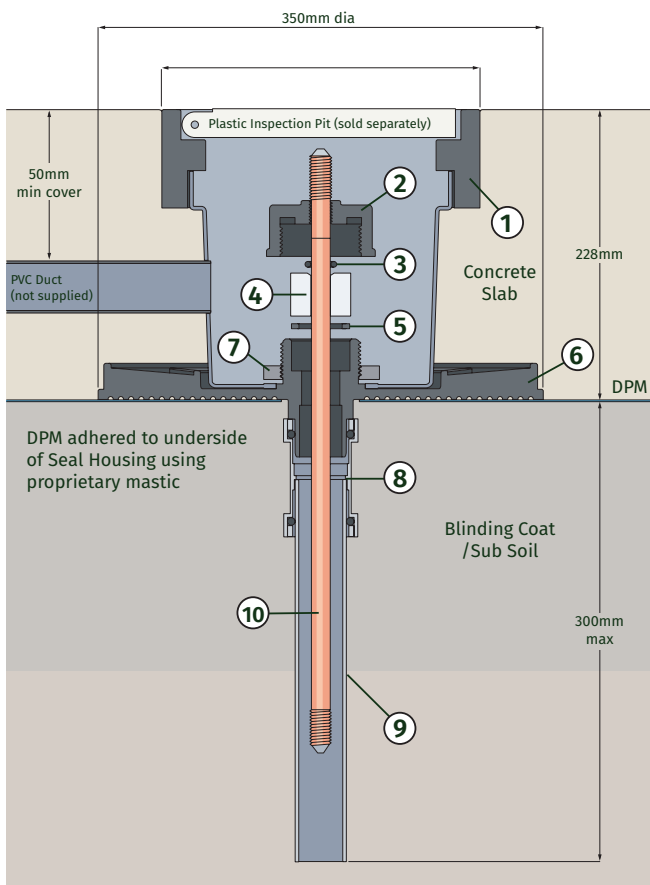
A waterproof earth electrode **Single Flange Seal** for use in constructions where internal earths are specified.

Unique design allows the seals to be used with a broad range of rod diameters. Use with PPIT-G **Plastic Inspection Pit** (page EAR:26).

ROD DIA. (in : mm)	ROD TYPE	LENGTH (mm)	WEIGHT (kg)	PART NO.
5/8" UNC	Copperbond	300	1.92	KES-58
3/4" UNC	Copperbond	300	1.92	KES-34
15mm	Solid Copper/Stainless Steel	300	1.92	KES-15
16mm	Solid Copper/Stainless Steel	300	1.92	KES-16
20mm	Solid Copper/Stainless Steel	300	1.92	KES-20

**Material:** High Density Plastic

**Standard:** BS:EN 62561-5:2011 and an extended 5 day test following BS:EN 62561-5 test conditions.



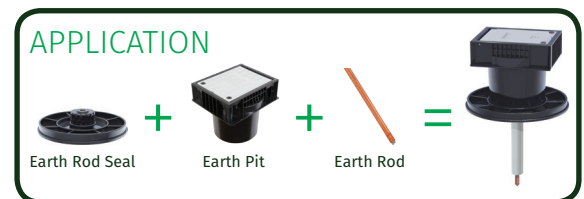
**Benefits:**

Additional Earth Rods can be driven at a later date, with no additional parts or causing damage to the Earth Rod Seal.



Kingsmill **Single Flange Earth Rod Seals** have been designed for use in concrete slabs with a nominal thickness of 300mm. They will withstand a pressure up to 80psi (5.5 bar) and have been tested accordingly.

- ① Plastic Inspection Pit (sold separately)
- ② Seal Cap
- ③ 'O' Ring Rod Seal
- ④ Compression Collar
- ⑤ EDPM Flat Seal Washer
- ⑥ Seal Housing
- ⑦ Inspection Pit Lock Nut
- ⑧ Seal Tube Coupler
- ⑨ Seal Tube
- ⑩ Earth Rod (sold separately)



**Installation Notes:**

Ingress of water from anywhere other than around the Earth Rod Seal is the responsibility of the installation contractor. The Earth Rod Seal flange and components must be free from dust/debris/grease/paint before pouring the concrete (highest quality and fully compacted to ensure sealing).

Performance depends on the integrity of the surrounding concrete. The main concrete slab must not be shuttered out and the Earth Rod Seal fitted later.

## Double Flange Earth Rod Seal



Kingsmill **Double Flange Earth Rod Seals** have been designed for use in concrete slabs with a nominal thickness of 300mm. They will withstand a pressure up to 80psi (5.5 bar) and have been tested accordingly.

- ① Plastic Inspection Pit (Sold Separately)
- ② Seal Cap
- ③ 'O' Ring Rod Seal
- ④ Compression Collar
- ⑤ EDPM Flat Seal Washer
- ⑥ Seal Housing
- ⑦ Inspection Pit Lock Nut
- ⑧ Seal Tube Coupler
- ⑨ Seal Tube
- ⑩ Bottom Flange
- ⑪ Earth Rod (sold separately)



### Installation Notes:

Ingress of water from anywhere other than around the Earth Rod Seal is the responsibility of the installation contractor. The Earth Rod Seal flange and components must be free from dust/debris/grease/paint before pouring the concrete (highest quality and fully compacted to ensure sealing).

Performance depends on the integrity of the surrounding concrete. The main concrete slab must not be shuttered out and the Earth Rod Seal fitted later.

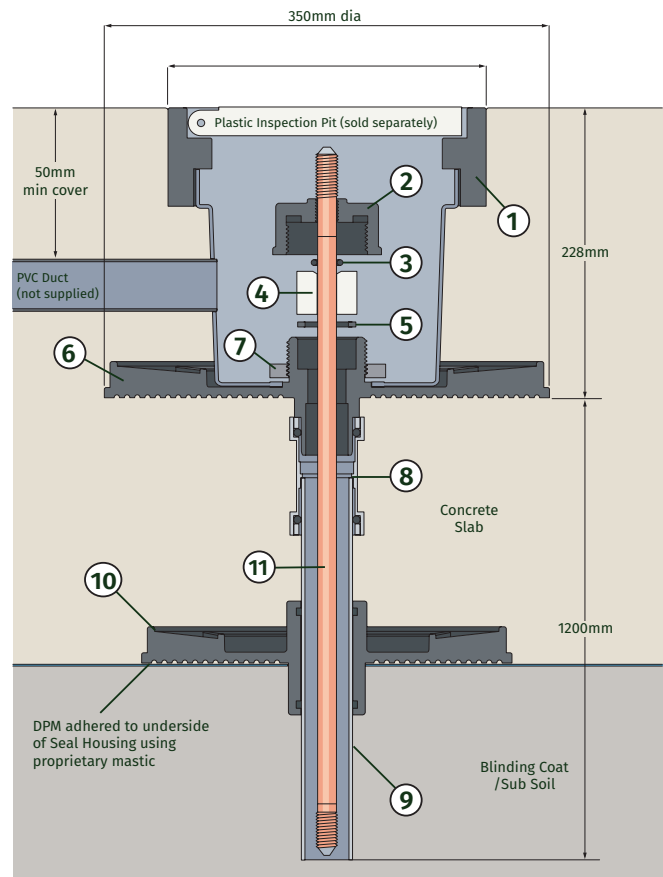
A waterproof earth electrode **Double Flange Earth Rod Seal** for use in constructions where internal earths are specified.

Unique design allows the seals to be used with a broad range of rod diameters. Use with PPIT-G **Plastic Inspection Pit** (page EAR:26).

ROD DIA. (in : mm)	ROD TYPE	LENGTH (mm)	WEIGHT (kg)	PART NO.
5/8" UNC	Copperbond	1200	2.80	KES-58-DBL
3/4" UNC	Copperbond	1200	2.80	KES-34-DBL
15mm	Solid Copper/Stainless Steel	1200	2.80	KES-15-DBL
16mm	Solid Copper/Stainless Steel	1200	2.80	KES-16-DBL
20mm	Solid Copper/Stainless Steel	1200	2.80	KES-20-DBL

**Material:** High Density Plastic

**Standard:** BS:EN 62561-5:2011 and an extended 5 day test following BS:EN 62561-5 test conditions.



### Benefits:

Additional Earth Rods can be driven at a later date, with no additional parts or causing damage to the Earth Rod Seal.

### Extended Seal Tubes

The **Double Flange Earth Rod Seal** is supplied with a 300mm long seal tube. Longer tube lengths are available (*see below*).

DESCRIPTION	LENGTH (mm)	WEIGHT (kg)	PART NO.
500mm seal tube	500	0.12	KES-TUBE-500
1200mm seal tube	1200	0.28	KES-TUBE-1200
2000mm seal tube	2000	0.47	KES-TUBE-2000
3000mm seal tube	3000	0.70	KES-TUBE-3000



## Rod To Tape Clamps (A Type)

**Rod To Tape Type 'A' Clamps** are designed to join various sizes of conductor tape to the earth electrode.

The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

ROD DIAMETER (in : mm)	MAX CONDUCTOR SIZE (mm)	BOLT SIZE (mm)	BOLT MATERIAL	WEIGHT (kg)	PART NO.
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Stainless steel	0.10	CLA2530
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Stainless steel	0.23	CLA2510
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Stainless steel	0.21	CLA4012
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Stainless steel	0.21	CLA5060
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Phosphor bronze	0.10	CLA2530/PB
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Phosphor bronze	0.23	CLA2510/PB
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Phosphor bronze	0.21	CLA4012/PB
5/8 : 16 - 3/4 : 20	29 x 16 - 29 x 13	M10	Phosphor bronze	0.21	CLA5060/PB

**Material:** High Strength Copper Alloy (body), Stainless Steel or Phosphor Bronze (bolt)

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 15Nm



## Rod To Tape Clamps (U Bolt Single Plate Type)

**Rod To Tape Type 'U' Bolt Single Plate Clamps** are designed to join various sizes of conductor tape to the earth electrode.

The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

ROD DIAMETER (in : mm)	HOLE CENTRES (mm)	WEIGHT (kg)	PART NO.
5/8 : 16	37	0.21	CLUB16
3/4 : 20	37	0.21	CLUB20
1 : 25	37	0.22	CLUB25
1 1/4 : 30	43	0.22	CLUB30
2 : 50	64	0.36	CLUB50

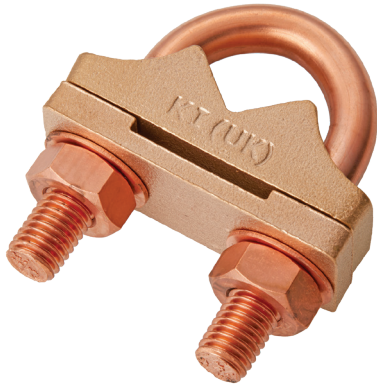
**Material:** High Strength Copper Alloy (body), 99.9% HD Copper ('U' bolt)

**Standard:** BS:EN 62561-1 Class H, BS 7430

**Tightening torque:** 12Nm



## Rod To Tape Clamps (U Bolt Double Plate Type)



**Rod To Tape Type Clamps (U Bolt Double Plate Type)** join 25 x 3 conductor tape to the earth electrode/rebar without the need to drill the tape.

The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

ROD DIAMETER (in : mm)	TAPE WIDTH (mm)	WEIGHT (kg)	PART NO.
5/8 : 16	25	0.26	CLUB16-2
3/4 : 20	25	0.27	CLUB20-2
1 : 25	25	0.28	CLUB25-2
2 : 50	25	0.40	CLUB50-2

**Material:** High Strength Copper Alloy (body)  
99.9% HD copper ('U' bolt material)

**Standard:** BS 7430

**Tightening torque:** 12Nm

## Rod To Cable Clamps (JAB Type)



**Rod To Cable Clamps (JAB Type)** are used to join various sizes of cable to the earth electrode.

The clamps have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

ROD DIAMETER (in : mm)	CONDUCTOR RANGE (mm <sup>2</sup> )	BOLT MATERIAL	BOLT SIZE (mm)	WEIGHT (kg)	PART NO.
5/8" : 16mm	16 - 70	Stainless steel	M10	0.07	CLJA16
3/4" : 20mm	35 - 95	Stainless steel	M10	0.09	CLJA20
5/8" : 16mm	16 - 70	Phosphor bronze	M10	0.07	CLJA16/PB
3/4" : 20mm	35 - 95	Phosphor bronze	M10	0.09	CLJA20/PB

**Material:** High Strength Copper Alloy (body)  
Stainless steel/phosphor bronze (bolt - see table)

**Standard:** BS:EN 62561-1 class H, BS 7430

**Tightening torque:** 12Nm

## Rod To Strand Clamp



The **Rod To Strand Clamp** connects **Earth Rods** to stranded conductor.

ROD DIAMETER (in : mm)	CONDUCTOR RANGE (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
5/8" : 16mm	35 - 70	0.38	CGUV16S

**Material:** Bronze (body), 99.9% HD Copper ('U' bolt)

## Rod to Cable Clamps (GUV Type)

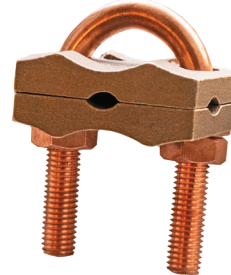
**Rod to Cable Clamps (GUV Type)** are designed to join various sizes of cable to earth electrodes/rebars etc. They have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

ROD DIAMETER (in : mm)	CONDUCTOR RANGE (mm <sup>2</sup> )	WEIGHT (kg)	PART NO.
5/8 : 16 - 3/4 : 20	16 - 70	0.39	CGUV16
5/8 : 16 - 3/4 : 20	70 - 185	0.35	CGUV70
5/8 : 16 - 3/4 : 20	150 - 300	0.52	CGUV150

**Material:** High Tensile Copper Alloy (body)  
99.9% HD Copper ('U' bolt)

**Standard:** BS:EN 62561-1, Class H

**Tightening torque:** 12Nm



CGUV16 & CGUV70



CGUV150

## Rod To Cable Clamps (Keyhole Type)

**Rod To Cable Clamps (Keyhole Type)** are designed to join various sizes of compression lugs to the earth electrode. They have a high resistance to corrosion and are mechanically strong to ensure a lasting connection.

**For use with copperbond rods**

ROD DIAMETER	BOLT MATERIAL	BOLT SIZE	WEIGHT (kg)	PART NO.
9.5mm	Stainless steel	M08	0.09	CLUG10
5/8" UNC	Stainless steel	M10	0.22	CLUG16
3/4" UNC	Stainless steel	M10	0.20	CLUG20
9.5mm	Phosphor bronze	M08	0.09	CLUG10/PB
5/8" UNC	Phosphor bronze	M10	0.22	CLUG16/PB
3/4" UNC	Phosphor bronze	M10	0.20	CLUG20/PB

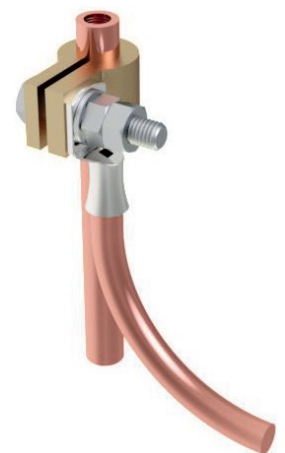
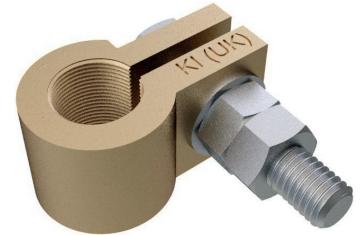
**For use with solid copper rods**

ROD DIAMETER (mm)	BOLT MATERIAL	BOLT SIZE	WEIGHT (kg)	PART NO.
15	Stainless steel	M10	0.21	CLUG15S
16	Stainless steel	M10	0.28	CLUG16S
20	Stainless steel	M10	0.18	CLUG20S
15	Phosphor bronze	M10	0.21	CLUG15S/PB
16	Phosphor bronze	M10	0.28	CLUG16S/PB
20	Phosphor bronze	M10	0.18	CLUG20S/PB

**Material:** High Tensile Copper Alloy (body)  
Stainless Steel or Phosphor Bronze (bolt - see above)

**Standard:** BS:EN 62561-1 Class H, BS7430

**Tightening torque:** 12Nm



## Tinmans Solder



**Tinmans solder** is used to braze copper bar and tape.

DESCRIPTION	LENGTH (mm)	WEIGHT (kg)	PART NO.
Tinmans solder (1/2lb stick)	300	0.26	TINS1/2

**Material:** Tin (60%), Lead (40%)

## Denso Tape



**Denso Tape** offers a weatherproof seal when wrapped around joints to stop the ingress of moisture, preventing corrosion.

COIL SIZE (mm)	MATERIAL	WEIGHT (kg)	PART NO.
50 x 10000	Synthetic fabric	0.76	DEN050

**Material:** Synthetic - impregnated and coated with a neutral petroleum compound

## Inteltrux Oxide Inhibiting Paste



**Inteltrux Paste** assures a high conductivity joint by sealing out air and moisture for prevention of corrosion and reformation of oxide film.

*Recommended for use on aluminium to copper connections, bare conductors or bus bar.*

DESCRIPTION	SIZE (kg)	PART NO.
Inteltrux anti-oxide compound	0.25	INTELTRUX250

Supplied in a squeeze bottle with a resealable plastic cap.

## Silfos



**Silfos** allows copper to be brazed in air without the use of flux.

SIZE (W x L) (mm)	MATERIAL	WEIGHT (kg)	PART NO.
50 x 8000	Silver, phosphorus and copper alloy	0.425	SF050

ATEX and FM approval

STAT:2

Clamps, Cables and Reels

STAT:3 - 4

# Static Earthing Control

Static electricity is a serious potential hazard for operations taking place in flammable, combustible or potentially explosive atmospheres. The uncontrolled build up and discharge of electrostatic must be avoided in these environments in order to prevent ignition so that the people, plant, processes and environment are constantly protected.

Kingsmill offer a full range of static earthing, grounding and bonding products that can help eliminate, control or ease these risks.

## ATEX and FM Approval

**When flammable or combustible products are being handled and processed in hazardous areas it is essential to specify certified equipment that will protect personnel from sources of electrostatic ignition.**

Static earthing clamps that combine ATEX & Factory Mutual approvals are rigorously tested and certified to ensure they are capable of dissipating static charges from potentially charged equipment. This is especially significant when the equipment can be covered in coatings, product deposits or rust that is capable of preventing the clamp from making low resistance electrical contact with the equipment to be earthed.

Establishing a solid electrical connection can only be achieved by penetrating any connection inhibitors like coatings, product deposits and rust. Factors like this will impede the dissipation of static charges from the object to earth if the clamp is not capable of penetrating them and making a connection to the base metal of the container or vessel. Once a strong connection is established, it is vital that this connection remains constant for the duration of the process operation.



**ATEX certification** ensures there are no sources of mechanical sparking, like thermite reactive materials such as aluminium, or sources of stored mechanical energy, present in the construction of the clamp.



**Factory Mutual approved** clamps undergo a series of mechanical and electrical tests to ensure they can function as reliable static earthing clamps in EX/HAZLOC areas.



# Clamps, Cables and Reels

Static Earthing clamps, cables and reels are single circuit applications that rely on high strength mechanical circuits to dissipate static electricity from potentially charged equipment.

Clamps are specially designed to dissipate static electricity from potentially charged equipment and are subjected to rigorous FM & ATEX testing standards.

In some cases, hazardous area operators rely on small clips and welding clamps to earth equipment without any guarantee they are penetrating hardened product deposits, rust or paint. To mitigate against this uncertainty our clamps are fitted with a pair of tungsten carbide tips to bite through connection inhibitors and achieve direct electrical contact to potentially charged equipment. The stainless steel construction provides corrosion resistant benefits and is capable of working in tough industrial environments.

The clamps can be supplied with static dissipative Hytrel coated retractable spiral cable or static discharge reels.

The range offers an entry level of protection from static electricity.

The FM and ATEX approved clamps are designed and manufactured to work in the toughest conditions, enabling them to constantly maintain good electrical contact with the equipment at risk of a static hazard. Supplied in a range of clamps, cables and reels.

## Typical Applications:

- Small containers, drums, vessels,
- IBC's (Intermediate Bulk Containers),
- Wide Range of Containers.

## Benefits of Kingsmill Static Control

### Clamp Pressure Testing

Ensures the earthing clamp is capable of establishing and maintaining low resistance electrical contact with equipment (FM approvals).

### Electrical Continuity Testing

Ensuring the continuity from the teeth throughout the earthing clamp is less than 1 ohm (FM approvals).

### High Frequency Vibration Testing

Ensures the earthing clamp is capable of maintaining positive contact when attached to vibrating equipment (FM approvals).

### Mechanical Pull Testing

Ensures the earthing clamp cannot be pulled off the equipment without an intentional application of force (FM approvals).

### Sources of Mechanical Sparking

Ensures no mechanical sparking sources are present in the clamp (ATEX certification).

## Stainless Steel M/D Clamp

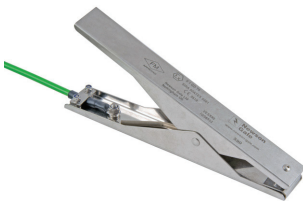


Twin tungsten carbide teeth to provide a very reliable earth connection. Designed for small drums and containers. Ergonomic design.

CLAMP	WEIGHT (kg)	PART NO.
Medium Duty Clamp	0.15	VESX45

**Material:** Stainless Steel

## Stainless Steel H/D Clamp



Twin Tungsten carbide teeth to provide a very reliable earth connection. Designed for drums, vessels and IBCs.

CLAMP	WEIGHT (kg)	PART NO.
Heavy Duty Clamp	0.45	VESX90

**Material:** Stainless Steel

## Clamps with Spiral Cable



Coiled cable retracts when not in use (1:10 extension ratio). Proven to hold its shape after at least 20,000 extensions. Tested against 174 different chemicals with superior abrasion resistance.

CLAMP	CABLE LENGTH (m)	WEIGHT (kg)	PART NO.
Medium Duty Clamp with 3m cable	3	0.50	VESX45/CAB1G03
Medium Duty Clamp with 5m cable	5	0.80	VESX45/CAB1G05
Medium Duty Clamp with 10m cable	10	1.45	VESX45/CAB1G10
Heavy Duty Clamp with 3m cable	3	0.80	VESX90/CAB1G03
Heavy Duty Clamp with 5m cable	5	1.10	VESX90/CAB1G05
Heavy Duty Clamp with 10m cable	10	1.75	VESX90/CAB1G10

## Clamps with Static Discharge Reel



Self-retracting yellow Hytrel coated galvanised steel cable. 3 reels available with varying lengths.

CLAMP	REEL LENGTH (m)	WEIGHT (kg)	PART NO.
Medium Duty Clamp with 6.1m reel	6.1	2.25	VESX45/R20
Medium Duty Clamp with 9.2m reel	9.2	2.45	VESX45/R30
Medium Duty Clamp with 15.2m reel	15.2	2.55	VESX45/R50
Heavy Duty Clamp with 6.1m reel	6.1	2.60	VESX90/R20
Heavy Duty Clamp with 9.2m reel	9.2	2.75	VESX90/R30
Heavy Duty Clamp with 15.2m reel	15.2	2.85	VESX90/R50

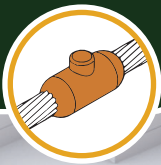
<b>Introduction to exothermic welding</b>	<b>WELD:3</b>
<b>The KingsWeld process</b>	<b>WELD:4</b>
<b>Making a KingsWeld connection</b>	<b>WELD:4 - 5</b>
<b>The product (weld metals and moulds)</b>	<b>WELD:6</b>
<b>How to use this catalogue</b>	<b>WELD:7</b>
<b>Mould care guide and inspection</b>	<b>WELD:7</b>
<b>Selector charts</b>	<b>WELD:8 - 9</b>
<b>Mould types:</b>	
- Cable to cable	<b>WELD:10 - 15</b>
- Cable to ground rod	<b>WELD:16 - 18</b>
- Cable to bar	<b>WELD:19 - 21</b>
- Bar to bar	<b>WELD:22 - 24</b>
- Cable to rebar	<b>WELD:25 - 28</b>
- Bar to ground rod	<b>WELD:29 - 31</b>
- Cable to surface	<b>WELD:32 - 35</b>
- Bar to surface	<b>WELD:36 - 37</b>
- Stud to surface	<b>WELD:38</b>
- Rail	<b>WELD:39 - 40</b>
<b>Accessories</b>	<b>WELD:41</b>
<b>Handle Clamps</b>	<b>WELD:42</b>
<b>Earth Points</b>	<b>WELD:43</b>
<b>Legend</b>	<b>WELD:44</b>



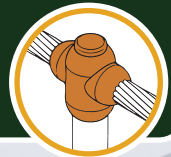
**“Exothermic” is a chemical term used to describe a reaction that produces heat.**

Exothermic welding, also known as “thermit welding” or “aluminothermic welding” is a welding process for permanently joining materials (usually copper conductors) that employs an exothermic reaction. The exothermic reaction requires no external heat or a power source. All that is required is a spark to initiate the reaction.

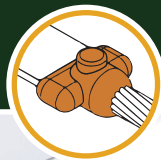
**CABLE TO CABLE**  
pages  
WELD:10 - 15



**CABLE TO GROUND ROD**  
pages  
WELD:16 - 18



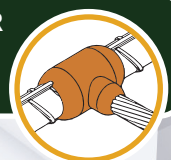
**CABLE TO BAR**  
pages  
WELD:19 - 21



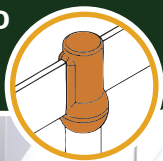
**BAR TO BAR**  
pages  
WELD:22 - 24



**CABLE TO REBAR**  
pages  
WELD:25 - 28



**BAR TO GROUND ROD**  
pages  
WELD:29 - 31



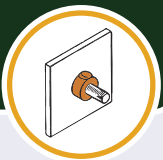
**CABLE TO SURFACE**  
pages  
WELD:32 - 35



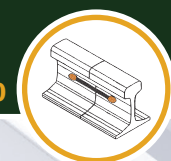
**BAR TO SURFACE**  
pages  
WELD:36 - 37



**STUD TO SURFACE**  
page WELD:38



**RAIL**  
pages  
WELD:39 - 40





## Introduction to exothermic welding

The exothermic reaction occurs between copper oxide and aluminium powder (contained within the weld metal) creating molten super-heated copper and an aluminium oxide slag. When an ignition spark comes into contact with the weld metal, it causes an exothermic reaction within the weld metal, melting and separating the metals. The aluminium rises to the top of the connection creating a slag leaving the molten copper to flow around the joint, creating the weld.

The KingsWeld exothermic connection is a permanent, maintenance-free weld that will not loosen overtime or deteriorate with age. The connections' current carrying capability is equal to or greater than that of the conductors being joined. In other words, there is no increase in resistance in an exothermically welded connection, unlike in most pressure type (bolt/crimp) connections.

*Throughout the world, exothermic welding has been shown to be the best choice where safety, reliability, current carrying capacity and longevity are critical.*

## The advantages of exothermic welding

- 1 The current carrying capacity of the connection is greater than or equal to that of the conductor
- 2 Has a lower electrical resistance than a mechanical connection
- 3 Does not deteriorate with age
- 4 Does not loosen over time
- 5 Can withstand repeated high current surges without deterioration
- 6 Does not require an external power source
- 7 Used to weld copper, copper alloys, copper bonded steel, various steel alloys, including stainless steel
- 8 Quick and easy to install
- 9 Exceptional corrosion resistance due a very high copper content (97%+)
- 10 Fusion temperature is in excess of 2000°C forming a molecular bond

This adds up to a superior connection when compared to mechanical or pressure type (crimp) connectors.

*The KingsWeld exothermic connection is the best choice, especially in safety critical environments where reliability, longevity and current carrying capacity are paramount.*

### KingsWeld online . . .

For additional moulds, troubleshooting guide, video tutorials and much more, visit [www.kingsmillearthing.co.uk/kingsweld](http://www.kingsmillearthing.co.uk/kingsweld)



## The KingsWeld process

**The KingsWeld exothermic process is a simple, self-contained, efficient way of welding copper-to-copper or copper-to-steel.**

Each connection uses a KingsWeld weld metal which, when ignited, creates an exothermic reaction between copper oxide and aluminium powder.

The connections are produced inside a graphite mould, specifically designed to suit the size of conductors to be welded as well as the specific joint configuration.

Each connection requires a specific mould designed to suit the joint configuration and conductors being used. Each mould type requires a specific weld metal size.

*This can be found in our mould selection charts detailed on pages WELD:8 - 9.*

Once the correct mould and weld metal have been selected, the process is simple and straightforward.

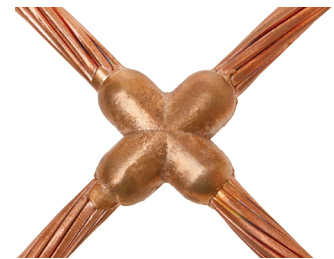
The conductors are positioned in the graphite mould. A steel retaining disc is then inserted into the mould before any weld metal is added. Only after the disc is in place and properly seated can the main weld metal (under the green cap) be poured into the reaction crucible. The ignition temperature of the main weld metal is approximately 1000°C. This is difficult to achieve and so we use a starter powder to start the exothermic reaction, this is contained under the red cap. The starter powder is similar to the main weld metal, but finer, allowing ignition at around 450°C (through using the spark from a flint ignitor).

The resultant exothermic reaction produces high temperature molten copper (in excess of 2000°C) and aluminium slag.

The molten copper melts the steel retaining disc and flows down the tap hole into the joint cavity. In doing so, the molten copper melts and welds the conductors into a solid homogenous joint.

*The whole process takes no more than a few seconds.*

The aluminium oxide produced stays on top of the joint and is easily removed.



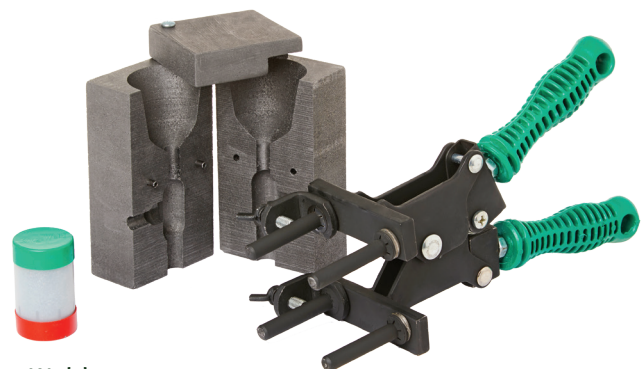
## Making a KingsWeld connection

### Items required to make a connection:

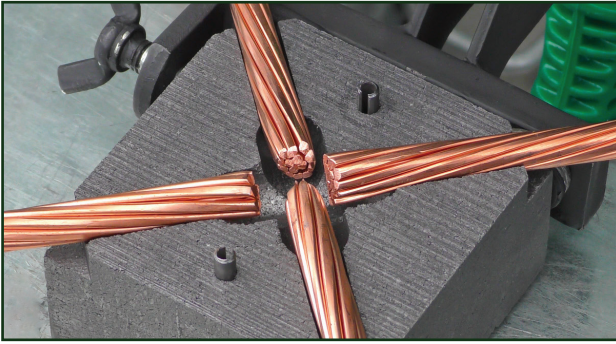
- KingsWeld mould
- Handle clamp
- Weld metal
- Flint gun

### Before making a KingsWeld connection:

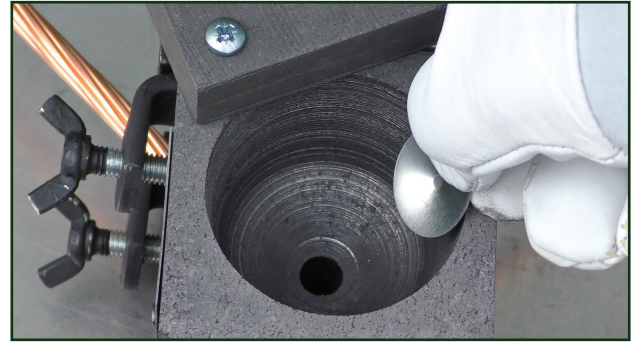
- Always wear proper clothing, gloves and safety glasses when exothermic welding.
- Read the general safety instructions and the positioning of conductors sheet supplied with each KingsWeld mould to familiarise yourself with the procedure you are going to perform.
- Make sure the conductors that are to be welded are dry, dirt-free and clean.
- Use the wire brush to clean the conductor surfaces being placed inside the mould - the cleaner the surface the better the connection will be.
- Attach the handle clamp to the KingsWeld mould and check it will open & close freely.
- Make sure that the KingsWeld mould is dry and moisture free. The best way to do this is by pre-heating the mould with a blow torch or by making a test connection.







- 1** **Position cleaned conductors in the mould**  
 Make sure the mould is dry & moisture-free by pre-heating or making a test connection.



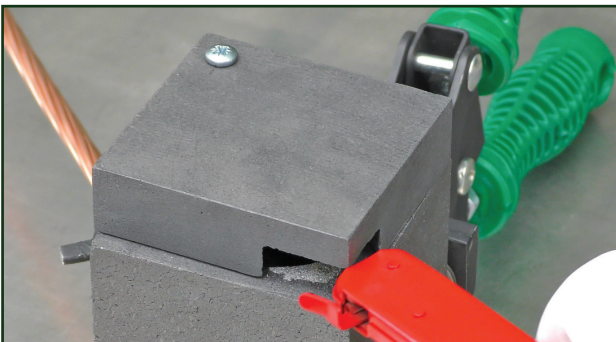
- 2** **Place the metal disc in the bottom of the mould crucible**  
 Discs are supplied with the weld metal.



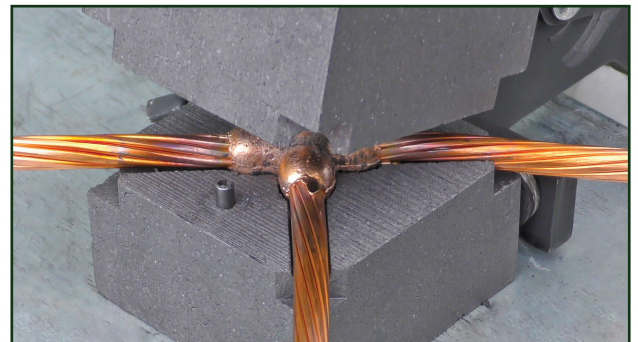
- 3** **Pour weld metal into the mould crucible**  
 Weld metal is under the green cap.  
 Pour all weld metal into the crucible.



- 4** **Add starting powder to the weld metal**  
 Starting powder is under the red cap.  
 Pour on top of the weld metal. Add a small amount of starting powder to the lip of the mould - to aid ignition - and close the lid.



- 5** **Use flint gun to ignite starting powder**  
 Pull flint gun away as soon as trigger is pulled to keep from fouling flint gun.  
**CAUTION:** do not place any exposed body part directly over lid or in front of opening.



- 6** **After approximately 20 seconds open the mould with the handle clamp**  
 Knock off slag with the mould cleaning brush handle and clean the mould thoroughly, including the crucible and lid.

## The product

A KingsWeld weld metal consists of copper oxide, aluminium and flux in a granular (powder) form.

Each weld metal is packed into a plastic container. Different connections require differing weld metal sizes and so each container is marked with the weld metal size (grams).

These sizes are detailed in the table (right), which also provides our standard packaging information.

DESCRIPTION	INNER PACK QTY.	PACK WEIGHT (kg)	PART NO.
Weld metal 15	20	0.60	#015
Weld metal 25	20	0.80	#025
Weld metal 32	20	0.90	#032
Weld metal 45	20	1.21	#045
Weld metal 65	10	0.88	#065
Weld metal 90	10	1.22	#090
Weld metal 115	10	1.58	#115
Weld metal 150	10	1.86	#150
Weld metal 200	10	2.06	#200
Weld metal 250	10	3.04	#250

## Weld metals

The weld metals are packed into plastic inner cartons, each of which contains metal discs, a moisture absorbing sachet and a box label, clearly identifying size, quantity and batch information.

The weld metal container has two compartments. The main weld metal is under the green cap and the starter powder is under the red cap.



## KingsWeld moulds

The KingsWeld exothermic mould is manufactured from high quality graphite. This lends itself to easy machining, as well as being able to withstand the high thermal and mechanical shocks produced during the exothermic welding process. Heat obtained in such reactions is in excess of 2000°C.

Our moulds are designed to have an average lifetime of 50 to 60 connections. But, if treated with care, it is possible to obtain a significantly longer life.

Graphite is both brittle and soft, therefore it is important that the operator takes care whilst handling the product.

Worn-out or damaged moulds should not be used.

Each mould has a nameplate, detailing the connection type, part code and the correct weld metal size to be used.



**The KingsWeld range of moulds can be seen on pages WELD:8 - 9. If you do not see the connection, configuration or size of conductor that you require, please contact our sales office who will be pleased to assist you.**

# How to use this catalogue







The KingsWeld catalogue lists the most commonly used exothermic connections. However, if you cannot find the one that you are looking for, please contact our sales office who will be pleased to assist.

Select the mould connection configuration required using charts on pages WELD:8 - 9. Go to the pages highlighted under that connection type and refer to the connection table. Select the conductor sizes to be joined.

**By following the line across you will find:**

- Mould price key
- Weld metal size
- Handle clamp size
- Accessories
- Part number

Now, all you need to add is a tool kit and you are set to go.

<b>A</b> <b>B</b>						
Conductor size	Price key	Weld metal	Clamp	Mould	Sleeve	Hammer die

Product table icons, above, are explained in detail on page WELD:41 - Legend.

## Mould care guide

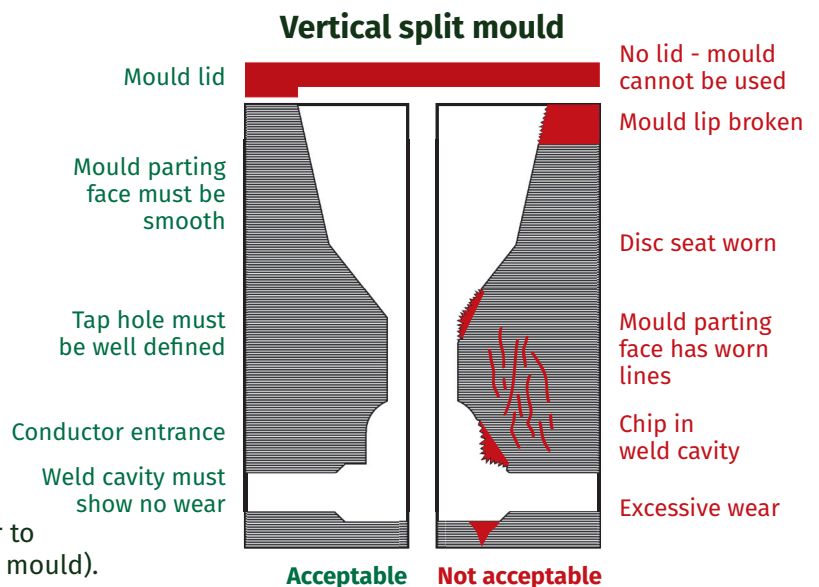
KingsWeld moulds are manufactured from high quality graphite which, by nature, is soft and needs to be handled with care in order to get the maximum lifetime.

- Always clean the mould after every weld
- Only use KingsWeld cleaning equipment (soft brush) to clean the mould
- Keep the mould dry and away from moisture
- Do not hit or drop the mould
- When not in use, keep the mould in its packaging for protection
- Try not to hit the edges of the mould with the conductors to be connected
- Never use a wire brush to clean the mould
- Always use the correct weld metal size, tools and handle clamps

## Mould inspection

- Handle the mould with care.
- Mould must be dry with fixed lid.
- Identification plate must be attached.
- Mould faces must be smooth, so they seal properly.
- Mould steel disc seat must not show signs of wear, chips or gouges (steel disc must seal the hole properly to prevent weld metal entering the weld cavity prior to welding).
- Tap hole must be well defined.
- Weld cavity must not show signs of wear, chips or gouges (conductors must have a 3mm gap between them prior to welding, fit snugly and not be loose in the mould).

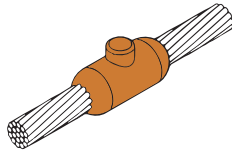
**Regular checks help keep moulds in good condition.**



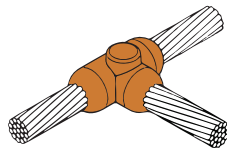


## Selector charts

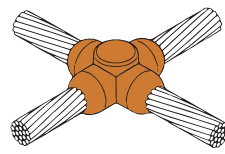
### Cable to cable



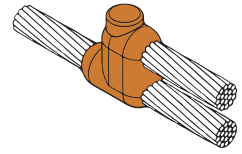
**CC1 - WELD:10**



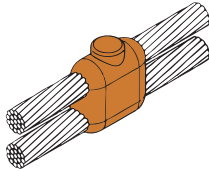
**CC2 - WELD:11**



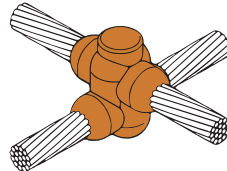
**CC4 - WELD:12**



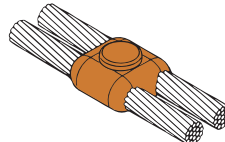
**CC6 - WELD:13**



**CC7 - WELD:14**

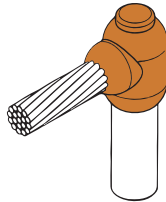


**CC11 - WELD:15**

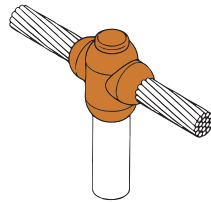


**CC14 - WELD:15**

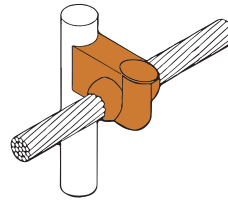
### Cable to ground rod



**CR1 - WELD:16**

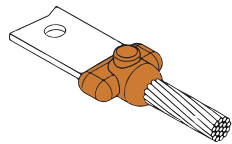


**CR2 - WELD:17**

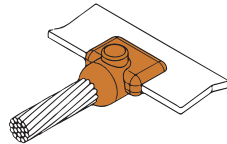


**CR3 - WELD:18**

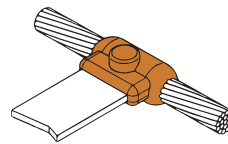
### Cable to bar



**CB1 - WELD:19**

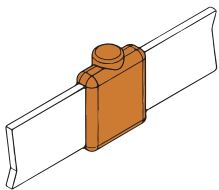


**CB4 - WELD:20**

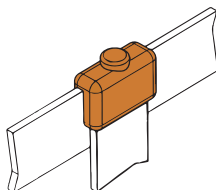


**CB5 - WELD:21**

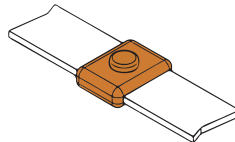
### Bar to bar



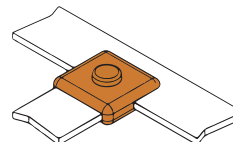
**BB1 - WELD:22**



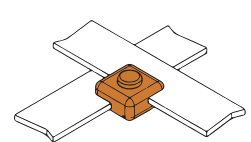
**BB3 - WELD:22**



**BB7 - WELD:23**

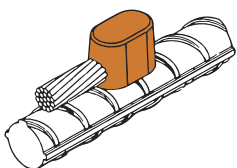


**BB14 - WELD:23**

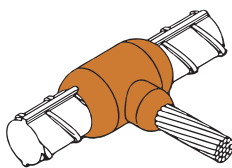


**BB41 - WELD:24**

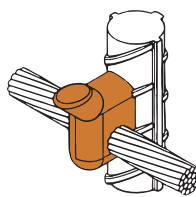
### Cable to rebar



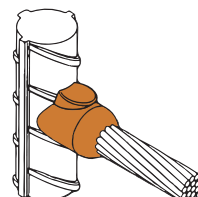
**CRE1 - WELD:25**



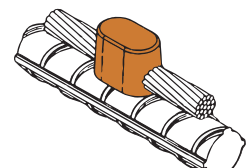
**CRE2 - WELD:26**



**CRE3 - WELD:27**



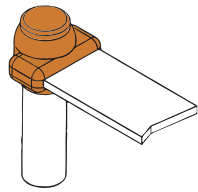
**CRE6 - WELD:27**



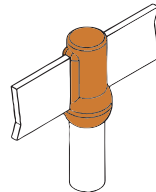
**CRE17 - WELD:28**

Selector charts

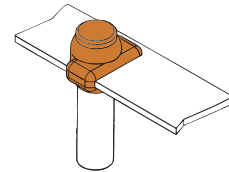
Bar to ground rod



BR1 - WELD:29

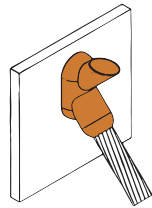


BR2 - WELD:30

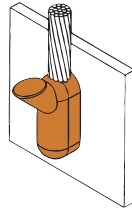


BR7 - WELD:31

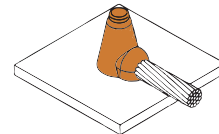
Cable to surface



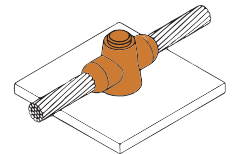
CS3 - WELD:32



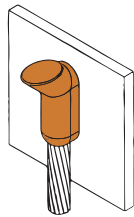
CS7 - WELD:32



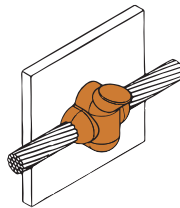
CS8 - WELD:33



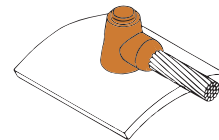
CS9 - WELD:33



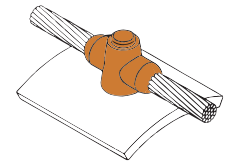
CS25 - WELD:34



CS27 - WELD:34

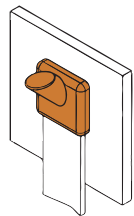


CS32 - WELD:35

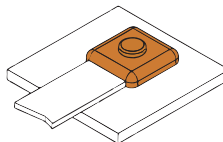


CS34 - WELD:35

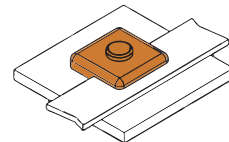
Bar to surface



BS1 - WELD:36

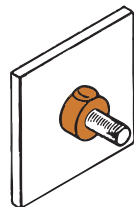


BS2 - WELD:36

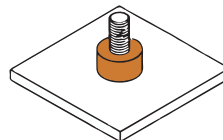


BS3 - WELD:37

Stud to surface

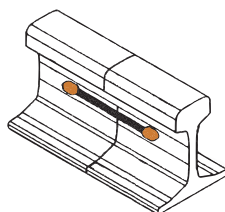


RS1 - WELD:38

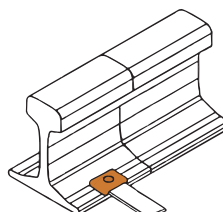


RS2 - WELD:38

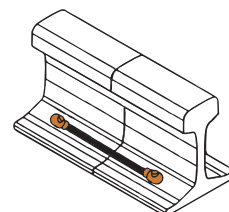
Rail



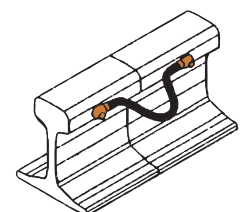
R4 - WELD:39



R6 - WELD:39

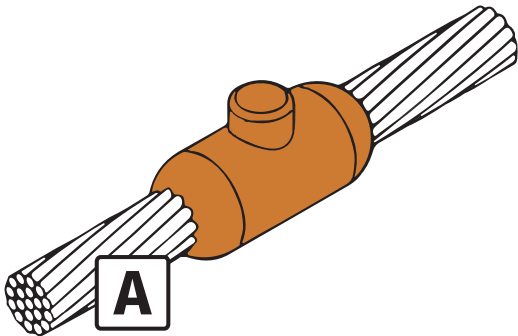


R10 - WELD:40



R12 - WELD:40

## Horizontal end to end joint - CC1



A	°			
16	D	#032	HCD	MDCC116
25	D	#032	HCD	MDCC125
35	D	#032	HCD	MDCC135
50	D	#045	HCD	MDCC150
70	D	#065	HCD	MDCC170
95	D	#090	HCD	MDCC195
120	D	#115	HCD	MDCC1120
150	D	#115	HCD	MDCC1150
185	D	#150	HCD	MDCC1185
240	D	#200	HCD	MDCC1240
300	D	#250	HCD	MDCC1300
400	E	2 x #150	HCE	MECC1400
8 dia	D	#045	HCD	MDCC18S
10 dia	D	#065	HCD	MDCC110S

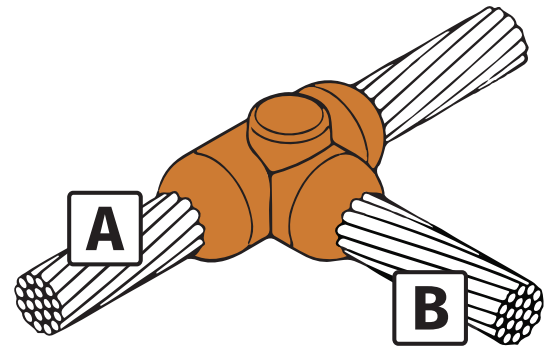
16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300 and 400  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel



## Horizontal cable run to horizontal cable tap tee joint - CC2

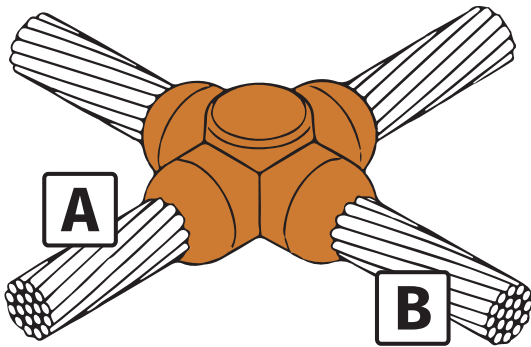
A	B	Sp	Weld	Weld	Weld
16	16	D	#045	HCD	MDCC21616
25	25	D	#045	HCD	MDCC22525
35	25	D	#045	HCD	MDCC23525
35	35	D	#045	HCD	MDCC23535
50	25	D	#065	HCD	MDCC25025
50	35	D	#065	HCD	MDCC25035
50	50	D	#090	HCD	MDCC25050
70	25	D	#065	HCD	MDCC27025
70	35	D	#065	HCD	MDCC27035
70	50	D	#090	HCD	MDCC27050
70	70	D	#090	HCD	MDCC27070
95	35	D	#090	HCD	MDCC29535
95	50	D	#090	HCD	MDCC29550
95	70	D	#090	HCD	MDCC29570
95	95	D	#115	HCD	MDCC29595
95	240	D	#150	HCD	MDCC295240
120	50	D	#090	HCD	MDCC212050
120	70	D	#090	HCD	MDCC212070
120	95	D	#150	HCD	MDCC212095
120	120	D	#150	HCD	MDCC2120120
150	70	D	#090	HCD	MDCC215070
150	95	D	#150	HCD	MDCC215095
150	120	D	#150	HCD	MDCC2150120
150	150	D	#200	HCD	MDCC2150150
185	95	D	#150	HCD	MDCC218590
185	120	D	#200	HCD	MDCC2185120
185	150	D	#200	HCD	MDCC2185150
185	185	D	#200	HCD	MDCC2185185
240	120	D	#200	HCD	MDCC2240120
240	150	D	#200	HCD	MDCC2240150
240	185	D	#200	HCD	MDCC2240185
240	240	E	2 x #150	HCE	MECC2240240
300	35	D	#115	HCD	MDCC230035
300	70	D	#200	HCD	MDCC230070
300	120	D	#200	HCD	MDCC2300120
300	150	D	#200	HCD	MDCC2300150
300	185	D	#250	HCD	MDCC2300185
300	240	E	2 x #200	HCE	MECC2300240
300	300	E	2 x #200	HCE	MECC2300300
400	240	E	2 x #250	HCE	MECC2400240
400	400	E	2 x #250	HCE	MECC2400400
8 dia	8 dia	D	#065	HCD	MDCC28S8S
10 dia	10 dia	D	#090	HCD	MDCC210S10S






16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300 and 400  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Horizontal to horizontal cable cross joint - CC4



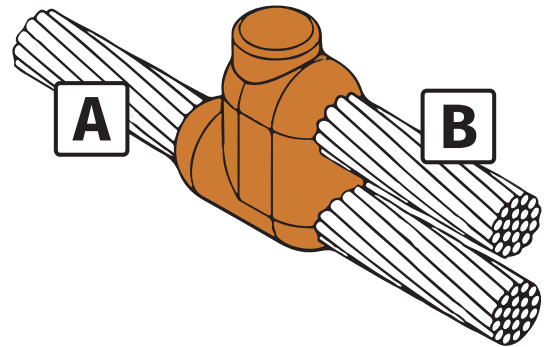
A	B	°			
16	16	D	#045	HCD	MDCC41616
25	25	D	#045	HCD	MDCC42525
35	25	D	#065	HCD	MDCC43525
35	35	D	#065	HCD	MDCC43535
50	25	D	#090	HCD	MDCC45025
50	35	D	#090	HCD	MDCC45035
50	50	D	#090	HCD	MDCC45050
70	25	D	#115	HCD	MDCC47025
70	35	D	#115	HCD	MDCC47035
70	50	D	#115	HCD	MDCC47050
70	70	D	#115	HCD	MDCC47070
95	35	D	#115	HCD	MDCC49535
95	50	D	#115	HCD	MDCC49550
95	70	D	#150	HCD	MDCC49570
95	95	D	#150	HCD	MDCC49595
120	50	D	#150	HCD	MDCC412050
120	70	D	#150	HCD	MDCC412070
120	95	D	#200	HCD	MDCC412095
120	120	D	#200	HCD	MDCC4120120
150	70	D	#150	HCD	MDCC415070
150	95	D	#200	HCD	MDCC415095
150	120	D	#250	HCD	MDCC4150120
150	150	D	#250	HCD	MDCC4150150
185	70	D	#200	HCD	MDCC418570
185	95	D	#200	HCD	MDCC418595
185	120	D	#250	HCD	MDCC4185120
185	150	D	#250	HCD	MDCC4185150
185	185	E	2 x #150	HCE	MECC4185185
240	120	E	2 x #150	HCE	MECC4240120
240	150	E	2 x #200	HCE	MECC4240150
240	185	E	2 x #200	HCE	MECC4240185
240	240	E	2 x #250	HCE	MECC4240240
300	95	E	2 x #200	HCE	MECC430095
300	120	E	2 x #200	HCE	MECC4300120
300	150	E	2 x #250	HCE	MECC4300150
300	185	E	2 x #250	HCE	MECC4300185
300	240	E	3 x #200	HCE	MECC4300240
300	300	E	3 x #200	HCE	MECC4300300
8 dia	8 dia	D	#090	HCD	MDCC48S8S
10 dia	10 dia	D	#115	HCD	MDCC410S10S

16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

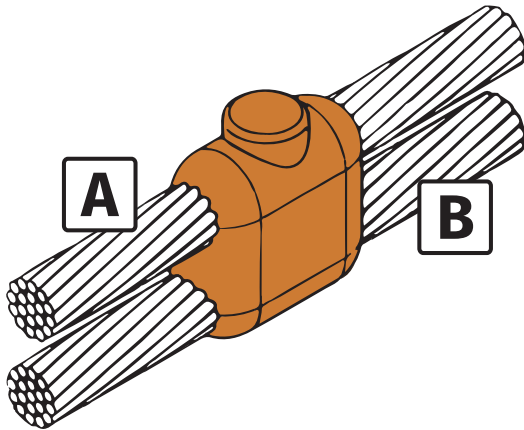
Three way cable joint - CC6

A	B	°	☐	✂	☐
16	16	D	#045	HCD	MDCC61616
25	25	D	#045	HCD	MDCC62525
35	25	D	#065	HCD	MDCC63525
35	35	D	#065	HCD	MDCC63535
50	25	D	#065	HCD	MDCC65025
50	35	D	#065	HCD	MDCC65035
50	50	D	#090	HCD	MDCC65050
70	25	D	#090	HCD	MDCC67025
70	35	D	#090	HCD	MDCC67035
70	50	D	#115	HCD	MDCC67050
70	70	D	#115	HCD	MDCC67070
95	35	D	#115	HCD	MDCC69535
95	50	D	#115	HCD	MDCC69550
95	70	D	#115	HCD	MDCC69570
95	95	D	#150	HCD	MDCC69595
120	50	D	#150	HCD	MDCC612050
120	70	D	#150	HCD	MDCC612070
120	95	D	#200	HCD	MDCC612095
120	120	D	#200	HCD	MDCC6120120



16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

## Vertical parallel cable joint - CC7



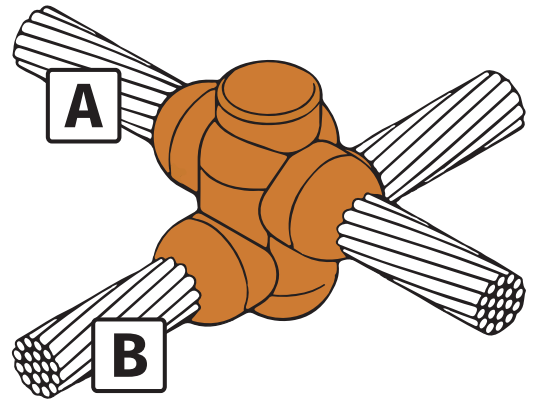
A	B	Sp	Weld	Tool	Part No.
16	16	D	#045	HCD	MDCC71616
25	25	D	#045	HCD	MDCC72525
35	25	D	#065	HCD	MDCC73525
35	35	D	#065	HCD	MDCC73535
50	25	D	#065	HCD	MDCC75025
50	35	D	#065	HCD	MDCC75035
50	50	D	#090	HCD	MDCC75050
70	25	D	#090	HCD	MDCC77025
70	35	D	#090	HCD	MDCC77035
70	50	D	#115	HCD	MDCC77050
70	70	D	#115	HCD	MDCC77070
95	35	D	#115	HCD	MDCC79535
95	50	D	#115	HCD	MDCC79550
95	70	D	#115	HCD	MDCC79570
95	95	D	#150	HCD	MDCC79595
120	50	D	#150	HCD	MDCC712050
120	70	D	#150	HCD	MDCC712070
120	120	D	#200	HCD	MDCC7120120
120	150	D	#200	HCD	MDCC7120150
150	70	D	#150	HCD	MDCC715070
150	95	D	#200	HCD	MDCC715095
150	120	D	#250	HCD	MDCC7150120
150	150	E	2 x #150	HCE	MECC7150150
185	95	D	#200	HCD	MDCC718595
185	120	D	#250	HCD	MDCC7185120
185	150	E	2 x #150	HCE	MECC7185150
185	185	E	2 x #150	HCE	MECC7185185
240	120	D	#250	HCD	MDCC7240120
240	150	E	2 x #150	HCE	MECC7240150
240	185	E	2 x #150	HCE	MECC7240185
240	240	E	2 x #200	HCE	MECC7240240
300	150	E	2 x #150	HCE	MECC7300150
300	185	E	2 x #200	HCE	MECC7300185
300	240	E	2 x #250	HCE	MECC7300240
300	300	E	2 x #250	HCE	MECC7300300
8 dia	8 dia	D	#090	HCD	MDCC78S8S
10 dia	10 dia	D	#115	HCD	MDCC710S10S

16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Crossover cable joint - CC11**

A	B	Sp	Icon 1	Icon 2	Icon 3
50	50	D	#150	HCD	MDCC115050
70	70	D	#200	HCD	MDCC117070
95	95	D	#250	HCD	MDCC119595
120	120	E	2 x #150	HCE	MECC11120120
150	150	E	2 x #200	HCE	MECC11150150
185	185	F	2 x #250	HCE	MFCC11185185
240	240	F	3 x #250	HCE	MFCC11240240
300	300	F	3 x #250	HCE	MFCC11300300
8 dia	8 dia	D	#150	HCD	MDCC118S8S
10 dia	10 dia	D	#150	HCD	MDCC1110S10S

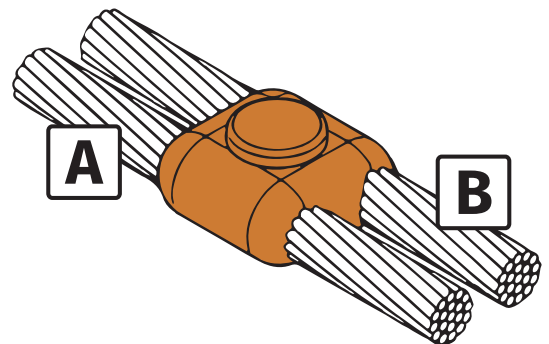


50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Horizontal parallel cable joint - CC14**

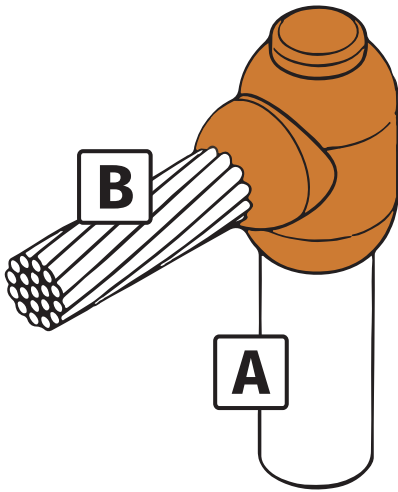
A	B	Sp	Icon 1	Icon 2	Icon 3
16	16	D	#045	HCD	MDCC141616
25	25	D	#045	HCD	MDCC142525
35	25	D	#065	HCD	MDCC143525
35	35	D	#065	HCD	MDCC143535
50	25	D	#090	HCD	MDCC145925
50	35	D	#090	HCD	MDCC145035
50	50	D	#090	HCD	MDCC145050
70	25	D	#090	HCD	MDCC147025
70	35	D	#090	HCD	MDCC147035
70	50	D	#115	HCD	MDCC147050
70	70	D	#115	HCD	MDCC147070
95	35	D	#115	HCD	MDCC149535
95	50	D	#150	HCD	MDCC149550
95	70	D	#150	HCD	MDCC149570
95	95	D	#150	HCD	MDCC149595
120	50	D	#150	HCD	MDCC1412050
120	70	D	#200	HCD	MDCC1412070
120	95	D	#200	HCD	MDCC1412095
120	120	D	#200	HCD	MDCC14120120
8 dia	8 dia	D	#090	HCD	MDCC148S8S
10 dia	10 dia	D	#115	HCD	MDCC1410S10S



16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Horizontal cable terminal to ground rod joint - CR1



A	B	Ⓢ	Ⓢ	Ⓢ	Ⓢ
12.7	16	D	#065	HCD	MDCR112.716
12.7	25	D	#065	HCD	MDCR112.725
12.7	35	D	#065	HCD	MDCR112.735
12.7	50	D	#065	HCD	MDCR112.750
12.7	70	D	#090	HCD	MDCR112.770
12.7	95	D	#090	HCD	MDCR112.795
12.7	120	D	#090	HCD	MDCR112.7120
12.7	8 dia	D	#065	HCD	MDCR112.78S
12.7	10 dia	D	#090	HCD	MDCR112.710S
14.2	16	D	#065	HCD	MDCR114.216
14.2	25	D	#065	HCD	MDCR114.225
14.2	35	D	#065	HCD	MDCR114.235
14.2	50	D	#090	HCD	MDCR114.250
14.2	70	D	#090	HCD	MDCR114.270
14.2	95	D	#090	HCD	MDCR114.295
14.2	120	D	#090	HCD	MDCR114.2120
14.2	150	D	#115	HCD	MDCR114.2150
14.2	185	D	#115	HCD	MDCR114.2185
14.2	240	D	#150	HCD	MDCR114.2240
14.2	8 dia	D	#090	HCD	MDCR114.28S
14.2	10 dia	D	#115	HCD	MDCR114.210S
17.2	16	D	#065	HCD	MDCR117.216
17.2	25	D	#065	HCD	MDCR117.225
17.2	35	D	#065	HCD	MDCR117.235
17.2	50	D	#090	HCD	MDCR117.250
17.2	70	D	#090	HCD	MDCR117.270
17.2	95	D	#090	HCD	MDCR117.295
17.2	120	D	#090	HCD	MDCR117.2120
17.2	150	D	#115	HCD	MDCR117.2150
17.2	185	D	#115	HCD	MDCR117.2185
17.2	240	D	#150	HCD	MDCR117.2240
17.2	300	D	#200	HCD	MDCR117.2300
16	16	D	#65	HCD	MDCR11616
16	25	D	#65	HCD	MDCR11625
16	35	D	#65	HCD	MDCR11635
16	50	D	#90	HCD	MDCR11650
16	70	D	#90	HCD	MDCR11670
16	95	D	#90	HCD	MDCR11695
16	120	D	#90	HCD	MDCR116120
16	150	D	#115	HCD	MDCR116150
16	185	D	#115	HCD	MDCR116185
16	240	D	#150	HCD	MDCR116240
16	300	D	#200	HCD	MDCR116300
20	16	D	#90	HCD	MDCR12016
20	25	D	#90	HCD	MDCR12025
20	35	D	#90	HCD	MDCR12035
20	50	D	#90	HCD	MDCR12050
20	70	D	#90	HCD	MDCR12070
20	95	D	#90	HCD	MDCR12095
20	120	D	#115	HCD	MDCR120120
20	150	D	#115	HCD	MDCR120150
20	185	D	#115	HCD	MDCR120185
20	240	D	#200	HCD	MDCR120240
20	300	D	#200	HCD	MDCR120300

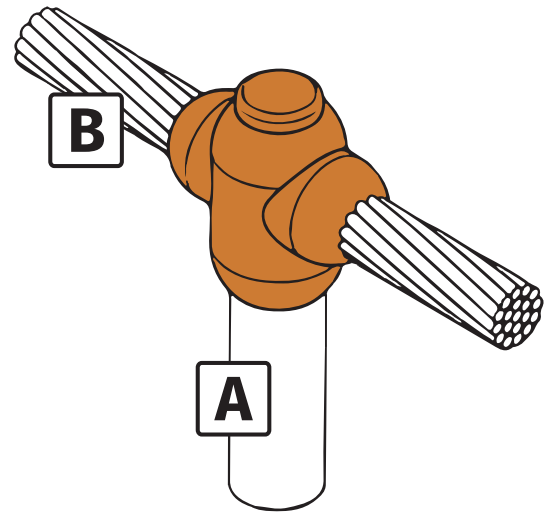
**A** 12.7, 14.2 and 17.2 = copperbond  
16 and 20 = solid copper/steel

**B** 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300 and 400 = stranded cable (mm<sup>2</sup>)  
8 dia and 10 dia = solid copper/steel



## Horizontal cable to ground rod tee joint - CR2

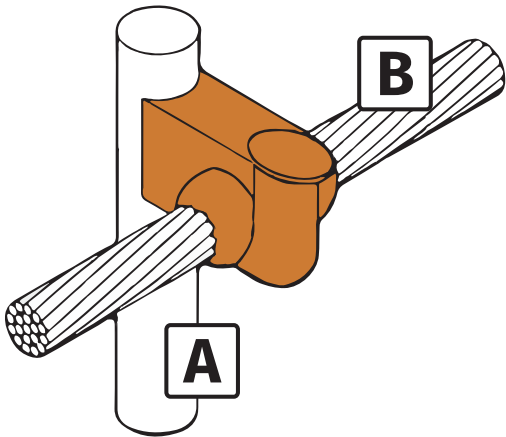
A	B	Sp			
12.7	16	D	#090	HCD	MDCR212.716
12.7	25	D	#090	HCD	MDCR212.725
12.7	35	D	#090	HCD	MDCR212.735
12.7	50	D	#090	HCD	MDCR212.750
12.7	70	D	#090	HCD	MDCR212.770
12.7	95	D	#115	HCD	MDCR212.795
12.7	8 dia	D	#065	HCD	MDCR212.78S
12.7	10 dia	D	#090	HCD	MDCR212.710S
14.2	16	D	#090	HCD	MDCR214.216
14.2	25	D	#090	HCD	MDCR214.225
14.2	35	D	#090	HCD	MDCR214.235
14.2	50	D	#090	HCD	MDCR214.250
14.2	70	D	#115	HCD	MDCR214.270
14.2	95	D	#115	HCD	MDCR214.295
14.2	120	D	#150	HCD	MDCR214.2120
14.2	150	D	#200	HCD	MDCR214.2150
14.2	185	D	#200	HCD	MDCR214.2185
14.2	240	D	#250	HCD	MDCR214.2240
14.2	8 dia	D	#090	HCD	MDCR214.28S
14.2	10 dia	D	#115	HCD	MDCR214.210S
17.2	16	D	#090	HCD	MDCR217.216
17.2	25	D	#090	HCD	MDCR217.225
17.2	35	D	#090	HCD	MDCR217.235
17.2	50	D	#115	HCD	MDCR217.250
17.2	70	D	#115	HCD	MDCR217.270
17.2	95	D	#115	HCD	MDCR217.295
17.2	120	D	#150	HCD	MDCR217.2120
17.2	150	D	#200	HCD	MDCR217.2150
17.2	185	D	#200	HCD	MDCR217.2185
17.2	240	D	#250	HCD	MDCR217.2240
17.2	300	E	2 x #150	HCE	MECR217.2300
16	16	D	#90	HCD	MDCR21616
16	25	D	#90	HCD	MDCR21625
16	35	D	#90	HCD	MDCR21635
16	50	D	#90	HCD	MDCR21650
16	70	D	#115	HCD	MDCR21670
16	95	D	#115	HCD	MDCR21695
16	120	D	#150	HCD	MDCR216120
16	150	D	#200	HCD	MDCR216150
16	185	D	#200	HCD	MDCR216185
16	240	D	#250	HCD	MDCR216240
16	300	D	#250	HCD	MDCR216300
16	400	E	2 x #200	HCE	MECR216400
20	16	D	#90	HCD	MDCR22016
20	25	D	#90	HCD	MDCR22025
20	35	D	#90	HCD	MDCR22035
20	50	D	#150	HCD	MDCR22050
20	70	D	#150	HCD	MDCR22070
20	95	D	#115	HCD	MDCR22095
20	120	D	#200	HCD	MDCR220120
20	240	D	#250	HCD	MDCR220240
20	300	D	2 x #150	HCD	MDCR220300
20	400	E	2 x #200	HCE	MECR220400



**A** 12.7, 14.2 and 17.2 = copperbond  
16 and 20 = solid copper/steel

**B** 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300 and 400  
= stranded cable (mm<sup>2</sup>)  
8 dia and 10 dia = solid copper/steel

## Horizontal thru cable to ground rod cross joint - CR3

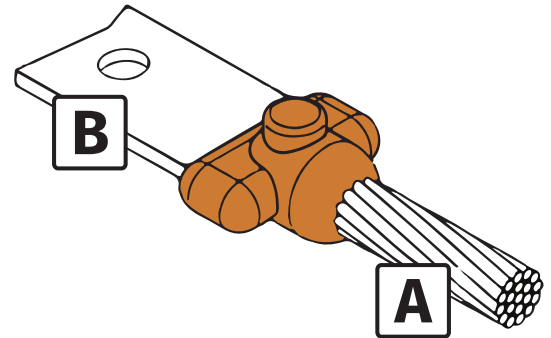


A	B	°	Icon 1	Icon 2	Icon 3
12.7	16	F	#090	HCE	MFCR312.716
12.7	25	F	#090	HCE	MFCR312.725
12.7	35	F	#090	HCE	MFCR312.735
12.7	50	F	#115	HCE	MFCR312.750
12.7	70	F	#115	HCE	MFCR312.770
12.7	95	F	#115	HCE	MFCR312.795
12.7	8 dia	F	#115	HCE	MFCR312.78S
14.2	16	F	#090	HCE	MFCR314.216
14.2	25	F	#090	HCE	MFCR314.225
14.2	35	F	#090	HCE	MFCR314.235
14.2	50	F	#115	HCE	MFCR314.250
14.2	70	F	#115	HCE	MFCR314.270
14.2	95	F	#115	HCE	MFCR314.295
14.2	8 dia	F	#115	HCE	MFCR314.28S
14.2	120	F	#150	HCE	MFCR314.2120
14.2	150	F	#200	HCE	MFCR314.2150
14.2	185	F	#250	HCE	MFCR314.2185
14.2	240	F	2 x #200	HCE	MFCR314.2240
14.2	300	F	2 x #250	HCE	MFCR314.2300
17.2	16	F	#90	HCE	MFCR317.216
17.2	25	F	#90	HCE	MFCR317.225
17.2	35	F	#90	HCE	MFCR317.235
17.2	50	F	#115	HCE	MFCR317.250
17.2	70	F	#150	HCE	MFCR314.270
17.2	95	F	#150	HCE	MFCR317.295
17.2	120	F	#200	HCE	MFCR317.2120
17.2	150	F	#250	HCE	MFCR317.2150
17.2	185	F	2 x #200	HCE	MFCR317.2185
17.2	240	F	2 x #200	HCE	MFCR317.2240
17.2	300	F	3 x #200	HCE	MFCR317.2300
16	50	F	#115	HCE	MFCR31650
16	70	F	#115	HCE	MFCR31670
20	50	F	#115	HCE	MFCR32050
20	70	F	#150	HCE	MFCR32070
20	95	F	#150	HCE	MFCR32095
20	120	F	#200	HCE	MFCR320120
20	300	F	3 X #200	HCE	MFCR320300

- A** 12.7, 14.2 and 17.2 = copperbond / 16 and 20 = solid copper/steel
- B** 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)  
8 dia = solid copper/steel

## Horizontal cable to horizontal bar joint - CB1

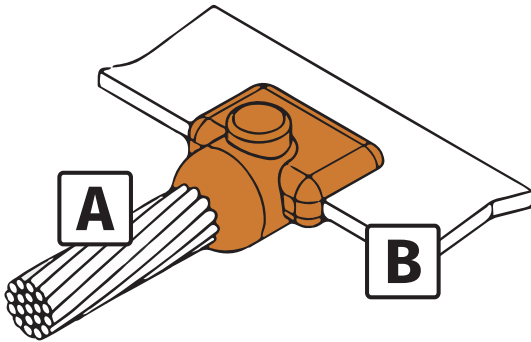
A	B	Sp			
10	20 x 2	D	#032	HCD	MDCB110202
16	20 x 2	D	#032	HCD	MDCB116202
16	20 x 3	D	#045	HCD	MDCB116203
16	25 x 3	D	#045	HCD	MDCB116253
25	20 x 3	D	#045	HCD	MDCB125203
25	25 x 3	D	#045	HCD	MDCB125253
35	20 x 3	D	#045	HCD	MDCB135203
35	25 x 3	D	#045	HCD	MDCB135253
50	20 x 3	D	#045	HCD	MDCB150203
50	25 x 2	D	#045	HCD	MDCB150252
50	25 x 3	D	#065	HCD	MDCB150253
70	25 x 3	D	#065	HCD	MDCB170253
70	25 x 4	D	#065	HCD	MDCB170254
70	25 x 5	D	#065	HCD	MDCB170255
70	25 x 6	D	#065	HCD	MDCB170256
95	25 x 4	D	#090	HCD	MDCB195254
95	25 x 5	D	#090	HCD	MDCB195255
95	25 x 6	D	#090	HCD	MDCB195256
120	25 x 5	D	#090	HCD	MDCB1120255
120	25 x 6	D	#090	HCD	MDCB1120256
120	30 x 5	D	#115	HCD	MDCB1120305
150	25 x 6	D	#115	HCD	MDCB1150256
150	30 x 5	D	#115	HCD	MDCB1150305
150	40 x 5	D	#150	HCD	MDCB1150405
185	31 x 6	D	#150	HCD	MDCB1185316
185	40 x 5	D	#150	HCD	MDCB1185405
185	50 x 5	E	#200	HCE	MECB1185505
240	50 x 5	E	#200	HCE	MECB1240505
240	50 x 6	E	2 x #150	HCE	MECB1240506
300	50 x 6	E	2 x #150	HCE	MECB1300506
300	50 x 8	D	2 x #200	HCD	MDCB1300508
8 dia	20 x 3	D	#045	HCD	MDCB18S203
8 dia	25 x 2	D	#045	HCD	MDCB18S252
8 dia	25 x 3	D	#065	HCD	MDCB18S253
10 dia	25 x 3	D	#065	HCD	MDCB110S253
10 dia	25 x 4	D	#065	HCD	MDCB110S254
10 dia	25 x 6	D	#065	HCD	MDCB110S256






10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Horizontal cable run to horizontal bar tee joint - CB4



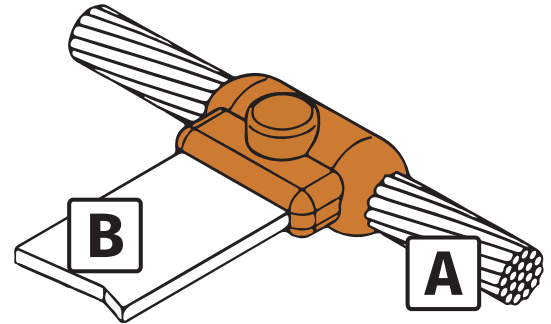
A	B	Ⓢ			
10	20 x 2	D	#032	HCD	MDCB410202
16	20 x 2	D	#032	HCD	MDCB416202
16	20 x 3	D	#045	HCD	MDCB416203
16	25 x 3	D	#045	HCD	MDCB416253
16	40 x 6	D	#090	HCD	MDCB416406
16	50 x 6	D	#090	HCD	MDCB416506
25	20 x 2	D	#032	HCD	MDCB425202
25	20 x 3	D	#032	HCD	MDCB425203
25	25 x 3	D	#032	HCD	MDCB425253
35	20 x 2	D	#032	HCD	MDCB435202
35	20 x 3	D	#045	HCD	MDCB435203
35	25 x 3	D	#045	HCD	MDCB435253
50	20 x 3	D	#045	HCD	MDCB450203
50	25 x 2	D	#045	HCD	MDCB450252
50	25 x 3	D	#045	HCD	MDCB450253
70	25 x 3	D	#065	HCD	MDCB470253
70	25 x 4	D	#065	HCD	MDCB470254
70	25 x 6	D	#090	HCD	MDCB470256
70	40 x 6	D	#090	HCD	MDCB440670
70	50 x 6	D	#115	HCD	MDCB470506
95	25 x 3	D	#090	HCD	MDCB495253
95	25 x 4	D	#090	HCD	MDCB495254
95	25 x 5	D	#090	HCD	MDCB495255
95	25 x 6	D	#115	HCD	MDCB495256
95	40 x 6	D	#150	HCD	MDCB440695
95	50 x 6	D	#115	HCD	MDCB495506
120	25 x 5	D	#115	HCD	MDCB4120255
120	25 x 6	D	#115	HCD	MDCB4120256
120	30 x 5	D	#115	HCD	MDCB4120305
120	40 x 6	D	#115	HCD	MDCB4406120
120	50 x 6	D	#150	HCD	MDCB4120506
150	25 x 6	D	#115	HCD	MDCB4150256
150	30 x 5	D	#115	HCD	MDCB4150305
150	40 x 5	D	#115	HCD	MDCB4150405
150	50 x 6	D	#150	HCD	MDCB4150506
185	31 x 6	D	#150	HCD	MDCB4185316
185	40 x 5	D	#150	HCD	MDCB4185405
185	40 x 6	D	#150	HCD	MDCB4406185
185	50 x 5	D	#150	HCD	MDCB4185505
185	50 x 6	D	#150	HCD	MDCB4185506
240	40 x 6	D	#200	HCD	MDCB4406240
240	50 x 5	D	#200	HCD	MDCB4240505
240	50 x 6	D	#250	HCD	MDCB4240506
300	25 x 3	D	#200	HCD	MDCB4300253
300	40 x 6	D	#250	HCD	MDCB4406300
300	50 x 6	E	2 x #150	HCE	MECB4300506
300	50 x 8	E	2 x #200	HCE	MECB4300508
8 dia	20 x 3	D	#045	HCD	MDCB48S203
8 dia	25 x 3	D	#045	HCD	MDCB48S253
10 dia	25 x 3	D	#065	HCD	MDCB410S253
10 dia	25 x 4	D	#065	HCD	MDCB410S254
10 dia	25 x 6	D	#090	HCD	MDCB410S256

10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Horizontal bar tap to horizontal cable run tee joint - CB5

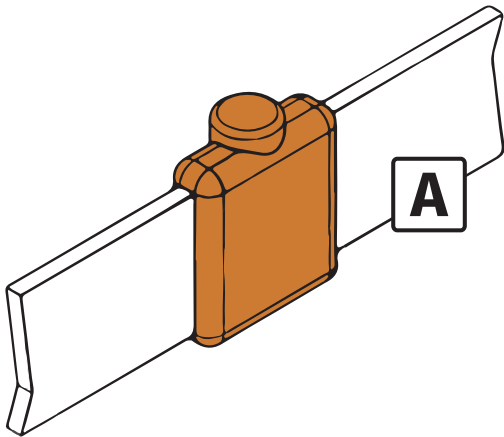
A	B	°			
16	20 x 2	D	#045	HCD	MDCB516202
16	20 x 3	D	#045	HCD	MDCB516203
16	25 x 3	D	#065	HCD	MDCB516253
25	20 x 2	D	#045	HCD	MDCB525202
25	20 x 3	D	#045	HCD	MDCB525203
25	25 x 3	D	#065	HCD	MDCB525253
35	20 x 2	D	#045	HCD	MDCB535202
35	20 x 3	D	#045	HCD	MDCB535203
35	25 x 3	D	#065	HCD	MDCB535253
50	20 x 3	D	#065	HCD	MDCB550203
50	25 x 2	D	#065	HCD	MDCB550252
50	25 x 3	D	#065	HCD	MDCB550253
70	25 x 3	D	#090	HCD	MDCB570253
70	25 x 4	D	#115	HCD	MDCB570254
70	25 x 6	D	#115	HCD	MDCB570256
95	25 x 4	D	#150	HCD	MDCB595254
95	25 x 5	D	#150	HCD	MDCB595255
95	25 x 6	D	#150	HCD	MDCB595256
120	25 x 5	D	#150	HCD	MDCB5120255
120	25 x 6	D	#150	HCD	MDCB5120256
120	30 x 5	D	#200	HCD	MDCB5120305
150	25 x 6	D	#200	HCD	MDCB5150256
150	30 x 5	D	#200	HCD	MDCB5150305
150	40 x 5	D	#250	HCD	MDCB5150405
150	50 x 6	E	2 x #150	HCE	MECB5150506
185	31 x 6	D	#250	HCD	MDCB5185316
185	40 x 5	E	#250	HCE	MECB5185405
185	50 x 5	E	2 x #150	HCE	MECB5185505
240	50 x 5	E	2 x #150	HCE	MECB5240505
240	50 x 6	E	2 x #200	HCE	MECB5240506
300	50 x 6	E	2 x #250	HCE	MECB5300506
300	50 x 8	E	2 x #250	HCE	MECB5300508
8 dia	20 x 3	D	#065	HCD	MDCB58S203
8 dia	25 x 2	D	#065	HCD	MDCB58S252
8 dia	25 x 3	D	#065	HCD	MDCB58S253
10 dia	25 x 3	D	#115	HCD	MDCB510S253
10 dia	25 x 4	D	#150	HCD	MDCB510S254
10 dia	25 x 6	D	#150	HCD	MDCB510S256






10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

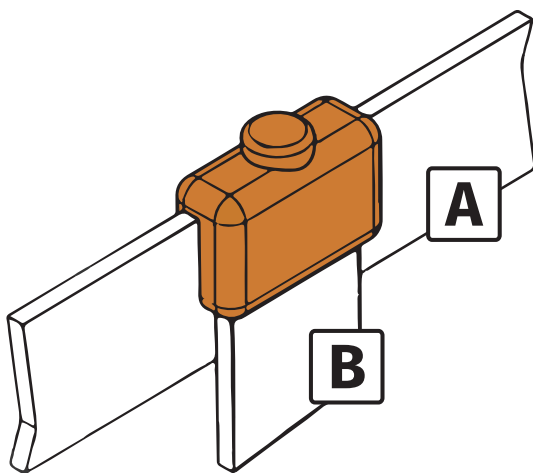
8 dia and 10 dia = solid copper/steel




## Vertical flat bar end to end joint - BB1



A	Ⓢ			
20 x 3	D	#045	HCD	MDBB1203
25 x 3	D	#065	HCD	MDBB1253
25 x 4	D	#090	HCD	MDBB1254
25 x 5	D	#115	HCD	MDBB1255
25 x 6	D	#150	HCD	MDBB1256
30 x 2	D	#065	HCD	MDBB1302
30 x 3	D	#090	HCD	MDBB1303
30 x 4	D	#115	HCD	MDBB1304
30 x 5	D	#115	HCD	MDBB1305
38 x 3	D	#115	HCD	MDBB1383
38 x 5	D	#150	HCD	MDBB1385
38 x 6	D	#200	HCD	MDBB1386
40 x 3	D	#115	HCD	MDBB1403
40 x 4	D	#150	HCD	MDBB1404
40 x 5	D	#150	HCD	MDBB1405
40 x 6	D	#200	HCD	MDBB1406
50 x 3	D	#150	HCD	MDBB1503
50 x 4	D	#200	HCD	MDBB1504
50 x 5	D	#200	HCD	MDBB1505
50 x 6	D	#250	HCD	MDBB1506
50 x 8	E	2 x #150	HCE	MEBB1508
60 x 6	E	#250	HCE	MEBB1606
60 x 8	E	2 x #200	HCE	MEBB1608





## Bar to bar vertical joint - BB3

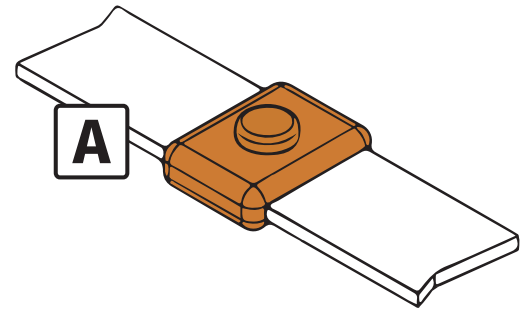


A	B	Ⓢ			
20 x 3	20 x 3	D	#065	HCD	MDBB3203203
25 x 3	25 x 3	D	#065	HCD	MDBB3253253
25 x 4	25 x 4	D	#090	HCD	MDBB3254254
25 x 5	25 x 5	D	#115	HCD	MDBB3255255
25 x 6	25 x 6	D	#150	HCD	MDBB3256256
30 x 2	30 x 2	D	#065	HCD	MDBB3302302
30 x 3	30 x 3	D	#090	HCD	MDBB3303303
30 x 4	30 x 4	D	#115	HCD	MDBB3304304
30 x 5	30 x 5	D	#115	HCD	MDBB3305305
38 x 3	38 x 3	D	#115	HCD	MDBB3383383
38 x 5	38 x 5	E	#150	HCE	MEBB3385385
38 x 6	38 x 6	E	#200	HCE	MEBB3386386
40 x 3	40 x 3	E	#115	HCE	MEBB3403403
40 x 4	40 x 4	E	#150	HCE	MEBB3404404
40 x 5	40 x 5	E	#150	HCE	MEBB3405405
40 x 6	40 x 6	E	#200	HCE	MEBB3406406
50 x 3	50 x 3	E	#200	HCE	MEBB3503503
50 x 4	50 x 4	E	#200	HCE	MEBB3504504
50 x 5	50 x 5	E	#200	HCE	MEBB3505505
50 x 6	50 x 6	E	#250	HCE	MEBB3506506
50 x 8	50 x 8	E	2 x #150	HCE	MEBB3508508
60 x 6	60 x 6	E	2 x #150	HCE	MEBB3606606
60 x 8	60 x 8	F	2 x #200	HCE	MEBB3608608







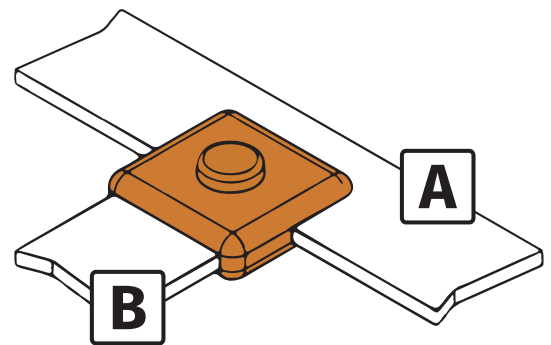
**Horizontal flat bar end to end joint - BB7**

<b>A</b>				
20 x 3	D	#045	HCD	MDBB7203
25 x 3	D	#065	HCD	MDBB7253
25 x 4	D	#090	HCD	MDBB7254
25 x 5	D	#090	HCD	MDBB7255
25 x 6	D	#115	HCD	MDBB7256
30 x 2	D	#065	HCD	MDBB7302
30 x 3	D	#065	HCD	MDBB7303
30 x 4	D	#090	HCD	MDBB7304
30 x 5	D	#115	HCD	MDBB7305
31 x 6	D	#150	HCD	MDBB7316
38 x 3	D	#090	HCD	MDBB7383
38 x 5	D	#150	HCD	MDBB7385
38 x 6	D	#200	HCD	MDBB7386
40 x 3	D	#090	HCD	MDBB7403
40 x 4	D	#115	HCD	MDBB7404
40 x 5	D	#150	HCD	MDBB7405
40 x 6	D	#200	HCD	MDBB7406
50 x 3	E	#150	HCE	MEBB7503
50 x 4	E	#200	HCE	MEBB7504
50 x 5	E	#200	HCE	MEBB7505
50 x 6	E	#250	HCE	MEBB7506
50 x 8	E	2 x #150	HCE	MEBB7508
60 x 6	E	2 x #150	HCE	MEBB7606
60 x 8	E	2 x #200	HCE	MEBB7608

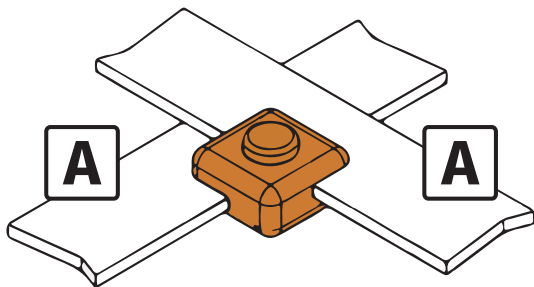


**Horizontal flat bar run and tap tee joint - BB14**

<b>A</b>	<b>B</b>				
20 x 3	20 x 3	D	#045	HCD	MDBB14203203
25 x 3	25 x 3	D	#065	HCD	MDBB14253253
25 x 4	25 x 4	D	#090	HCD	MDBB14254254
25 x 6	25 x 6	D	#115	HCD	MDBB14256256
30 x 2	30 x 2	D	#065	HCD	MDBB14302302
30 x 3	30 x 3	D	#065	HCD	MDBB14303303
30 x 4	30 x 4	D	#090	HCD	MDBB14304304
30 x 5	30 x 5	D	#115	HCD	MDBB14305305
31 x 6	31 x 6	D	#150	HCD	MDBB14316316
38 x 3	38 x 3	D	#090	HCD	MDBB14383383
38 x 5	38 x 5	D	#150	HCD	MDBB14385385
38 x 6	38 x 6	D	#200	HCD	MDBB14386386
40 x 3	40 x 3	D	#090	HCD	MDBB14403403
40 x 4	40 x 4	D	#115	HCD	MDBB14404404
40 x 5	40 x 5	D	#150	HCD	MDBB14405405
40 x 6	40 x 6	D	#200	HCD	MDBB14406406
40 x 6	50 x 6	D	#250	HCE	MEBB14406506
50 x 3	50 x 3	E	#150	HCE	MEBB14503503
50 x 4	50 x 4	E	#200	HCE	MEBB14504504
50 x 5	50 x 5	E	#200	HCE	MEBB14505505
50 x 6	25 x 3	E	#150	HCE	MEBB14506253
50 x 6	31 x 3	E	#150	HCE	MEBB14506313
50 x 6	50 x 6	E	#250	HCE	MEBB14506506







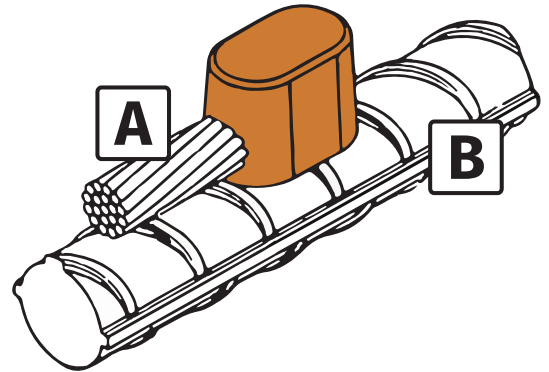
## Horizontal flat bar (uncut) cross joint - BB41



A	°			
20 x 3	D	#065	HCD	MDBB41203203
25 x 3	D	#065	HCD	MDBB41253253
25 x 4	D	#090	HCD	MDBB41254254
25 x 5	D	#090	HCD	MDBB41255255
25 x 6	D	#115	HCD	MDBB41256256
30 x 2	D	#90	HCD	MDBB41302302
30 x 3	D	#115	HCD	MDBB41303303
30 x 4	D	#115	HCD	MDBB41304304
30 x 5	D	#115	HCD	MDBB41305305
31 x 6	D	#115	HCD	MDBB41316316
38 x 3	D	#150	HCD	MDBB41383383
38 x 5	D	#150	HCD	MDBB41385385
38 x 6	D	#200	HCD	MDBB41386386
40 x 3	D	#200	HCD	MDBB41403403
40 x 4	D	#200	HCD	MDBB41404404
40 x 5	D	#200	HCD	MDBB41405405
40 x 6	D	#200	HCD	MDBB41406406
50 x 3	E	#200	HCE	MEBB41503503
50 x 4	E	#200	HCE	MEBB41504504
50 x 5	E	#200	HCE	MEBB41505505
50 x 6	E	#200	HCE	MEBB41506506

**Horizontal parallel cable to horizontal rebar joint - CRE1**

A	B				
16	10 - 40	D	#045	HCD*	MDCRE116
25	10 - 40	D	#045	HCD*	MDCRE125
35	10 - 40	D	#045	HCD*	MDCRE135
50	10 - 40	D	#090	HCD*	MDCRE150
70	10 - 40	D	#090	HCD*	MDCRE170
95	10 - 40	D	#090	HCD*	MDCRE195
120	10 - 40	D	#090	HCD*	MDCRE1120
8 dia	10 - 40	D	#090	HCD*	MDCRE18S
10 dia	10 - 40	D	#090	HCD*	MDCRE110S

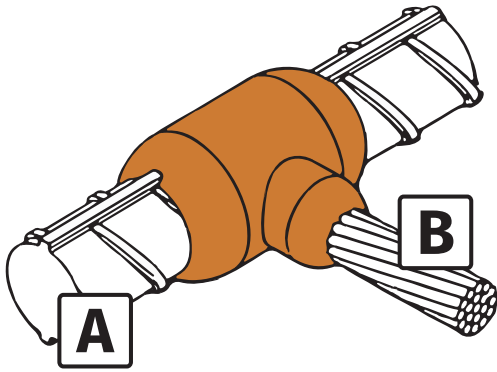


\*Requires chain clamp and butyl seal

16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel




## Horizontal rebar to horizontal cable tee joint - CRE2

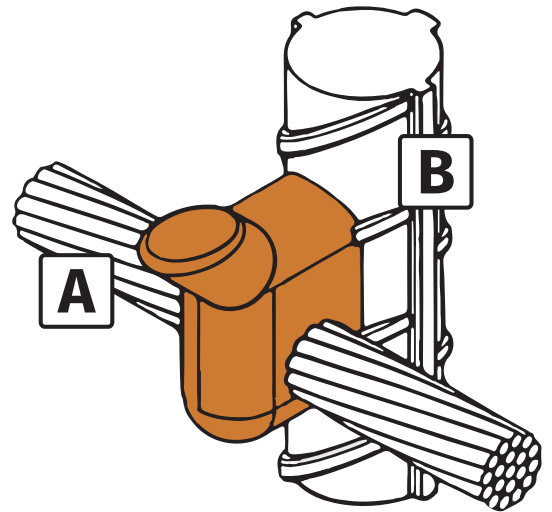


A	B	Ⓢ	🪄	🔪	📦
16	16	D	#090	HCD*	MDCRE216R16
16	25	D	#090	HCD*	MDCRE216R25
16	35	D	#090	HCD*	MDCRE216R35
16	50	D	#115	HCD*	MDCRE216R50
16	70	D	#115	HCD*	MDCRE216R70
16	95	D	#150	HCD*	MDCRE216R95
16	120	D	#150	HCD*	MDCRE216R120
16	150	D	#200	HCD*	MDCRE216R150
16	185	D	#200	HCD*	MDCRE216R185
16	240	D	#250	HCD*	MDCRE216R240
16	300	E	2 x #150	HCE*	MECRE216R300
18	16	D	#115	HCD*	MDCRE218R16
18	25	D	#115	HCD*	MDCRE218R25
18	35	D	#115	HCD*	MDCRE218R35
18	50	D	#150	HCD*	MDCRE218R50
18	70	D	#150	HCD*	MDCRE218R70
18	95	D	#150	HCD*	MDCRE218R95
18	120	D	#200	HCD*	MDCRE218R120
18	150	D	#200	HCD*	MDCRE218R150
18	185	D	#200	HCD*	MDCRE218R185
18	240	D	#250	HCD*	MDCRE218R240
18	300	E	2 x #150	HCE*	MECRE218R300
20	16	D	#115	HCD*	MDCRE220R16
20	25	D	#115	HCD*	MDCRE220R25
20	35	D	#115	HCD*	MDCRE220R35
20	50	D	#150	HCD*	MDCRE220R50
20	70	D	#150	HCD*	MDCRE220R70
20	95	D	#200	HCD*	MDCRE220R95
20	120	D	#200	HCD*	MDCRE220R120
20	150	D	#200	HCD*	MDCRE220R150
20	185	D	#250	HCD*	MDCRE220R185
20	240	E	2 x #150	HCE*	MECRE220R240
20	300	E	2 x #200	HCE*	MECRE220R300
25	16	D	#200	HCD*	MDCRE225R16
25	25	D	#200	HCD*	MDCRE225R25
25	35	D	#200	HCD*	MDCRE225R35
25	50	D	#200	HCD*	MDCRE225R50
25	70	D	#250	HCD*	MDCRE225R70
25	95	D	#250	HCD*	MDCRE225R95
25	120	D	#250	HCD*	MDCRE225R120
25	150	E	2 x #150	HCE*	MECRE225R150

\*Requires chain clamp and butyl seal

### Horizontal thru cable to vertical rebar joint - CRE3

A	B	Ⓢ			
16	10 - 40	D	#045	HCD*	MDCRE316
25	10 - 40	D	#045	HCD*	MDCRE325
35	10 - 40	D	#045	HCD*	MDCRE335
50	10 - 40	D	#090	HCD*	MDCRE350
70	10 - 40	D	#090	HCD*	MDCRE370
95	10 - 40	D	#090	HCD*	MDCRE395
120	10 - 40	D	#090	HCD*	MDCRE3120
8 dia	10 - 40	D	#090	HCD*	MDCRE38S
10 dia	10 - 40	D	#090	HCD*	MDCRE310S






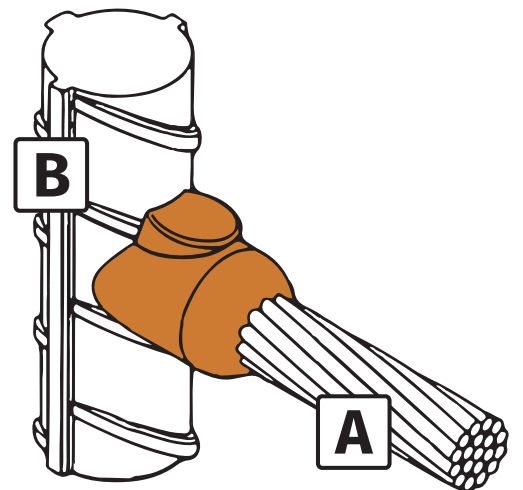
\*Requires chain clamp and butyl seal

16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

### Horizontal cable tap to vertical rebar joint - CRE6

A	B	Ⓢ			
16	10 - 40	D	#045	HCD*	MDCRE616
25	10 - 40	D	#045	HCD*	MDCRE625
35	10 - 40	D	#045	HCD*	MDCRE635
50	10 - 40	D	#065	HCD*	MDCRE650
70	10 - 40	D	#090	HCD*	MDCRE670
95	10 - 40	D	#090	HCD*	MDCRE695
120	10 - 40	D	#090	HCD*	MDCRE6120
8 dia	10 - 40	D	#065	HCD*	MDCRE68S
10 dia	10 - 40	D	#090	HCD*	MDCRE610S

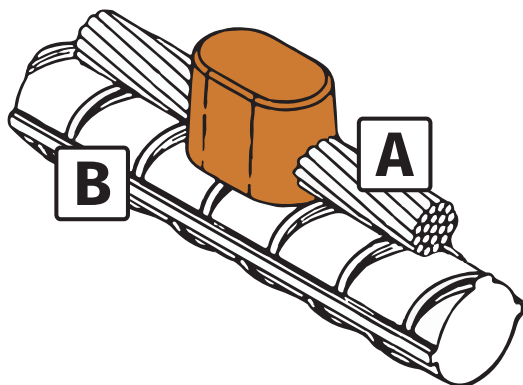


\*Requires chain clamp and butyl seal

16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Horizontal cable to horizontal rebar joint - CRE17



A	B	°	Icon 1	Icon 2	Icon 3
16	10 - 40	D	#045	HCD	MDCRE1716
25	10 - 40	D	#045	HCD	MDCRE1725
35	10 - 40	D	#045	HCD	MDCRE1735
50	10 - 40	D	#090	HCD	MDCRE1750
70	10 - 40	D	#090	HCD	MDCRE1770
95	10 - 40	D	#090	HCD	MDCRE1795
120	10 - 40	D	#090	HCD	MDCRE17120
8 dia	10 - 40	D	#090	HCD	MDCRE178S
10 dia	10 - 40	D	#090	HCD	MDCRE1710S

\*Requires chain clamp and butyl seal

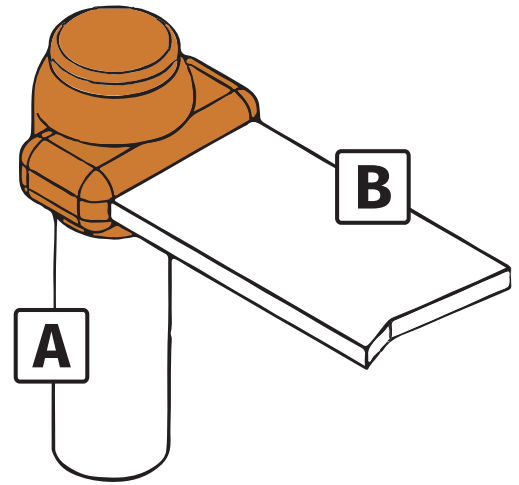
16, 25, 35, 50, 70, 95 and 120 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel



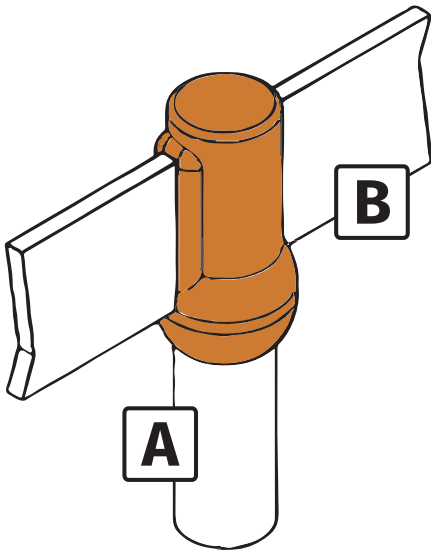
## Horizontal bar terminal to ground rod joint - BR1




A	B	°			
12.7	20 x 3	D	#090	HCD	MDBR112.7203
12.7	25 x 3	D	#090	HCD	MDBR112.7253
12.7	25 x 4	D	#090	HCD	MDBR112.7254
12.7	30 x 2	D	#090	HCD	MDBR112.7302
12.7	30 x 3	D	#090	HCD	MDBR112.7303
12.7	31 x 3	D	#090	HCD	MDBR112.7313
12.7	38 x 3	D	#090	HCD	MDBR112.7383
12.7	40 x 3	D	#090	HCD	MDBR112.7403
12.7	50 x 3	D	#115	HCD	MDBR112.7503
12.7	50 x 6	D	#115	HCD	MDBR112.7506
14.2	20 x 3	D	#090	HCD	MDBR114.2203
14.2	25 x 3	D	#090	HCD	MDBR114.2253
14.2	25 x 4	D	#115	HCD	MDBR114.2254
14.2	25 x 6	D	#115	HCD	MDBR114.2256
14.2	30 x 2	D	#115	HCD	MDBR114.2302
14.2	30 x 3	D	#115	HCD	MDBR114.2303
14.2	30 x 4	D	#150	HCD	MDBR114.2304
14.2	30 x 5	D	#150	HCD	MDBR114.2305
14.2	38 x 3	D	#115	HCD	MDBR114.2383
14.2	38 x 5	D	#150	HCD	MDBR114.2385
14.2	38 x 6	D	#200	HCD	MDBR114.2386
14.2	40 x 3	D	#115	HCD	MDBR114.2403
14.2	40 x 4	D	#150	HCD	MDBR114.2404
14.2	40 x 5	D	#150	HCD	MDBR114.2405
14.2	40 x 6	D	#200	HCD	MDBR114.2406
14.2	50 x 3	D	#150	HCD	MDBR114.2503
14.2	50 x 4	D	#200	HCD	MDBR114.2504
14.2	50 x 5	D	#200	HCD	MDBR114.2505
14.2	50 x 6	D	#200	HCD	MDBR114.2506
17.2	20 x 3	D	#115	HCD	MDBR117.2203
17.2	25 x 3	D	#150	HCD	MDBR117.2253
17.2	25 x 4	D	#200	HCD	MDBR117.2254
17.2	25 x 6	D	#200	HCD	MDBR117.2256
17.2	30 x 2	D	#150	HCD	MDBR117.2302
17.2	30 x 3	D	#150	HCD	MDBR117.2303
17.2	30 x 4	D	#250	HCD	MDBR117.2304
17.2	30 x 5	D	#250	HCD	MDBR117.2305
17.2	38 x 3	D	#250	HCD	MDBR117.2383
17.2	38 x 5	D	#200	HCD	MDBR117.2385
17.2	38 x 6	D	#250	HCD	MDBR117.2386
17.2	40 x 3	D	#200	HCD	MDBR117.2403
17.2	40 x 4	D	#200	HCD	MDBR117.2404
17.2	40 x 5	D	#200	HCD	MDBR117.2405
17.2	40 x 6	E	2 x #150	HCE	MEBR117.2406
17.2	50 x 3	E	2 x #150	HCE	MEBR117.2503
17.2	50 x 4	E	2 x #150	HCE	MEBR117.2504
17.2	50 x 5	E	2 x #150	HCE	MEBR117.2505
17.2	50 x 6	E	2 x #200	HCE	MEBR117.2506
16	25 x 3	D	#90	HCD	MDBR116253
16	50 x 3	E	#150	HCE	MEBR116503
16	50 x 6	E	#200	HCE	MEBR116506
20	25 x 3	D	#150	HCD	MDBR120253
20	25 x 6	D	#200	HCD	MDBR120256
20	50 x 6	E	2 x #200	HCE	MEBR120506



12.7, 14.2 and 17.2 = copperbond / 16 and 20 = solid copper/steel





## Horizontal bar terminal to ground rod joint - BR2



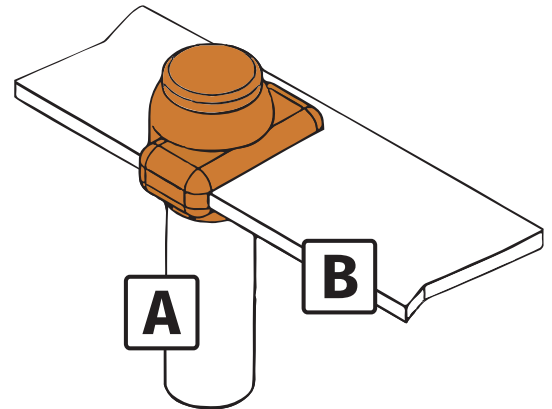
A	B	Ⓢ			
12.7	20 x 3	D	#090	HCD	MDBR212.7203
12.7	25 x 3	D	#090	HCD	MDBR212.7253
12.7	25 x 4	D	#090	HCD	MDBR212.7254
12.7	30 x 2	D	#090	HCD	MDBR212.7302
12.7	30 x 3	D	#090	HCD	MDBR212.7303
12.7	38 x 3	D	#090	HCD	MDBR212.7383
12.7	40 x 3	D	#090	HCD	MDBR212.7403
12.7	50 x 3	D	#115	HCD	MDBR212.7503
12.7	50 x 6	D	#250	HCD	MDBR212.7506
14.2	20 x 3	D	#090	HCD	MDBR214.2203
14.2	25 x 3	D	#090	HCD	MDBR214.2253
14.2	25 x 4	D	#115	HCD	MDBR214.2254
14.2	25 x 5	D	#115	HCD	MDBR214.2255
14.2	25 x 6	D	#150	HCD	MDBR214.2256
14.2	30 x 2	D	#090	HCD	MDBR214.2302
14.2	30 x 3	D	#115	HCD	MDBR214.2303
14.2	30 x 4	D	#150	HCD	MDBR214.2304
14.2	30 x 5	D	#150	HCD	MDBR214.2305
14.2	30 x 6	D	#150	HCD	MDBR214.2306
14.2	31 x 3	D	#115	HCD	MDBR214.2313
14.2	31 x 6	D	#150	HCD	MDBR214.2316
14.2	38 x 3	D	#150	HCD	MDBR214.2383
14.2	38 x 5	D	#150	HCD	MDBR214.2385
14.2	38 x 6	D	#200	HCD	MDBR214.2386
14.2	40 x 3	D	#150	HCD	MDBR214.2403
14.2	40 x 4	D	#150	HCD	MDBR214.2404
14.2	40 x 5	D	#150	HCD	MDBR214.2405
14.2	40 x 6	D	#200	HCD	MDBR214.2406
14.2	50 x 3	D	#200	HCD	MDBR214.2503
14.2	50 x 4	D	#200	HCD	MDBR214.2504
14.2	50 x 5	D	#200	HCD	MDBR214.2505
14.2	50 x 6	D	#250	HCD	MDBR214.2506
17.2	20 x 3	D	#150	HCD	MDBR217.2203
17.2	25 x 3	D	#150	HCD	MDBR217.2253
17.2	25 x 4	D	#200	HCD	MDBR217.2254
17.2	25 x 6	D	#200	HCD	MDBR217.2256
17.2	30 x 2	D	#150	HCD	MDBR217.2302
17.2	30 x 3	D	#150	HCD	MDBR217.2303
17.2	30 x 4	D	#250	HCD	MDBR217.2304
17.2	30 x 5	D	#200	HCD	MDBR217.2305
17.2	38 x 3	D	#200	HCD	MDBR217.2383
17.2	38 x 5	D	#200	HCD	MDBR217.2385
17.2	38 x 6	D	#250	HCD	MDBR217.2386
17.2	40 x 3	D	#200	HCD	MDBR217.2403
17.2	40 x 4	D	#200	HCD	MDBR217.2404
17.2	40 x 5	D	#200	HCD	MDBR217.2405
17.2	40 x 6	D	#250	HCD	MDBR217.2406
17.2	50 x 3	E	2 x #150	HCE	MEBR217.2503
17.2	50 x 4	E	2 x #150	HCE	MEBR217.2504
17.2	50 x 5	E	2 x #150	HCE	MEBR217.2505
17.2	50 x 6	E	2 x #150	HCE	MEBR217.2506
16	25 x 3	D	#90	HCD	MDBR216253
20	25 x 3	D	#200	HCD	MDBR220253

12.7, 14.2 and 17.2 = copperbond / 16 and 20 = solid copper/steel

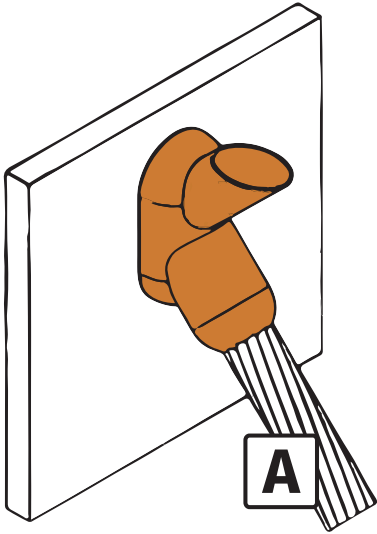
## Earth rod to bar tee horizontal tape - BR7

A	B				
14.2	25 x 3	D	#150	HCD	MDBR714.2253
14.2	25 x 6	D	#115	HCD	MDBR714.2256
14.2	50 x 6	E	#200	HCE	MEBR714.2506
17.2	25 x 3	D	#150	HCD	MDBR717.2253
17.2	50 x 6	E	#200	HCE	MEBR717.2506
16	25 x 3	D	#150	HCD	MDBR716253
16	25 x 6	D	#200	HCD	MDBR716256
16	50 x 6	E	#200	HCE	MEBR716506
20	25 x 3	D	#150	HCD	MDBR720253

14.2 and 17.2 = copperbond / 16 and 20 = solid copper/steel



## 45° cable to vertical steel surface joint - CS3



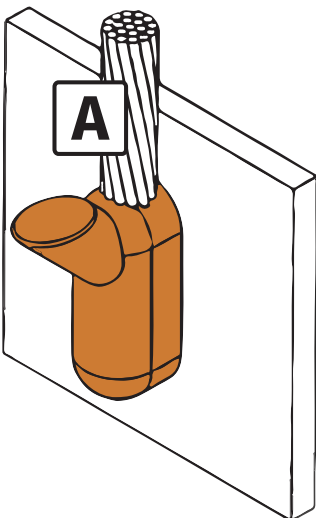
A	°			
16	D	#045	HCD*	MDCS316
25	D	#045	HCD*	MDCS325
35	D	#045	HCD*	MDCS335
50	D	#065	HCD*	MDCS350
70	D	#090	HCD*	MDCS370
95	D	#115	HCD*	MDCS395
120	D	#115	HCD*	MDCS3120
150	D	#115	HCD*	MDCS3150
185	D	#200	HCD*	MDCS3185
240	D	#200	HCD*	MDCS3240
300	D	#250	HCD*	MDCS3300
8 dia	D	#065	HCD*	MDCS38S
10 dia	D	#090	HCD*	MDCS310S

\*Requires chain clamp

16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

## Vertical cable (upwards) to vertical steel surface joint - CS7







A	°			
16	D	#045	HCD*	MDCS716
25	D	#065	HCD*	MDCS725
35	D	#065	HCD*	MDCS735
50	D	#090	HCD*	MDCS750
70	D	#150	HCD*	MDCS770
95	D	#200	HCD*	MDCS795
120	D	#200	HCD*	MDCS7120
150	D	#250	HCD*	MDCS7150
185	E	2 x #150	HCE*	MECS7185
240	E	2 x #150	HCE*	MECS7240
300	E	2 x #200	HCE*	MECS7300
8 dia	D	#090	HCD*	MDCS78S
10 dia	D	#150	HCD*	MDCS710S

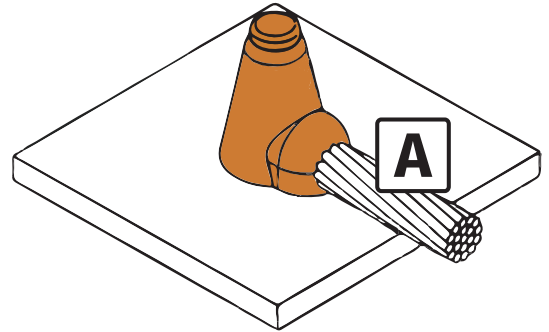
\*Requires chain clamp

16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Horizontal cable to horizontal steel surface joint - CS8**





<b>A</b>				
10	A	#025	HCCP75	MACS810
16	A	#025	HCCP75	MACS816
25	A	#032	HCCP75	MACS825
35	A	#032	HCCP75	MACS835
50	B	#045	HCCP75	MBCS850
70	B	#065	HCCP75	MBCS870
95	C	#090	HCCP100	MCCS895
120	D	#115	HCCP100	MDCS8120
150	D	#150	HCCP100	MDCS8150
185	D	#200	HCCP100	MDCS8185
240	D	#200	HCCP100	MDCS8240
300	D	#250	HCCP100	MDCS8300
8 dia	C	#045	HCCP100	MCCS885
10 dia	C	#065	HCCP100	MCCS810S

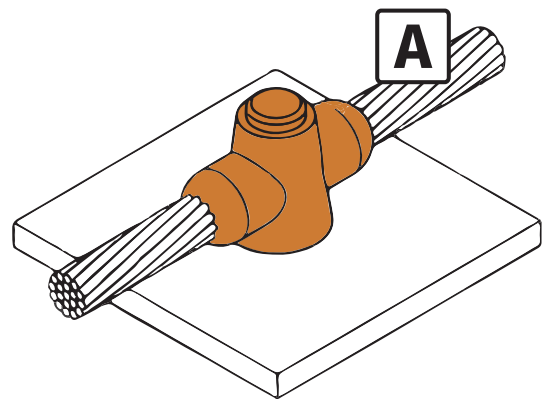


10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Horizontal thru cable to horizontal steel surface joint - CS9**

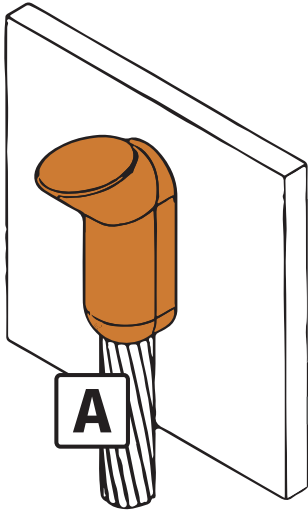
<b>A</b>				
10	A	#025	HCCP75	MACS910
16	A	#025	HCCP75	MACS916
25	A	#032	HCCP75	MACS925
35	A	#045	HCCP75	MACS935
50	B	#090	HCCP75	MBCS950
70	D	#115	HCCP75	MDCS970
95	D	#115	HCCP100	MDCS995
120	D	#150	HCCP100	MDCS9120
150	D	#200	HCCP100	MDCS9150
185	D	#250	HCCP100	MDCS9185
240	E	2 x #200	HCCP100	MECS9240
300	E	2 x #250	HCCP100	MECS9300
8 dia	D	#090	HCCP75	MDCS985
10 dia	D	#115	HCCP75	MDCS910S



10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Vertical cable (downwards) to vertical steel surface joint - CS25**



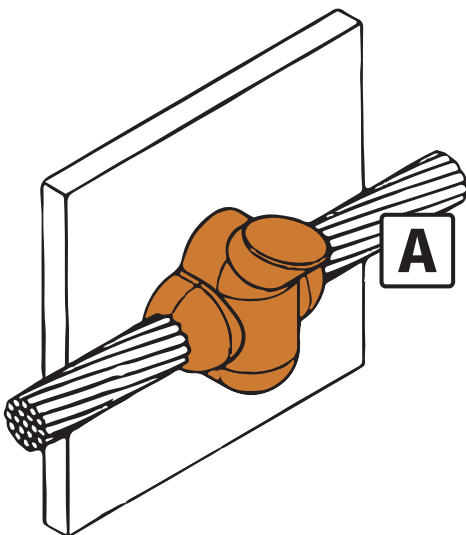
A	\$	Icon	Icon	Icon
16	D	#045	HCD*	MDCS2516
25	D	#045	HCD*	MDCS2525
35	D	#045	HCD*	MDCS2535
50	D	#065	HCD*	MDCS2550
70	D	#090	HCD*	MDCS2570
95	D	#115	HCD*	MDCS2595
120	D	#115	HCD*	MDCS25120
150	D	#150	HCD*	MDCS25150
185	D	#200	HCD*	MDCS25185
240	D	#200	HCD*	MDCS25240
300	D	#250	HCD*	MDCS25300
8 dia	D	#065	HCD*	MDCS2585
10 dia	D	#090	HCD*	MDCS25105

\*Requires chain clamp

16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Horizontal thru cable to vertical steel surface joint - CS27**



A	\$	Icon	Icon	Icon
16	D	#045	HCD	MDCS2716
25	D	#045	HCD	MDCS2725
35	D	#045	HCD	MDCS2735
50	D	#065	HCD	MDCS2750
70	D	#115	HCD	MDCS2770
95	D	#150	HCD	MDCS2795
120	D	#150	HCD	MDCS27120
150	D	#200	HCD	MDCS27150
185	D	#250	HCD	MDCS27185
240	E	2 x #150	HCD	MECS27240
300	E	2 x #200	HCD	MECS27300
8 dia	D	#065	HCD	MDCS2785
10 dia	D	#115	HCD	MDCS27105





\*Requires chain clamp

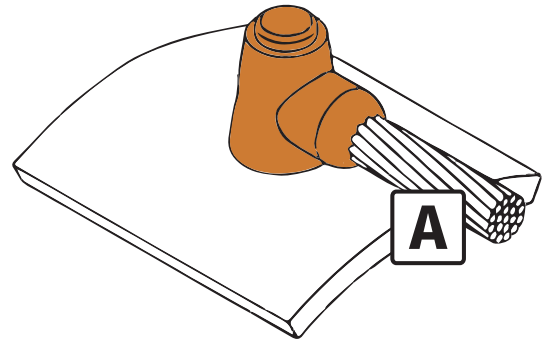
10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300 = stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel



**Horizontal cable to horizontal steel pipe joint - CS32**

<b>A</b>				
16	A	#025	HCCP75	MACS3216
25	A	#025	HCCP75	MACS3225
35	A	#032	HCCP75	MACS3235
50	A	#045	HCCP75	MACS3250
70	B	#065	HCCP75	MBCS3270
95	D	#090	HCD	MDCS3295
120	D	#115	HCD	MDCS32120
150	D	#150	HCD	MDCS32150
185	D	#200	HCD	MDCS32185
240	D	#200	HCD	MDCS32240
300	D	#200	HCD	MDCS32300
8 dia	B	#045	HCCP75	MBCS328S
10 dia	B	#065	HCCP75	MBCS3210S







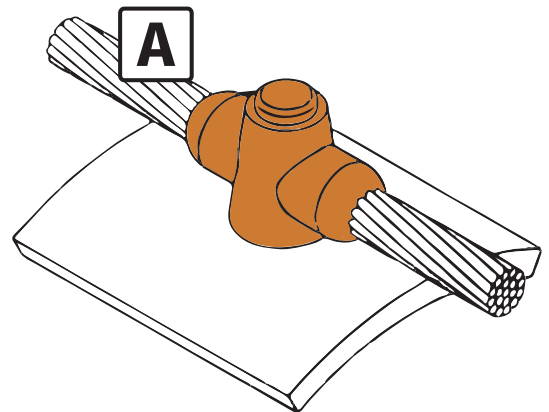
\*State pipe diameter when ordering moulds

10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

**Horizontal thru cable to horizontal steel pipe joint - CS34**

<b>A</b>				
10	A	#025	HCCP75	MACS3410
16	A	#025	HCCP75	MACS3416
25	A	#032	HCCP75	MACS3425
35	A	#045	HCCP75	MACS3435
50	A	#090	HCCP75	MACS3450
70	A	#115	HCD	MACS3470
95	D	#115	HCD	MDCS3495
120	D	#150	HCD	MDCS34120
150	D	#200	HCD	MDCS34150
185	D	#250	HCD	MDCS34185
240	E	2 x #150	HCE	MECS34240
8 dia	A	#090	HCCP75	MACS348S
10 dia	D	#115	HCCP75	MDCS3410S

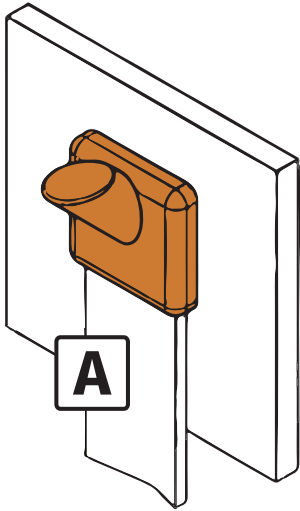


\*State pipe diameter when ordering moulds

10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240 and 300  
= stranded cable (mm<sup>2</sup>)

8 dia and 10 dia = solid copper/steel

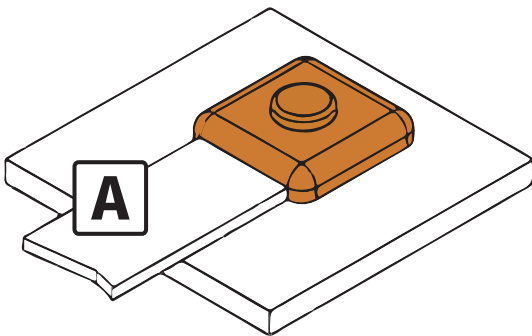
## Vertical bar to vertical steel surface joint - BS1



A	Ⓢ	🗑️	✂️	📦
20 x 3	D	#065	HCD*	MDBS1203
25 x 3	D	#090	HCD*	MDBS1253
25 x 4	D	#090	HCD*	MDBS1254
25 x 6	D	#150	HCD*	MDBS1256
30 x 2	D	#090	HCD*	MDBS1302
30 x 3	D	#090	HCD*	MDBS1303
30 x 4	D	#115	HCD*	MDBS1304
30 x 5	D	#150	HCD*	MDBS1305
38 x 3	D	#150	HCD*	MDBS1383
38 x 5	D	#200	HCD*	MDBS1385
38 x 6	D	#250	HCD*	MDBS1386
40 x 3	D	#150	HCD*	MDBS1403
40 x 4	D	#200	HCD*	MDBS1404
40 x 5	D	#200	HCD*	MDBS1405
40 x 6	D	#250	HCD*	MDBS1406
50 x 3	D	#200	HCD*	MDBS1503
50 x 4	D	#250	HCD*	MDBS1504
50 x 5	D	#250	HCD*	MDBS1505
50 x 6	E	2 x #150	HCE*	MEBS1506
50 x 8	E	2 x #200	HCE*	MEBS1508
60 x 6	E	2 x #200	HCE*	MEBS1606
60 x 8	F	2 x #250	HCE*	MFBS1608
60 x 10	F	3 x #200	HCE*	MFBS16010





\*Requires chain clamp

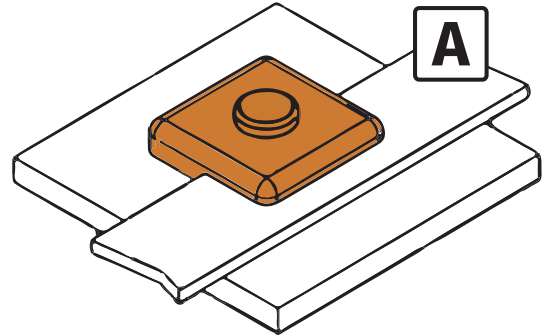
## Horizontal bar to horizontal steel surface joint - BS2



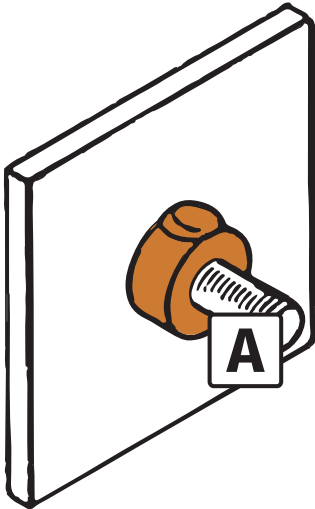
A	Ⓢ	🗑️	✂️	📦
20 x 3	D	#090	HCD	MDBS2203
25 x 3	D	#090	HCD	MDBS2253
25 x 4	D	#090	HCD	MDBS2254
25 x 6	D	#150	HCD	MDBS2256
30 x 2	D	#115	HCD	MDBS2302
30 x 3	D	#115	HCD	MDBS2303
30 x 4	D	#150	HCD	MDBS2304
30 x 5	D	#200	HCD	MDBS2305
38 x 3	D	#150	HCD	MDBS2383
38 x 5	D	#200	HCD	MDBS2385
38 x 6	D	#200	HCD	MDBS2386
40 x 3	D	#115	HCD	MDBS2403
40 x 4	D	#200	HCD	MDBS2404
40 x 5	D	#200	HCD	MDBS2405
40 x 6	D	#250	HCD	MDBS2406
50 x 3	D	#200	HCD	MDBS2503
50 x 4	E	2 x #150	HCE	MEBS2504
50 x 5	E	2 x #150	HCE	MEBS2505
50 x 6	E	2 x #150	HCE	MEBS2506
50 x 8	E	2 x #200	HCE	MEBS2508

## Horizontal thru bar to horizontal steel surface joint - BS3

<b>A</b>				
20 x 3	D	#090	HCD	MDBS3203
25 x 3	D	#115	HCD	MDBS3253
25 x 4	D	#115	HCD	MDBS3254
30 x 2	D	#115	HCD	MDBS3302
30 x 3	D	#115	HCD	MDBS3303
30 x 4	D	#150	HCD	MDBS3304
30 x 5	D	#200	HCD	MDBS3305
38 x 3	D	#150	HCD	MDBS3383
38 x 5	D	#200	HCD	MDBS3385
38 x 6	D	#250	HCD	MDBS3386
40 x 3	D	#150	HCD	MDBS3403
40 x 4	D	#200	HCD	MDBS3404
40 x 5	D	#250	HCD	MDBS3405
40 x 6	D	#250	HCD	MDBS3406
50 x 3	D	#250	HCD	MDBS3503
50 x 4	D	#250	HCD	MDBS3504
50 x 5	D	#250	HCD	MDBS3505
50 x 6	D	#250	HCD	MDBS3506



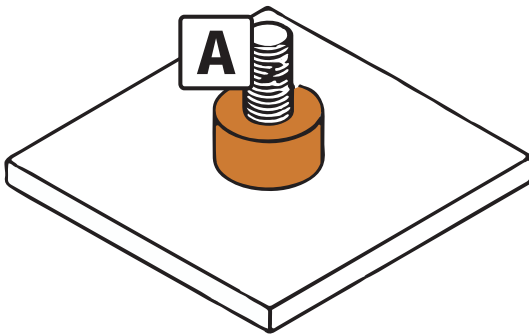
## Stud to vertical steel surface - RS1



A	\$	Icon: Powder	Icon: Tongs	Icon: Box
M6	D	#025	HCD*	MDRS1M6
M8	D	#032	HCD*	MDRS1M8
M10	D	#045	HCD*	MDRS1M10
M12	D	#065	HCD*	MDRS1M12
M16	D	#115	HCD*	MDRS1M16






\*Requires chain clamp

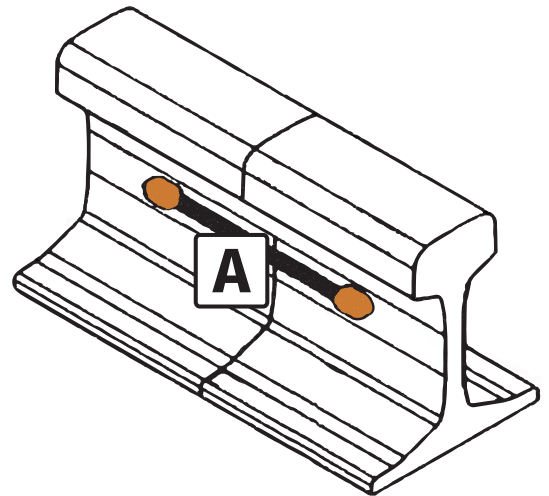
## Stud to horizontal steel surface - RS2



A	\$	Icon: Powder	Icon: Tongs	Icon: Box
M6	D	#025	HCD	MDRS2M6
M8	D	#032	HCD	MDRS2M8
M10	D	#045	HCD	MDRS2M10
M12	D	#065	HCD	MDRS2M12
M16	D	#115	HCD	MDRS2M16





**Cable to rail web - R4**

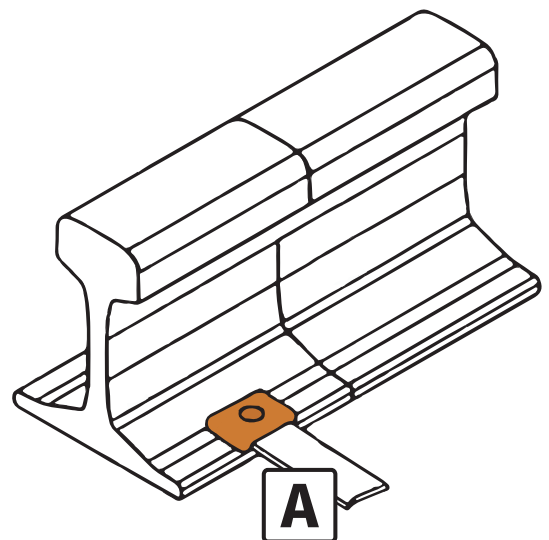
<b>A</b>					
16	HD16	F	#045	HCRW	MFR416L
16	HD16	F	#045	HCRW	MFR416R
25	HD25	F	#045	HCRW	MFR425L
25	HD25	F	#045	HCRW	MFR425R
35	HD35	F	#045	HCRW	MFR435L
35	HD35	F	#045	HCRW	MFR435R
50	HD50	F	#065	HCRW	MFR450L
50	HD50	F	#065	HCRW	MFR450R
70	HD70	F	#090	HCRW	MFR470L
70	HD70	F	#090	HCRW	MFR470R
95	HD95	F	#090	HCRW	MFR495L
95	HD95	F	#090	HCRW	MFR495R
120	HD120	F	#115	HCRW	MFR4120L
120	HD120	F	#115	HCRW	MFR4120R
150	HD150	F	#150	HCRW	MFR4150L
150	HD150	F	#150	HCRW	MFR4150R



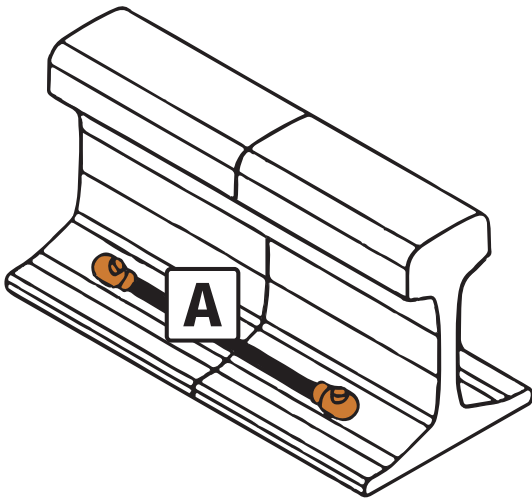
Mould part code suffix L denotes left hand rail  
 Mould part code suffix R denotes right hand rail

**Horizontal flat tape to rail flange/foot - R6**

<b>A</b>				
25 x 3	B	#065	HCCP75	MBR6253



## Cable to rail flange/foot - R10

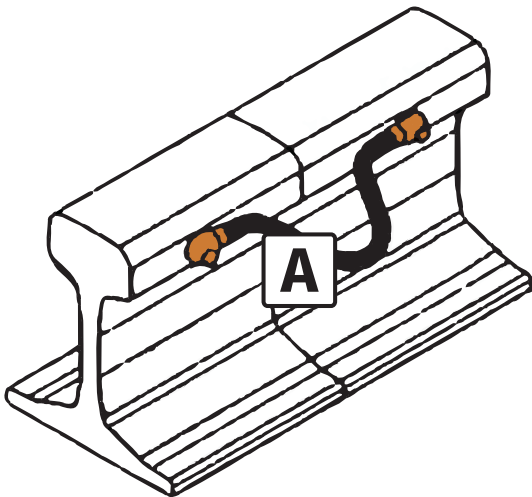


A						
16	KWF016	HD16	A	#025	HCCP75	MAR1016L
16	KWF016	HD16	A	#025	HCCP75	MAR1016R
25	KWF025	HD25	A	#025	HCCP75	MAR1025L
25	KWF025	HD25	A	#025	HCCP75	MAR1025R
35	KWF035	HD35	A	#032	HCCP75	MAR1035L
35	KWF035	HD35	A	#032	HCCP75	MAR1035R
50	KWF050	HD50	B	#045	HCCP75	MBR1050L
50	KWF050	HD50	B	#045	HCCP75	MBR1050R
70	KWF070	HD70	B	#065	HCCP75	MBR1070L
70	KWF070	HD70	B	#065	HCCP75	MBR1070R
95	KWF095	HD95	B	#065	HCCP75	MBR1095L
95	KWF095	HD95	B	#065	HCCP75	MBR1095R
120	KWF0120	HD120	B	#090	HCCP75	MBR10120L
120	KWF0120	HD120	B	#090	HCCP75	MBR10120R
150	KWF0150	HD150	B	#115	HCCP75	MBR10150L
150	KWF0150	HD150	B	#115	HCCP75	MBR10150R

Mould part code suffix L denotes left hand rail

Mould part code suffix R denotes right hand rail

## Cable to rail crown - R12



A						
25	KWF025	HD25	C	#032	HCRC	MCR1225L
25	KWF025	HD25	C	#032	HCRC	MCR1225R
35	KWF035	HD35	C	#032	HCRC	MCR1235L
35	KWF035	HD35	C	#032	HCRC	MCR1235R
50	KWF050	HD50	C	#045	HCRC	MCR1250L
50	KWF050	HD50	C	#045	HCRC	MCR1250R
70	KWF070	HD70	C	#065	HCRC	MCR1270L
70	KWF070	HD70	C	#065	HCRC	MCR1270R
95	KWF095	HD95	C	#090	HCRC	MCR1295L
95	KWF095	HD95	C	#090	HCRC	MCR1295R
120	KWF0120	HD120	C	#115	HCRC	MCR12120L
120	KWF0120	HD120	C	#115	HCRC	MCR12120L

Mould part code suffix L denotes left hand rail

Mould part code suffix R denotes right hand rail



Exothermic welding accessories

Part number	Item description
MS34	Mould scraper to suit type C moulds
MS55	Mould scraper to suit type D moulds
MS65	Mould scraper to suit type E/F moulds
RSC	Rail crown scraper
RWSC	Rail web scraper
RFSC	Rail foot scraper
CBM	Graphite mould cleaning brush
FBRUSH	Conductor cleaning brush
YBRUSH	Conductor cleaning brush (Y-shaped)
FIGN	Flint ignitor
IGNFL	Spare flints (9 per container)
SEAP	0.5kg sealing putty
MSC	Mould support clamp
HD35	Hammer die 35mm <sup>2</sup>
HD50	Hammer die 50mm <sup>2</sup>
HD70	Hammer die 70mm <sup>2</sup>
HD97	Hammer die 97mm <sup>2</sup>
HD120	Hammer die 120mm <sup>2</sup>
HD150	Hammer die 150mm <sup>2</sup>
HD185	Hammer die 185mm <sup>2</sup>
HD240	Hammer die 240mm <sup>2</sup>
510P	Empty tool box
CAP	Cathodic weld cap (for MCPT joint)



Safety accessories

Part number	Item description
SAFEG	Safety goggles
SAFEGE	Safety gloves
SAFEA	Safety apron (leather)



Exothermic welding must be used in accordance with instructions and with all safety precautions taken. This includes the use of personal protective equipment (PPE).

We run operator training courses to train field operatives on how to safely carry out an exothermic weld.

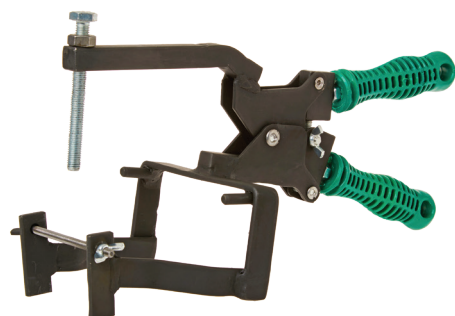
Exothermic welding toolkit

Part number	Item description
KWTKIT	Toolkit comprising: conductor cleaning brush, safety goggles, plastic tool box, spare flints, sealing putty, safety gloves, mould cleaning brush, minor burn kit, flint ignitor, safety apron (leather), earth rod driving cap (M16), handle clamp (cathodic protection), handle clamp (for type D moulds), handle clamp (for type E/F moulds), mould scraper (to suit C moulds), mould scraper (to suit D moulds) and mould support clamp



All essential safety and operational items to carry out an exothermic weld. Each toolkit (*order KWTKIT*) contains the items listed in the table above.

## Handle Clamps



Part number	Item description
HCD	Handle Clamp for use on D type moulds
HCE	Handle Clamp for use on E and F type moulds
HCCP75	Handle Clamp cathodic protection
HCCP100	Handle Clamp cathodic protection
HCC1	Chain Handle/Support Clamp
FRAME	Conductor Support Clamp



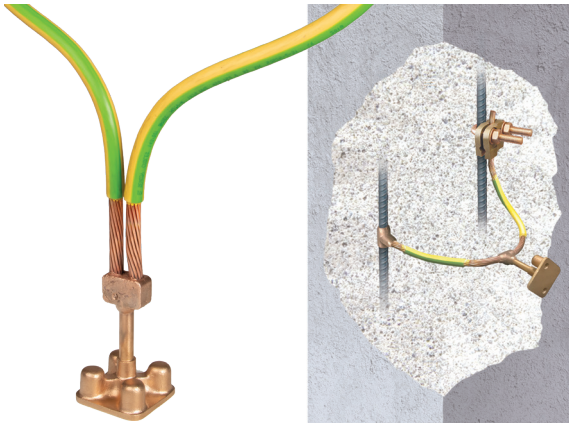
## Handle Clamps for rail applications

Part number	Item description
HCRC300	Rail crown double mould Support Clamp (157 to 320mm)
HCRC370	Rail crown double mould Support Clamp (175 to 260mm)
HCRS	Rail crown single mould Support Clamp
HCRW	Rail web Handle Clamp
HCCP75	Rail foot Handle Clamp
HCCP100	Rail foot Handle Clamp

**Earth Points**

A range of Earth Points are available to cover a variety of applications.

They are available with single, twin and four holes. Earth Points can also be supplied with, and without, plates to accommodate different conductors.



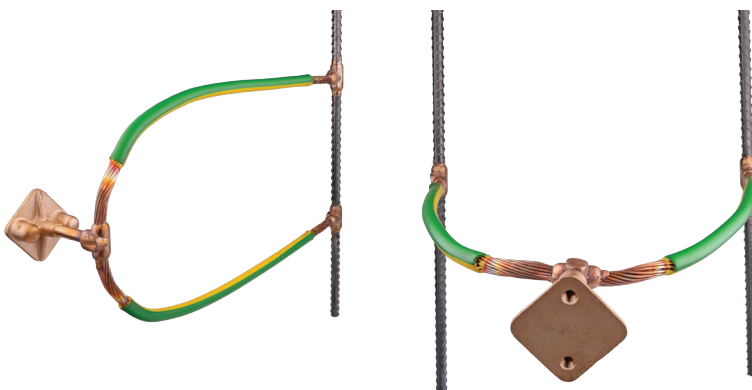
**Earth Points** (with green/yellow tail)



**Earth Points** (without cover plate)



**Single Hole Earth Points** (with solid tail)



**Pre-Welded Rebar/Earth Points**



**Earth Points** (with cover plate)

For details of the Kingsmill range of Earth Points see the BONDING section (pages BOND:7 - 8).

# Legend

Icons used throughout this catalogue denote the different elements that make up a KingsWeld connection.



## Conductor size

The size of conductors to be joined are denoted by **A** and **B** (where applicable). Bar is denoted by its x and y dimensions. Circular conductors are stranded (cable) or solid (ground rod, rebar). Where both stranded and solid circular conductors can be used these are noted in the relevant table footer. Dimensions are given in mm (diameter) unless otherwise stated.



## Price key

Moulds are priced in bands according to their size and complexity. These are denoted by the price key.



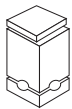
## Weld metal

Weld metal is sized specifically for each mould. In most cases a single weld metal carton is required. In cases where multiple cartons are required these are denoted by a multiplier (eg 2 x #150).



## Clamp

Each KingsWeld mould type requires a specific clamp. If ordering multiple moulds that utilise the same clamp you only need to purchase a quantity of clamps suitable for the number of operators for your application.



## Mould

Mould part numbers are compiled in a logical manner - prefix 'MD' followed by the mould type then followed by size relevant figures (eg CC2 mould to join a 70mm cable to a 50mm cable = MDCC27050).



## Sleeve (rail applications)

A copper sleeve that increases the diameter of a small conductor to make it possible to weld the conductor.



## Hammer die

A hammer die flattens one side of a conductor giving better contact with the rail. *Used in rail applications.*

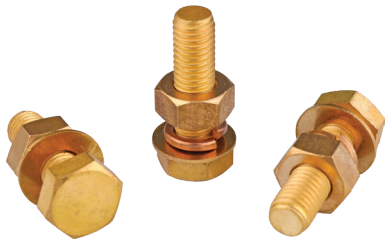
**Hexagon Sets**

**FIX:2 -3**

**Screws and Plugs**

**FIX:4**

### Brass Hexagon Sets



DESCRIPTION	SIZE (mm)	WEIGHT (kg)	PART NO.
Brass Hexagon Set	M6 x 25	0.006	BHS0625
Brass Hexagon Set	M6 x 35	0.009	BHS0635
Brass Hexagon Set	M8 x 16	0.011	BHS0816
Brass Hexagon Set	M8 x 25	0.0013	BHS0825
Brass Hexagon Set	M8 x 35	0.0016	BHS0835
Brass Hexagon Set	M10 x 25	0.02	BHS1025
Brass Hexagon Set	M10 x 35	0.03	BHS1035
Brass Hexagon Set	M12 x 25	0.03	BHS1225
Brass Hexagon Set	M12 x 35	0.05	BHS1235
Brass Hexagon Set	M12 x 40	0.06	BHS1240
Brass Full Nut	M6	0.002	BFN06
Brass Full Nut	M8	0.005	BFN08
Brass Full Nut	M10	0.011	BFN10
Brass Full Nut	M12	0.016	BFN12
Brass Flat Washer	M6	0.0001	BFW06
Brass Flat Washer	M8	0.001	BFW08
Brass Flat Washer	M10	0.0025	BFW10
Brass Flat Washer	M12	0.004	BFW12

**Material:** Brass  
**Standard:** BS:EN 12163

**STAINLESS STEEL, PHOSPHOR BRONZE AND BRIGHT ZINC PLATED SETS ARE ALSO AVAILABLE**

### Stainless Steel Hexagon Sets



DESCRIPTION	SIZE (mm)	WEIGHT (kg)	PART NO.
A2 S/S Hex Set	M6 x 16	0.005	A2HS0616
A2 S/S Hex Set	M8 x 25	0.0135	A2HS0825
A2 S/S Hex Set	M10 x 12	0.0170	A2HS1012
A2 S/S Hex Set	M10 x 16	0.0195	A2HS1016
A2 S/S Hex Set	M10 x 25	0.0235	A2HS1025
A2 S/S Hex Set	M10 x 35	0.0285	A2HS1035
A2 S/S Hex Set	M12 x 30	0.04	A2HS1230
A2 S/S Hex Set	M12 x 40	0.046	A2HS1240
A2 S/S Full Nut	M6	0.002	A2FN06
A2 S/S Full Nut	M8	0.0040	A2FN08
A2 S/S Full Nut	M10	0.001	A2FN10
A2 S/S Full Nut	M12	0.016	A2FN12
A2 S/S Flat Washer	M6	0.0001	A2FW06
A2 S/S Flat Washer	M8	0.001	A2FW08
A2 S/S Flat Washer	M10	0.002	A2FW10
A2 S/S Flat Washer	M12	0.003	A2FW12
A2 S/S Spring Washer	M6	0.0001	A2SPW06
A2 S/S Spring Washer	M8	0.001	A2SPW08
A2 S/S Spring Washer	M10	0.002	A2SPW10
A2 S/S Spring Washer	M12	0.003	A2SPW12

**Material:** Stainless steel  
**Standard:** BS:EN 12163

**BRASS, PHOSPHOR BRONZE AND BRIGHT ZINC PLATED SETS ARE ALSO AVAILABLE**



### Phosphor Bronze Hexagon Sets

DESCRIPTION	SIZE (mm)	WEIGHT (kg)	PART NO.
Phosphor Bronze Hex Sets	M10 x 25	0.03	PBHS1025
Phosphor Bronze Hex Sets	M10 x 35	0.03	PBHS1035
Phosphor Bronze Hex Sets	M12 x 25	0.03	PBHS1225
Phosphor Bronze Hex Sets	M12 x 35	0.04	PBHS1235
Phosphor Bronze Full Nut	M10	0.01	PBFN10
Phosphor Bronze Full Nut	M12	0.02	PBFN12
Phosphor Bronze Flat Washer	M10	0.0025	PBFW10
Phosphor Bronze Flat Washer	M12	0.02	PBFW12
Phosphor Bronze Spring Washer	M10	0.002	PBSPW10
Phosphor Bronze Spring Washer	M12	0.0025	PBSPW12



**Material:** Phosphor bronze

**Standard:** BS:EN 12163

**BRASS, STAINLESS STEEL AND BRIGHT ZINC PLATED SETS ARE ALSO AVAILABLE**

### Bright Zinc Plated Hexagon Sets

DESCRIPTION	SIZE (mm)	WEIGHT (kg)	PART NO.
BZP Hex Set	M6 x 25	0.006	BZPHS0625
BZP Hex Set	M8 x 25	0.008	BZPHS0825
BZP Hex Set	M10 x 35	0.03	BZPHS1035
BZP Full Nut	M6	0.002	BZPFN06
BZP Full Nut	M8	0.005	BZPFN08
BZP Full Nut	M10	0.01	BZPFN10
BZP Full Nut	M12	0.016	BZPFN12
BZP Flat Washer	M6	0.0001	BZPFW06
BZP Flat Washer	M8	0.001	BZPFW08
BZP Flat Washer	M10	0.002	BZPFW10
BZP Flat Washer	M12	0.003	BZPFW12
BZP Spring Washer	M6	0.0001	BZPSPW06
BZP Spring Washer	M8	0.001	BZPSPW08
BZP Spring Washer	M10	0.002	BZPSPW10
BZP Spring Washer	M12	0.003	BZPSPW12



**Material:** Tinned copper

**Standard:** BS:EN 12163

**BRASS, STAINLESS STEEL AND PHOSPHOR BRONZE SETS ARE ALSO AVAILABLE**

## Screws and Plugs



DESCRIPTION	SIZE	WEIGHT (kg)	PART NO.
Brass C/S Woodscrew	1½" x 10g	0.50	BCSW1.5-10
Brass C/S Woodscrew	1½" x 12g	0.60	BCSW1.5-12
CSK SLT ST/ST Screws	1" x 10g	0.60	A2CSKSLT101
CSK SLT ST/ST Screws	1½" x 10g	0.60	A2CSKSLT1.5-10
Plastic Wall Plug (Red) 8 - 10G	No. 10	0.06	PP-10
Plastic Wall Plug (Brown) 10 - 12G	No. 12	0.06	PP-12
Brass Roundhead Woodscrew	No. 12	0.60	BRHW1.5-12
Stainless Steel Roundhead Woodscrew	No. 12	0.60	A2RHSL1.5-12

**OTHER MATERIALS ARE AVAILABLE ON REQUEST**

<b>A to Z</b>	<b>IND:2 - 9</b>
Products listed in alphanumeric order	
<b>CATEGORY:</b>	
Products listed by category section and in alphanumeric order	
<b>Monitoring</b>	<b>IND:10</b>
<b>Surge Protection Devices</b>	<b>IND:10</b>
<b>Air Termination Network</b>	<b>IND:10</b>
<b>Conductors</b>	<b>IND:10 - 11</b>
<b>Fittings</b>	<b>IND:11</b>
<b>Bonding</b>	<b>IND:11 - 12</b>
<b>Earth Bars</b>	<b>IND:12 - 13</b>
<b>Earthing</b>	<b>IND:13</b>
<b>Static Control</b>	<b>IND:13</b>
<b>KingsWeld Exothermic Welding</b>	<b>IND:13 - 16</b>
<b>Fixings</b>	<b>IND:16</b>

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#032	WELD:6	BBAB	BOND:5	BZPHS1035	FIX:3	CBHD2530/T	EB:13
#045	WELD:6	BBCB	BOND:5	BZPSPW06	FIX:3	CBHD2560	EB:13
#065	WELD:6	BBCB316	BOND:5	BZPSPW08	FIX:3	CBHD2560/T	EB:13
#090	WELD:6	BBPF	FIT:14	BZPSPW10	FIX:3	CBHD3130	EB:13
#115	WELD:6	BCSW1.5-10	FIT:20/FIX:4	BZPSPW12	FIX:3	CBHD3830	EB:13
#150	WELD:6	BCSW1.5-12	FIT:20/FIX:4	C10	BOND:16	CBHD3860	EB:13
#200	WELD:6	BENT01	EAR:15	C10E	BOND:16	CBHD5010	EB:13
#250	WELD:6	BENT02	EAR:15	C120	BOND:16	CBHD5060	EB:13
A2CSKSLT1.5-10	FIT:20/FIX:4	BFN06	FIX:2	C120E	BOND:16	CBHD5060/T	EB:13
A2CSKSLT101	FIT:20/FIX:4	BFN08	FIX:2	C150	BOND:16	CBHD6060	EB:13
A2FN06	FIX:2	BFN10	FIX:2	C150E	BOND:16	CBHD7506	EB:13
A2FN08	AT:49/FIX:2	BFN12	FIX:2	C16	BOND:16	CBT200/10/7	BOND:12
A2FN10	AT:49/FIX:2	BFW06	FIX:2	C16E	BOND:16	CBT200/16/9	BOND:12
A2FN12	AT:49/FIX:2	BFW08	FIX:2	C185	BOND:16	CBT200/25/11	BOND:12
A2FN16	AT:49	BFW10	FIX:2	C185-95	BOND:16	CBT200/50/11	BOND:12
A2FW06	FIX:2	BFW12	FIX:2	C185-95E	BOND:16	CBT200/6/7	BOND:12
A2FW08	FIX:2	BHS0625	FIX:2	C185E	BOND:16	CBT200/70/13	BOND:12
A2FW10	FIX:2	BHS0635	FIX:2	C240	BOND:16	CBT200/95/13	BOND:12
A2FW12	FIX:2	BHS0816	FIX:2	C240E	BOND:16	CBT400/10/7	BOND:12
A2HS0616	FIX:2	BHS0825	FIX:2	C25	BOND:16	CBT400/16/9	BOND:12
A2HS0825	FIX:2	BHS0835	FIX:2	C25-10	BOND:16	CBT400/25/11	BOND:12
A2HS1012	FIX:2	BHS1025	FIX:2	C25-10E	BOND:16	CBT400/50/11	BOND:12
A2HS1016	FIX:2	BHS1035	FIX:2	C25E	BOND:16	CBT400/6/7	BOND:12
A2HS1025	FIX:2	BHS1225	FIX:2	C25PM	BOND:16	CBT400/70/13	BOND:12
A2HS1035	FIX:2	BHS1235	FIX:2	C25PME	BOND:16	CBT400/95/13	BOND:12
A2HS1230	FIX:2	BHS1240	FIX:2	C35	BOND:16	CC08	COND:15
A2HS1240	FIX:2	BM08253SS	FIT:18	C35E	BOND:16	CCA08	COND:15
A2RHSL1.5-12	FIT:20/FIX:4	BM08HS	FIT:18	C50	BOND:16	CCAT2530	COND:9
A2SPW06	FIX:2	BM253FC	FIT:18	C50E	BOND:16	CCBL	COND:15
A2SPW08	FIX:2	BM253HS	FIT:18	C6	BOND:16	CCBN	COND:15
A2SPW10	FIX:2	BRHW1.5-12	FIT:20/FIX:4	C6E	BOND:16	CCGY	COND:15
A2SPW12	FIX:2	BSCW006	COND:16	C70	BOND:16	CCGY016	COND:17
AATB10	AT:16	BSCW016	COND:16	C70-35	BOND:16	CCGY025	COND:17
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AELV1605	AT:15	BSCW025/T	COND:17	C75	BOND:16	CCGY070	COND:17
AELV1610	AT:15	BSCW035	COND:16	C75E	BOND:16	CCGY095	COND:17
AELV1615	AT:15	BSCW035/T	COND:17	C95	BOND:16	CCGY120	COND:17
AELV1620	AT:15	BSCW050	COND:16	C95-35	BOND:16	CCGY150	COND:17
AELV1625	AT:15	BSCW050/T	COND:17	C95-35E	BOND:16	CCGY185	COND:17
AELV1630	AT:15	BSCW070	COND:16	C95E	BOND:16	CCGY240	COND:17
AGBH	FIT:14	BSCW070/T	COND:17	CA08	COND:16	CCGY300	COND:17
APF	AT:21	BSCW095	COND:16	CAB1G03	STAT:6	CCGY400	COND:17
ARWB	BOND:5	BSCW095/T	COND:17	CAB1G05	STAT:6	CCP12	EAR:24
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ATAR1005	AT:14	BSCW150	COND:16	CABN	COND:16	CCP6R	EAR:24
ATAR1010	AT:14	BSCW150/T	COND:17	CAGY	COND:16	CCP9	EAR:24
ATAR1010	AT:14	BSCW185	COND:16	CAST	COND:16	CCP9R	EAR:24
ATAR1605	AT:14	BSCW185/LS	COND:18	CATB16	AT:16	CCST	COND:15
ATAR1610	AT:14	BSCW185/T	COND:17	CATB316	AT:16	CCWH	COND:15
ATAR1615	AT:14	BSCW240	COND:16	CATB50	AT:16	CELV1605	AT:15
ATAR1620	AT:14	BSCW240/LS	COND:18	CATB70	AT:16	CELV1610	AT:15
ATAR1625	AT:14	BSCW240/T	COND:17	CATB95	AT:16	CELV1620	AT:15
ATAR1630	AT:14	BSCW300	COND:16	CAWH	COND:16	CELV1625	AT:15
ATBA12515	COND:14	BSCW300/LS	COND:18	CB200/10/7	BOND:12	CELV1630	AT:15
ATBA2030	COND:14	BSCW300/LS	COND:18	CB200/16/9	BOND:12	CGUV150	EAR:31
ATBA2530	COND:14	BSCW300/T	COND:17	CB200/25/11	BOND:12	CGUV16	EAR:31
ATBA2560	COND:14	BSCW400	COND:16	CB200/50/11	BOND:12	CGUV16S	EAR:30
ATBA3030	COND:14	BSCW400/LS	COND:18	CB200/6/7	BOND:12	CGUV70	EAR:31
ATBA4060	COND:14	BSCW400/T	COND:17	CB200/70/13	BOND:12	CLA2510	EAR:29
ATBA5060	COND:14	BZPFN06	FIX:3	CB200/95/13	BOND:12	CLA2510/PB	EAR:29
ATCR1005	AT:14	BZPFN08	FIX:3	CB400/10/7	BOND:12	CLA2530	EAR:29
ATCR1010	AT:14	BZPFN10	FIX:3	CB400/16/9	BOND:12	CLA2530/PB	EAR:29
ATCR1605	AT:14	BZPFN12	FIX:3	CB400/25/11	BOND:12	CLA4012	EAR:29
ATCR1610	AT:14	BZPFW06	FIX:3	CB400/50/11	BOND:12	CLA4012/PB	EAR:29
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CPIT-BP	EAR:23	EBAR16-1	EB:8	EBOSS3040M10	BOND:9	ERSS1606	EAR:12
CPIT-LE	EAR:23	EBAR16-1-T	EB:9	EBOSS3050M08	BOND:9	ERSS1608	EAR:12
CPIT-LE-BP	EAR:23	EBAR16-2	EB:10	EBOSS3050M10	BOND:9	ERSS1610	EAR:12
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CTBA1230	COND:9	EBAR18-2	EB:10	EBOSS4050M10	BOND:9	ERSS2504	EAR:12
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CTBA3040	COND:9	EBAR22-1	EB:8	EBP1-M8-5	BOND:8	FB200/35/11	BOND:10
CTBA3050	COND:9	EBAR22-1-T	EB:9	EBP1-M8-T	BOND:8	FB200/50/11	BOND:10
CTBA3130	COND:9	EBAR22-2	EB:10	EBP1SS-M10	BOND:7	FB200/50/11	BOND:14
CTBA3160	COND:9	EBAR22-2-T	EB:11	EBP1SS-M10	BOND:8	FB200/50/9	BOND:14
CTBA3830	COND:9	EBAR22-T	EB:7	EBP1-T	BOND:8	FB200/6/7	BOND:10
CTBA3850	COND:9	EBAR24	EB:6	EBP2	BOND:7	FB200/70/13	BOND:10
CTBA4030	COND:9	EBAR24-1	EB:8	EBP2-2T	BOND:8	FB200/75/11	BOND:14
CTBA4040	COND:9	EBAR24-1-T	EB:9	EBP2P	BOND:7	FB200/75/9	BOND:14
CTBA4050	COND:9	EBAR24-2	EB:10	EBP2P-08	BOND:7	FB200/95/13	BOND:10
CTBA4060	COND:9	EBAR24-2-T	EB:11	EBP2P-08-2T	BOND:8	FB400/10/7	BOND:10
CTBA5030	COND:9	EBAR24-T	EB:7	EBP2P-08-T	BOND:8	FB400/120/17	BOND:10
CTBA5040	COND:9	EBAR26	EB:6	EBP2P-2T	BOND:8	FB400/150/17	BOND:10
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FBT400/120/17	BOND:10	KES-16-DBL	EAR:28	KM96223005	AT:40	KMFBHDATM30	AT:23
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FCB3260	BOND:13	KM1+2-12.5-3+0-SC	SPD:37	KM96573005	AT:38	KMFBSS-PCGY08P/PUSH	FIT:15
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FCB4560	BOND:13	KM1+2-12.5-4+0-SC	SPD:35	KM96575005	AT:38	KMFBSS-PCGY253P	FIT:15
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PBAR7	EAR:20	PCWH08P/PUSH	FIT:6	SQCC25395	FIT:11	TCW316	COND:10
PBAR7	EAR:23	PCWH08P/PUSH/FB	FIT:9	SQCC256	FIT:10	TCWH253	COND:10
PBAR7/LW	EAR:21	PCWH253P	FIT:6	SQCC313	FIT:10	TEA2550	BOND:6
PBAR7/PP	EAR:26	PCWH253P/AD	FIT:7	SQCC316	FIT:10	TEC1670	BOND:6
PBAR7CBP500	EAR:22	PCWH253P/FB	FIT:9	SQCC406	FIT:10	TEC2550	BOND:6
PBAR7CTP500	EAR:22	PHFB08	FIT:13	SQCC506	FIT:10	TEC70120	BOND:6
PBAR7PPK	EAR:25	PHFB08X2	FIT:13	SQCCF253	FIT:10	TEEA08	FIT:11
PBFN10	FIX:3	PHFB10	FIT:13	SQCCF256	FIT:10	TEEC08	FIT:11
PBFN12	FIX:3	PHFBM6	FIT:13	SQCCF313	FIT:10	TINS1/2	EAR:32
PBFW10	FIX:3	PP-10	FIT:20/FIX:4	SQCCF316	FIT:10	TPA203	FIT:7
PBFW12	FIX:3	PP-12	FIT:20/FIX:4	SQCCF406	FIT:10	TPA253	FIT:7
PBHS1025	FIX:3	PPIT-G	EAR:26	SQCCF506	FIT:10	TPC203	FIT:7
PBHS1225	FIX:3	PPIT-K	EAR:25	SQCS08-MV	FIT:11	TPC253	FIT:7
PBHS1235	FIX:3	PTTC253	FIT:16	SQCW08	FIT:11	TPC253P	FIT:7
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PBS1-6	BOND:5	R30	STAT:6	SQCW70	FIT:11	VESX45/CAB1G03	STAT:4
PBSPW10	FIX:3	R50	STAT:6	SQCW95	FIT:11	VESX45/CAB1G05	STAT:4
PBSPW12	FIX:3	RBA16	AT:18	TA08	FIT:17	VESX45/CAB1G10	STAT:4
PCBL08P/AD	FIT:7	RBC16	AT:18	TABL12515	COND:14	VESX45/R20	STAT:4
PCBL08P/BUTT	FIT:6	RBCA16	AT:17	TABL2030	COND:14	VESX45/R30	STAT:4
PCBL08P/PUSH	FIT:6	RBCC08	AT:17	TABL253	COND:14	VESX45/R50	STAT:4
PCBL08P/PUSH/FB	FIT:9	RBCC16	AT:17	TABN253	COND:14	VESX90	STAT:4
PCBL253P	FIT:6	RFSC	WELD:41	TAGN253	COND:14	VESX90/CAB1G03	STAT:4
PCBL253P/AD	FIT:7	RSC	WELD:41	TAGY253	COND:14	VESX90/CAB1G05	STAT:4
PCBL253P/FB	FIT:9	RWSC	WELD:41	TAST253	COND:14	VESX90/CAB1G10	STAT:4
PCBN08B/AD	FIT:7	SAFEA	WELD:41	TAWH253	COND:14	VESX90/R20	STAT:4
PCBN08B/BUTT	FIT:6	SAFEGL	WELD:41	TC08	FIT:17	VESX90/R30	STAT:4
PCBN08B/PUSH	FIT:6	SAFEGL	WELD:41	TC50	FIT:17	VESX90/R50	STAT:4
PCBN08B/PUSH/FP	FIT:9	SBC1	BOND:15	TC70	FIT:17	YBRUSH	WELD:41
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PCBN08P/BUTT	FIT:6	SBC2	BOND:15	TCBL253	COND:10		
PCBN08P/PUSH	FIT:6	SBC20	BOND:15	TCBN253	COND:10		
PCBN08P/PUSH/FB	FIT:9	SBC30	BOND:15	TCGN/Y253	COND:11		
PCBN203B	FIT:6	SBC4	BOND:15	TCGN253	COND:10		
PCBN253B	FIT:6	SBC40	BOND:15	TCGN253LS	COND:11		
PCBN253B/AD	FIT:7	SBC50	BOND:15	TCGN253LS/50	COND:11		
PCBN253B/FB	FIT:9	SBC8	BOND:15	TCGN256	COND:10		
PCBN253P	FIT:6	SCEP615	EAR:14	TCGN256LS	COND:11		
PCBN253P/AD	FIT:7	SCEP630	EAR:14	TCGN506	COND:10		
PCBN253P/FB	FIT:9	SCEP915	EAR:14	TCGN506LS	COND:11		
PCBN506B	FIT:6	SDTC253	FIT:16	TCGY253	COND:10		
PCBNF/BASE	FIT:9	SEAP	WELD:41	TCGY3160	COND:10		
PCBNFAD/BASE	FIT:9	SER130	BOND:9	TCIV316	COND:10		
PCGN253P	FIT:6	SER68	BOND:9	TCLD253	COND:11		
PCGN253P/FB	FIT:9	SF050	EAR:32	TCOW316	COND:10		
PCGY08B/AD	FIT:7	SHBL08P/PUSH	FIT:12	TCST253	COND:10		
PCGY08B/BUTT	FIT:6	SHBL253P	FIT:12	TCTD1215	COND:12		
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GAVGW	COND:18	HDSC300INS	FIT:5	OH050	FIT:8	PCWH253P/AD	FIT:7
GSC10	COND:17	HDSC35	FIT:5	OH050INS	FIT:8	PCWH253P/FB	FIT:9
GST3035	COND:12	HDSC35INS	FIT:5	OH070	FIT:8	PHFB08	FIT:13
KM30000199	COND:13	HDSC400	FIT:5	OH070INS	FIT:8	PHFB08X2	FIT:13
TABL12515	COND:14	HDSC400INS	FIT:5	OH095	FIT:8	PHFB10	FIT:13
TABL2030	COND:14	HDSC50	FIT:5	OH095INS	FIT:8	PHFBM6	FIT:13
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TCBN253	COND:10	HDSCS16INS	FIT:5	OH185INS	FIT:8	SHBN08P/PUSH	FIT:12
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TCGN256	COND:10	KMFBAL-MDA253P	FIT:15	OH400	FIT:8	SHGY08P/PUSH	FIT:12
TCGN256LS	COND:11	KMFBAL-PCGY08B/PUSH	FIT:15	OH400INS	FIT:8	SHGY253B	FIT:12
TCGN506	COND:10	KMFBAL-PCGY08P/PUSH	FIT:15	OH8A	FIT:8	SHGY253P	FIT:12
TCGN506LS	COND:11	KMFBAL-PCGY253B	FIT:15	OH8C	FIT:8	SHST08P/PUSH	FIT:12
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TCLD253	COND:11	KMFBSS	FIT:15	OTCC404	FIT:16	SQCA08	FIT:11
TCOW316	COND:10	KMFBSS-MDA253	FIT:15	OTCC506	FIT:16	SQCA08-MV	FIT:11
TCST253	COND:10	KMFBSS-MDCF253	FIT:15	PCBL08P/AD	FIT:7	SQCA253	FIT:10
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TCTD1230	COND:12	KMFBSS-PCBN08B/PUSH	FIT:15	PCBL08P/PUSH	FIT:6	SQCC08-MV	FIT:11
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TCTD2030	COND:12	KMFBSS-PCBN253B	FIT:15	PCBL253P	FIT:6	SQCC25308	FIT:11
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TCTD3160	COND:12	MDA203	FIT:4	PCBN08P/PUSH/FB	FIT:9	SQCCF256	FIT:10
TCTD3830	COND:12	MDA253	FIT:4	PCBN203B	FIT:6	SQCCF313	FIT:10
TCTD3850	COND:12	MDA253P	FIT:4	PCBN253B	FIT:6	SQCCF316	FIT:10
TCTD3860	COND:12	MDA256	FIT:4	PCBN253B/AD	FIT:7	SQCCF406	FIT:10
TCTD4030	COND:12	MDA506	FIT:4	PCBN253B/FB	FIT:9	SQCCF506	FIT:10
TCTD4040	COND:12	MDA506P	FIT:4	PCBN253P	FIT:6	SQCS08-MV	FIT:11
TCTD4050	COND:12	MDAF253	FIT:4	PCBN253P/AD	FIT:7	SQCW08	FIT:11
TCTD4060	COND:12	MDAF253P	FIT:4	PCBN253P/FB	FIT:9	SQCW50	FIT:11
TCTD5030	COND:12	MDC203	FIT:4	PCBN506B	FIT:6	SQCW70	FIT:11
TCTD5040	COND:12	MDC253	FIT:4	PCBNF/BASE	FIT:9	SQCW95	FIT:11
TCTD5050	COND:12	MDC253LD	FIT:4	PCBNFAD/BASE	FIT:9	TA08	FIT:17
TCTD5060	COND:12	MDC253P	FIT:4	PCGN253P	FIT:6	TC08	FIT:17
TCW316	COND:10	MDC254	FIT:4	PCGN253P/FB	FIT:9	TC50	FIT:17
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		MDC256P	FIT:4	PCGY08B/BUTT	FIT:6	TC95	FIT:17
		MDC313	FIT:4	PCGY08B/BUTT	FIT:6	TEEA08	FIT:11
		MDC316	FIT:4	PCGY08B/PUSH	FIT:6	TEEC08	FIT:11
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		MDC404	FIT:4	PCGY08P/PUSH/FB	FIT:9	TPC253	FIT:7
		MDC406	FIT:4	PCGY153B/FB	FIT:9	TPC253P	FIT:7
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		MDC504	FIT:4	PCGY253B	FIT:6		
		MDC506	FIT:4	PCGY253B/AD	FIT:7		
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		MDCF253	FIT:4	PCGY253P/AD	FIT:6	ARWB	BOND:5
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		MDCF256	FIT:4	PCGYF/BASE	FIT:9	BBCB	BOND:5
		MDCF256P	FIT:4	PCGYFAD/BASE	FIT:9	BBCB316	BOND:5
		MDCF316	FIT:4	PCST08P/AD	FIT:7	C10	BOND:16
		MDCF316P	FIT:4	PCST08P/BUTT	FIT:6	C10E	BOND:16
		MDCF404	FIT:4	PCST08P/PUSH	FIT:6	C120	BOND:16
		MDCF404P	FIT:4	PCST08P/PUSH/FB	FIT:9	C120E	BOND:16
		MDCF506	FIT:4	PCST253P	FIT:6	C150	BOND:16
		MDCF506P	FIT:4	PCST253P/AD	FIT:6	C150E	BOND:16
		OH016	FIT:8	PCST253P/FB	FIT:7	C16	BOND:16
		OH016INS	FIT:8	PCWH08P/AD	FIT:9	C16E	BOND:16
		OH025	FIT:8	PCWH08P/BUTT	FIT:7	C185	BOND:16
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AGBH	FIT:14
BBPF	FIT:14
BCSW1.5-10	FIT:20
BCSW1.5-12	FIT:20
BM08253SS	FIT:18
BM08HS	FIT:18
BM253FC	FIT:18
BM253HS	FIT:18
BRHW1.5-12	FIT:20
GGBH	FIT:14
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HDSC120INS	FIT:5
HDSC150	FIT:5
HDSC150INS	FIT:5
HDSC185	FIT:5
HDSC185INS	FIT:5
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BBAB	BOND:5
BBCB	BOND:5
BBCB316	BOND:5
C10	BOND:16
C10E	BOND:16
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C120E	BOND:16
C150	BOND:16
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MDBB41386386	WELD:24	MDBR214.2303	WELD:30	MDBS3386	WELD:37	MDCB470256	WELD:20
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A2SPW12	FIX:2
BCSW1.5-10	FIX:4
BCSW1.5-12	FIX:4
BFN06	FIX:2
BFN08	FIX:2
BFN10	FIX:2
BFN12	FIX:2
BFW06	FIX:2
BFW08	FIX:2
BFW10	FIX:2
BFW12	FIX:2
BHS0625	FIX:2
BHS0635	FIX:2
BHS0816	FIX:2
BHS0825	FIX:2
BHS0835	FIX:2
BHS1025	FIX:2
BHS1035	FIX:2
BHS1225	FIX:2
BHS1235	FIX:2
BHS1240	FIX:2
BRHW1.5-12	FIX:4
BZPFN06	FIX:3
BZPFN08	FIX:3
BZPFN10	FIX:3
BZPFN12	FIX:3
BZPFW06	FIX:3
BZPFW08	FIX:3
BZPFW10	FIX:3
BZPFW12	FIX:3
BZPHS0625	FIX:3
BZPHS0825	FIX:3
BZPHS1035	FIX:3
BZPSPW06	FIX:3
BZPSPW08	FIX:3
BZPSPW10	FIX:3
BZPSPW12	FIX:3
PBFN10	FIX:3
PBFN12	FIX:3
PBFW10	FIX:3
PBFW12	FIX:3
PBHS1025	FIX:3
PBHS1225	FIX:3
PBHS1235	FIX:3
PBSPW10	FIX:3
PBSPW12	FIX:3
PP-10	FIX:4
PP-12	FIX:4



## UK Head Office

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**Fax:** +44 (0)1773 417850

Company Reg No. 3608807

Vat No. GB 716 3841 34

**Sales:** sales@kingsmillearthing.co.uk

**Non UK Sales:** exportsales@kingsmillearthing.co.uk

**Accounts:** accounts@kingsmillearthing.co.uk

## Group Companies

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### Dubai Office

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**Fax:** +971-4-2677349

**Sales:** sales@ravcodubai.com

**Accounts:** accounts@ravcodubai.com

### Kingsmill Concrete Products Ltd

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NG22 9LD

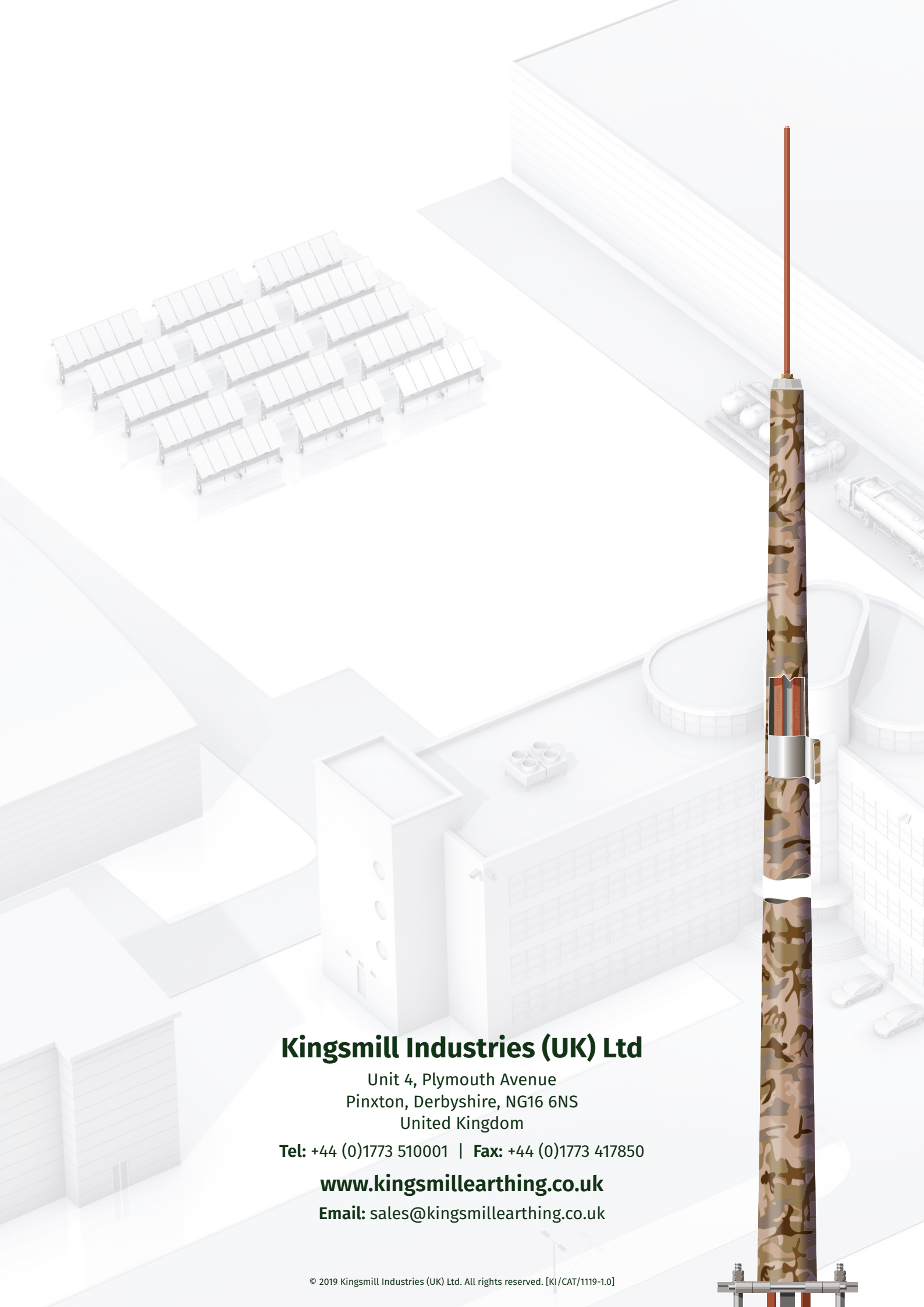
**Tel:** +44 (0)1623 869333

**Fax:** +44 (0)8450 090296

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**Accounts:** accounts@kingsmillearthing.co.uk





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