



AUSTRALIA



PLP (PREFORMED LINE PRODUCTS)

Earthing Range








The connection you can count on

“ PLP supplies a large range of earthing solutions for domestic, commercial and industrial applications. ”



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General Information



The purpose of earthing is to provide protection for people and animals against the danger of electric shock, and maintain a reliable electrical power distribution system.

PLP has extensive experience in the design and production of a variety of copper and stainless steel earth rods for domestic, industrial and substation applications.

Types of earth rods

At one time or another, all manner of conductor materials and shapes have been installed in the ground to provide an electrical earth.

Taking into account conductivity, high resistance to atmospheric corrosion and soil attack, ease and economy of installation and overall reliability, the steel rod clad with either copper or stainless steel has proven to be superior over other materials.

The copper bonded steel rod is simple to install and the connection to the earthing system is easy. The installation is also accessible for inspection and testing.

Extendable earth rods have been developed to reach underlying strata of low permanent resistivity unaffected by seasonal drying.

Steel core earth rods

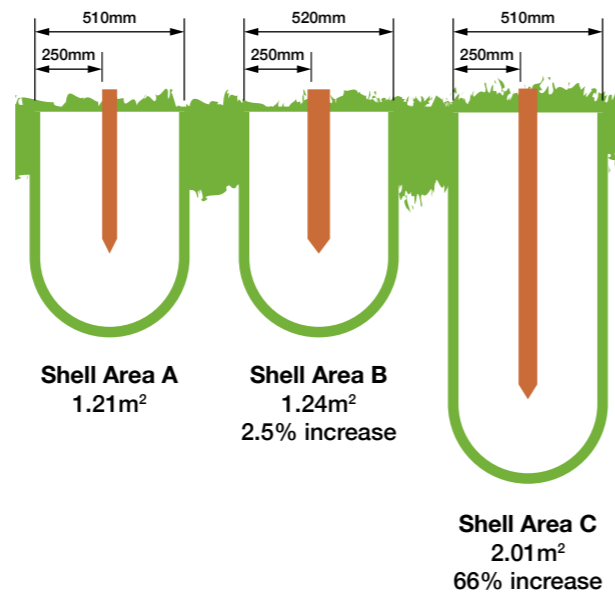
Electrically, a high quality earth rod should have a low intrinsic resistance and have a sufficient cross-section to carry high electrical currents without damage when required.

Mechanically, a high quality earth rod should exhibit strength, have a rigid core for easy driving and be constructed from durable and corrosion resistant material.

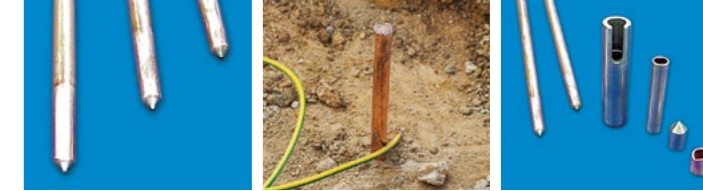
Earth rod length is more important than diameter and quantity

The combined resistance of parallel rods is a complex function involving the number of rods, rod diameter, rod length, rod separation, the configuration of earth rods and soil resistivity.

The recommended practice is to use an earth rod with a diameter that has enough strength to be driven into the soil without bending or splitting. Large diameter rods may be more difficult to drive into the earth than smaller diameter rods.



Fewer rods coupled together for deep driving will achieve a lower resistance than the same number in parallel. The installation of multiple earth rods at sufficient distances apart takes up a large area, requiring long cables and many connections that add to increased installation time, higher labour and equipment costs.



Electrical resistance

The depth to which an earth rod is driven into the earth has much more influence on its electrical resistance characteristics than its diameter.

It is not the actual area of contact with the soil that counts but the total resistance area of the sheath or shell surrounding the earth rod.

There is a dramatic change in resistance when the length of the earth rod is increased.

Good earthing requires low soil resistivity

Soil resistivity varies greatly from one location to another. For example, soil around the banks of a river have very low resistivity and dry sand in elevated areas can have very high resistivity.

The resistance of the earth path is determined by the resistivity of the soil surrounding the earth rod, its contact resistance between the earth rod and the surrounding soil, and the resistance of the earth rod and connecting conductors.

Factors affecting soil resistivity

The factors affecting soil resistivity include the types of soil, climate conditions and seasonal weather patterns. The effects of heat, moisture, drought and frost can introduce wide variations in soil resistivity.

Soil resistivity usually decreases with depth, and an increase of only a few percent of moisture content in a normally dry soil will significantly decrease the soil resistivity.

Conversely, soil temperatures below freezing greatly increase soil resistivity, requiring earth rods to be driven to even greater depths.

Other soil properties conducive to low resistivity are chemical composition, soil ionisation, grain distribution and homogeneous grain size.

All these factors relate to the retention of soil moisture, and provide good conditions for a closely packed soil and good contact with the earth rod.

In view of all the above factors, there is a large variation of soil resistivity between different soil types and moisture contents.

If the soil resistivity increases with depth, earth rods should be installed parallel to obtain a lower resistance reading. Best results are achieved when the spacing of the parallel earth rods is greater than their depth.

Non-Extendable Bonded Earth Rod – Domestic

Each earth rod incorporates an integral driving point, machined not ground to preserve the strength and rigidity of cold-drawn steel.

Part Number	Description
CBE-127-1400-DOM	Domestic earth rod assembly (includes earthing clips and tags)



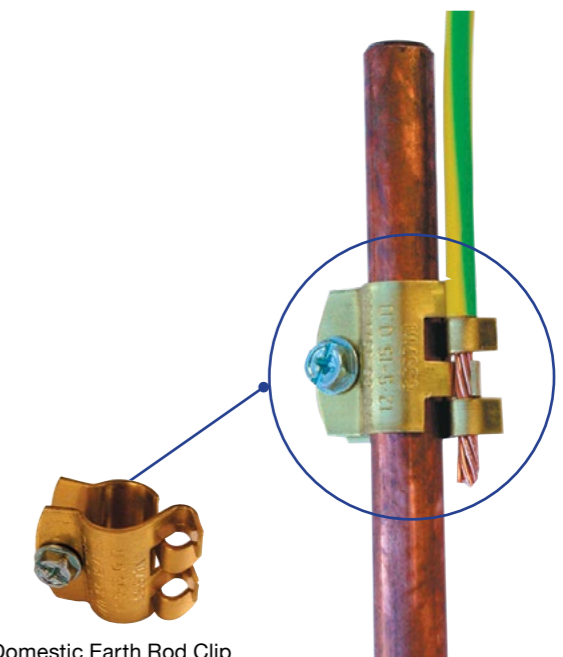
Note: Non-extendable earth rods are supplied with rod and tag.

Copper Bonded Earth Rod – Domestic and Commercial

The CBE Copper Bonded Earth Rod provides an effective solution for domestic as well as commercial earthing applications.

Manufactured from low carbon high tensile steel with pure copper plating at >250 microns, molecularly bonded onto the steel rod.

All Copper Bonded Earth Rods supplied by PLP are tested in accordance with IEC62561-2 : 2018.



Domestic Earth Rod Clip



Copper Bonded Earth Rod – Pointed

CBE



Rod Diameter (mm)	Part Number	Length (mm)
12.7	CBE-127-1400	1400
12.7	CBE-127-1800	1800
12.7	CBE-127-3000	3000
14.2	CBE-142-1500	1500
14.2	CBE-142-1800	1800
14.2	CBE-142-2400	2400
19	CBE-190-1800	1800
19	CBE-190-2400	2400
19	CBE-190-3000	3000

CBE Rods based on Imperial Diameter

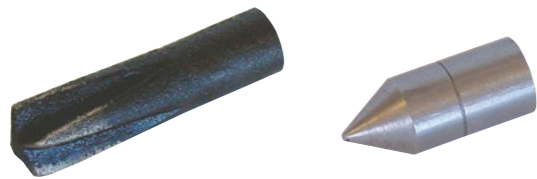
Rod Diameter (mm)	Part Number
17.2	CBE-190-xxxx

Couplers for Pointed Rod



Rod Diameter (mm)	Part Number
12.7	CBE-127-COUPLER
14.2	CBE-142-COUPLER
19	CBE-190-COUPLER

Driving Points



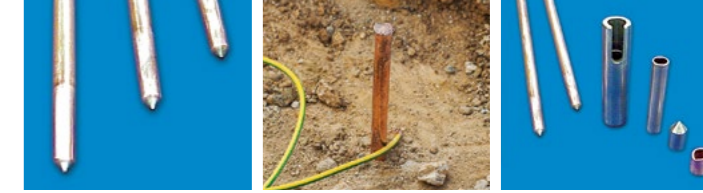
Part Number	Description
CBE-127-DP	Standard Driving Point
CBE-127-SDP	Star Driving Point
CBE-142-DP	Standard Driving Point
CBE-142-SDP	Star Driving Point
CBE-190-DP	Standard Driving Point
CBE-190-SDP	Star Driving Point

Driving Heads



Rod Diameter mm	Part Number
12.7 / 13 mm	DHT15
14.8 / 15 mm	DHT15
17.2 / 19 mm	DHT19

Note: CBE and CBET based on Imperial Diameter.



Copper Bonded Earth Rod – Threaded

CBET



Rod Diameter (mm)	Part Number	Length (mm)
13	CBET-130-1400	1400
13	CBET-130-1800	1800
15	CBET-150-1800	1800
15	CBET-150-2400	2400
15	CBET-150-3000	3000
19	CBET-190-1400	1400
19	CBET-190-1800	1800
19	CBET-190-3000	3000

CBET Rods based on Imperial Diameter

Rod Diameter (mm)	Part Number
12.7	CBET-130-xxxx
14.2	CBET-150-xxxx
17.2	CBET-190-xxxx

Couplers for Threaded Rod



Rod Diameter (mm)	Part Number
13	CBET-130-COUPLER
15	CBET-150-COUPLER
19	CBET-190-COUPLER

Driving Stud for Threaded Rod



Rod Diameter (mm)	Part Number
13	DS-13
15	DS-15
19	DS-19



STE Series Stainless Steel Clad Rods

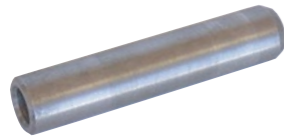
STE



Rod Length	13 mm Diameter	Pack/ Bulk Quantity	14 mm Diameter	Pack/ Bulk Quantity
1200	STE1312	10/500	STE1412	10/500
1440	STE1314	10/500	STE1415	10/500
1800	STE1318	5/500	STE1418	5/500
2400	STE1324	5/500	STE1424	5/500
3000	STE1330	1/50	STE1430	1/40

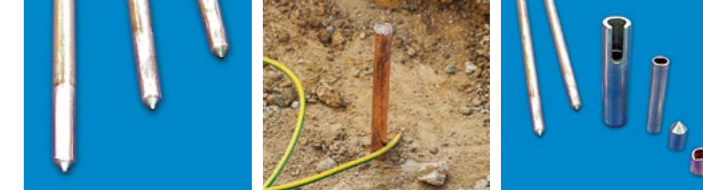
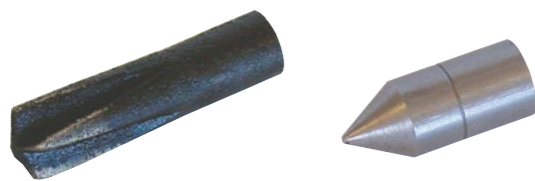
Stainless Steel Earth Rod Accessories

Accessories	Part Number	Quantity	Part Number	Quantity
Coupling	SCT13	10/100	SCT15	10/100
Point	DPT12	50/200	DPT15	50/200
Star Point	SDP12T	10/100	SDP15T	10/100



Driving Points

Part Number	Description
DPT12	Average Driving Point 13 mm
DPT15	Average Driving Point 19 mm
SDP12T	Hard Driving Point 13 mm
SDP15T	Hard Driving Point 19 mm



Connection Boxes

These enclosures provide a tidy means of protecting the connection of the main earth conductor to the earth rod. Manufactured from high strength aluminium alloy or polymer concrete, they are well suited to use in high traffic areas. Hinged covers allow easy access for inspection or testing.

ERB



ERB1 – Aluminium alloy casting



ERB3 – Polymer concrete



ERBP3 – Plastic

Part Number	Material	Dimensions	Entry holes	Load rating
ERB1	Aluminium	138 x 144 x 74 mm	2 x 19 mm	5000 kg
ERB3	Polymer Concrete	220 x 220 x 150	1 x 40 mm	Pedestrian
ERBP3	Plastic	300 x 300 x 207	1 x 70 mm	5000 kg

Earthing Enhancement Compounds

Features

- Stable, high conductivity providing long term low ground resistance.
- High expansion, low shrink characteristics.
- Non-toxic and non-corrosive.

Packaging

20kg non-tear, plastic lined bags.

Installation

1. Apply as a dry mix or pourable slurry.
2. Dry mix will yield a volume of approximately 0.0176 m³ (roughly 57 bags to the cubic metre).
3. Slurry will yield a volume of approximately 0.030 m³ when mixed with 20 to 25 litres of water (roughly 33 bags to the cubic metre).

EEC



Description	Composition	Standard
EARTHRITE	Bentonite, Gypsum, Sodium Sulphate	N/A
EARTH5050	Calcium, Bentonite, Natural Gypsum	Conforms to AS2239



Earth Rod Clamps

Single Conductor Clamps – Parallel

The Pinch and U-Bolt clamps are simple, robust and have a ‘V’ groove in the casting to accommodate the earthing cable.

Material: Copper alloy casting, bronze set screw or stainless steel U-Bolt and nuts.

ERC



Type GRC5



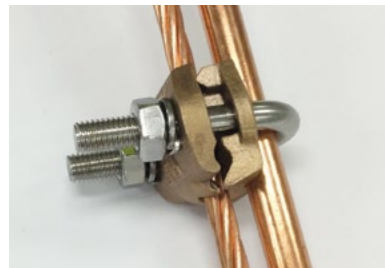
Clamp 210

Part Number	Pack Quantity	Rod Diameter (mm)	Conductor Size	
			CSA (mm ²)	Diameter (mm)
GRC5	100	13 - 15	10 - 35	4.05 - 7.65
CLAMP210	10/50	13 - 15	16 - 120	5.10 - 14.21
EP1	40	17 - 19	16 - 120	5.10 - 14.21

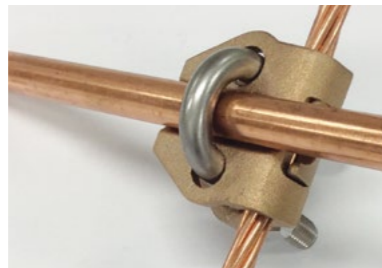
Single Conductor Clamps– Versatile

The Single Conductor clamps are designed for either parallel or right angle connections.

Material: High copper content alloy castings with stainless steel U-Bolt, spring washers and nuts.



Parallel Connection



Right Angle Connection



Right Angle Connection

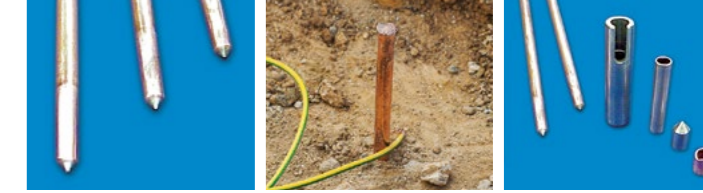


Type GB1



Type GB2

Part Number	Pack Quantity	Rod Diameter (mm)	Conductor Size	
			CSA (mm ²)	Diameter (mm)
GB1	25	13 - 19	16 - 35	5.1 - 7.7
GB2	20	13 - 19	50 - 120	8.9 - 14.2
GB3	10	13 - 19	150 - 185	15.7 - 17.6
EL21090	10	12 - 15	35 - 120	7.6 - 14.2



Multi-conductor Clamps

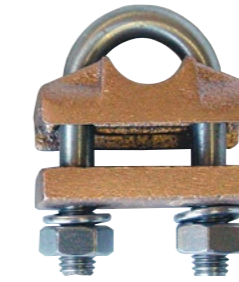
The EP and ET series clamps are useful for multiple conductor earthing installations.

Suitable for two earth conductors parallel to a rod and two or three earth conductors at right angles to a rod.

Material: High copper content alloy castings with stainless steel U-Bolt, spring washers and nuts.



EP3



ET1

Earth rod clamp configurations

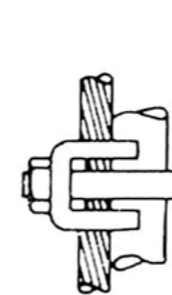


Image No. 1

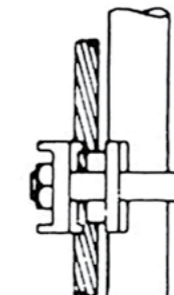


Image No. 2

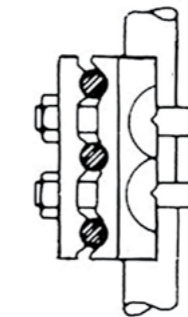


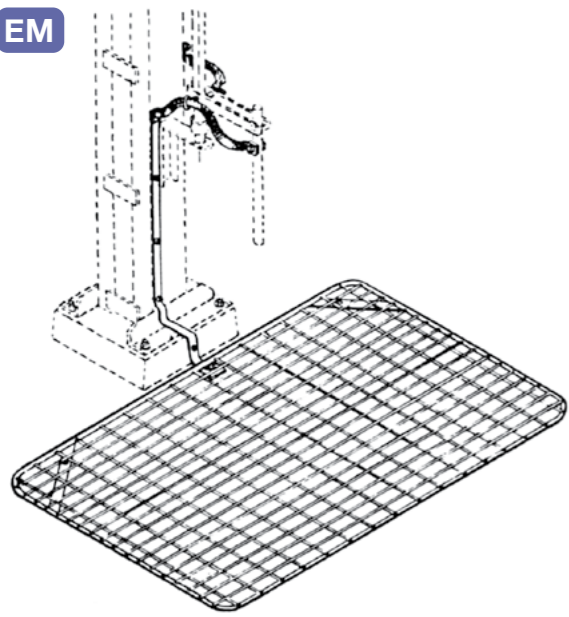
Image No. 3

Part Number	Pack Quantity	Rod	Conductor Size		No. Of Conductors	Image No.
			CSA (mm ²)	Diameter (mm)		
EP3	20	13 - 19	16 - 35	5.1 - 7.7	2	1
EP4	20	13 - 19	50 - 120	8.9 - 14.2	2	1
ET1	25	13 - 19	16 - 35	5.1 - 7.7	2	2
ET2	15	13 - 19	50 - 120	8.9 - 14.2	2	2
ET4	10	13 - 19	50 - 120	8.9 - 14.2	3	3

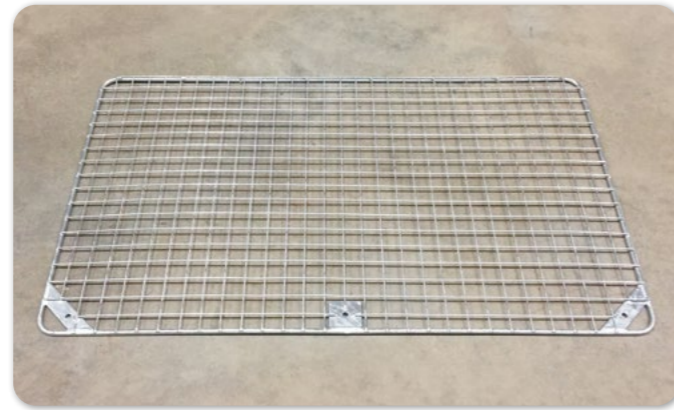


Earth Mats and Installation Kits

EM



Earth Mat and Kit



Earth Mat

Part Number	Material	Size (mm)	Mesh Size (mm)
Earthmat	Galvanised Steel	1500 x 900	75 x 60
Earthmat-1	Galvanised Steel	2500 x 1200	75 x 50 x 5
Earthmat-2	Galvanised Steel	2500 x 1000	75 x 50 x 5
Earthmat-3	Galvanised Steel	1500 x 1000	75 x 50 x 5
Earthmat-4	Galvanised Steel	1800 x 1200	75 x 50 x 5

Note: Contact PLP for other earth mat sizes available.

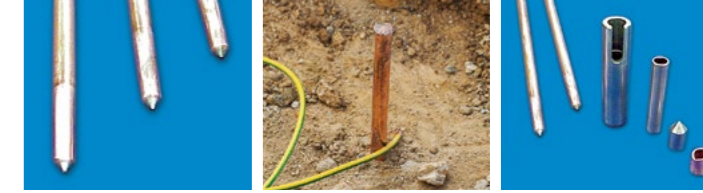
KITY	Installation kit for type RDB rotary switches with earth switch.
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Installation of galvanised steel earth mat and kit



Kit for type RDB rotary switches



Earthing Bond

For commercial earthing installations, the Earthing Bond system provides an earth connection welded to the steel reinforcement, providing a stable and low resistance path to earth.

EB



Earthing Bond



Earthing Bond on Ribbar

Part Number	Bonding Conductor (mm ²)	Length of Bonding Conductor	Lug Diameter	Fault Rating kA for 1 Sec	Terminal Thread and Depth
C70-*	70	3m	Ø12 mm	5	M10 x 20 mm
C70-1-*	70	1m	Ø12 mm	5	M10 x 20 mm
C95-*	95	3m	Ø16 mm	8.5	M10 x 20 mm
C95-1-*	95	1m	Ø16 mm	8.5	M10 x 20 mm
C120-*	120	3m	Ø20 mm	10.5	M10 x 20 mm
C120-1-*	120	1m	Ø20 mm	10.5	M10 x 20 mm

Note: * Add -12 for 12 mm terminal thread.

Earth Bonding Clamp – For Permanent Earth Bonds

EBC



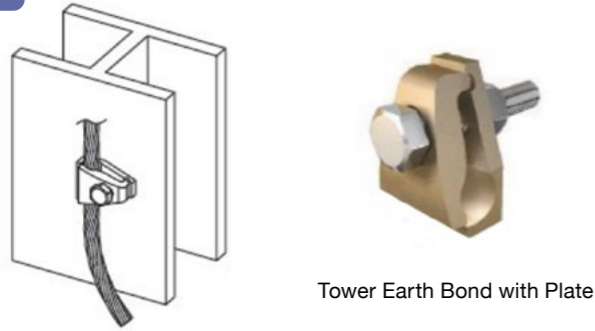
- Aluminium body
- Stainless fasteners

Part Number	Diameter Range (mm)
EBC-0719	17 - 19
EBC-1937	19 - 37



Tower Bond

TB



Tower Earth Bond with Plate

Tower Bond for bonding copper cables or wires to steel structures.

Material: High Grade Copper Alloy, Bolt: Stainless Steel – SS304

Conductor Range (mm ²)	Channel Thickness (mm)	Bolt Size	Part Number
16 – 35	10	M10	TEB1635
50 – 70	10	M10	TEB5070
95 – 120	10	M10	TEB95120
185 – 240	10	M10	TEB185240

Earth Stubs

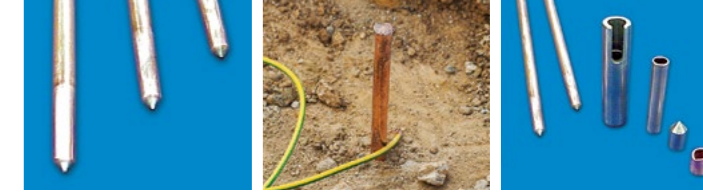
ESB



Earth Stubs Brass

Part Number	Length	Diameter	A/F	Thread Depth	Thread Size
ESB-M12-1	80 mm ²	25 mm	30 A/F	40 mm	M12
ESB-M16-120	120 mm ²	25 mm	30 A/F	50 mm	M16

Other custom versions are available upon request.



Copper Clad Steel Wire Conductor

SC/CU



Copper Clad Steel Wire Conductor

Copper Clad Steel (CCS) wire conductor comprises strands of single copper clad steel wire.

CCS has the strength of steel and the conductivity and corrosion resistance of copper. Other advantages include low density and low cost.

The copper clad steel conductor is an excellent replacement for traditional pure copper wire and there is also less theft as the copper cannot be recovered by scrap dealers.

Advantages of Copper Clad Steel Conductors

- Higher tensile strength than pure copper wire conductor
- 13% lighter than pure copper wire conductor
- Less expensive than pure copper wire conductor
- Reduced incidence of copper theft
- Reduced production costs while ensuring the same quality

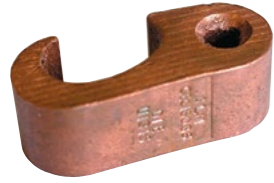
Part Number	CSA (mm ²)	Stranding	Overall Diameter	Weight (kg/km)
SC/CU-070-19	70 mm ²	19/2.14 mm	10.60 mm	550
SC/CU-095-19	95 mm ²	19/2.52 mm	12.60 mm	766
SC/CU-120-19	120 mm ²	19/2.84 mm	14.00 mm	980



Compression Earth Connectors

A heavy duty compression connector for earth rods and conductors

CEC



CEC 6



CEC070



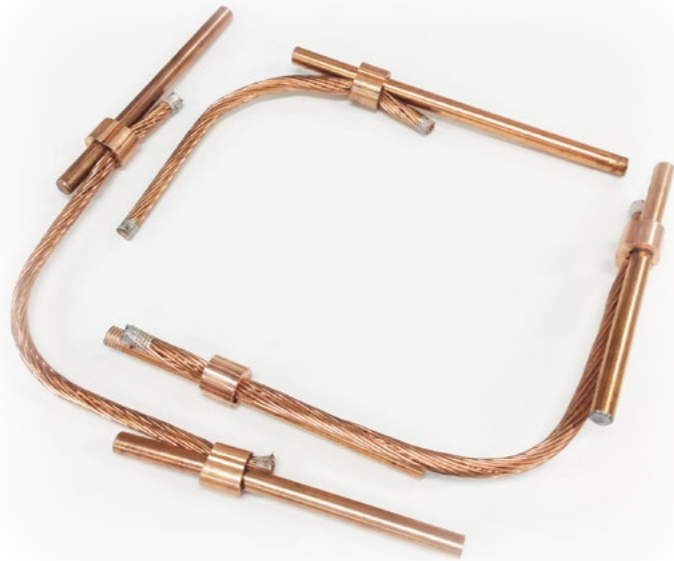
CEC095

PLP Compression Earth Connectors (CEC) were specifically developed to dissipate surges of high fault current quickly and effectively to limit any potential damage to equipment, and to safeguard personnel close to that equipment.

Manufactured from pure wrought copper, the CEC connector is fitted with standard compression tools to form a dependable, tamper-proof joint from conductor to earth rod or buried earthing cable.

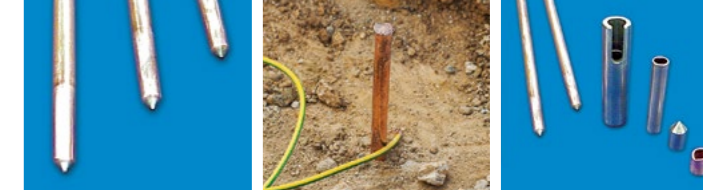
Earthing Grid Applications

By joining two Compression Connectors with the same or different part numbers, various combinations of conductor size and grid connections are possible. This enables a quick and economical assembly.



Features and Benefits

- Simple installation – one crimp from a standard compression tool.
- Connector design – current carrying capacity greater than that of the conductor.
- Corrosion resistant – identical material to the conductor eliminates problems caused by electrolytic corrosion and the corrosive effects to some soil.
- Pre-coated with Coppalube – a specially formulated jointing compound heavily laden with copper particles to increase the mechanical and electrical integrity of the connection, exclude moisture and resist rotation of the connector on the earth rod.
- All weather application – this connector may be installed in damp or fire risk areas with no adverse effects on the joint or the environment.
- Easy identification – each CEC connector is clearly stamped with the appropriate catalogue number, conductor size and installation die reference.
- Individually packed – for cleanliness and ease of handling.



Installation Notes

Standard “C” head compression tool of minimum 12 tonne capacity is recommended.

Full compressive force of the tool is utilised as application is not limited by die halves meeting, but the pressure release valve in the tool.

Regular use of a load test cell to check compression performance of the tool is recommended.

C Style Crimps

Part Number	Conductor Combination (mm ²)		Die Set Part Number	Profile
CEC070	35	35	DUOT	C
	50	35	DUOT	C
	50	50	DUOT	C
	70	50	DUOT	C
	70	70	DUOT	C
CEC095	70	95	DU1315	C
	95	95	DU1315	C
CEC12070	120	70	DU1315	C
CEC120	95	120	DU1315	C
	120	120	DU1315	C

Profile 6 Crimps

Part Number	Open Section	Tap Conductor Diameter (mm)	Tap Conductor (mm ²)	Profile
CEC15035	Conductors 50-120 mm ² OR	8.4	25-40	6
CEC15070		11	50-70	6
CEC15120	Earth Rods 13-15 mm Diameter	15	95-120	6
CEC15150		16.5	120-150	6

Die Set Part Number for Profile 6 Crimps is DU1315

E Style Crimps

Part Number	Conductor Combination (mm ²)		Die Set Part Number	Profile
CEE3535	25	35	DUOT	E
CEE7070	50	70	DUOT	E
CEE120120	95	120	DU1315	E
CEE240240	185	240	DU1315*	E



Exothermic Welding

Exothermic connections are the best bond for copper and steel as they provide an irreversible molecular bond that is far superior to any other type of connection.

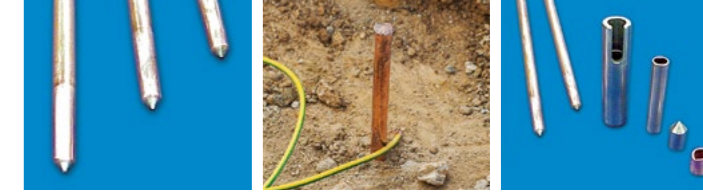
Although the temperatures reached to achieve this weld are extremely high, the process is instant when compared to brazing, soldering and all types of mechanical connections.

Exothermic welding connections provide:

- Permanent connection, unaltered throughout the facility's lifetime.
- A cross-sectional area that in most cases is twice that of the conductors.
- A connection without contact pressures that tend to loosen and corrode over time.
- High electrical current, equal to or higher than the conductors. On short-circuit tests, the conductors melt before the exothermic connection.
- Capability to withstand repeated high electrical currents without any wear or erosion
- Quick and easy visual inspection.

The Exothermic system is suitable for welding copper to the following materials:

- Mild steel
- Stainless steel
- Copper clad steel
- Galvanised steel
- Copper
- Bronze
- Brass
- Monel Metal



Apliweld® Secure+

PLP supplies the Apliweld® Secure+ exothermic system that uses a unique tablet compound for every weld type, eliminating the traditional multiple powders required for different welds.

This unique tablet eliminates all explosive and flammable materials, whilst the robust electronic ignition with remote Bluetooth activation offers the user the safest exothermic welding system on the market.

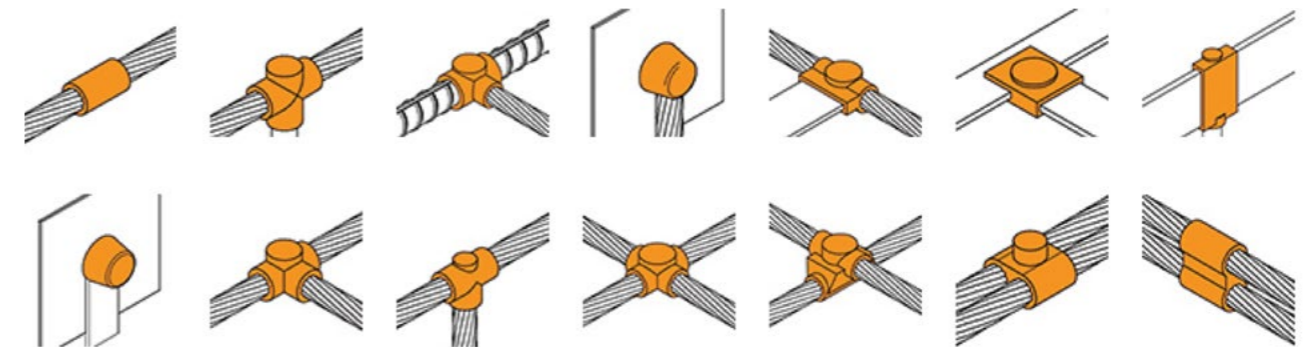


Apliweld® Secure+ is the safe, versatile and reliable exothermic system for:

- Electrical systems earthing
- Busbar connections
- Energy transport and communications
- Industrial equipment earthing

Apliweld® Secure+ exothermic connections are:

- Self-contained
- Use zero flammable and explosive materials
- Does not require flammable and explosive gas cylinders
- Does not require external power source



Illustrated above are the various types of connections used in earthing systems above and below ground. Contact PLP for more information.



Airport Earthing Terminal

AET



Part Number: AET1918 (Surface)

Part Number: AET1918F (Flush)



Static electricity earthing terminals

Type AET electrodes provide for the earthing of airport tarmac areas where any generation of static electricity could be hazardous, for example aircraft refuelling, servicing and cargo loading areas.

The heavy duty capping on the terminal has a ribbed design providing a fast and positive earthing connection by means of earth lead connector clips.

Material: Solid steel core overlaid with copper bonding and a heavy bronze cap.

Length: The standard length is 1800 mm, other lengths are available via special order.

Installation Procedure: Drive electrode into ground to required depth. Remove protruding portion of rod above cap and finish flush.

Methods of installing Earth Rods

Earth rods can be driven into the ground by either a hand held hammer or mechanically operated hammer. When driving is difficult, the only option is to drill a hole to take the earth rod.

Where holes are drilled, the gap between the earth rod and wall of the drilled hole is commonly filled with a water expanding earthing compound such as EARTHRITE. This is a mixture of Bentonite and Gypsum with a small amount of Sodium Sulphate to reduce the resistivity of the backfill.

Driving Methods

Earth rods up to 3 m long can be driven satisfactorily in one length. Where rods have to be longer than 3 m, it is preferable to use one of the PLP extendable series earth rods.

There are a variety of methods for driving earth rods into the ground from the simple hand held hammer to power operated mobile rigs. The method used is dictated by the nature of the soil and terrain, the length of drive needed to secure minimum resistance, and the number of rods to be driven.

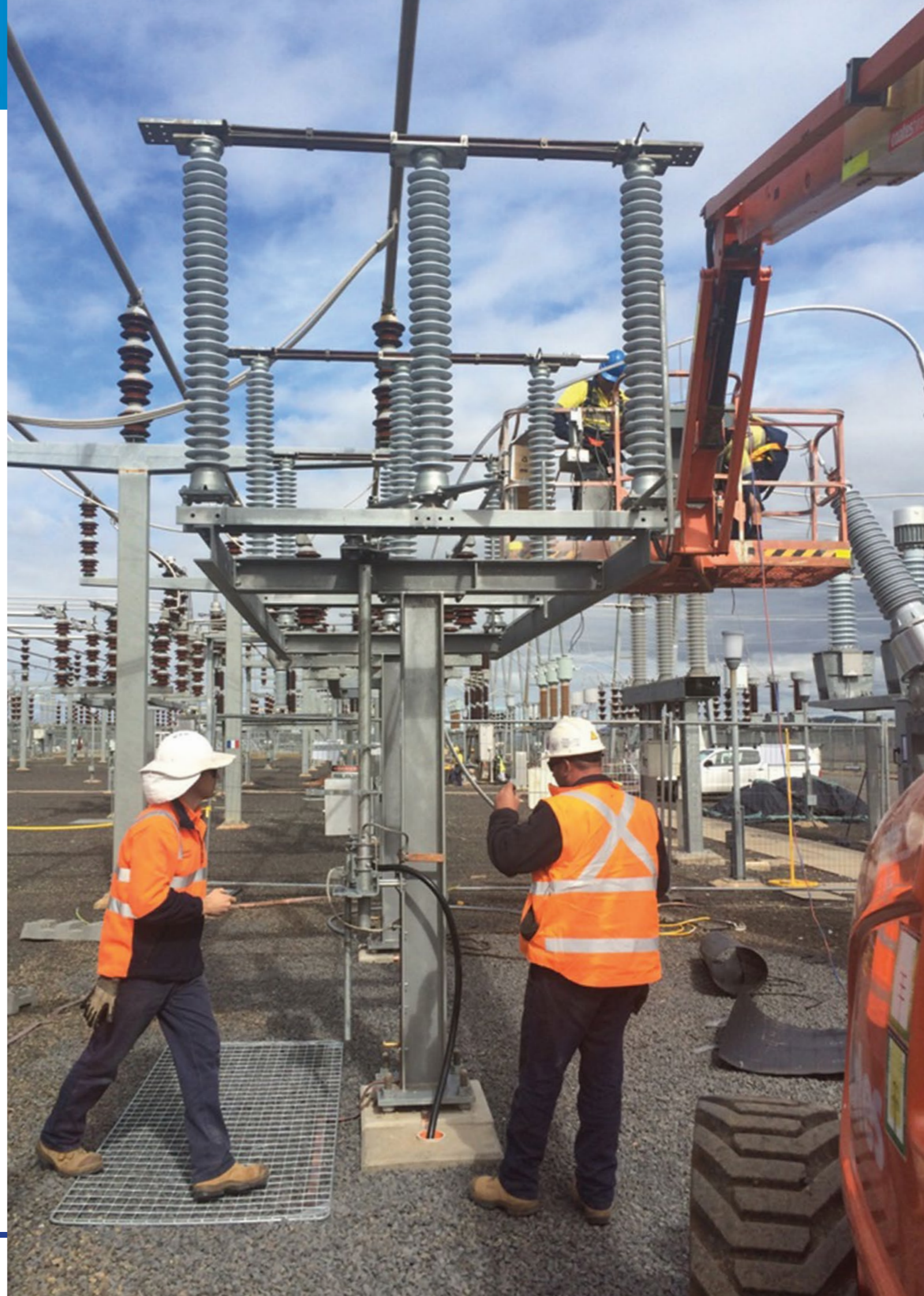
The Hand Held Hammer is an effective method for most domestic installations. The earth rod should be driven lightly using a hammer of around 1.5 to 3 kgs, keeping the force of the blows axial to the rod to obviate the risk of whipping.

A large number of light hammer blows are more effective, and preferable, to heavy blows which are destructive to the metal and can cause deformation to the rod end as well as bending and possible splitting. The fitting of a guide to the rod will assist rigidity and reduce whipping when the rod comes up against resistance to penetration.

The Mechanical Hammer can be one of three types, electric, pneumatic or petrol engine driven. These power operated aids are used when soil conditions are not suited to hand driving and when long earth rods have to be driven to great depths.

Driving Method Precautions

Driving an earth rod with a mechanical hammer calls for special care to ensure the force of the blows are axial to the rod. While it may be possible to maintain this when manually using a light type hammer such as an electric Kanga, it is advisable to use rig mounting to ensure correct driving, especially when it comes to driving the longer earth rods.



PLP's precision-engineered products and technical services provide support for critical energy networks and is trusted by utility providers worldwide for performance and longevity.

Operating as a united global organisation with facilities in more than 20 countries, PLP delivers quality products and unparalleled service for our customers.



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