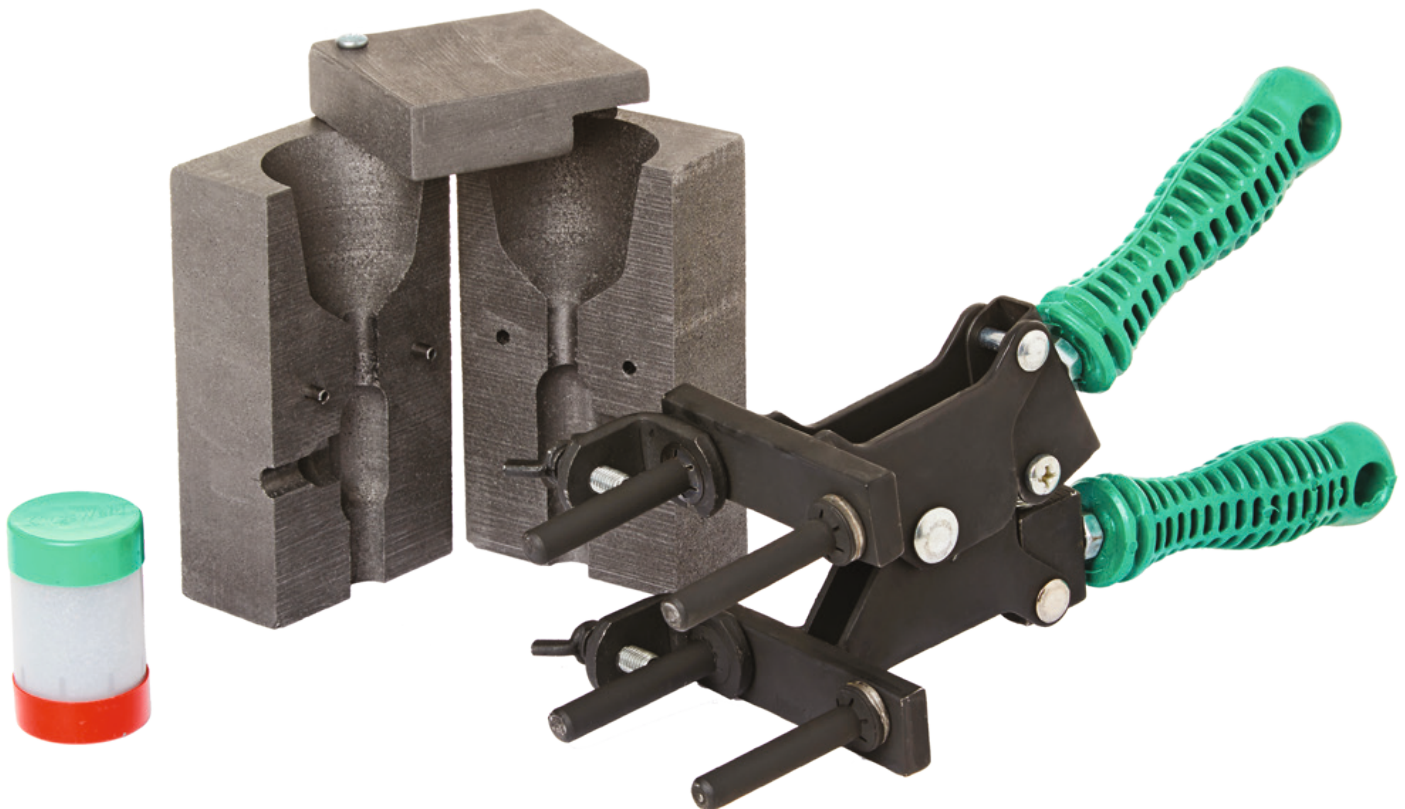


Introduction to exothermic welding	WELD:3
The GreenWeld process	WELD:4
Making a GreenWeld connection	WELD:4
The product (weld metals and moulds)	WELD:6
How to use this catalogue	WELD:7
Mould care guide and inspection	WELD:7
Selector charts	WELD:8
Accessories	WELD:41
Handle Clamps	WELD:42
Earth Points	WELD:43
Legend	WELD:44



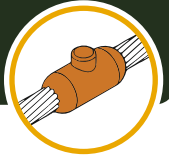
“Exothermic” is a chemical term used to describe a reaction that produces heat.

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

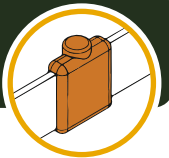
WELD:19 - 21



BAR TO BAR

pages

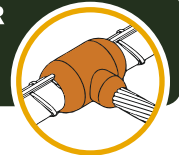
WELD:22 - 24



CABLE TO REBAR

pages

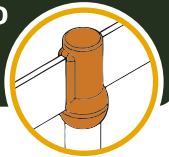
WELD:25 - 28



BAR TO GROUND ROD

pages

WELD:29 - 31



CABLE TO SURFACE

pages

WELD:32 - 35



BAR TO SURFACE

pages

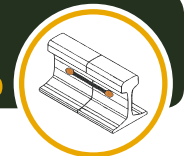
WELD:36 - 37



RAIL

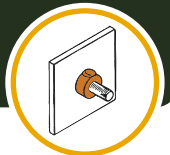
pages

WELD:39 - 40



STUD TO SURFACE

page WELD:38



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 GreenWeld 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 GreenWeld exothermic connection is the best choice, especially in safety critical environments where reliability, longevity and current carrying capacity are paramount.



The GreenWeld process

The GreenWeld exothermic process is a simple, self-contained, efficient way of welding copper-to-copper or copper-to-steel.

Each connection uses a GreenWeld 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.



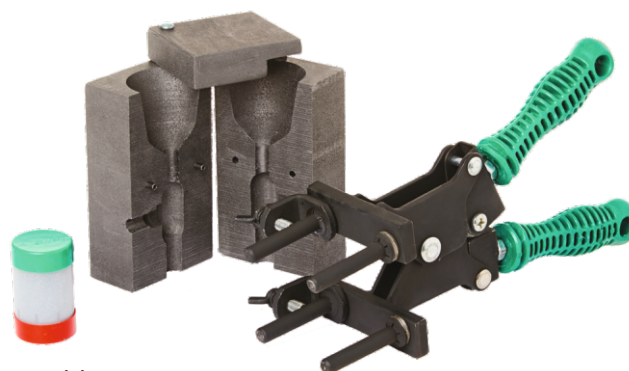
Making a GreenWeld connection

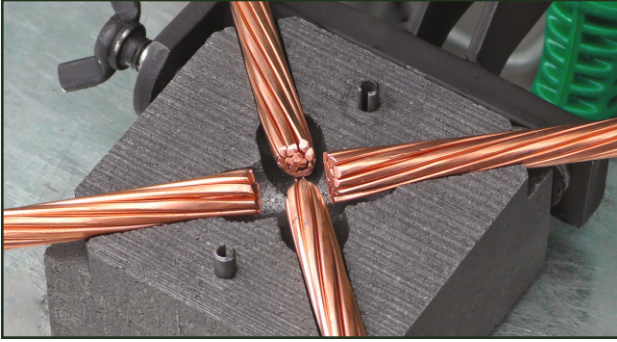
Items required to make a connection:

- GreenWeld mould
- Handle clamp
- Weld metal
- Flint gun

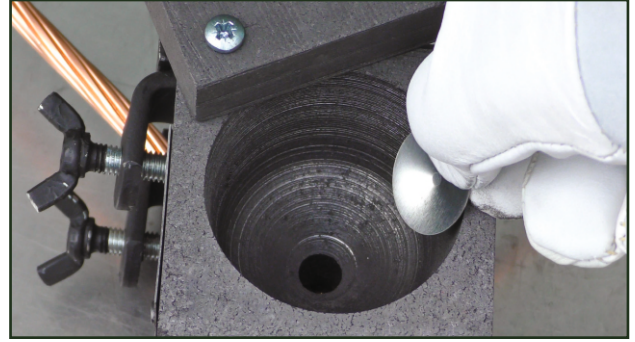
Before making a GreenWeld connection:

- 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 greenWeld 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 GreenWeld mould and check it will open & close freely.
- Make sure that the GreenWeld 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.





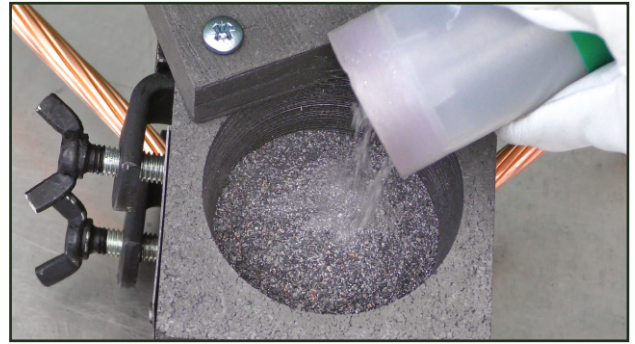
- 1 Position cleaned conductors in the mould**
Make sure the mould is dry & moisture-free by pre-heating or making a test connection.



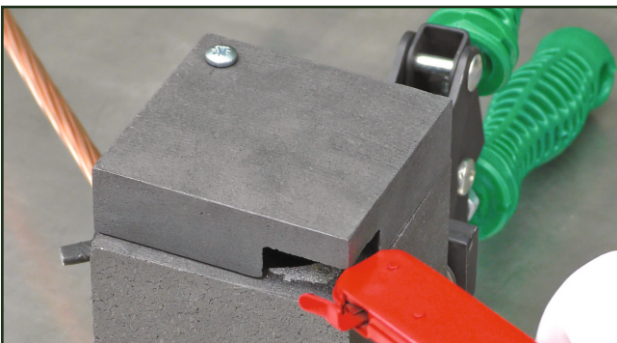
- 2 Place the metal disc in the bottom of the mould crucible**
Discs are supplied with the weld metal.



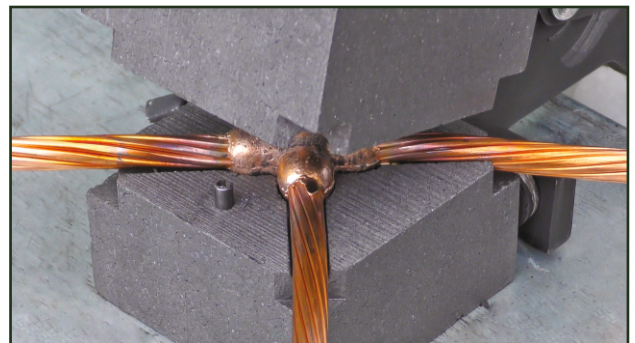
- 3 Pour weld metal into the mould crucible**
Weld metal is under the green cap.
Pour all weld metal into the crucible.



- 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 GreenWeld 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

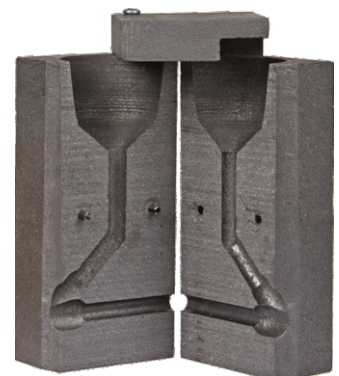
Weld metals

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.



GreenWeld moulds

The GreenWeld 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 Weld 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 GreenWeld 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.

[A] [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

GreenWeld 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.

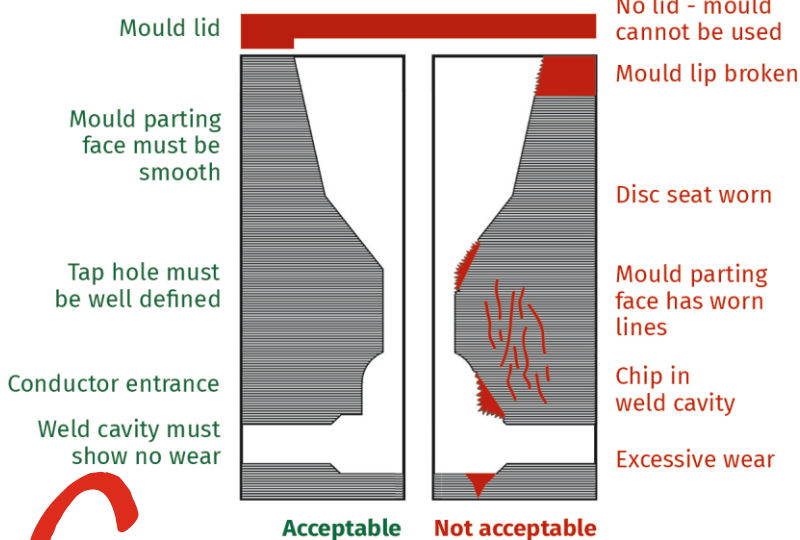
- Always clean the mould after every weld
- Only use GreenWeld cleaning equipment (soft brush) to clean the mould
- Keep the mould dry and away from moisture
- Do not hit or drop the mould
- When not in use, keep the mould in its packaging for protection
- Try not to hit the edges of the mould with the 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).

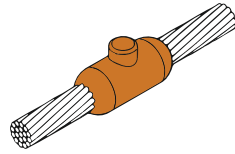
Regular checks help keep moulds in good condition.

Vertical split mould

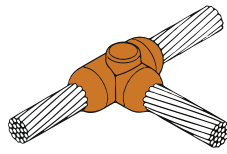


Selector charts

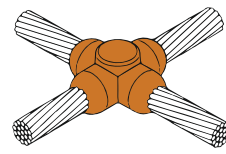
Cable to cable



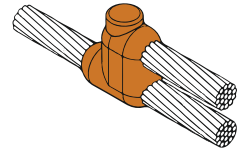
CC1 - WELD:10



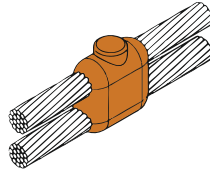
CC2 - WELD:11



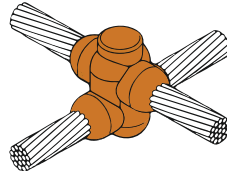
CC4 - WELD:12



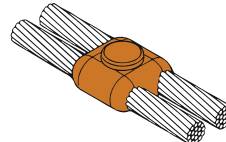
CC6 - WELD:13



CC7 - WELD:14

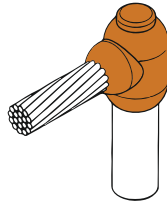


CC11 - WELD:15

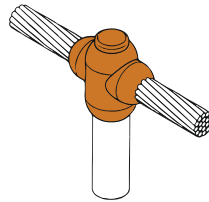


CC14 - WELD:15

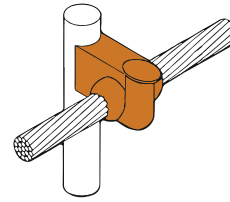
Cable to ground rod



CR1 - WELD:16

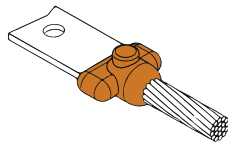


CR2 - WELD:17

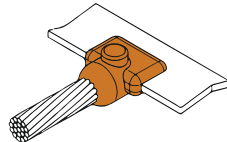


CR3 - WELD:18

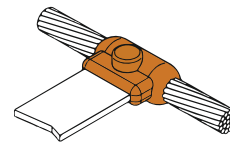
Cable to bar



CB1 - WELD:19

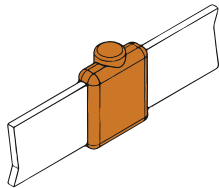


CB4 - WELD:20

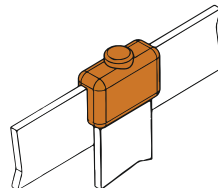


CB5 - WELD:21

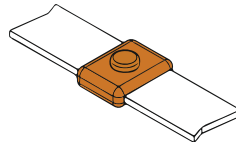
Bar to bar



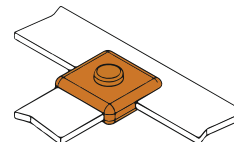
BB1 - WELD:22



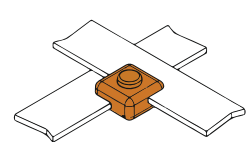
BB3 - WELD:22



BB7 - WELD:23

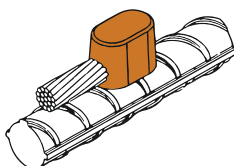


BB14 - WELD:23

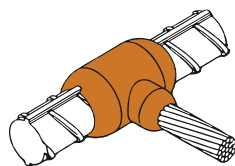


BB41 - WELD:24

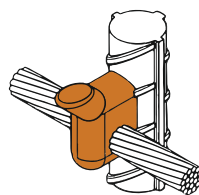
Cable to rebar



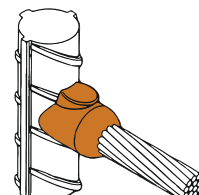
CRE1 - WELD:25



CRE2 - WELD:26



CRE3 - WELD:27

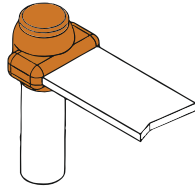


CRE6 - WELD:27

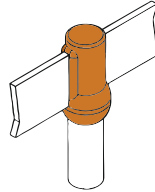


Selector charts

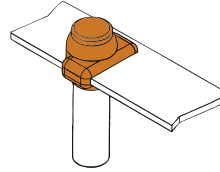
Bar to ground rod



BR1 - WELD:29

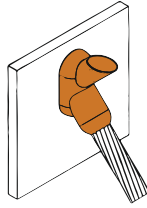


BR2 - WELD:30

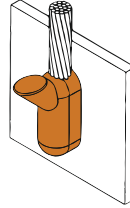


BR7 - WELD:31

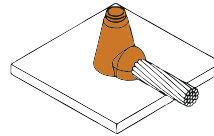
Cable to surface



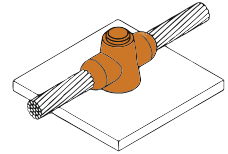
CS3 - WELD:32



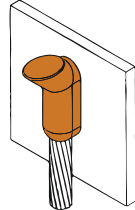
CS7 - WELD:32



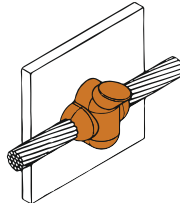
CS8 - WELD:33



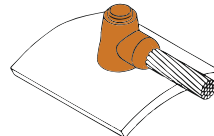
CS9 - WELD:33



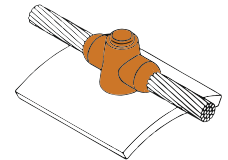
CS25 - WELD:34



CS27 - WELD:34

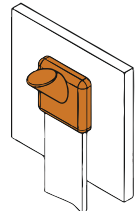


CS32 - WELD:35

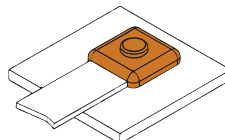


CS34 - WELD:35

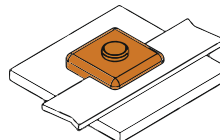
Bar to surface



BS1 - WELD:36

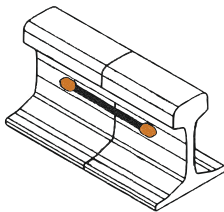


BS2 - WELD:36

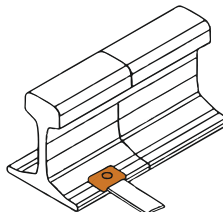


BS3 - WELD:37

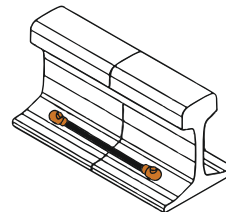
Rail



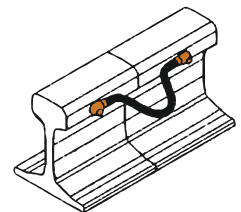
R4 - WELD:39



R6 - WELD:39

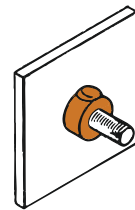


R10 - WELD:40

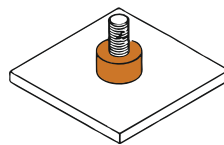


R12 - WELD:40

Stud to surface



RS1 - WELD:38



RS2 - WELD:38



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 ²
HD50	Hammer die 50mm ²
HD70	Hammer die 70mm ²
HD97	Hammer die 97mm ²
HD120	Hammer die 120mm ²
HD150	Hammer die 150mm ²
HD185	Hammer die 185mm ²
HD240	Hammer die 240mm ²
510P	Empty tool box
CAP	Cathodic weld cap (for MCPT joint)



Safety accessories

Part number	Item description
SAFEG	Safety goggles
SAFEGL	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

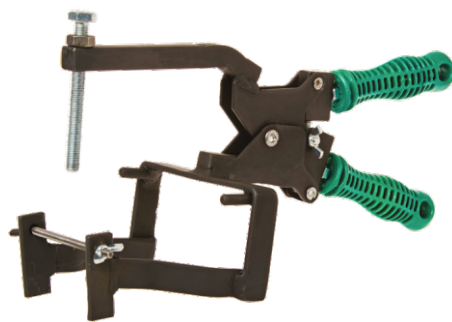


All essential safety and operational items to carry out an exothermic weld. Each toolkit (order KWTKIT) contains the items listed in the table above.

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

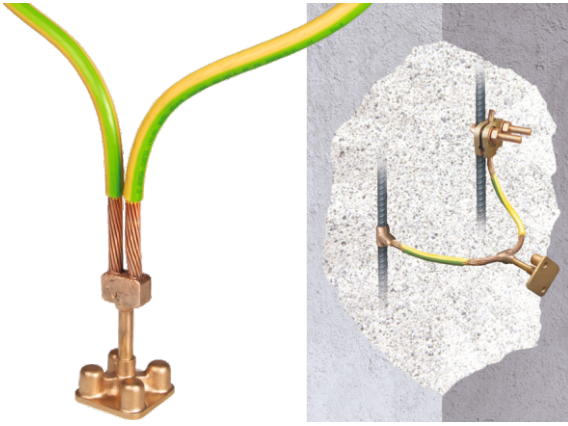
Part number	Item description
HCRCD300	Rail crown double mould Support Clamp (157 to 320mm)
HCRCD370	Rail crown double mould Support Clamp (175 to 260mm)
HCRS	Rail crown single mould Support Clamp
HCRW	Rail web Handle Clamp
HCCP75	Rail foot Handle Clamp
HCCP100	Rail foot Handle Clamp



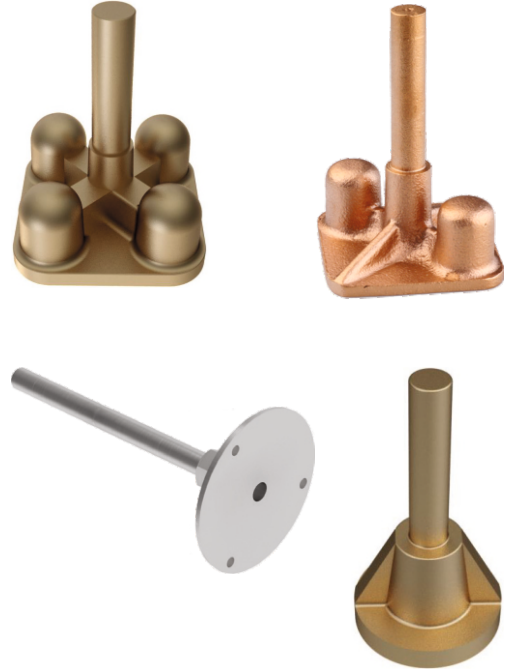
Earth Points

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.



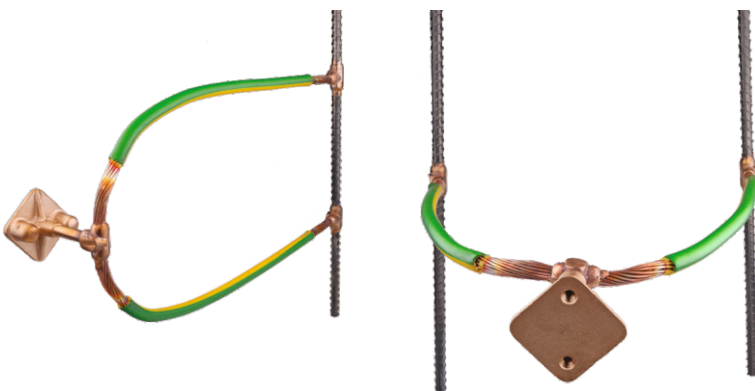
Earth Points (with green/yellow tail)



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 Greenweld 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 GREENWeld connection.

A 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.



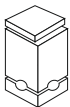
Weld metal

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 greenWeld 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.

Technical Data Specification

Exothermic powder

Chemical composition - 75 % copper
- 25 % Aluminium

Mechanical strength - 15 Kn or higher
Resistance Test - As per ASTM B 193
Salt spray test - 66.8 hours (passed)
As per IEEE 837 & ASTM B 117



Exothermic Mold

Chemical composition - Synthetic Graphite
Grade - ACF - 10 Q - MG
Density of Graphite - 1.77 gms / CC
Weight of Mould - 3 kgs approx
Operating temp - 1600 degree centigrade
Minimum numbers of joint - 50 Nos.
CAS Number - 7782-42-5

