

# P O R T A B L E E A R T H I N G



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## PORTABLE EARTHING DEVICES (PEDs)

### General

Portable Earthing Devices (portable earths) are personal protective devices which are used to protect electrical workers if the high voltage equipment they are working on is re-energised. In the event that a conductor is energised inadvertently, the aim of a portable earth is to:

- + provide a controlled path for the short-circuit current away from an exposed worker to allow short-circuit detection equipment to operate and disconnect supply quickly, and
- + to minimize the voltage rise and reduce the chance of electric shock occurring.



In Australia and New Zealand, portable earths must be used when working on high voltage (>1000V) networks. They are not generally required for work on low voltage networks.

### Legislative Requirements

In Australia and New Zealand, electrical safety laws apply to a broad range of electrical work and apparatus. These laws encompass a number of concepts in legislation to ensure the safety of people and plant when working on electrical apparatus.

Four concepts that are related to the use of portable earths are:

1. It is illegal to perform work on high voltage electrical equipment without a system of earthing in place unless live working procedures are being used,
2. Safety clearance exclusion zones apply to energised and de-energised electrical apparatus at all times unless it has been disconnected from supply, tested, and earthed,
3. Employers are obliged to provide safe systems of work including portable earths for employees to ensure their electrical safety when working on high voltage networks, and
4. Employees who are required to use portable earths must use them when required and ensure that they are used and fitted properly, and are adequate for the job.

Harsh penalties apply for breaches of legislation.

### IEC Standards for Portable Earths

Within Australia, there is no particular national standard that applies to the development and use of portable earthing systems. However, the International Electrotechnical Commission (IEC) provides a suitable standard that can be adopted to provide safe and reliable portable earthing systems. The IEC is a world-wide organization for standardization and seeks to promote international co-operation on issues concerning electrical and electronic fields.

### IEC Standard 61230

IEC Standard 61230 applies to portable equipment for earthing and short-circuiting. This document sets standards for the design of complete portable earth systems which includes clamps, cables, type tests of one or more items representative of the production, short circuit tests, sampling tests and routine tests. The use of an IEC standard which is adopted and exercised daily around the world for earth systems provides confidence for workers and business that these systems will protect personnel in the event that the work area is inadvertently energised.

## Type Testing

Type testing is a process which is recognized as the best means to ensure that a design will do the job. Sicame Australia has the benefit of over 20 years of designing and supplying portable earth systems to industry around Australia that meet or exceed IEC 61230. A key feature of these systems is that the components of each type of earth system design have been type tested according to the requirements of IEC61230.

One of the most important features of any earthing system is its thermal and mechanical abilities to withstand the heat and dynamic mechanical forces that are created during a fault without being destroyed. Type testing to simulate these conditions is critical to ensure that any given design will not fail under conditions that simulate its design rating.

## Voltage Ratings

Portable earths are not designed for any particular voltage. However, legislation requires that safety clearance exclusion zones must apply during the earthing process. Therefore, the length of any operating stick which is used to apply a portable earth must be longer than the minimum safe distance to the apparatus as defined by the normal energised voltage and the safety exclusion zones where it will be used.

## Current and Time Ratings

Portable earths are designed, manufactured and rated to a maximum energy which is determined by a specific current measured in amps for a specific time measured in seconds. For example, a typical rating is 25,000 amps for 0.5 seconds. During a short-circuit fault current, a portable earth must be able to withstand a maximum amount of electrical energy without failing. There are two mechanisms working together by which a portable earth may fail. These are:

- 1. Thermal mechanism** - High temperature rise of the conductor and sheath caused by the current which will soften and melt the cable strands and the sheath, and
- 2. Magnetic mechanism** - Enormous mechanical forces caused by the magnetic field of the current which will tend to tear the cables apart and also tear them from lugs, and may even break lugs and clamps.

These two mechanisms combine to destroy a portable earth set as a result of high temperatures that soften the cable conductor strands which reduce its ability to withstand the mechanical forces that attempt to pull it apart.

It is therefore critical that any portable earth is rated to a higher short circuit current than the prospective short-circuit and earth fault levels that are possible on the network in which it will be used.

Within Australia and New Zealand, most supply utilities operate high voltage networks that use short circuit protection systems which will detect and disconnect a short-circuit current between about 0.3 seconds and 1 second. For this reason, typical ratings of portable earths are specified for a standard time of either 0.5 seconds or 1 second.

Generally, Sicame Australia carries out type tests of its designs to 0.5 second ratings in favour of 1 second ratings. The reason for this is that a 0.5 second type test requires a test current that is  $1.414 (= \sqrt{2})$  times higher than the test current for a 1 second rating of the same energy rating. Consequently, this increases the dynamic mechanical forces by a factor of 1.414 compared to a 1 second fault rating.

For this reason, although it seems counter-intuitive, type tests which meet a 0.5 second rating are much tougher to pass than a 1 second rating.

A portable earth is made from a number of components such as cable, lugs, clamps, and other connectors which usually have different fault ratings. The overall fault rating of a complete portable earth is determined by the component with the lowest fault rating used in it. Clamps which are used in any given portable earth are generally rated higher than the cable and lug combination.

There is a wide range of short circuit fault levels in supply networks, and users must consider the configuration and resulting weight of any portable earth they need. Portable earths must be carried to the work site and fitted to apparatus which, due to normal construction practices for overhead electricity supply networks, is usually at height. The overall weight and frequency of use of any portable earth is then a very important factor in the choice of configuration and use of components.

To meet these requirements, Sicame Australia has standardized its range of portable earths around three different aluminium cable sizes to deliver four different ratings as determined by the cable used in a portable earth. The fourth rating of 45kA for 0.5 seconds is achieved by connecting two cables in parallel so that each cable carries half of the fault current in the event that it is energised.

1. 10,000 Amps for 0.5 seconds, (10kA/0.5secs)
2. 16,000 Amps for 0.5 seconds, (16kA/0.5secs)
3. 25,000 Amps for 0.5 seconds, (25kA/0.5secs)
4. 45,000 Amps for 0.5 seconds, (45kA/0.5secs)

### Conversion of Current and Time Ratings

Note that current ratings for 0.5 seconds can be converted to a thermal (heat rise) equivalent 1 second rating by dividing the current rating for 0.5 seconds by 1.414. For example, a rating of 10kA for 0.5 seconds is thermally equivalent to 7.1kA ( $=10\text{kA}/1.414$ ) for 1 second. This is a thermal equivalent rating only and not a mechanical force equivalent rating because although a test current of 10kA for 0.5 seconds will transfer the same amount of electrical energy in that time, the mechanical forces produced by 10kA will be greater than those produced by a lower current of 7kA by a factor of 1.414.

If required by a customer, portable earths that have been type tested and rated to a 0.5 second rating (say, 10kA for 0.5 seconds) can be labeled with a 1 second rating because for type testing purposes, the test current required for 1 second is lower than a 0.5 second rating. However, as explained above, a 1 second rating cannot be converted to a 0.5 second rating because the test current required for 1 second would be lower than that required for a 0.5 second rating.

### Aluminium Cables

For the benefit of the worker who must lift and attach portable earths, Sicame Australia uses multi-stranded aluminium cables in a wide range of lightweight earth sets designed to reduce the risk of back and other strain injuries. These cables are covered in a distinctive yellow PVC sheath for high visibility.

Earth set configurations for almost any type of installation, including overhead and underground networks, and substations can be designed. They have been tested to 0.5 second ratings to meet IEC-61230.

Details of aluminium cables made by Olex in Australia are in table 1 below.

Rating for 0.5 second	Conductor Area (mm sq)	No. of Strands/Strand diameter (mm)	PVC V75 Sheath	OD(mm)	ID(mm)	Wt (kg/m)
10kA	55	570	Yellow, Black stripe	12.9	10.7	0.22
16kA	85	874	Yellow, Orange stripe	15.4	13.3	0.32
25kA	130	1332	Yellow	18.5	16.4	0.47
45kA	2x130	2 x 666/0.5	2 x Yellow	18.5	16.4	0.94

### Copper Cables

Copper cables made by Catu in France can also be supplied in those cases where customers specifically require portable earths that are made using copper cables. These cables have been tested by Catu to 1 second ratings. They are available in two types of sheath, either transparent PVC, or transparent silicon. The transparent silicon sheath cables have been tested to 1 second ratings under IEC-61230.

Details of copper cables with silicon sheaths to IEC-61230 made by Catu are in table 2 below.

Rating for 1 second	Conductor Area (mm sq)	Silicon Sheath	OD(mm)	Wt (kg/m)
3.5kA	16	Transparent	5.6	0.156
6kA	25	Transparent	7.5	0.275
8kA	35	Transparent	9	0.386
12kA	50	Transparent	10	0.545
16kA	70	Transparent	12	0.768
20kA	95	Transparent	14	0.800
30kA	120	Transparent	17	1.280
40kA	150	Transparent	19	1.630

## CATU Electrical Safety Equipment

CATU is a European manufacturer of high quality electrical safety equipment based in France. CATU tools and equipment are used by power utilities, electrical contractors, large industries and railways in about 100 countries spread over five continents.

### CATU Clamps

Catu manufacture a wide range of clamps for short-circuiting and earthing situations for both indoors and outdoors. Variations include:

- + fault rating,
- + jaw opening distances,
- + clamping mechanism,
- + application methods and tightening of jaws,
- + fittings that attach clamps to a temporary operating stick or rod.



These clamps are generally designed and type tested to IEC 61230. Catu performs type testing of its clamp range to meet 1 second ratings. Furthermore, Sicame Australia has also conducted type tests of these clamps over time, but usually under more onerous conditions to meet 0.5 second ratings. This requires a higher test current than 1 second rating tests, so it creates higher mechanical forces during the first few cycles of a short-circuit.

### CATU Snap-On clamps

These are a 'Snap on' spring-loaded clamp which is particularly easy to use and very quick to place on a conductor compared to traditional screw type of clamps. The product code for these clamps is MT-613/3.

The Catu 'snap-on' clamps shown at right offer the quickest and easiest way to apply phase clamps to a conductor.

To apply these clamps, the operator sets the spring-loaded jaw on each clamp, and then mounts the clamps onto an application plate on the end of a removable operating stick. The clamps can then be lifted over the conductor and 'snapped' onto it.

To remove the clamps, a clamp removal tool is used to pull each clamp from the conductor. Refer to product code series, CRA for the clamp remover, also known as a 'pigtail'.



### CATU Clamps

The CATU range of earthing clamps are available in three distinct connection types. The hexagon, shotgun and bayonet fitting. When ordering our range of CATU clamps, please refer to the table below for appropriate connection type.

Ordering Suffix	Part Number Example	Description
<b>C</b>	MT-815-C	Hexagon Fitting
<b>S</b>	MT-815-S	Shotgun Fitting
<b>E</b>	MT-815-E	Bayonet Fitting



**MT-815-C**  
Hexagon Fitting



**MT-815-S**  
Shotgun Fitting



**MT-815-E**  
Bayonet Fitting

## Portable Earth Configurations

Portable earth configurations vary by the way that connections are made of the phase leads and earth leads. The connection configuration of any earth set is determined by its application and the particular operating practices and experience of the user. Sicame Australia generally manufactures earth sets to the requirements of the user, and also has a standard range of earth sets from which to choose that use aluminium cable made by Olex in Australia, and clamps made by Catu in France.

The major types of connection configuration are summarized below.

### 1. Three Phase Shorting Circuit sets and separate earth lead.

Three phase shorting sets without an attached earth lead are generally used for shorting the 3 phases of a rural overhead distribution network. A separate earth lead is then used to connect the shorted phases to the earthing system.

The separation of the earth lead helps to eliminate extra lifting weight, particularly in rural areas, where conductors may be higher than usual, resulting in very long earth leads. These configurations offer the lightest design for lifting onto overhead conductors as they eliminate one extra phase lead and a trifurcating plate.

For rural situations where there may be significant amounts of single wire earth return networks (SWER), phase shorting sets with a separate earth lead may be more convenient because only the single phase earth set in the kit will need to be applied.

A convenient clamp parking bar for screw type clamps can be fitted to the centre phase clamp for storage of the outer phase clamps until the centre phase clamp has been placed onto the conductor.



### 2. Looped Shorting and Earth sets

These are three phase shorting sets with an attached earth lead and are generally used for urban overhead distribution networks where there are no SWER networks.

### 3. Three Phase Trifurcating Plate Sets

Three Phase Trifurcating Plate sets are generally used in substations and switchboards where there is a single earth attachment point for connection of all three phases together. The tri-plate is fitted with an insulating cover rated to 600V where a separate earth lead is connected.

## 4. Fixed Stick Earth Sets.

Permanently fixed sticks can be fitted to different types of phase clamps. Generally, the fixed sticks are made from fibreglass insulated rods which are 1800mm long and 32mm in diameter. If required, customers can specify the stick length they need when they request a quote.

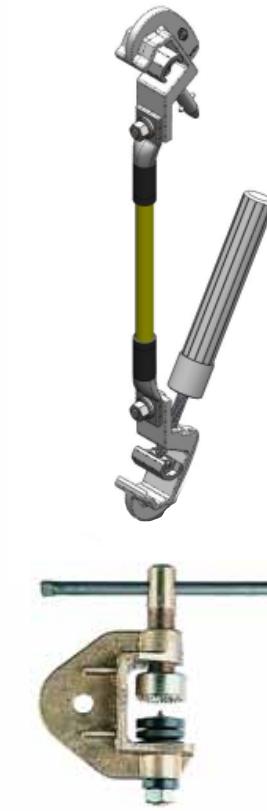
Typical phase clamps that can accept a fixed stick include the MT-815-E, and MT-1921-E clamps.



## 5. Single Phase Earth Sets

Single phase earth sets are commonly found where it is more practical to connect each phase to a separate earth point. Examples are SWER networks, or MV (medium voltage) and EHV (extra high voltage) transmission line and substation situations where there is considerable distance between phases on large towers and other structures.

Transmission networks often employ 3 single phase earths due to the long distances between phases and earth points on large steel structures. For these applications in particular, Catu make an earth clamp which has been specifically designed for clamping onto steel structures.



The clamp, known as an MT-847, has a moving jaw which has been designed to cut through pollutants and high resistance surfaces on steel work.



## 6. Equipotential Bonds (EQB's).

Equipotential bonds are a limited type of portable earth which are intended to connect only non-energised metallic parts within a work zone to a common earth point. The purpose is to limit the potential voltage rise in the event of a short circuit occurring in the vicinity of the worksite.

They are usually a single phase lead with an earth clamp on one end, and either another earth clamp, or a phase clamp at the other.

These should be rated to the same rating as any portable earth which are used at the same work site.

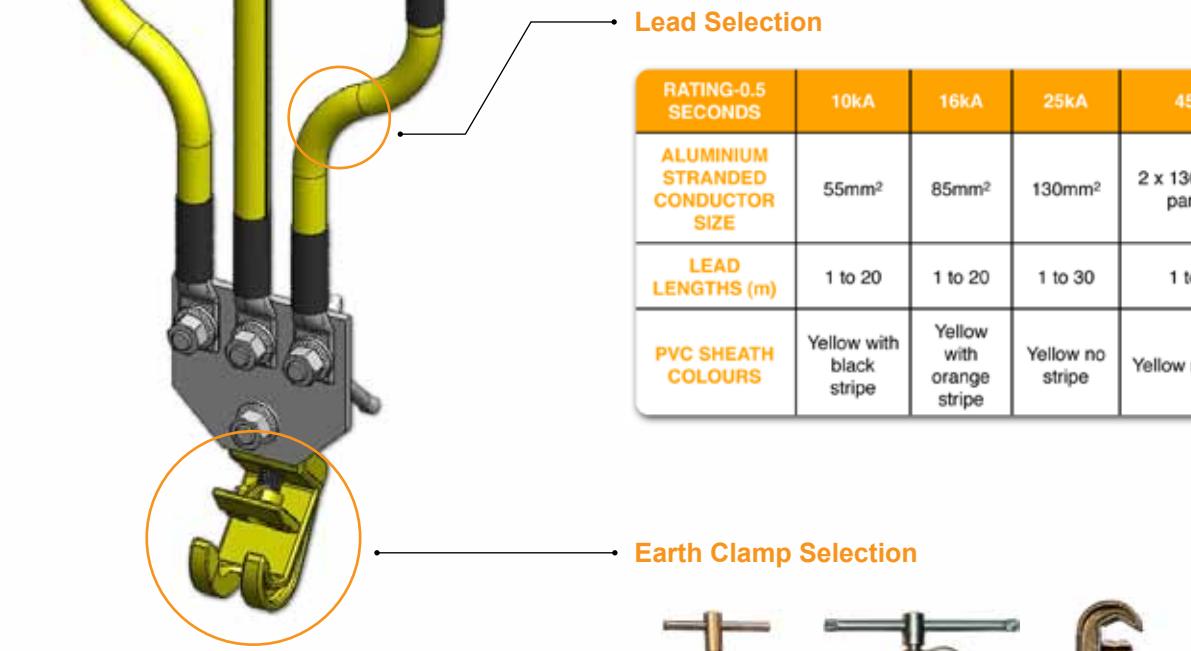
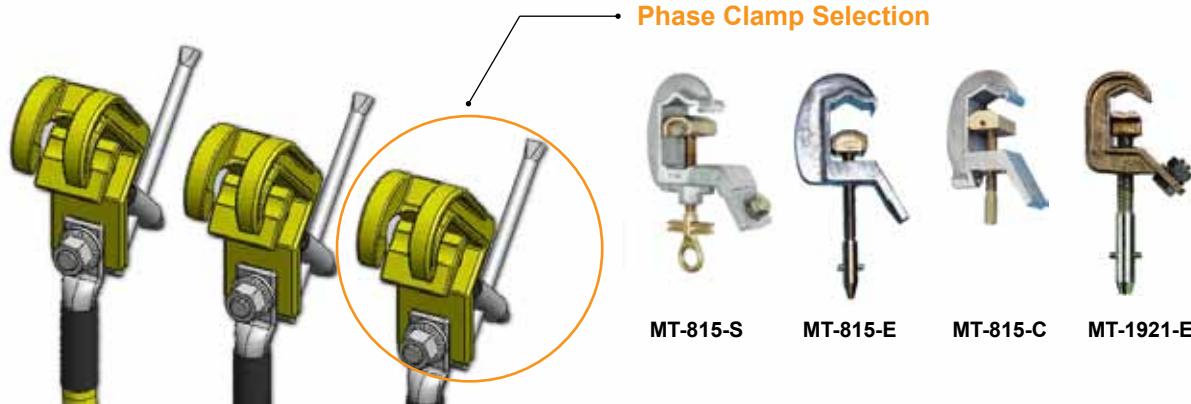
These are commonly used as earth bonds on vehicles that are required to work around exposed live parts such as trucks and cranes.

## SUBSTATION &amp; SWITCHBOARD EARTHS

## Three Phase Shorting Set with Tri-plate

Typical use:

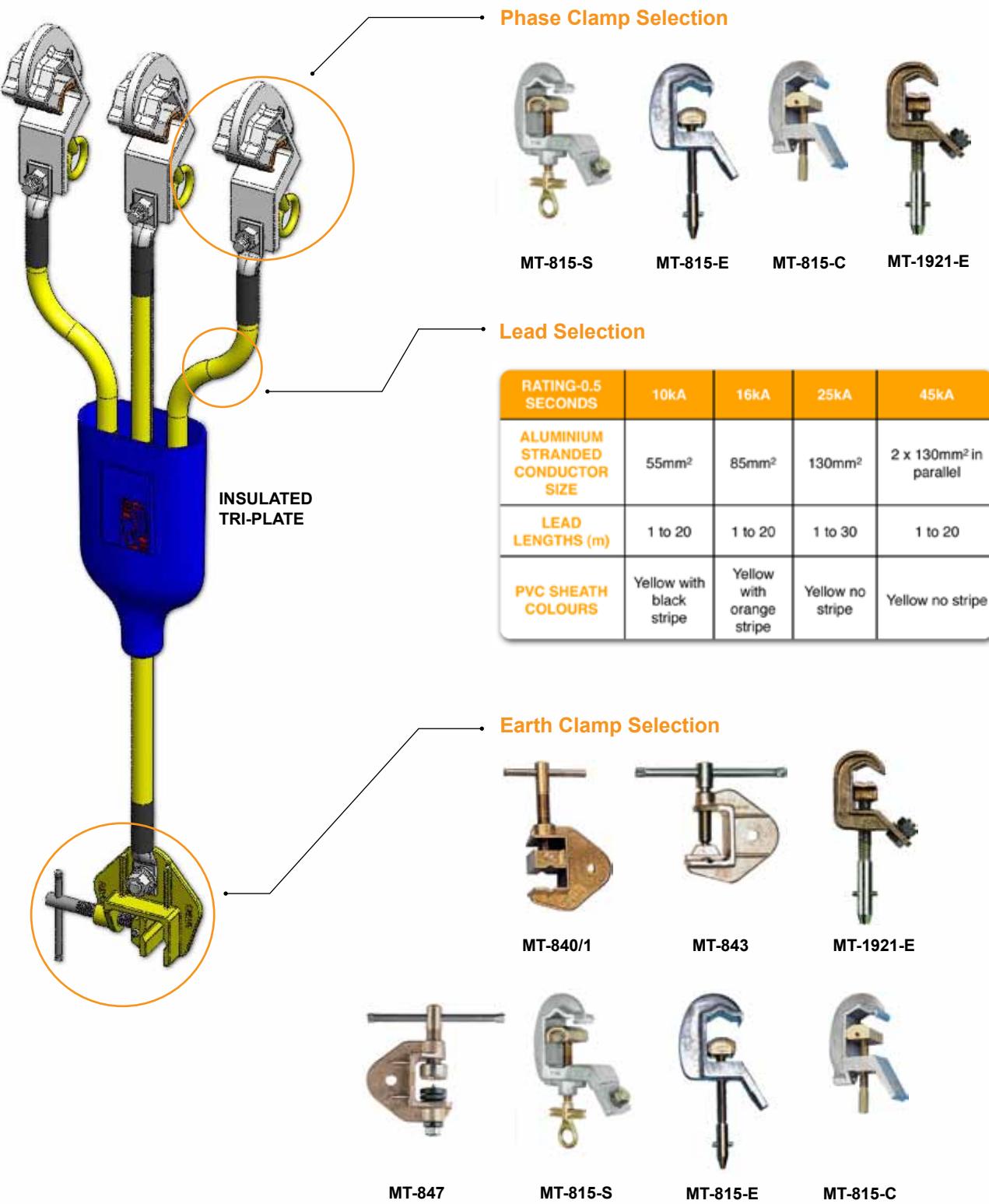
- + For earthing of indoor and outdoor substation bus bars



### Three Phase Shorting Set with Tri-plate and Earth Lead

Typical use:

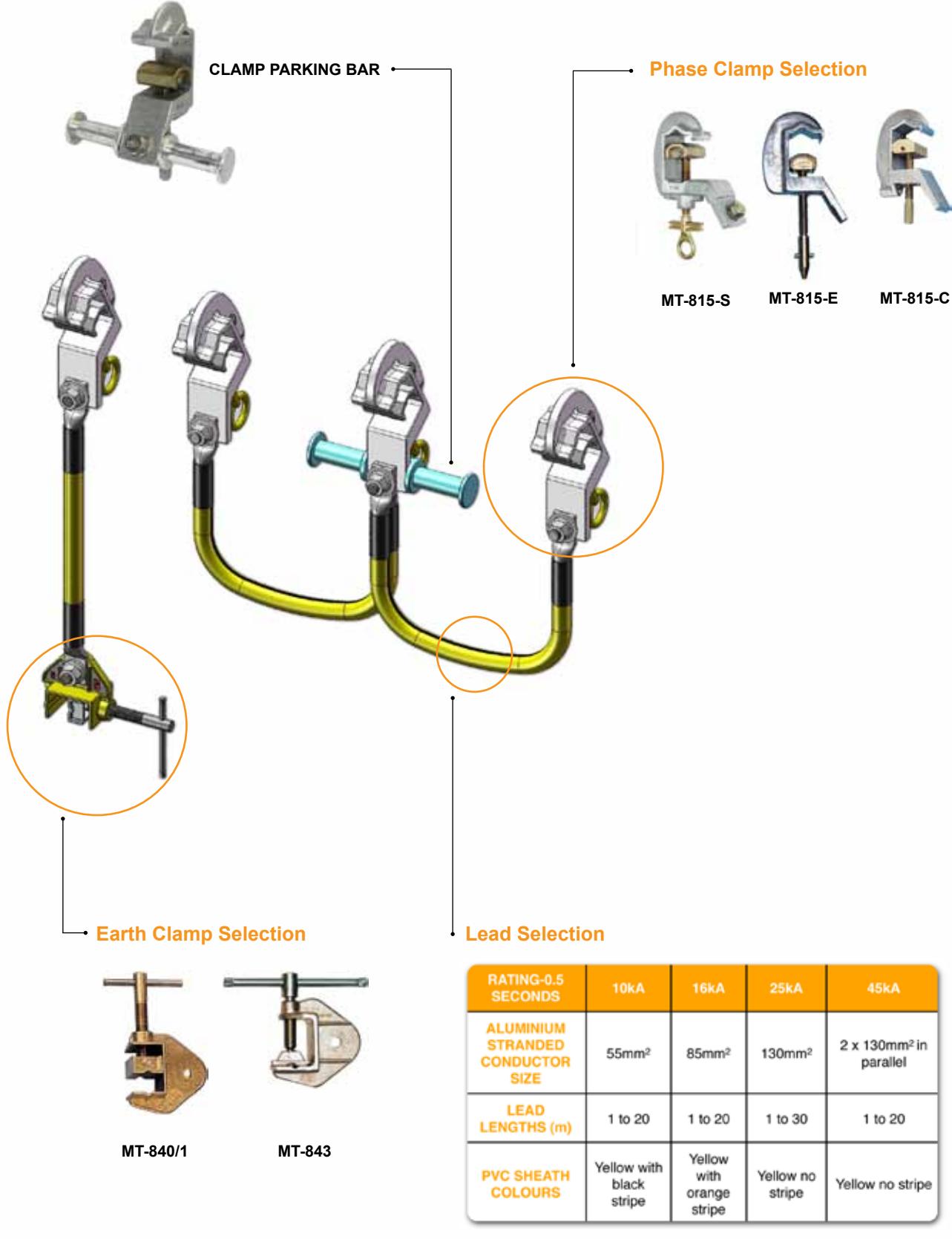
- + For earthing of indoor and outdoor substation bus bars



**OH EARTH SETS - SCREW CLAMPS****Three Phase Shorting Set with Separate Earth Lead**

Typical use:

- + OH conductors, including SWER systems
- + Convenient parking bar for outer phases

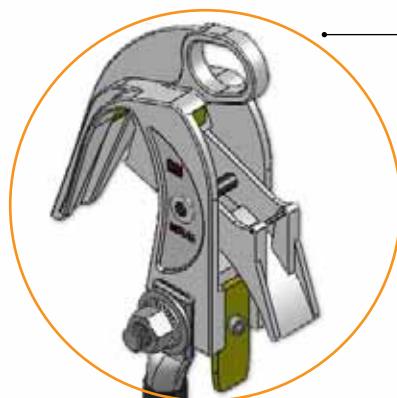


## EQUIPOTENTIAL BOND

## Single Phase Snap-on Earth Set

Typical use:

- + Equipotential bond in OH Networks where non-energised metallic parts need to be connected to earth

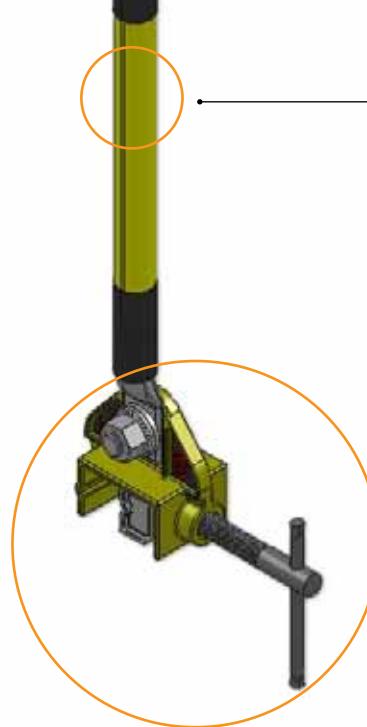


Phase Clamp Selection



MT-613/3

Snap on clamp



Lead Selection

RATING-0.5 SECONDS	10kA	16kA	25kA	45kA
ALUMINIUM STRANDED CONDUCTOR SIZE	55mm <sup>2</sup>	85mm <sup>2</sup>	130mm <sup>2</sup>	2 x 130mm <sup>2</sup> in parallel
LEAD LENGTHS (m)	1 to 20	1 to 20	1 to 30	1 to 20
PVC SHEATH COLOURS	Yellow with black stripe	Yellow with orange stripe	Yellow no stripe	Yellow no stripe

Earth Clamp Selection



MT-840/1



MT-843



MT-847



MT-1921-E

## HOT STICK ACCESSORIES TO SUIT

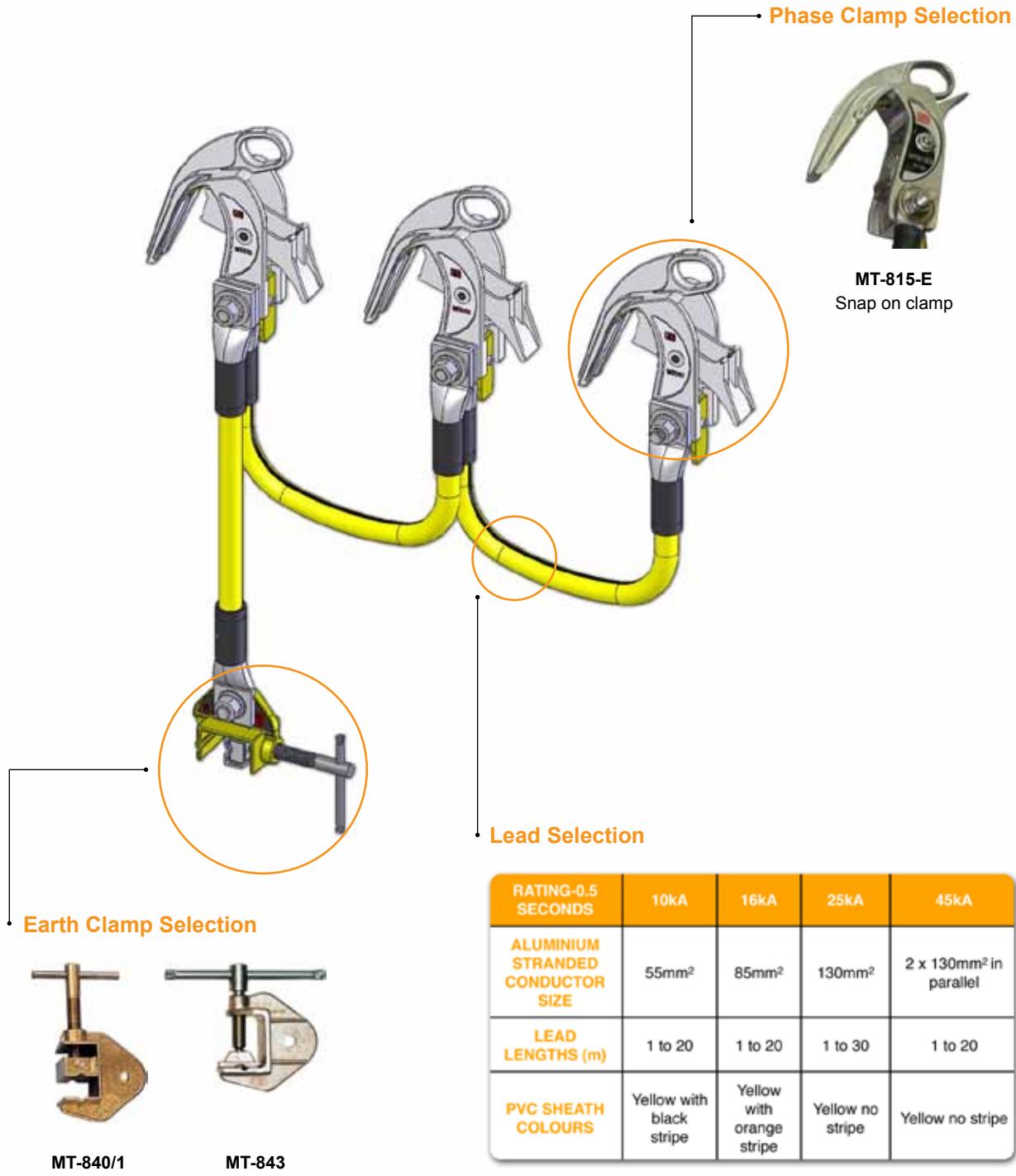
- + MT-630 # Application Platform
- + CRA- # Removal tool

Where # is "C" for CATU Hexagonal quick fit system, or "K" for universal sunrise fitting.

MT-630-C  
Application platformCRA-C  
Clamp RemoverMT-630-K  
Application platformCRA-K  
Clamp Remover

**OH SNAP-ON EARTHS****Three Phase Shorting Set with Looped Earth Lead**

Typical use:  
+ OH Conductor Networks

**HOT STICK ACCESSORIES TO SUIT**

- + MT-630 # Application Platform
- + CRA- # Removal tool

Where # is "C" for CATU Hexagonal quick fit system, or "K" for universal sunrise fitting.



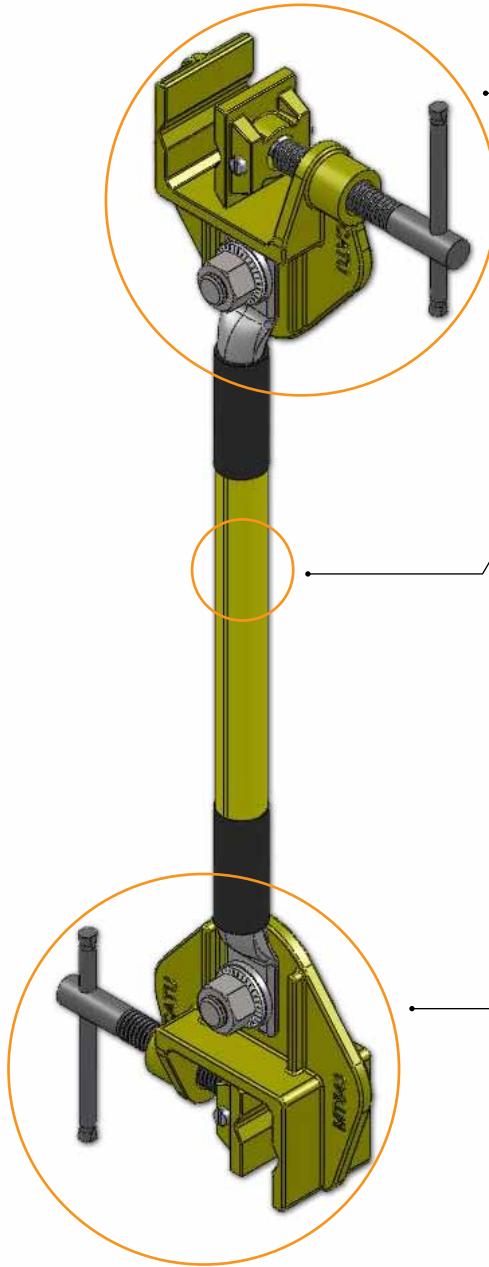
## EQUIPOTENTIAL BOND

## Single Phase Earth Set

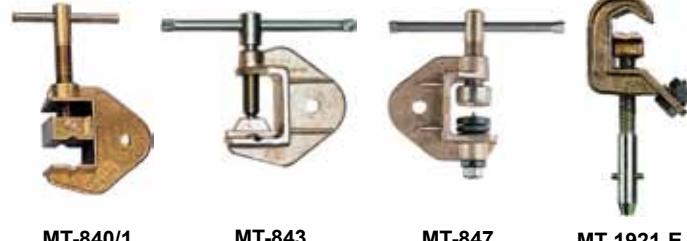
Typical use:

+ Bond any metallic parts to earth. Not intended for connection to normally energised apparatus

Example: Vehicle earth set



Clamp Selection

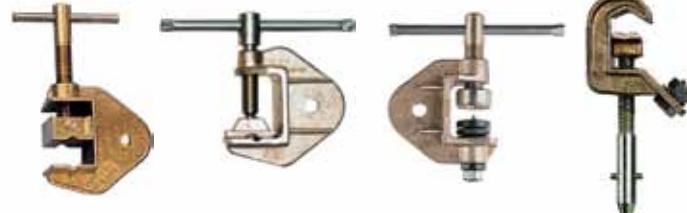


MT-840/1                    MT-843                    MT-847                    MT-1921-E

Lead Selection

RATING-0.5 SECONDS	10kA	16kA	25kA	45kA
<b>ALUMINIUM STRANDED CONDUCTOR SIZE</b>	55mm <sup>2</sup>	85mm <sup>2</sup>	130mm <sup>2</sup>	2 x 130mm <sup>2</sup> in parallel
<b>LEAD LENGTHS (m)</b>	1 to 20	1 to 20	1 to 30	1 to 20
<b>PVC SHEATH COLOURS</b>	Yellow with black stripe	Yellow with orange stripe	Yellow no stripe	Yellow no stripe

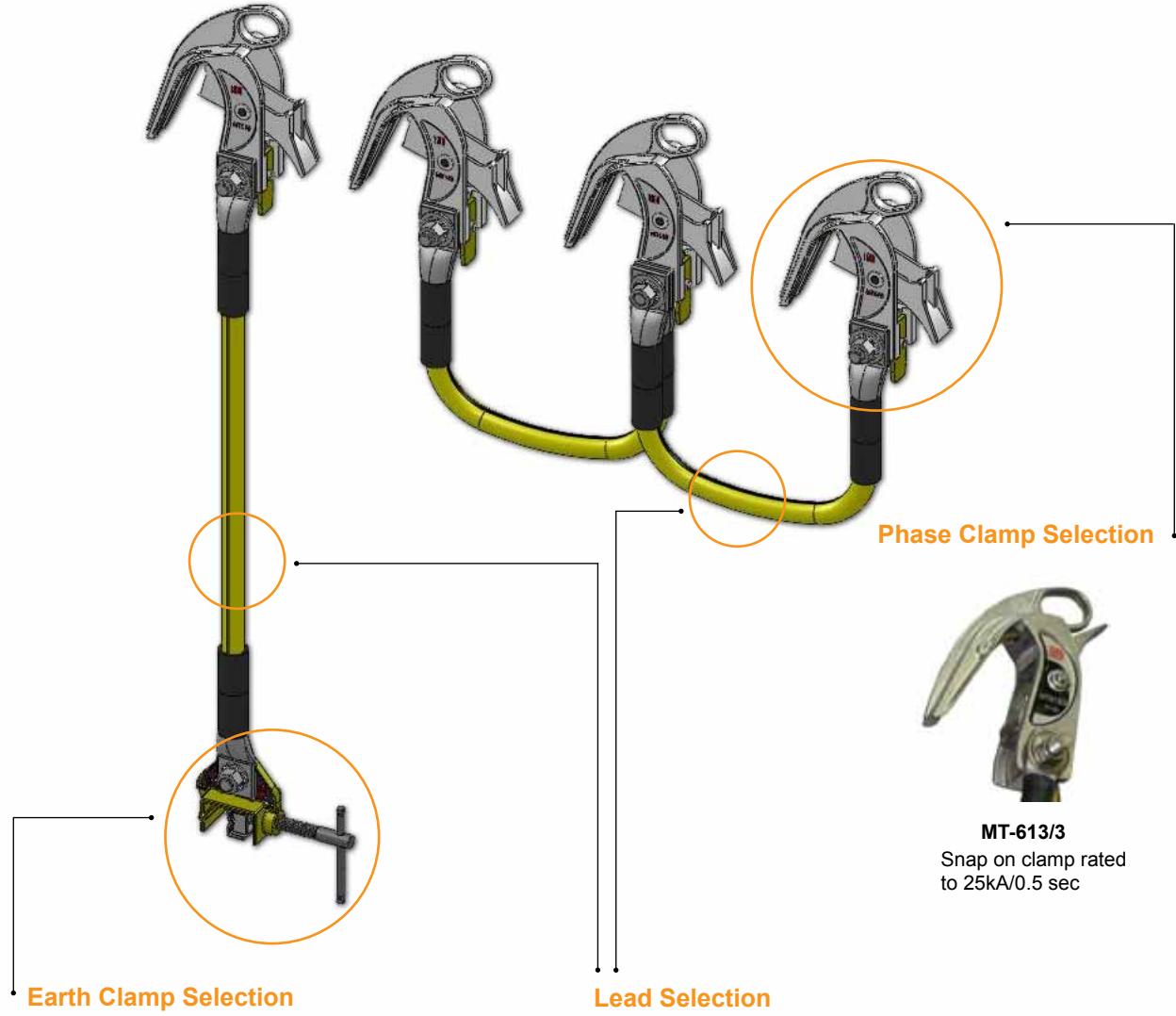
Earth Clamp Selection



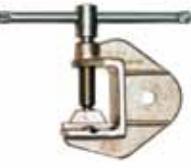
MT-840/1                    MT-843                    MT-847                    MT-1921-E

## OH EARTH SETS - SNAP-ON KITS

Typical use:

+ MV. OH networks - Use universal end sticks (**K type**)

**MT-613/3**  
Snap on clamp rated  
to 25kA/0.5 sec

**MT-840/1****MT-843**

RATING-0.5 SECONDS	10kA	16kA	25kA
<b>ALUMINIUM STRANDED CONDUCTOR SIZE</b>	55mm <sup>2</sup>	85mm <sup>2</sup>	130mm <sup>2</sup>
<b>LEAD LENGTHS (m)</b>	1 to 20	1 to 20	1 to 30
<b>PVC SHEATH COLOURS</b>	Yellow with black stripe	Yellow with orange stripe	Yellow no stripe

## HOT STICK ACCESSORIES TO SUIT



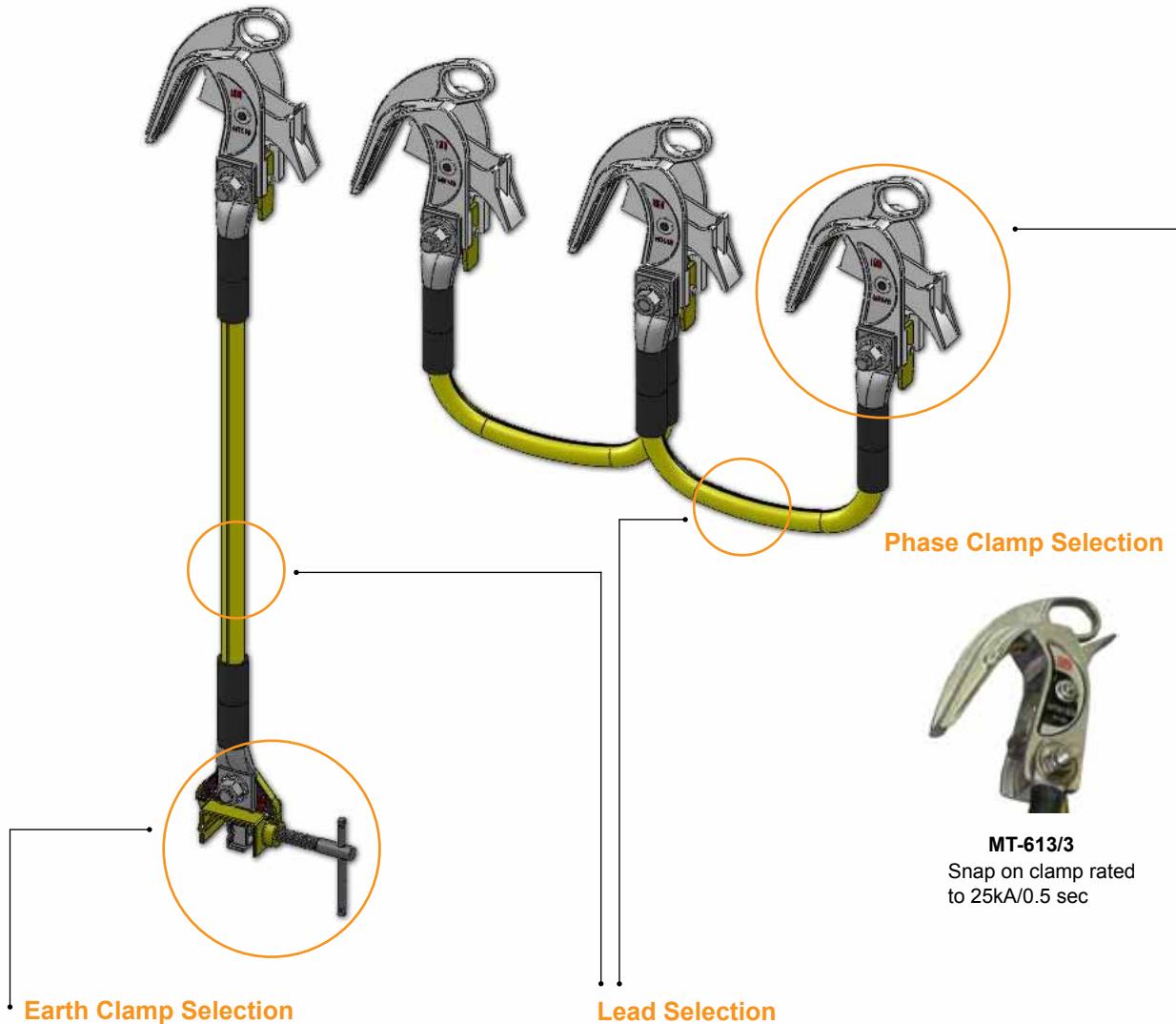
**MT-630-K**  
Application platform



**CRA-K**  
Clamp Remover

## OH EARTH SETS - SNAP-ON KITS

Typical use:  
+ MV. OH networks - Use 'CATU' quick fit hexagonal connection (C type)



MT-840/1



MT-843

RATING-0.5 SECONDS	10kA	16kA	25kA
ALUMINIUM STRANDED CONDUCTOR SIZE	55mm <sup>2</sup>	85mm <sup>2</sup>	130mm <sup>2</sup>
LEAD LENGTHS (m)	1 to 20	1 to 20	1 to 30
PVC SHEATH COLOURS	Yellow with black stripe	Yellow with orange stripe	Yellow no stripe

## HOT STICK ACCESSORIES TO SUIT

MT-630-C  
Application platformCRA-C  
Clamp Remover



### CLAMP REMOVAL ARM (PIGTAIL)

- + Used for removing MT-613/3 snap-on clamps from overhead lines
- + Available in 3 different fittings
- + Normally sold with MT-630 clamp application platform (refer below)

Product Number	Description
CRA-C	"C" - Hexagon fitting
CRA-K	"K" - Universal fitting
CRA-S	"S" - Shotgun fitting



### CLAMP APPLICATION PLATFORM

- + Used for attaching MT-613/3 snap-on clamps onto overhead lines.
- + Available in 3 different fittings
- + Normally sold with CRA clamp removal arm (Pigtail). (see above)

Product Number	Description
MT-630-C	"C" - Hexagon fitting
MT-630-K	"K" - Universal fitting
MT-630-S	"S" - Shotgun fitting



### FUSE REMOVER ADAPTOR

- + Used to remove drop-out fuses
- + Available in 2 different fittings

Product Number	Description
FRA-C	"C" - Hexagon fitting
FRA-K	"K" - Universal fitting



### DROP-OUT FUSE EARTHING ADAPTOR

- + Used for providing an earthing point on the bottom of drop out fuse carriers where conductors from drop out fuses to transformers are fully insulated.

Product Number
DOFEA



### LINK ADAPTOR

- + Used for attaching and removing drop-out fuses prior to applying a DOFEA.
- + Available in 3 different fittings

Product Number	Description
LKA/C	"C" - Hexagon fitting
LKA/K	"K" - Universal fitting
LKA/S	"S" - Shotgun fitting

## ACCESSORIES



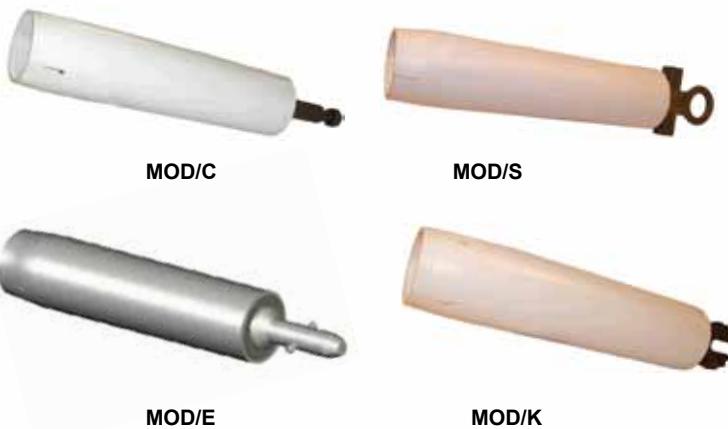
MDS/2

MDS/2 Ext

**MINES DISCHARGE STICKS**

- + Used to discharge residual charge on underground cables after they have been earthed.

Product Number	Description
MDS/2	Mines Discharge Stick with Standard with 2 m lead Handle length: 1 m
MDS/2 EXT	Mines Discharge Stick with Standard with 2 m lead & extended nipple Handle length: 1 m
MDS/3	Mines Discharge Stick with Standard 3 m lead Handle length: 1 m



MOD/C

MOD/S

MOD/E

MOD/K

**MODIWARK ADAPTORS**

- + Used for holding Modiwerk type voltage detectors on the end of a high voltage stick.
- + Available in 4 different fittings

Product Number	Description
MOD-C	"C" - Hexagon fitting
MOD-K	"K" - Universal fitting
MOD-S	"S" - Shotgun fitting
MOD-E	"E" - Bayonet fitting



LLCR/K

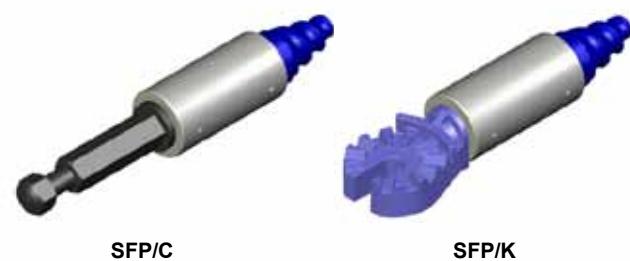
LLCR/C

LLCR/S

**LIVE LINE CLAMP REMOVER**

- + Fits onto a high voltage stick and is used for removing live line clamps.
- + Available in 3 different fittings

Product Number	Description
LLCR-C	"C" - Hexagon fitting
LLCR-K	"K" - Universal fitting
LLCR-S	"S" - Shotgun fitting



SFP/C

SFP/K

**SERVICE FUSE PULLER**

- + Used for pulling services fuses on poles/houses.
- + Available in 2 different fittings

Product Number	Description
SFP-C	"C" - Hexagon fitting
SFP-K	"K" - Universal fitting



M12/22 BRS STUB

### FIXED EARTH CONNECTION POINT

- + An earthing point used in substations and switchrooms.
- + Includes Bolts & Washers.
- + Two diameters are available - 22 & 25 mm

Product Number	Rating (kA)	Fixing Bolt	Stub Diameter (mm)	Stub Length (mm)
M12/22 BRS STUB	25kA/0.5 secs	M12	22mm	60
M12/25 BRS STUB	25kA/0.5 secs	M12	25mm	60
M16/22 BRS STUB	45kA/0.5 secs	M16	22mm	60
M16/25 BRS STUB	45kA/0.5 secs	M16	25mm	60



CM-02-C

### MANOEUVERING HOOK

- + Bronze-Copper nickel aluminium
- + Weight : 0.120Kg
- + Available in two different fittings

Product Number	Description
CM-02-C	"C" - Hexagon fitting
CM-02-K	"K" - Universal fitting



POLE SAFETY STEPS

### POLE SAFETY STEP - STAINLESS STEEL

Product Number	Description
POLE SAFETY STEPS	Safety pole steps with washer



### EQUIPMENT BOXES

- + Ideal for storage & transport of high voltage detectors, accessories & other instruments.
- + Watertight, shock & vibration proof and also dust proof
- + Complete with foam inserts

Product Number	Description
CASE EX LGE	Inside Dim 485x355x186mm
CASE LGE	Inside Dim 395x320x117mm
CASE MED	Inside Dim 300x220x90mm

## ACCESSORIES



CI-7-K

CI-4-K

CI-5-K

CI-6-K



CI-4-E

CI-6-C

CI-7-E

CI-7-C

CI-5-C



CI-3-C

End Cap for CI-3-C

### CONNECTION ADAPTORS FOR INSULATING STICKS

With this range, any accessory can be attached to any stick by using connection adaptors. For other models, please consult us.

	<b>C</b> Hexagonal	<b>K</b> Universal	<b>E</b> Bayonet	<b>S</b> Clamp - Stick	<b>A or B</b> "MAJOR" Serie CM-4/ CM-6/ CM-7							
<b>ACCESSORIES</b>												
<b>CONNECTION ADAPTORS</b>												
<b>STICKS</b>												



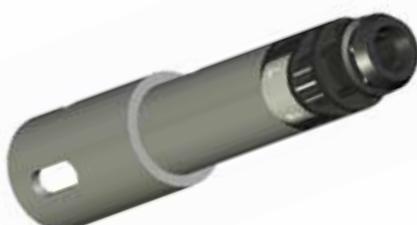
HEC-250-E

### CLAMP APPLICATION HANDLE

Small PVC handle to apply Bayonet type earth clamps.

Fits MT-815-E, MT-192-E clamps

Product Number	Description
HEC-250-E	Length - 340mm



CAPALEC ADAPTOR

### STICK ADAPTOR

To connect Ergon sticks with hexagonal "C" fittings.

Product Number	Description
CAPALEC ADAPTOR	Length - 210mm



IATH-K



IATH-C

### STICK ADAPTOR

To connect Integral Energy sticks to universal head tools or hexagonal "C" fittings.  
Available in 2 different fittings.

Product Number	Description
IATH-C	"C" - Hexagon fitting Length - 150mm
IATH-K	"K" - Universal fitting Length - 200mm



### STICK ADAPTOR

To connect SECV/C sticks with hexagonal "C" fittings.

Product Number	Description
SECV/C	SECV to C adaptor Length - 230mm



### CONDUCTORS BRUSHES

Pivoting - 95 x 90 x 64mm  
Weight : 0.090Kg

Product Number	Description
MG-206-AK	Moulded red colour body with card. Reserved for aluminium conductors
MG-206-CK	Moulded red colour body with card. Reserved for copper conductors.



### CONDUCTORS BRUSHES

Pivoting - 110 x 110 x 70mm  
Weight : 0.250Kg

**MG-354-K**

Product Number	Description
MG-352-K	Moulded orange colour body with card. Reserved for aluminium conductors
MG-352-VK	Moulded green colour body with card. Reserved for copper conductors.
MG-353-R	Orange spare brush for MG-353-K. For hand brushing use.
MG-353-V	Green spare brush for MG-353-K. For hand brushing use.
MG-354-K	Round brush - Ø 58 x 100mm Weight: 0.250 Kg
MG-355	Spare brush for MG-354-K



### DIAMETER MEASURING GAUGE

Conductor range 3 to 16mm Ø.  
Entirely insulated material 270 x 35 x 12mm  
Weight: 0.090 Kg  
Rising Sun' fitting  
Delivered in bag

Product Number
MD-535-K



### CLEANING BRUSHES

Hex fitting

**MD-14-C**

**MD-12-C**



**MD-10-C**

Product Number	Description
MD-10-C	Concave brush with two rows of perpendicular bristles 100 x 125 x 170mm - Weight: 0.500Kg
MD-12-C	Round head brush Ø 175 x 228mm - Weight: 0.500Kg
MD-14-C	Adjustable hinged round head brush Ø 175 x 328mm - Weight: 0.500Kg

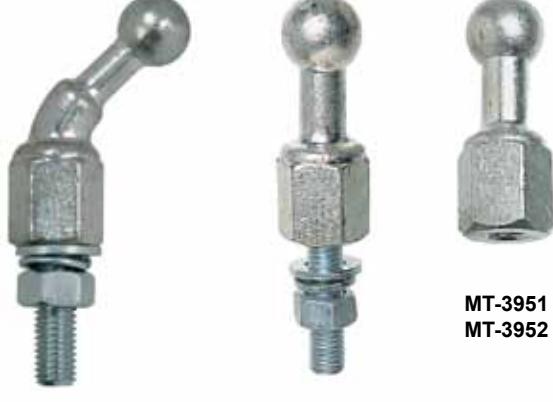


MT-1921EH

### HAND APPLIED EARTH CLAMPS

For connection of MT-1921-E clamps to fixed earthing points.

Product Number	Description
MT-1921EH	Earth Clamp with PVC Handle Length - 350mm



MT-3950/35

MT-3951/1  
MT-3952/1

### FIXED POINTS

Used for providing earthing points in substations/ switchrooms and flat conductors

Commonly used with MT-1921-E earth clamps (refer to above)

Product Number	Rating (kA)	Sphere Dimension	Weight (g)	Fixing
MT-3951	25kA/0.5 sec	Ø 25mm	240	Thread: M12
MT-3952	45kA/0.5 sec	Ø 25mm	240	Thread: M16
MT-3951/1	25kA/0.5 sec	Ø 25mm	300	Bolt: M12 - L = 45mm
MT-3952/1	45kA/0.5 sec	Ø 25mm	350	Bolt: M16 - L = 45mm
MT-3950/35*		Ø 25mm	300	Bolt: M16 - L = 35mm

\* = Not IEC

**CARRY BAGS****EARTHS SET & STICK BAGS****EARTH SET CARRY BAGS**

ARB/500

**STICK CARRY BAGS**

ARB/S115



ARB/S415



Product Number	Description
BAG PVC ARB/454	Carry Bag 400 x 500 x 400 + Zipper
BAG PVC ARB/500	Carry Bag 500 x 500 x 150
BAG PVC ARB/501	Carry Bag 500 x 500 x 150 + 1 Divider
BAG PVC ARB/502	Carry Bag 500 x 500 x 150 + 2 Divider
BAG PVC ARB/600	Carry Bag 600 x 600 x 150
BAG PVC ARB/601	Carry Bag 600 x 600 x 150 + 1 Divider
BAG PVC ARB/602	Carry Bag 600 x 600 x 150 + 2 Divider
BAG PVC ARB/700	Carry Bag 700 x 700 x 200
BAG PVC ARB/762	Carry Bag 700 x 600 x 200 + Zipper

Product Number	Description
BAG PVC ARB/MDS	AES-MDS Stick Carry Bag
BAG PVC ARB/S110	1 x 1.0 Mt Stick Carry Bag
BAG PVC ARB/S115	1 x 1.5 Mt Stick Carry Bag
BAG PVC ARB/S120	1 x 2.0 Mt Stick Carry Bag
BAG PVC ARB/S125	1 x 2.5 Mt Stick Carry Bag
BAG PVC ARB/S130	1 x 3.0 Mt Stick Carry Bag
BAG PVC ARB/S210	2 x 1.0 Mt Stick Carry Bag
BAG PVC ARB/S215	2 x 1.5 Mt Stick Carry Bag
BAG PVC ARB/S220	2 x 2.0 Mt Stick Carry Bag
BAG PVC ARB/S310	3 x 1.0 Mt Stick Carry Bag
BAG PVC ARB/S315	3 x 1.5 Mt Stick Carry Bag
BAG PVC ARB/S320	3 x 2.0 Mt Stick Carry Bag
BAG PVC ARB/S410	4 x 1.0 Mt Stick Carry Bag
BAG PVC ARB/S415	4 x 1.5 Mt Stick Carry Bag
BAG PVC ARB/S420	4 x 2.0 Mt Stick Carry Bag
BAG PVC ARB/S510	5 x 1.0 Mt Stick Carry Bag
BAG PVC ARB/S515	5 x 1.5 Mt Stick Carry Bag
BAG PVC ARB/520	5 x 2.0 Mt Stick Carry Bag
BAG Extra Pockets	Extra Pockets /P or /A for Adaptors etc..



### LANYARD FOR MT-701/1 CLMAPS

8mm Megalon insulated

Used for applying CATU clamp MT-701/1 onto overhead wires.

### LANYARDS & SANDBAGS

Product Number	Length (Mt)
LANYARD 08M	8
LANYARD 09M	9
LANYARD 10M	10
LANYARD 11M	11
LANYARD 12M	12
LANYARD 13M	13
LANYARD 14M	14
LANYARD 15M	15
LANYARD 16M	16
LANYARD 17M	17
LANYARD 18M	18
LANYARD 19M	19
LANYARD 20M	20
LANYARD 21M	21
LANYARD 22M	22
LANYARD 23M	23
LANYARD 24M	24
LANYARD 25M	25
LANYARD 30M	30
LANYARD 35M	35
LANYARD 40M	40
LANYARD 45M	45
LANYARD 50M	50



SANDBAG ASSEMBLY

SAND W/LOOP

### SANDBAGS

Used with Megalon lanyards (see above) to hoist MT-701/1 clamps onto conductors.

Product Number	Description
SANDBAG ASSEMBLY	Sandbag with link & sister clip
SANDBAG W/LOOP	Bag with sand & carry loop



**DNOB-TAG**

**CLA-DNOB-TAG**

**CLA-DNOB-TAG-KIT1**

## **DANGER DO NOT OPERATE TAGS**

- + Available with or without hot stick mounting brackets
- + Bright yellow colour easily identifiable
- + Reflective "danger" label
- + weighted base
- + Large application and removal eye
- + Can be applied and removed with standard shot-gun stick



Product Number	Description	Additional Information
<b>DNOB-TAG</b>	Tag alone	Not supplied with bracket
<b>CLA-DNOB-TAG</b>	Tag with bracket to suit hot stick application heads MT-630 C, K, S	"C" - Hexagon fitting "K" - Universal fitting "S" - Shotgun fitting
<b>CLA-DNOB-KIT1</b>	Retro-fit bracket for existing DNOB	<b>Kit contents:</b> 6 x S/S Screw 3 x Bracket 1 x Plastic Bag 1 x Installation Instructions

## INSULATING STICKS FOR SUBSTATION USE

Telescopic sticks for voltage detectors and earthing systems for use in dry and wet conditions

Telescopic stick contains 2 elements made of resin polyester/glass fiber foam filled tube, which slide together and are equipped with a push button lock.

Product Number	Rated Insulation (kV)	Ø (mm)	Overall Length (m)		Weight (kg)
			Folded	Extended	
CE-4-21*	90	41/32	1.15	2	1.5

\* Add end-piece C, K or E



### Fixed length stick for use in dry and wet conditions

Manufactured from 36 mm dia. elements, with single 100 dia. skirts, light and rigid, shock resistant.

Product Number	Rated Insulation (kV)	Ø (mm)	Overall Length (m)	Weight (kg)
CF-5-40*	40	36	1.5	1.15

\* Add end-piece C, K or E

### Standard stick for use in dry conditions

Product Number	Rated Insulation (kV)	Ø (mm)	Overall Length (m)	Weight (kg)
CF-3-72*	72.5	36	1.5	0.88

\* Add end-piece C, K or E

### Short length clamp stick

Product Number	Ø (mm)	Overall Length (m)	Weight (kg)
MG-115/1-S	32	1.5	2.4

### Rescue stick

Product Number	Ø (mm)	Overall Length (m)	Weight (kg)
CS-45	45	1.65	1



### TELESCOPIC STICKS FOR VOLTAGE DETECTORS

Telescopic stick contains 2 elements made of resin polyester/glass fiber foam filled tube, which slide together and are equipped with a push button lock.

Product Number	Rated Insulation (kV)	$\varnothing$ (mm)	Overall Length (m)		Weight (kg)
			Folded	Extended	
CE-4-21*	90	41/32	1.15	2	1.5

\* Add end-piece C, K or E

### TELESCOPIC STICKS FOR VOLTAGE DETECTORS

Contains 2 elements:

- + A yellow lower element made of resin polyester/glass fiber foam filled 41 mm diameter base tube.
- + An upper orange element made of glass fiber/resin epoxy foam filled of 32 mm diameter (\*\*).

Product Number	Rated Insulation (kV)	$\varnothing$ (mm)	Overall Length (m)		Weight (kg)
			Folded	Extended	
CE-75*	75	41/32**	1.15	2	1.2

\* Add end-piece C, K or E

CE-4-21

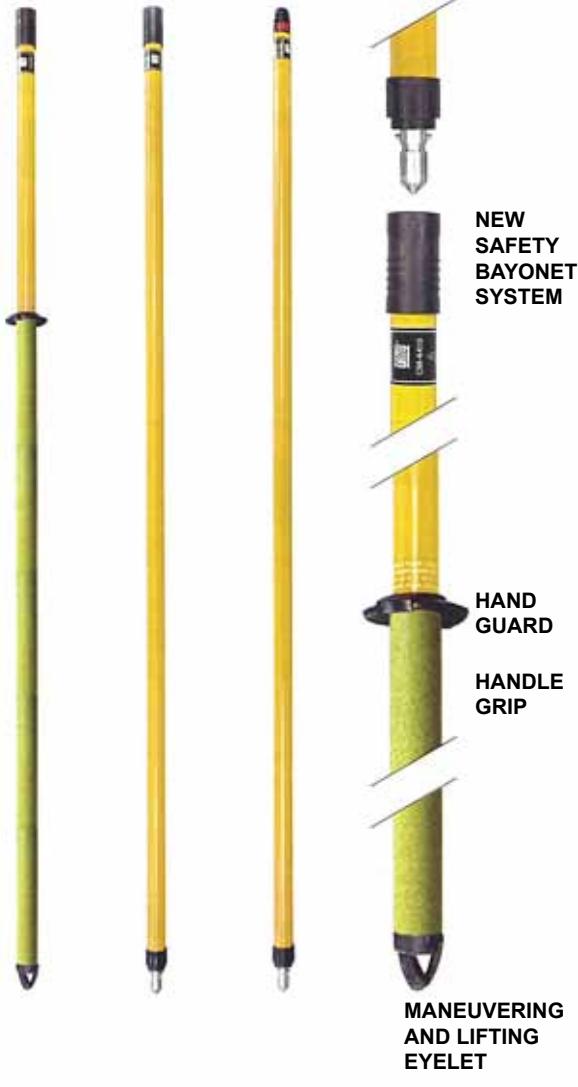
### EXTENSION FOR INSULATION STICKS

Extension with a male end-piece

Product Number	Overall Length (m)	Weight (kg)
CM-7-10-A	1	1

CE-75

CM-7-10-A



## INSULATING STICKS FOR SHORT-CIRCUITING AND EARTHING SYSTEMS

These 39 mm dia. elements are assembled using a new safety bayonet system connector in aluminium alloy. They allow construction of a large variety of custom made sticks that meet the most varied conditions of application. Calibrated lengths of 1 to 3 meters (with fraction of 0.50 m) permit a huge number of applications.

This range thus allows a stick-length limitation in case of space requirements and carrying capabilities. For common applications a series of complete sets including 2 or 3 elements are made to give simple solutions for working distance from 2 to 6 meters.

Product Number	Complete Stick Length (m)•	Complete Stick Length (mm)••	Insulating Length (m)	Weight (kg)
<b>Basic Elements</b>				
<b>CM-4410</b>	1.13		0.7	1.25
<b>CM-4415</b>	1.63		1	1.7
<b>CM-4420</b>	2.13		1.2	2.7
<b>CM-4425</b>	2.63		1.5	3.2
<b>Intermediate Elements</b>				
<b>CM-4410-I</b>	1.165		0.9	1.2
<b>CM-4415-I</b>	1.665		1.4	1.6
<b>CM-4420-I</b>	2.165		1.9	2.5
<b>CM-4425-I</b>	2.665		2.4	3
<b>Terminal Elements</b>				
<b>CM-4410-*</b>	1.115	1.21	0.9-1	0.9
<b>CM-4415-*</b>	1.615	1.71	1.4-1.5	1.3
<b>CM-4420-*</b>	2.115	2.21	1.9-2	2.1
<b>CM-4425-*</b>	2.615	2.71	2.4-2.5	2.6
<b>Intermediate element with rain skirts</b>				
<b>CM-4400-J</b>	0.36			0.95

\* Add end-piece C, K or E



CM-4400-J

## STICKS WITH RAIN SKIRTS, C, K OR E TERMINALS

Epoxy reinforced fibre-glass insulating Ø 36 mm.  
Shock resisting polycarbonate rain skirts Ø 100 mm, height 90 mm.

Product Number	Length (m)	Rain Skirt Number	Weight (kg)
<b>CF-5-40*</b>	1.5	1	1.15
<b>CF-5-90*</b>	2	1	1.55

\* Add end-piece C, K or E



### CLAMPSTICKS

- + For operations carried out on dead line networks.
- + Clamp stick for M.V. systems.
- + Cylindrical tubular rod Ø 32 mm in laminated epoxy glass fiber foam-filled.
- + Test voltage: 100 kV applied for 1 min, between alternate electrodes 30 cm away from one another.
- + Plastic control rod reinforced with glass fibre Ø 10 mm.
- + Rack-system operating handle, with 3 positions.
- + Suspension hook on the upper part.
- + Protective cap on the lower part.

Product Number	Length (m)	Weight (kg)
<b>MGS-100-S</b>	2	2.8
<b>MGS-103-S</b>	3.8	4.3



### TELESCOPIC MEASURING STICK

- + 8 telescopic sections of insulated polyester glass, graduated and operated by a push-button mechanism.
- + Upper portion made of high voltage "live working tool" quality orange epoxy glass.
- + Direct reading at the top of the 1st section of the stick.
- + Max. length: 12 m Folded length: 1.50 m - 3.3 kg.

Product Number	Spec
<b>MO-832</b>	Max. Length: 12m - For use on L.V., M.V., H.V. lines 220 kV max.



### TELESCOPIC AND DISCONNECT TELESCOPIC STICKS

- + 8 telescopic sections of insulated polyester glass, graduated and operated by a push-button mechanism.
- + Upper portion made of high voltage "live working tool" quality orange epoxy glass.
- + Direct reading at the top of the 1st section of the stick.
- + Max. length: 12 m Folded length: 1.50 m - 3.3 kg.

Product Number	Max. Length (m)	Weight (kg)
<b>CE-5-50-(*)</b>	5	2.5
<b>CE-5-60-(*)</b>	6	3
<b>CE-5-70-(*)</b>	7	3.5
<b>CE-5-90-(*)</b>	9	4
<b>CE-5-105-(*)</b>	10.5	5.5

\* Add end-piece C, K or E

## CONNECTION ADAPTORS FOR INSULATING STICKS

	C	K	E	S	A or B			
Accessories					"MAJOR" Serie CM-4/CM-6/CM-7			
Connection Adaptors	 	 	 	 	 	 		
Sticks	 <b>E</b>	 <b>AB</b>	 <b>K</b>	 <b>S</b>	 <b>C</b>	 <b>AB</b>	 <b>K</b>	 <b>C</b>

With this range any accessory can be attached to any stick by using connection adaptors. Other models, please consult us.



Product Number	Weight (kg)	Dimensions (mm)	Conductors (mm)	Test Current (kA/1s)
MT-812-C	0.320	35 x 79 x 143	● Ø 5-16 ■ 0-16	21
MT-813-C	0.330	35 x 79 x 169	■ 40 x 16	21
MT-814/2	0.660	85 x 56 x 192	● Ø 5-28	14.5
MT-817-C	0.330	30 x 90 x 140	● Ø 5-16 ■ 40 x 16	21
MT-814/3	0.620	85 x 56 x 195	● Ø 18-33	15.4
MT-815-C MT-815-E MT-815-S MT-815-S1	0.650	44 x 108 x 173 44 x 126 x 173	● 5-40 ■ 16-40 ■ 5-40	30
MT-1911-E MT-1911-S1	0.580	For permanent fixed point Ø 20 mm and round conductors Ø 8 to 18 mm		20
MT-1921-E MT-1921-S1	0.69	For permanent fixed point Ø 25 mm and round conductors Ø 10 to 25 mm		30

## CLAMPS FOR MV INSTALLATIONS AND SUBSTATIONS

### Attachment (C-Type)

Hexagonal end-fitting. A circumferential braking system prevents the clamp from turning under the weight of the cable. Separates by simple pulling.

### Earth cable connection

With a crimped lug (12 mm Ø hole).

### Material

Aluminium alloy except MT-814, MT-1911 and MT-1921: copper-aluminium bronze.



## EARTH CLAMPS

Copper aluminium bronze earth clamps.

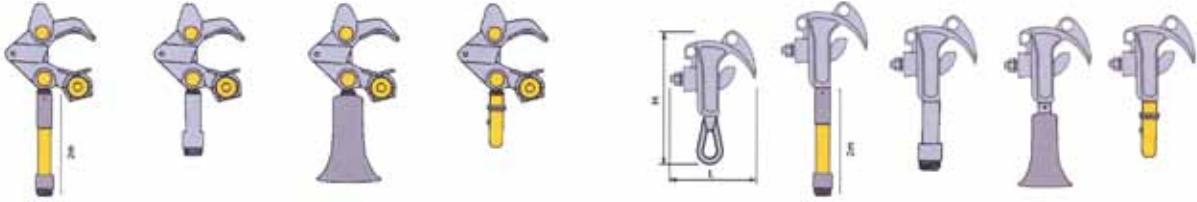
### FOR BARE CONDUCTORS

Product Number	Weight (kg)	Connection	Conductors (mm)
MT-840/1	0.48	Thread: Ø 12.5 mm	● Ø 6-25 ■ 0-25
MT-841	0.48	Thread: ≤ Ø 12.5 mm	● Ø 6-25 ■ 0-30

### FOR FIXED POINT

Product Number	Weight (kg)	Connection
MT-1911	0.58	Spheric fixed points MT-2951 Ø 20 mm Round conductors Ø 8 to 18 mm
MT-1921	0.69	Spheric fixed points MT-3951 Ø 25 mm Round conductors Ø 10 to 25 mm

ABOVE 52kV



### HV AND EHV CLAMPS MANOEUVABLE BY INSULATING STICK

Body in aluminium alloy with trapezoidal threaded screw. Interposed elastic washers in the clamping system improve efficiency and insure a higher withstand in case of electrodynamic shock. Manoeuvering by CM-6 insulated stick of appropriate length and characteristics.

Product Number	Clamping Capacity (Ø mm)	Test Current (kA/1s)	Copper Connection			Weight (Kg)	Dimensions (mm) h x L x thickness
			Copper Cables (mm <sup>2</sup> max.)	Contact Range Width (mm)	Stud or Hole		
MT-731*	5-60	40	150	45	M 12	1.45	200 x 200 x 50
MT-732*	40-120	40	150	45	M 12	1.45	200 x 200 x 50
MT-734*	5-40	40	150	40	M 12	0.8	145 x 125 x 52
MT-735*	15-60	40	150	40	M 12	0.8	195 x 135 x 45
MT-737*	20-120	40	150	40	M 12	1.35	340 x 200 x 55

\* Add type of connection A - B - E - H