



P&B Weir Electrical Ltd. Substation Earthing



THORNE &
DERRICK
INTERNATIONAL

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Substation Earthing

PRODUCT RANGE

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LINE END CLAMPS - SUBSTATION

The PBwel Substation portable earthing equipment range is designed to meet the specific requirements of ENA technical specification 41-21.

Line End Clamps are precision manufactured from robust aluminium castings with high-grade stainless steel fittings. All clamps, whether sprung loaded or not, should be applied by means of an operating socket attached to an insulated operating pole. The design of all Line End clamps is such that once hooked over the busbar they become self-supporting whilst the operating screw is tightened or loosened.

PRODUCT BENEFITS



Lightweight

Precision machined for improved performance



CE22/A LINE END CLAMP

Clamping Diameter: 10-38mm
Short Circuit Rating: 25kA/1s
17.5kA/2s
Max number of Leads: 1
Weight: 1.05kg
ENA 41-21 Reference: 41-21-LE1
Part Number: FA2738-A

CE25 LINE END CLAMP

Clamping Diameter: 35-75mm
Short Circuit Rating: 53.7kA/1s
Max number of Leads: 2
Weight: 1.73kg
ENA 41-21 Reference: 41-21-LE2
Part Number: FA2169-B



CE22/B LINE END CLAMP

Clamping Diameter: 38-76mm
Short Circuit Rating: 25kA/1s
17.5kA/2s
Max number of Leads: 1
Weight: 1.09kg
ENA 41-21 Reference: 41-21-LE3
Part Number: FA2143-B

CE22/A+B LINE END CLAMP

Clamping Diameter: 19-76mm
Short Circuit Rating: 25kA/1s
17.5kA/2s
Max number of Leads: 1
Weight: 1.09kg
ENA 41-21 Reference: 41-21-LE4
Part Number: FA2143-A



CE22/C LINE END CLAMP

Clamping Diameter: 60-90mm
Short Circuit Rating: 25kA/1s
17.5kA/2s
Max number of Leads: 1
Weight: 1.27kg
ENA 41-21 Reference: 41-21-LE5
Part Number: FA2739-A

CE15 LINE END CLAMP

Clamping Diameter: 90mm
Short Circuit Rating: 51.6kA/ 2s
Max number of Leads: 2
Weight: 1.37kg
ENA 41-21 Reference: 41-21-LE6
Part Number: FA2191-A



CE28 LINE END CLAMP

Clamping Diameter: 100mm
Short Circuit Rating: 45kA/ 1s and
31.8kA/ 2s
Max number of Leads: 2
Weight: 1.66kg
ENA 41-21 Reference: 41-21-LE7
Part Number: FA2367-A

CE27 LINE END CLAMP

Clamping Diameter: 101.6mm
Short Circuit Rating: 25kA/1s
17.5kA/2s
Max number of Leads: 1
Weight: 1.55kg
ENA 41-21 Reference: 41-21-LE8
Part Number: FA2180



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CE16/120 LINE END CLAMP

Clamping Diameter: 120mm
Short Circuit Rating: 61.2kA/ 2s
Max. Number of Leads: 3
Weight: 2.23 kg
ENA 41-21 Reference: 41-21-LE9
Part Number: FA2973-A

CE16/5 LINE END CLAMP

Clamping Diameter: 127mm only
Short Circuit Rating: 61.2kA/ 2s
Max number of Leads: 3
Weight: 1.9kg
ENA 41-21 Reference: 41-21-LE10
Part Number: FA2844-A



CE16/5.5 LINE END CLAMP

Clamping Diameter: 140mm
Short Circuit Rating: 61.2kA/ 2s
Max. number of Leads: 3
Weight: 2.41kg
ENA 41-21 Reference: 41-21-LE11
Part Number: FA2004-A

CE51 LINE END CLAMP

Clamping Diameter: 140-160mm
Short Circuit Rating: 53.7kA/ 1s
38kA/2s
Max number of Leads: 2
Weight: 2.85kg
ENA 41-21 Reference: 41-21-LE12
Part Number: EFP-16703



CE50 LINE END CLAMP

Clamping Diameter: 190-200mm
Short Circuit Rating: 53.7kA/ 1s
38kA/2s
Max number of Leads: 2
Weight: 3.03kg
ENA 41-21 Reference: 41-21-LE13
Part Number: EFP-16702

CE71 LINE END CLAMP

Clamping Diameter: 220-250mm
Short Circuit Rating: 25kA/ 1s
17.5kA/2s
Max number of Leads: 1
Weight: 3.5kg
ENA 41-21 Reference: 41-21-LE14
Part Number: EFP-16749






EARTH END CLAMPS - SUBSTATION

The PBwel Substation portable earthing equipment range is designed to meet the requirements of ENA technical specification 41-21. This includes our range of Earth End clamps, which are precision manufactured from robust aluminium castings with high-grade stainless steel fittings.

The spring-loaded feature of all types makes them suitable for application by hand to copper or aluminium earth tapes in any natural condition, with minimum strength required to achieve good contact and tightness.

PRODUCT BENEFITS

-  Solid construction for extended service
-  Proven service record used by ESI for over 40 years
-  Light weight with excellent corrosion resistance

Substation Earthing

PRODUCT RANGE

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CE20 EARTH END CLAMP

The CE20 is an Earth End clamp suitable to provide a connection to Substation Earth Tape. This is ideally suited for connection to tapes fitted with panhandles. Compatible with PB50T terminated leads and can be applied to clean or dirty copper and aluminium earth tape.

Earth Tape Thickness: 3.2-6.5mm
 Earth Tape Width: 38-50mm
 Short Circuit Rating: 25kA/ 1s & 17.5kA/2s
 Weight: 0.62kg

Part Number: FA2120-B

Applied to clean or dirty Copper or Aluminium



CE21 EARTH END CLAMP

Earth Tape Thickness: 3.2-13mm
 Earth Tape Width: 25-50mm
 Short Circuit Rating: 25kA/ 1s & 17.5kA/2s
 Weight: 0.64kg

Part Number: FA2121-B

Applied to clean or dirty Copper or Aluminium tape

CE20/2 EARTH END CLAMP

CE20 Earth End clamp with adapter to permit fitting of twin cables and increase short circuit capacity.

Earth Tape Thickness: 3.2-6.5mm
 Earth Tape Width: 38-50mm
 Short Circuit Rating: 53.7kA/ 1s & 38kA/2s
 Weight: 0.937kg

Part Number: FA2173-B



CE 20/2/50-60 EARTH END CLAMP

Special CE20/2 clamp suitable for fitting to wide aluminium earth tapes 50mm to 60mm wide. Ratings same as CE20/2.

Part Number: EFP-13727



CE35 CLAMP

Suitable for application to tee bar stubs/ ballstubs/ flat bar/ round bar.

For flat bars.

Max Thickness: 12mm
 Min Width: 31mm

For Round Bar

Max Diameter: 25mm
 Min Diameter: 12mm
 Short circuit rating: 25kA/1s & 17.5kA/2s

Part Number: FA3129-A

For use with ballstubs and T bar stubs.



FEMALE ADAPTOR STUD

Bronze bolted ball stud to provide a designated Earth point upon an Earth tape or within an electrical cabinet.

Part Number: 4814-01

MALE ADAPTOR STUD

Bronze bolted ball stud to provide a designated Earth point upon an Earth tape or within an electrical cabinet.

Part Number: 4814-02



Substation Earthing

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ALUFLEX LEADS

PBwel can supply Aluflex leads in any required length, in a wide range of sizes including specifically for Substation use 150sqmm & 50sqmm according to ENA specification 41-21. The flexible aluminium earth lead comes with tested and approved compression terminations and stress support springs/sleeves. Leads are used for connecting between a Line End clamp and an Earth End clamp. For use in Substations, Portable Primary Earths always employ 150 sq.mm Aluflex cable with a clear pvc sheath. Field Equipment earths employ 50 sq.mm Arctic orange Aluflex leads, 50 sq.mm clear leads are used for the control of induced voltages.

Leads are also available in blue and green, solid, opaque or semi-transparent coloured pvc sheaths for special applications on request.

PRODUCT BENEFITS



- Light and flexible
- Available In any lengths on-request
- Fully tested and approved to ENA 41-21

PORTABLE PRIMARY EARTH LEADS

Portable Primary Earth leads in accordance with ENA Technical Specification 41-21, 150 sq.mm Aluflex with clear pvc sheathing. Fitted with PB150T terminations and stress relieving springs to reduce flexing, which would otherwise create work hardening of the cable between the termination and the cable junction. Leads are carefully manufactured and tested rigorously throughout the manufacturing process to ensure quality and performance. Terminations are made from specially milled and certified material and precision machined.



150sqmm CLEAR ALUFLEX LEADS

Short Circuit Rating: 25kA/ 1s & 17.5kA/2s
 Cont. Current Rating: 350A
 Weight per Metre: 600g
Part Number: FA3025

SUBSTATION LEADS

Leads for Field Earths generally use two types of terminations. One end is PB150T which is suitable for the CE20 Clamp to connect to the Substation Earth Tape, whereas the other is a standard PB50 Palm Termination with a 13.5mm hole. Where a CE20 Earth End clamp is not fitted one end a lead having two PB50 palm terminations may be used.

50sq.mm ARCTIC ORANGE ALUFLEX LEAD

50sq.mm Aluflex Field Earth lead with PB50 Palm terminations both ends (not suitable for CE20 Earth End clamp).

Short Circuit Rating: 8.9kA/1s
 Cont. Current Rating: 150A
 Weight per Metre: 190g

Part Number: FA3347-C



Substation Earthing

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50sq.mm ARCTIC ORANGE ALUFLEX (TO SUIT CE20)

The flexible earth lead comes with tested and approved PB50T & PB50 compression terminations and stress relief spring/sleeve.

Short Circuit Rating: 8.9kA/1s

Cont. Current Rating: 150A

Weight per Metre: 190g

Part Number: EFL-19128



OTHER AVAILABLE FIELD EQUIPMENT EARTH ACCESSORIES INCLUDE

Earth Spike – Robust galvanised steel with capacity for up to five Earth leads.

Earth Rod – Copper clad Steel Rods which can be clustered to form an earth nest

Pan Handle – Bolted Earth Connection (aluminium)

OPERATING POLES

PBwel offers a range of Operating Poles suitable for 66-400kV use in accordance with ENA Technical Specification 41-21. These include single 8ft (2.44m) sections and single 4ft (1.22m) sections Poles, which can be interconnected to form the required length on site comprising bottom (with a handgrip), intermediate and top sections. Our operating poles are manufactured from lightweight resin-impregnated fibreglass of a high electrical Insulation grade and employ precision joints to reduce deflection and improve handling.

Operating poles are available as 8ft (2.44m) top and bottom single sections or two 1.22mm (4ft) sections permanently linked. Most commonly used are 4' (1.22m) sections due to their ease of transportation and the flexibility they offer when erecting on-site to suit busbar height. The top section should be fitted with an S9D or CEA/S2 Operating Socket.

PRODUCT BENEFIT



Lightweight

Precision machined for rigidity

High electrical resistance



8ft (2.44m) SINGLE SECTIONS

Sections Available: Top and Bottom

Compatible with: S9D and CEA/S2 Sockets

Length: 2.44 m

Weight: 1.40kg

Part Numbers: (Top) FA1346-E (Bottom) FA1322-H

Bottom sections available with End Plug.



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4ft (1.22m) SINGLE SECTIONS

Sections Available: Top, Bottom and Intermediate
 Compatible with: S9D and CEA/S2 Sockets
 Length: 1.22 m
 Weight: 0.70kg

Part Numbers: (Top) EBR-18101/4 (Bottom) EAR-18103/2
 (Intermediate) EAR-18103/1

Can be used with 4ft and 8ft sections to make required length.



8ft (2.44m) POLE (2X4ft SECTIONS JOINED BY CHAIN)

Sections Available: Used as single-pole only
 Compatible with: S9D and CEA/S2 Sockets
 Weight: 1.380kg

Part Number: EFR-18104/3

Compatible with other PBwel substation poles.

REMOVABLE POLE END PLUG

Material: Thermo-Plastic
 Colour: Grey

Part Number: EAR-18106

Protects lower joint on site



2ft SPECIAL POLE ASSEMBLIES FOR EARTH TAPE BRIDGING KITS

Special 2ft (0.6m) long upper and lower operating pole sections identified by blue pigmented open weave hand grip.

Part Numbers: (Top Section c/w socket) EFR-18114
 (Lower Section) EFR-18115



PBwel

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OPERATION SOCKETS

PBwel socket type S9D in accordance with ENA Technical Specification 41-21, supports Line End clamps being applied in an upward direction. It provides a quick deployment when used in conjunction with smaller clamps which have a 'NIB', this saves fully opening the clamp in order to fit the busbar. When the clamp is fully tightened, the socket should be pushed gently up towards the clamp, whilst maintaining the tightening pressure and the socket will then automatically disengage and the Operating Pole can be lowered.

Socket type CEA/S2 is an alternative type to the S9D where the operating screw of the Line End clamp is controlled by means of a sprung loaded plunger in the socket. This is suitable for use in any direction of application due to greater security of the clamp within the socket. Again manufactured and tested in accordance with ENA Technical Specification 41-21, it is also particularly suited to the application of the larger clamps.

PRODUCT BENEFITS

- 3 Solid construction for extended service
- 3 Proven service record used by ESI for over 50 years
- 3 Light weight and excellent corrosion resistance.
- 3 In accordance with ENA 41-21.



CEA/S2

Suitable for fitting substation Line End clamps (with short taper operating screws) in any direction. Spring loaded bayonet profile for secure location.

Weight: 0.385kg

Part Number: EFS-11203

S9D OPERATING SOCKET

Suitable for fitting substation Line End clamps (with short taper operating screws) in an upward direction.

Quick deployment feature.

Weight: 0.360kg

Part Number: FA1097-B



Clamp 'NIB' engages in the S9D socket to locate the clamp whilst being raised into position. The clamp does not require being fully opened/unscrewed as the socket controls the clamp whilst being fitted over the busbar.

Once the clamp fits over the busbar the socket releases the nib and allows the clamp to be tightened by rotating the Operating Pole. Once the springs upon the clamp are tightened a slight upward motion whilst maintaining tightening pressure will release the clamp.



Substation Earthing

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SUBSTATION EARTH TAPE KITS (INCLUDING NATIONAL GRID NSI 24)

These portable earthing kits have been developed to provide safe and secure high voltage connections to dirty or heavy oxidized copper/aluminium earth tapes. The CE57 Earth Tape clamp provides a drain earth before fitting a bridging earth suitable for fault protection, conductor sizes ranging from 25x3mm to 100x6mm are accommodated.

Earth tape defects range from deterioration of welded underground jointed interfaces on an earthing grid, high resistance connections between a tape and the primary plant or unauthorised removal leaving breaks in the system. PBwel supply kits to aid safe repairs of Earth Tapes.

PRODUCT BENEFITS



Conductor range 66kV to 400kV

In accordance with National Grid NSI 24



CE57 DRAIN EARTH CLAMP

Aluminium Drain Earth clamp for use in Earth Tape Bridging Kit.

Conductor range: 25mm x 3mm (Min)
100mm x 6mm (Max)

Short Circuit Rating: 16kA/1s

Continuous Current Rating: 300A

Part Number: EFP-16708

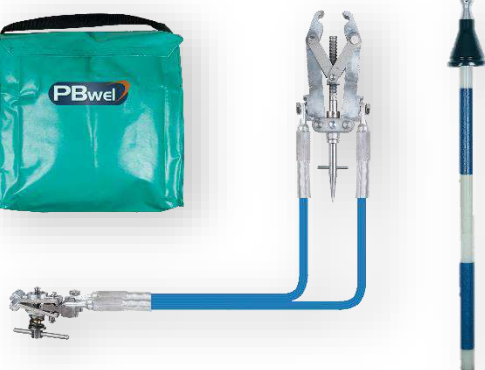
Kits are fully customisable if required, but the standard offering is the NSI 24 Temporary Earth Bond Kit.

CE20/2/A/S/RT RING TYPE EARTH CLAMP

Earth clamp to allow temporary earthing of earth tapes.

Short Circuit Rating: 25kA/1s and 17.5kA/2s

Part Number: EFP-16705



NSI 24

TEMPORARY EARTH BOND KIT

1x CE57 Earth Tape Clamp
2x 8m Blue 50sqmm Aluflex Leads
1x CE20/2 Clamp
1x 2ft Bottom Pole
1x 2ft Upper Pole c/w Socket
1x PVC Carry Bag

Short Circuit Rating: 16kA/ 1s

Continuous Current Rating: 300A

Part Number: MISC-00021

This kit can be used as an NSI26 Earth.

Substation Earthing

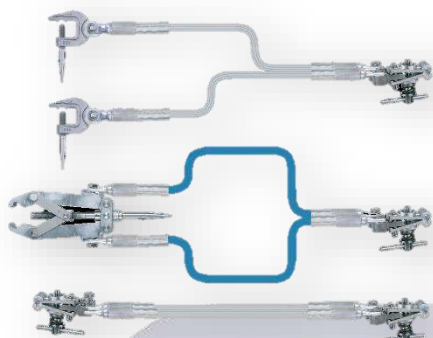
PRODUCT RANGE

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NSI24 KIT WITH CLEAR LEADS

- 1x CE57 Earth Tape Clamp
- 1x CE20/2 Clamp
- 2x 8m Clear 50sq mm Leads
- 1x 2ft Upper Pole Assembly c/w Socket
- 1x 2ft Lower Pole Assembly
- 1x PVC Carrying Bag

Part Number: MISC-00100



EARTH TAPE REPAIR KITS FOR NIE

Comprising three configurations CE57 + MTR 50SQ Blue + CE20/2, CE20/2 + 8MTR 150 Clear + S9A, CE20/2 + 8MTR 150 Clear + CE20/2.

Part Number: MISC-00137

ADDITIONAL CLAMPS FOR SPECIAL APPLICATIONS



CE5 CLAMP

Material: Bronze
Conductor size: 12.7mm – 25.4mm
Specification: Short taper Op.Screw
S/C Rating: 12kA/ 1s

Part Number: EMP-15065

CE4 SCAFFOLD CLAMP

Clamping Diameter: 20-50mm
Weight: 0.659kg
Short Circuit Rating: 8.9kA/1s
Cont. Current Rating: 150A

Part Number: FA3736-A



CE12/A/ST/135H CLAMP

Material: Aluminium
Conductor Size: Up to 20mm bars
 Up to 15mm dia.
Short Circuit Rating: 25kA/1s
 17.5kA/2s

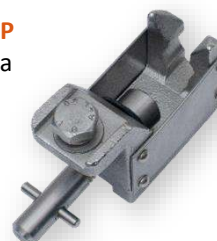
Part Number: FA3190-A

CE30 PRECIPITATOR EARTH CLAMP

Suitable to fit Earth ballstub using a GS1 Operating Socket.

Material: Stainless Steel

Part Number: FA2540



Substation Earthing

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GS1 OPERATING SOCKET

To suit square end op-screws.
Fits PBwel top section pole.
Suitable for use with CE30 clamp.

Part Number: EFS-12541



PB150T TERMINATION

Suitable for 150 sq.mm Aluflex cable.

Part Number: EMP-07882



PB50 PALM TERMINATION (13 DIA. HOLE)

Suitable for 50 sq.mm Aluflex cable to fit a CE20 Earth End clamp upon a Field Equipment Earth.

Part Number: EMP-07884



PB50T TERMINATION (13 mm HOLE)

For use upon Field Equipment Earth.

Part Number: EMP-07880/3



SUSPENDED EARTHING SPIGOT

This Spigot range is designed to be permanently fitted to new or existing busbars. It accommodates up to five PBwel Clamps suitable for 38mm (CE22/A or CE22/A+B), reducing the need for heavier large-diameter clamps.

National Grid EGI Code BC4P0001. Designed to fit UK standard busbar sizes. Lightweight, easily installed by one person. Suitable for busbars at any angle up to 60 degrees.

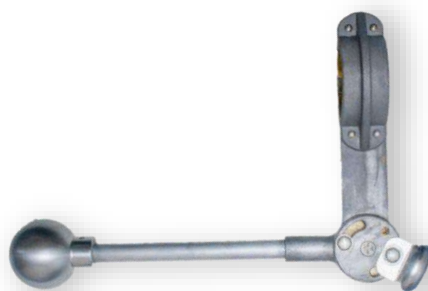
The machined clamp is supplied in two halves that are bolted together around the busbar using the supplied fasteners. A 38mm diameter spigot and corona shield, common to all spigot clamps and busbar sizes, is then bolted onto the clamp.

PERFORMANCE CHARACTERISTICS



- 1kN Mechanical Load
- 900 Amps Continuous Current Rating
- RIV and Corona Discharge Test @ 400kV Rating
- 80kA/1s Short Circuit Rating including a peak at 200kA.
- 40kA/3s Short Circuit Rating including a peak at 100kA.

Specifications	
Hight	530- 590mm
Width	900mm
Depth	260- 380mm
Clamp	5- 7kg
Spigot	3kg



SUSPENDED BUSBAR SPIGOT CE75, CE76 & CE77

Designed to fit any UK busbar size.
Lightweight, easily installed by one person.
Suitable for busbar at any angle up to 60 °.

National Grid EGI Code: BC4P0001

Part Number: See chart

Substation Earthing

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Product Reference	Body Part Number	Spigot Part Number	Busbar Size (mm)
CE75/250	EFF-16771	EFF-16780	250
CE75/220	EFF-16772	EFF-16780	220
CE76/200	EFF-16773	EFF-16780	200
CE76/190	EFF-16774	EFF-16780	190
CE76/160	EFF-16775	EFF-16780	160
CE77/140	EFF-16776	EFF-16780	140
CE77/127	EFF-16777	EFF-16780	127
CE77/120	EFF-16778	EFF-16780	120
CE77/115	EFF-16779	EFF-16780	115

* Note: A Suspended Busbar requires both a body and spigot assembly as shown upon the chart.

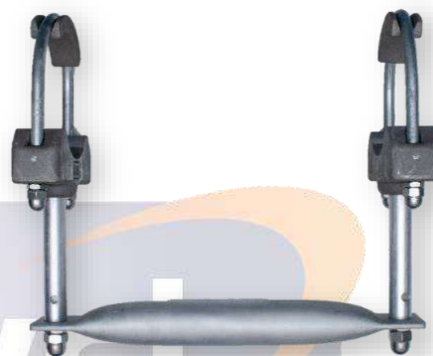
TYPE 'H' SUSPENDED BUSBAR ALUMINIUM SPIGOT

Underslung design Busbar to provide a standard busbar size to suit a smaller clamp such as the CE22/B or CE22/A+B Line End. Aluminium with stainless steel fittings.

Busbar Size: $\varnothing 140\text{mm}$

Spigot Diameter: $\varnothing 40\text{mm}$

Part Number: **FA2528-A**



TYPE 'A' & TYPE 'B' ALUMINIUM SPIGOTS

Suitable for 275kV & 400kV insulator post assemblies.

Available with varying length Spigots to suit required rating.

Optional Corona Shields available (bolt-on type) for non-shielded applications 275kV or 400kV.

Type A: 4-slots 18 wide on a 127mm PCD

Type B: 4-slots 22 wide on a 178 PCD

Type A Part Number: **FA2277**

Type B Part Number: **FA2369**



Substation Earthing

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TYPE C, E & M SPIGOTS

Simple clamp on spigots in aluminium and bronze to provide a suitable Earthing Point on-site from a busbar or stranded conductor. Optional bolt-on Corona Shields available. Different length 40mm diameter spigots are available to suit required rating.

TYPE C SPIGOTS

Simple clamp on spigot in aluminium. Stainless steel fittings optional bolt-on Corona Shields available.

Spigot Length: To suit rating/number of Line End clamps

Spigot Diameter: 40mm diameter.

Busbar size: 90mm diameter

Part Number: FA2438-A

TYPE E SPIGOTS

Simple clamp on spigot in bronze. Stainless steel fittings optional bolt-on Corona Shields available.

Spigot Length: To suit rating/number of Line End clamps

Spigot Diameter: 40mm diameter.

Busbar size: 75mm diameter

Part Number: FA2447

TYPE M SPIGOTS

Simple clamp on spigot in bronze. Stainless steel fittings optional bolt-on Corona Shields available.

Spigot Length: To suit rating/number of Line End clamps

Spigot Diameter: 40mm diameter.

Busbar size: 38mm diameter.

Part Number: FA3650



TYPE 'D' SPIGOT 63.5 230 AL

Type 'D' aluminium Spigot to suit isolator or circuit breaker head.

Spigot Diameter: 40mm

Spigot Length: To suit rating/number of Line End clamps

Part Number: FA2448-A

BOLT ON CORONA SHIELDS FOR SPIGOTS

Aluminium Corona Shields

Fully tested

275kV Corona Shield Part Number: A2617-A

400kV Corona Shield Part Number: EFF-16701



PBwel