



Best Practice Crimping and Potential Changes to NR/L2/ELP/23002

Reece Brenchley – Sales Engineer
Mark McKeown – Product Specialist

- Introduction to Cembre
- Best Practice Crimping for Aluminium & Bi-Metallic Connectors
- An update on the NR/L2/ELP/23002 requirements for double sheath cable



CEMBRE is **Europe's leading**
designer and manufacturer
of electrical connectors and
related installation tools



Year of
foundation: **1969**

Turnover 2024*:
229.7 million

Listed on the
Milan Stock
Exchange since
1997

Employees*:
903 (world)

Production sites:
2

Branches: **7**



ELECTRICAL CONNECTORS

- Pre-insulated electrical connectors
- Non-insulated electrical connectors
- Flexible bars and braids



TOOLS & MACHINES

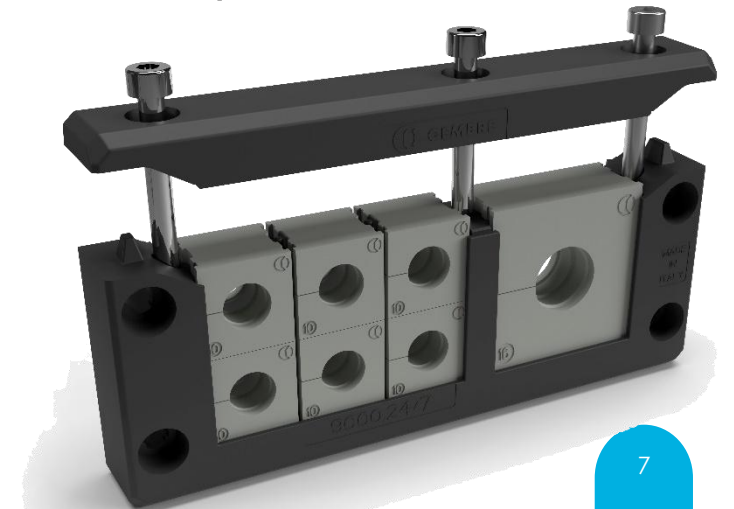
- Hydraulic tools & pumps for crimping, cutting and punching
 - Mechanical hand tools for crimping, cutting, punching and stripping
 - Professional equipment (GPT)
-





CABLE GLAND AND CABLE ENTRY SYSTEM

- Plastic, brass and stainless steel cable gland
- Modular cable glands
- Frames and grommets of various sizes and shapes
- Fastening Components





INDUSTRIAL MARKING

- Thermal transfer on sheets and roll marking systems
 - Manual marking systems
 - Cable tags, for terminals, buttons and PLCs
 - Labels
 - Customised labels
-



PRODUCTS FOR THE RAILWAY SECTOR

- Electrical rail connection systems and track fixtures
- Machines for the construction and maintenance of railway infrastructure
- Electrical component connection and identification systems on rail vehicles

Old



NR/PS/ELP/21101 Trackfeeder Cable



Eland Product Group: A3T

APPLICATION

Provides the 650/750V DC supply from Traction Substations and Track Paralleling Huts to conductor rails, negative cable connections and where appropriate, bonding.

CHARACTERISTICS

Voltage Rating
750V

Temperature Rating
Fixed: -25°C to +85°C

Minimum Bending Radius
Aluminium conductor - Fixed: 10 x overall diameter
Copper conductor - Fixed: 8 x overall diameter

CONSTRUCTION

Conductor
Class 2 stranded aluminium or tinned copper conductor

CABLE THIRD-PARTY ACCREDITATION



Network Rail (NR) certified and PADS listed as meeting the requirements for installation within their network

STANDARDS

NR/PS/ELP/21101, BS EN 60228

THE CABLE LAB®

AN ISO/IEC 17025 AND IECCE CBTL ACCREDITED FACILITY

Our world-class testing facility assures the quality and compliance of this cable through a continuous and rigorous testing regime.



SUSTAINABILITY COMMITMENT

New

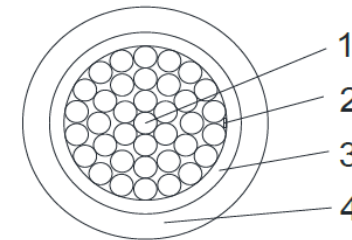


Cables for a moving world

Codice/code	DOCUMENTO / DOCUMENT	DATA/DATE	REV
DC TRACTION POWER CABLE 1500V AL	DC TRACTION POWER CABLE 1500V AL rev.1	30/07/2021	1

DC TRACTION POWER CABLE 1500V AL

DRAWING – GENERAL CONSTRUCTION - COLOUR CODE AND MARKING



1. CONDUCTOR
2. IDENTIFICATION TAPE
3. INSULATION
4. OUTER SHEATH

INSULATION COLOUR: Natural

OUTER SHEATH COLOUR: Black

NORMS OF REFERENCE: NR/2/PS/ELP/23002/02

Old



NR/PS/ELP/21101 Trackfeeder Cable



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Codice/code

DC TRACTION POWER CABLE 1500V AL

DOCUMENTO / DOCUMENT

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DATA/DATE

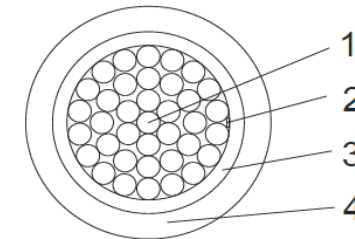
30/07/2021

REV

1

DC TRACTION POWER CABLE 1500V AL

DRAWING – GENERAL CONSTRUCTION - COLOUR CODE AND MARKING



1. CONDUCTOR

2. IDENTIFICATION TAPE

3. INSULATION

4. OUTER SHEATH

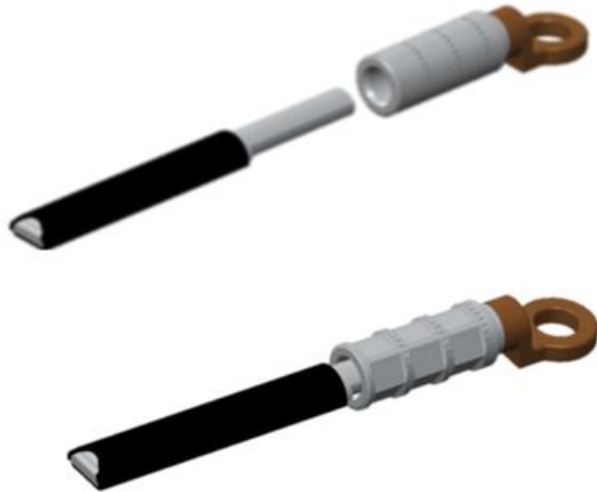
INSULATION COLOUR: Natural

OUTER SHEATH COLOUR: Black

NORMS OF REFERENCE: NR/2/PS/ELP/23002/02

- Transitioning between the Old and New
- Changes to the 150mm Cable

On Site Cable Termination:



Manufactured Bond Leads:



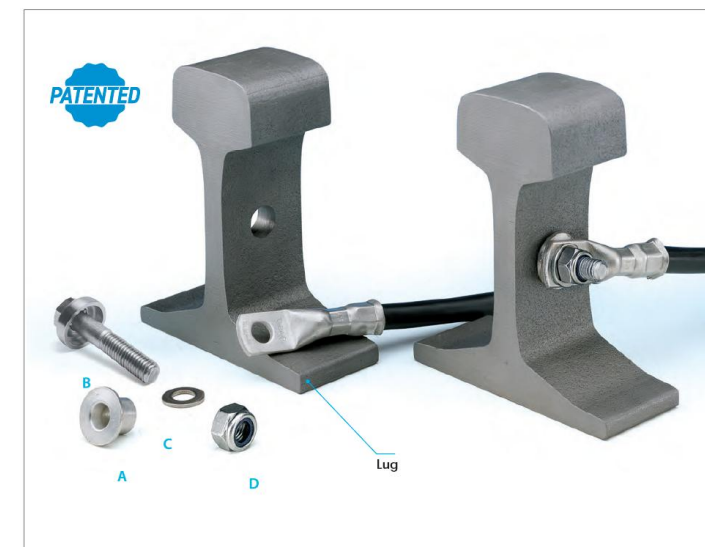
	Old	New
Cable	NR/PS/ELP/21101 Track Feeder	NR/2/PS/ELP/23002/02
Die Set	MK32L-C (using RHC131) MK32-3D (using ECW-H3D)	MK32L-C (using RHC131) MK32-3D (using ECW-H3D)
Connectors	AA240-M12-1G/340 AA240-M16-1G/340 AA240-M16-1G	AA240-M12-1G/340 AA240-M16-1G/340 AA240-M16-1G
Bushing Kit	AR61 / AR6116RR	AR61 / AR6116RR

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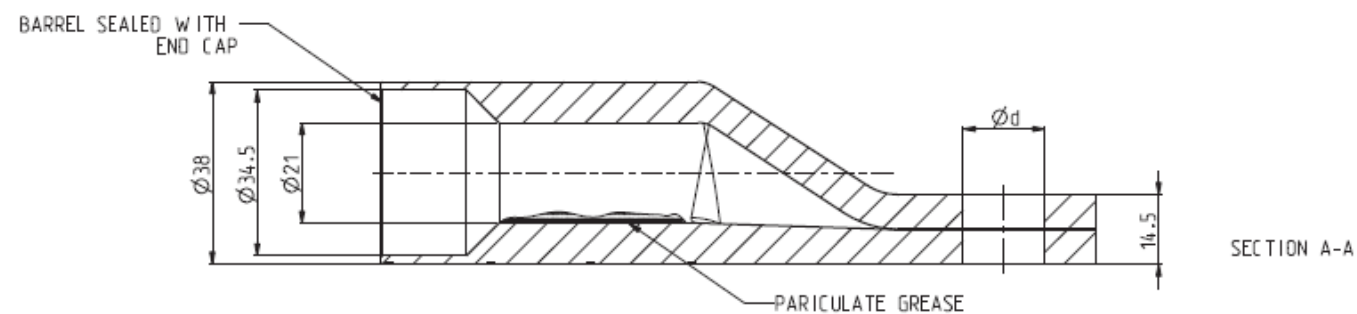
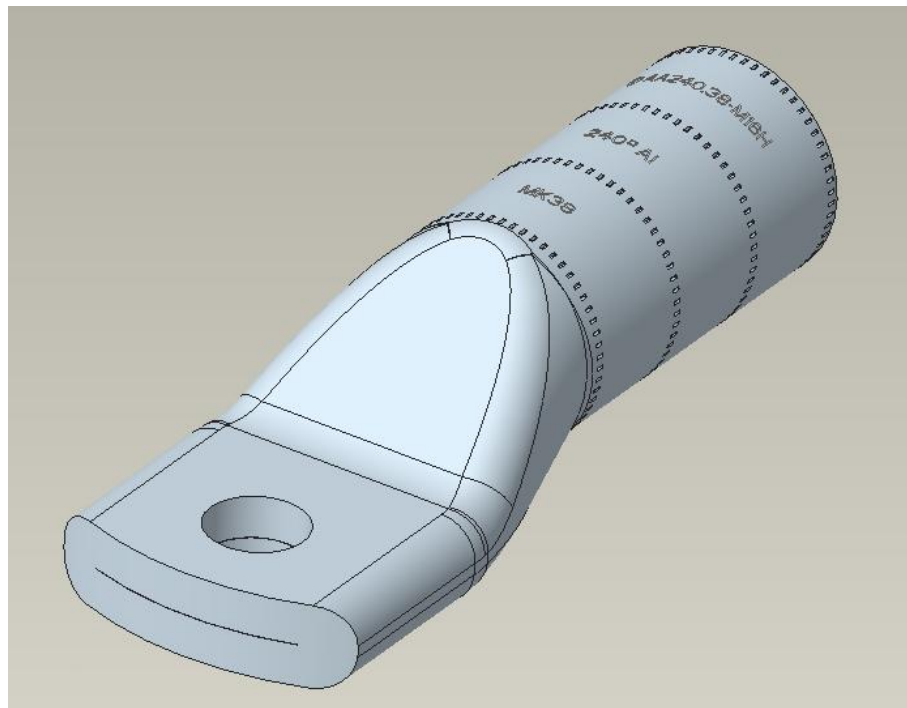
	Old	New
Cable	NR/PS/ELP/21101 Trackfeeder Cable	NR/2/PS/ELP/23002/02
Die Set	MK34-3D (using ECW-H3D)	MK38-3D (using ECW-H3D)
Connectors	AA240.34-M12H AA240.34-M16H	AA240.38-M12H * AA240.38-M16H *
Bushing Kit	AR61 / AR6116RR	TBC / AR6116RR

* Not sold separately, only as part of the Bond Lead kit

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* Not sold separately, only as part of the Bond Lead kit



Thank you!
Any questions?

Contact Details:

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CEMBRE

ALUMINIUM & BI-METALLIC TERMINALS

CPD

Cable preparation & crimping
(best practice)

SECTION 1.

COURSE FUNDAMENTALS

In this section we will cover;

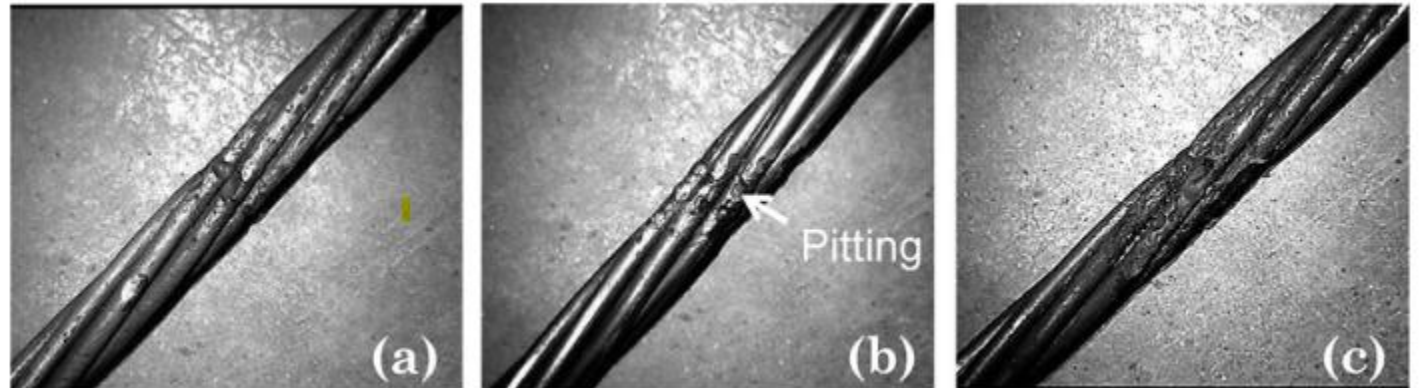
1. Aluminium oxide and its affect
2. Cable preparation
3. Crimping in accordance with BS7609
4. Protecting the CRIMPED joint against moisture ingress
5. Best practice for long term 'palm to contact face' performance

1. ALUMINIUM OXIDE AND ITS AFFECT ON CONTACT INTERFACE

Moisture

Aluminium oxide is a hard film, with high resistance, which builds on the surface of the conductor and is dependant on environmental conditions of humidity and temperature. It is transparent and therefore even a 'clean' surface will feature an oxide file which may compromise electrical contact.

Moisture containing contaminants may also affect the contact surface, causing pitting or crevice corrosion.



1. ALUMINIUM OXIDE AND ITS AFFECT ON CONTACT INTERFACE

For this reason, the aluminium oxide 'film' that exists on the exposed conductor, must be removed prior to crimping, and the joint should be sealed and protected from moisture/contaminant ingress after the terminal or connector has been installed.



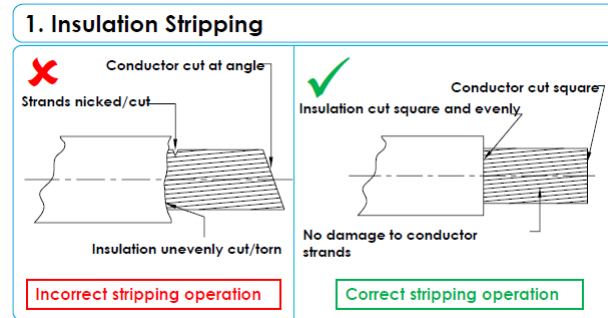
The following instructions show the correct procedure to follow to achieve a reliable connection every time



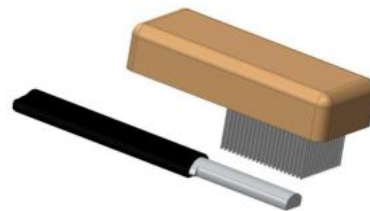
2. CABLE PREPARATION

Cable preparation

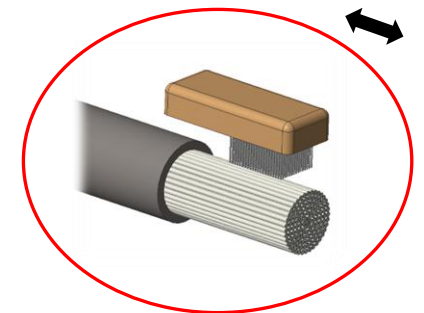
1. Cut the cable to the desired length ensuring that the cut is square.



2. Strip the cable to correct length, which should be equal to the barrel length of the connector.
3. Oxidation of a conductor surface yields a 'bulk' film of high resistivity, which must be removed by wire brushing with a stainless- steel brush, taking care to have previously spread a light layer of grease over the surfaces (e.g., Netoxal –G/Contactem C3)



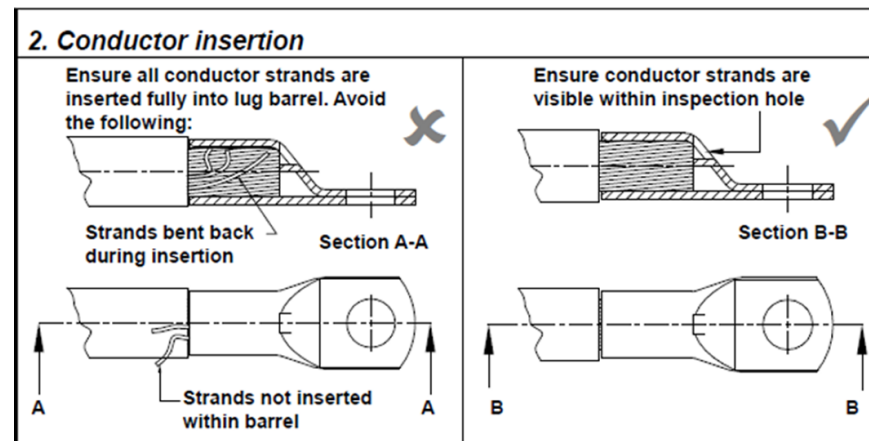
Note: when brushing stranded conductor, follow the helix of the cable



2. CABLE PREPARATION

Cable Preparation (cont'd)

4. Using a cloth, remove the grease that contains the aluminium oxide residue
5. Smear a small quantity of contact grease over the conductor, and fully insert it into the barrel of the lug, as is shown in the diagram below

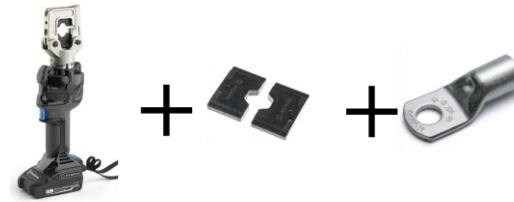


3. CRIMPING IN ACCORDANCE WITH BS7609

Note: For more information about 'Best Practice Crimping', Cembre offer a separate CPD Course – ask for details.

Crimping

1. The terminal should be crimped in accordance with the recommendations of BS7609, which outlines the procedure that should be adopted for the mechanical compression of copper and aluminium conductors. The guide outlines the use of a 'matched crimping system', whereby the same make of tool, crimp die, and connector should always be adopted.



2. Insert the cable into the barrel of the aluminium terminal, and crimp using the manufacturers recommended crimp tool and die set, remembering to apply the correct number of compressions, in the correct sequence, and according to the die selection chart provided.



4. PROTECTING THE 'CRIMPED JOINT' AGAINST MOISTURE INGRESS

Moisture protection

Wrap the completed crimp joint with self-amalgamating tape, then apply a heat or cold shrink over the top.



Note:

This procedure should be adopted regardless of whether the application is 'indoor' or 'outdoor', as moisture is always present in the air, and the joint needs to be protected against it.

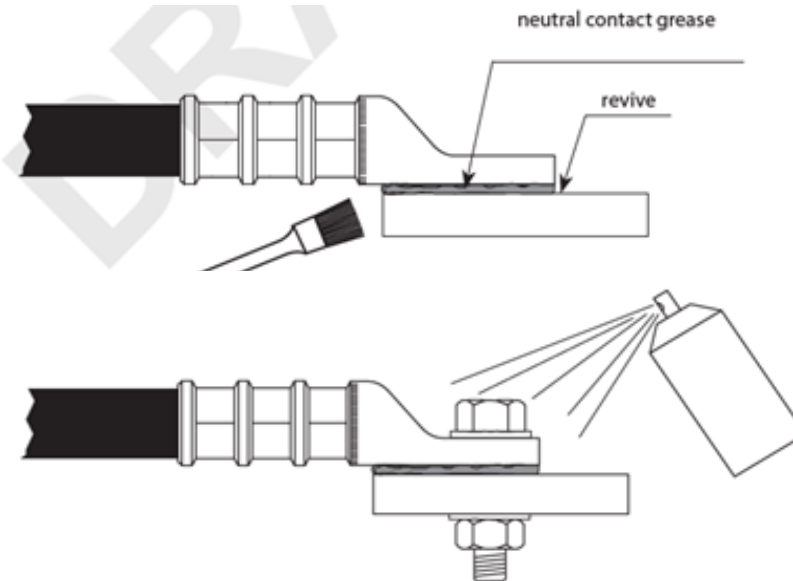


5. PALM TO CONTACT FACE (BEST PRACTICE)

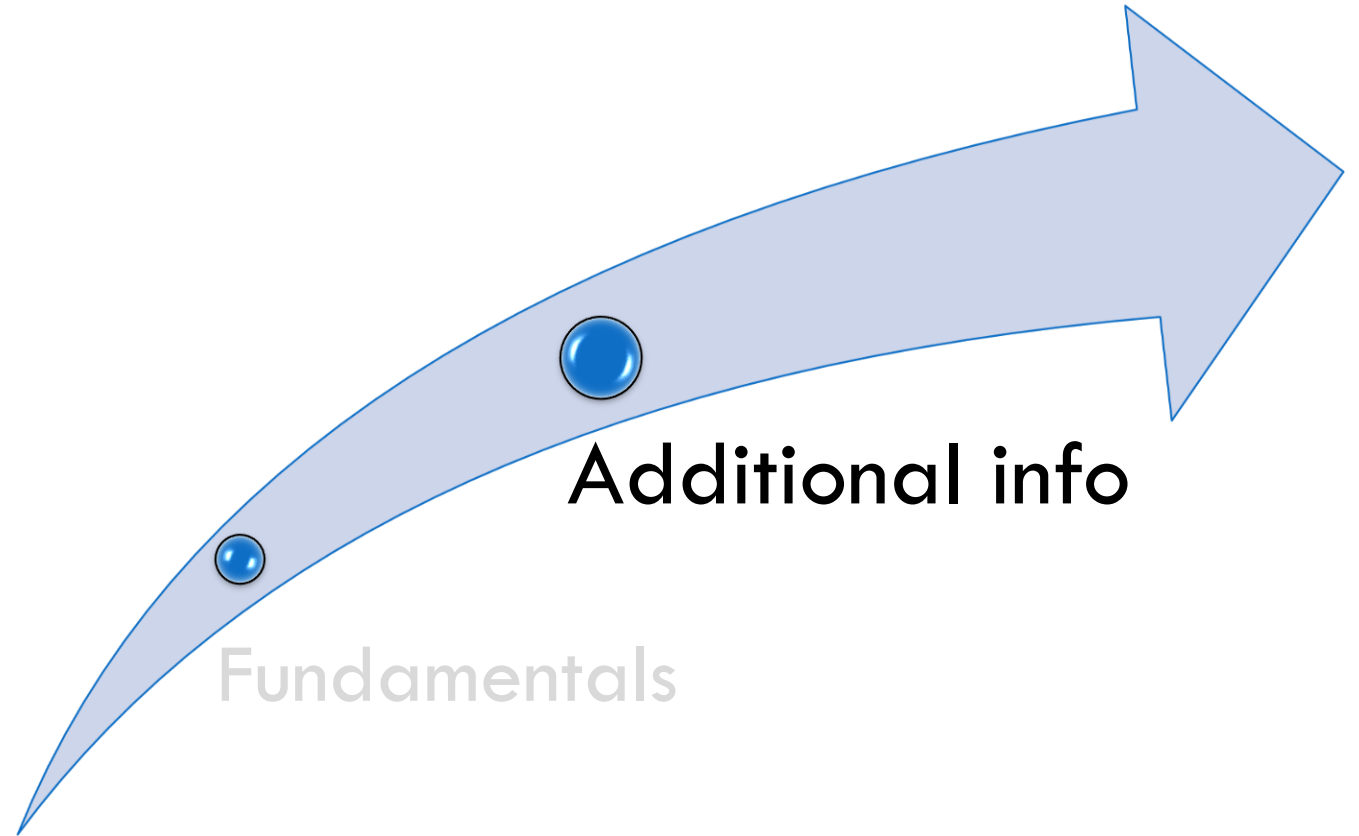
Contact Grease

It is good practice to ensure that a good contact is maintained at the contact face.

1. Prior to terminating aluminium or bi-metallic lugs, ensure the contact face of the palm is clean (wire brush and alcohol wipe Aluminium and Bi-metallic palm)
2. The application of a contact grease (JP-1) at the interface effectively seals the area, preventing atmospheric pollutants which may affect the connection over the long term

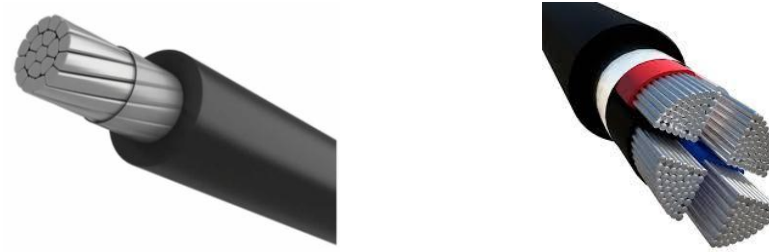


SECTION 2



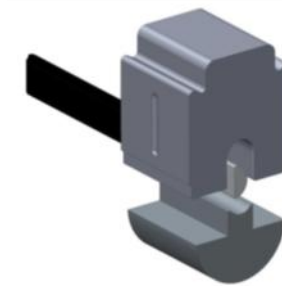
1. PRE ROUNDING SECTOR SHAPED CABLES

Aluminium conductors can be round in construction, or sector shaped, Solid (class1) or stranded (class 2).



Obtaining sector shaped terminals & connectors can be difficult, so when the barrel of the terminal or connector is 'round', it is necessary to 'pre-round' the conductor to match the profile to the barrel of the lug.

This can be achieved using dedicated 'pre-rounding' dies



1. PRE ROUNDING SECTOR SHAPED CABLES

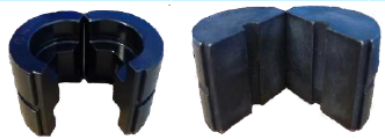
Manufacturers provide user guides or data sheets like the one below, that show the correct pre-rounding and crimping dies to be used for each size of cable.

Die selection Chart						
For Aluminium / Bi-metallic Terminal Lugs & Pin Terminals						
Conductor Size (sqmm)	Aluminium Terminal Lug	Bi-metallic Terminal Lug	Bi-metallic Pin Terminal	Pre-Rounding Die Set	Crimping Die Set	No. of Crimps
16	AA16-M8	CAA16-M12	MTA16-C	-	MK16-C	3
25	AA25-M8	CAA25-M12	MTA25-C	UP130-6.3-C	MK16-C	3
35	AA35-M8 AA35-M10	CAA35-M12	MTA35-C	UP130-7.5-C	MK16-C	3
50	AA50-M12 AA50-M14	CAA50-M12	MTA50-C	UP130-7.5-C	MK20-C	3
70	AA70-M12 AA70-M14	CAA70-M12	MTA70-C	UP130-9.0-C	MK20-C	3
95	AA95-M12 AA95-M14	CAA95-M12	MTA95-C	UP130-10.5-C	MK20-C	3
120	AA120-M12 AA120-M14	CAA120-M12	MTA120-C	UP130-12.5-C	MK25-C	3
150	AA150-M12 AA150-M14	CAA150-M12	MTA150-C	UP130-14.0-C	MK25-C	3
185	AA185-M12 AA185-M14	CAA185-M12	MTA185-C	UP130-15.7-C	MK32L-C	3
240	AA240-M12 AA240-M14	CAA240-M12	MTA240-C	UP130-17.5-C	MK32L-C	3
300	AA300-34-M12 AA300-34-M14 AA300-34-M16	CAA300-34-M12 CAA300-34-M16	-	UP130-20.2-C	MK34L-C	3

Information for use with the following tools:
HT120-C, HT131-C, HT131-UC, RHC-131, RHU131C,
B1300-CE, B1300-UC, B1350-CE, B1350-UC

Die Set: MK16-C

Pre-Rounding Die: UPC130-6.3-C





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West Midlands, B76 9EB
United Kingdom



3. HEX CRIMPING

Tests [by Cembre] have shown that hexagonal crimping can yield improved tensile strength, as the compression force and deformation is applied all around the barrel.

This can only be assured however if a 'matched crimping system' is used (same make of connector, tool and die)



5. TORQUE SETTINGS FOR BOLTS

Whether you are attaching a copper or an aluminium lug to a bus bar, the correct torque settings should be used when tightening the nut to the bolt, as defined by BS:7609.

Table 1 – Recommended torque wrench settings for aluminium and copper terminations

Stud size (full nut) mm	Grade 8.8 stainless steel or equivalent studs N · m	Brass or high conductivity copper studs N · m
6	7	5
8	20	10
10	35	20
12	50	40
14	70	65
16 ^a	90	90
20	150	—
^a 16 mm aluminium or copper stemmed bushings: full nuts, 70 N · m; half nuts, 55 N · m		

6. USING 'SPRING' OR 'BELVILLE' WASHERS

It is recommended to use spring or Belleville washers to maintain the mechanical and electrical integrity of the bolted connection by preserving the fastener pre-load, as aluminium is a softer material than copper, and can be more susceptible to joint relaxation as a result

