1 INTRODUCTION

This 33kV jointing manual covers the approved methods and associated jointing kits for use on all non fluid filled 33kV mains cables within UK Power Networks.

The 33kV jointing manual is split into four sections:

Section 1	Introduction and Health, Safety and Sustainability Statement
Section 2	Jointing Instructions
Section 3	Standard Procedures for Preparing 33kV Cables
Section 4	Installing Heatshrink Materials and Componants

Every attempt has been made to cover all the types of joint required. If the joint that you are required to make is not covered, refer either to the Craft Training Centres at Bury St Edmunds and Sundridge or to Asset Management.

1.1 Health, Safety and Sustainability Statement

UK Power Networks requires anyone working on its network to comply fully with its Health, Safety and Sustainability (HSS) policies and procedures, details of which can be found in the UK Power Networks' Central Document Library (CDL). This section is intended only as a summary of HSS requirements. Persons carrying out jointing works on the network, shall ensure they are up to date with all relevant HSS procedures and guidance before carrying out work. If in doubt, ask.

- The requirements of the Distribution Safety Rules and associated approved procedures and codes of practice shall be followed at all times.
- Appropriate Personal Protective Equipment shall be worn.
- An on-site risk assessment shall be carried out using the UK Power Networks standard on-site risk assessment sheet at the start of every job and reviewed at the start of every subsequent day of the job.
- Only approved materials shall be used. Materials and substances which have not been assessed by UK Power Networks under its COSHH procedure shall not be used without assessment.
- Only approved tools designed for the type of cable shall be used, and the condition of these shall be checked each day before use.
- Only persons who have been trained and assessed to a level acceptable to UK Power Networks may carry out jointing on the network owned by UK Power Networks. People shall only carry out work for which they have the necessary skills and training.
- Work may only be carried out in accordance with UK Power Networks' procedures and, where appropriate, the agreement of network control.
- Work may only be carried out if an appropriate task or job instruction has been issued for that work, unless the person concerned is specifically authorised to issue such instructions to them.
- Only competent or authorised persons specifically appointed to do so may carry out jointing work, receive Permits to Work and carry out the operational activities associated with jointing such as linking and fusing.
- The work site shall be kept tidy. Environmental risks created by the work and disposal of waste shall be managed in accordance with UK Power Networks Environmental procedures.

- All jointing works shall be carried out in accordance with this manual and other guidance issued by UK Power Networks.
- All work carried out shall be recorded in the approved manner and details returned for inclusion on the records management system.
- Any incidents or near misses that occur, and any hazards that come to light shall be reported to the AIRline reporting system.

2 JOINTING INSTRUCTIONS

This section contains a complete list of jointing instructions and kit selection tables for all 33kV joints.

Only joints contained within this section are to be used in UK Power Networks. No other joint kits or combinations of joint kit shall be used without the approval of UK Power Networks Asset Management.

To simplify the kit selection tables only metric cable sizes are used. To convert from imperial to metric conductor sizes refer to the comparison table below:

All sizes apply to both copper and aluminium conductor sizes.

Imperial Conductor Size (inch²)	Metric Equivalent Conductor Size (mm²)
0.007	4
0.0225	16
0.04	25
0.06	35
0.1	70
0.15	95
0.2	120
0.25	150
0.3	185
0.4	240
0.5	300
0.6	400
0.75	500
1.0	630
1.23	800
1.55	1000

The following sections contain tables which detail the joint kits required to complete particular types of joint for all the cable sizes listed.

Any jointing requirements for cable sizes not shown on this table should be referred to one of the UK Power Networks Jointing Schools.

2.1 Single-Core Polymeric Straight Joints

2.1.1 Single-Core Straight Joints with Similar Size Conductors (185 to 300mm²)

These are all heatshrink joints that contain both phase and copper wire screen connectors.

Cable Sizesin mm²		Joint Kit Description and Part Numbers
Tyco Part Number		MXSU-6131-GB01
UK Power Networks Stores Code		02640P
185	185	1 per Joint
185	300	1 per Joint
300	300	1 per Joint

2.1.2 Cable Preparation

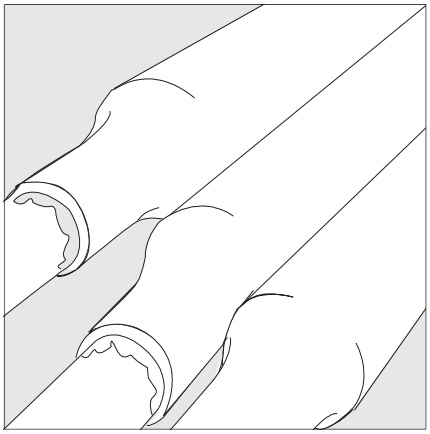
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.1.3 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.1 Single-Core Polymeric Straight Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.1 Single-Core Polymeric Straight Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.1 Single-Core Polymeric Straight Joints



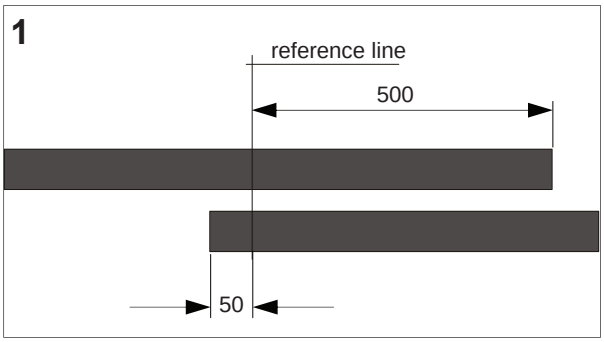
Installation Instruction

33kV Single Core Straight Joint for Polymeric Single Core XLPE Cables

For Cable Sizes:185 - 300mm^2
MXSU-6131-GB01
UK Power Networks Stores Code 02640P

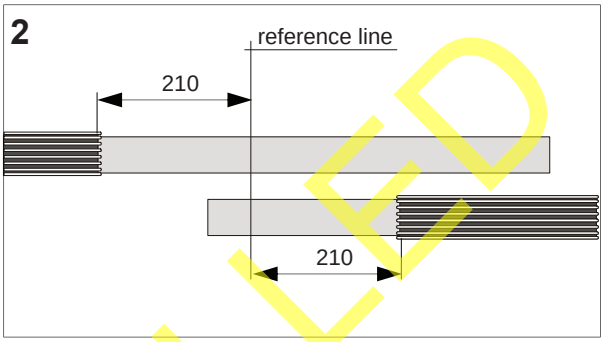
Cable Overlap

Overlap the cables to be jointed as shown in drawing and mark the reference line.



Cable Preparation

Remove the cable oversheaths to dimension shown in the drawing.
Clean the remaining oversheath for a distance of 1m. Bend the copper wire screen wires back onto the oversheath and tape the ends to the cable.

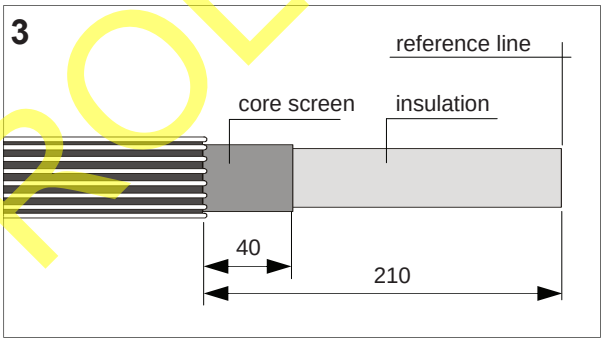


Core Preparation

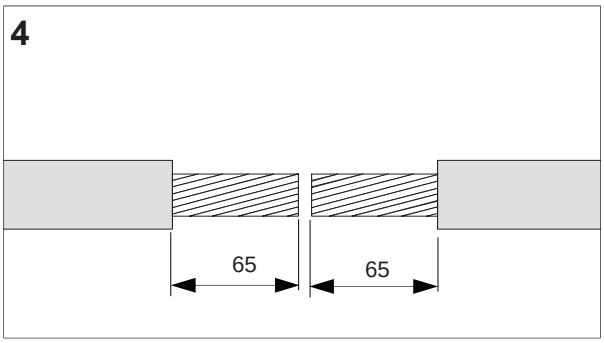
Cut the cores to measurement in the drawing using a hacksaw.

Remove the insulation screen to the dimensions shown in the drawing, ensuring that insulation surface is left smooth and free from all traces of conductive material.

Clean and degrease the insulation.



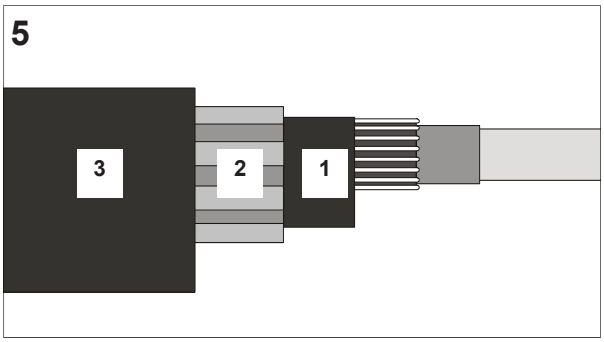
Remove the insulation from both cores to dimension shown in the drawing.



Completion of Joint

Slide each tube from the tubing set and the outer sleeve over one of the cable ends. Use the plastic bag the tubing set came in to protect the tubes until they need to be installed.

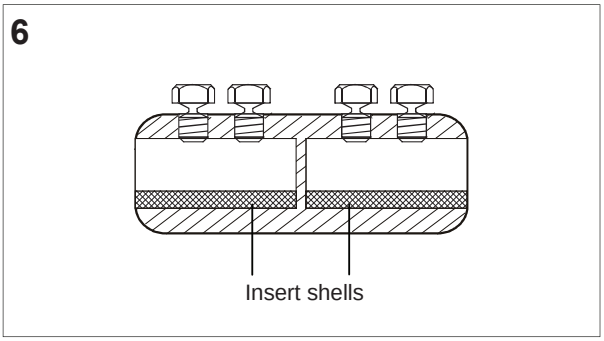
1. Black stress control tube.
2. Black and red screened insulation tube.
3. Black outer sleeve.



Installation of the Mechanical Connector

The connector is supplied with insert shells which have to be used if small cross section cables are to be jointed.

If the conductor to be jointed fits into the connector with the halfshells installed use them. If the core does not fit into the connector, remove them and use the connector on its own.

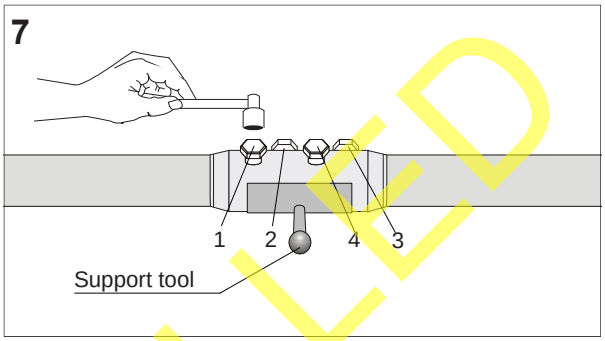


Insert the conductors into the connector so that the insulation butts up against its ends. Hand tighten the shear bolts so that the connector stays in place.

To avoid bending the cores use a connector holding tool.

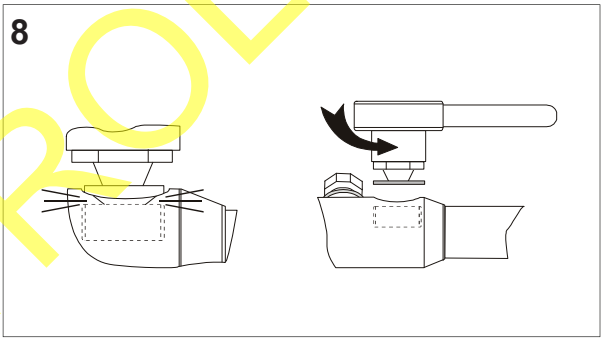
Shear off the heads of the shear bolts in the sequence shown in the drawing.

If a cordless impact wrench is used, it should not be used for more than two seconds at a time.

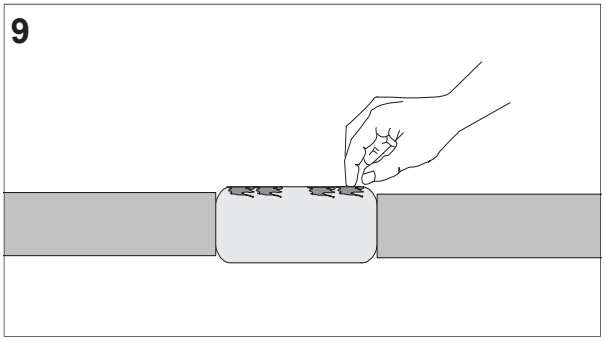


Once all bolts have been sheared off remove any sharp edges on any protruding bolts.

Clean and degrease the connector and the insulation wipe.



Fill the bolt holes with the clay supplied in the kit to form a smooth finish.

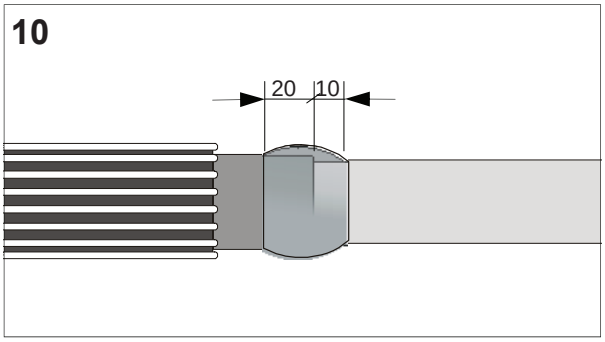


Remove the yellow void filling mastic tape from the aluminium foil bag.

Remove the release papers from both sides and wrap it around the core screen cut, starting 20mm from the end of the screen and continuing onto the insulation for 10mm.

Stretch the tape to half of its original width to ensure that it is applied with the correct tension.

Repeat this process on both ends.

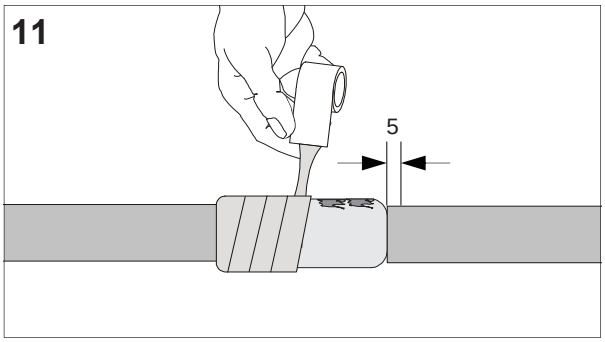


Remove the printed release paper from the yellow void filling mastic tape. Apply the tape with a 50% overlap, stretching it to half its original width to ensure that it is applied with the correct tension.

Completely cover the connector and continue onto the insulation for a distance of 5mm.

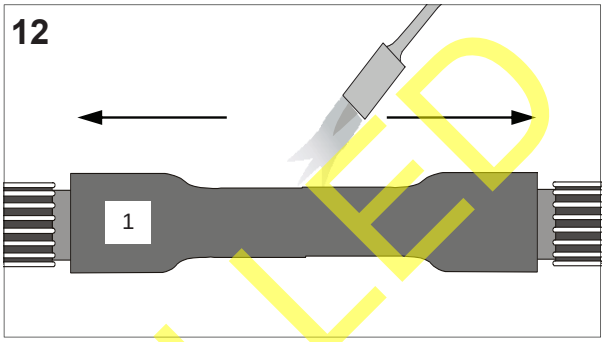
The mastic tape should be used to produce a smooth tapered edge between the connector and the insulation.

Note: Do not apply too much void filling mastic tape.



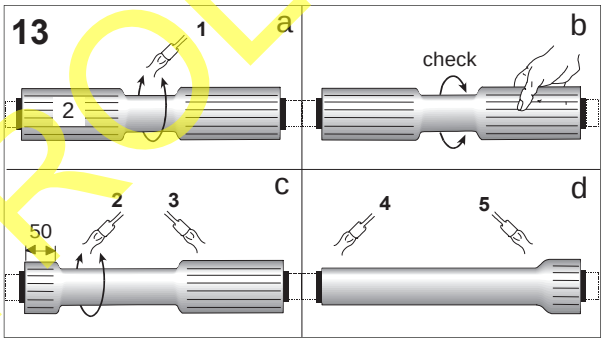
Pull the black stress control tube from the inside of the tubing set and position it centrally over the connector.

Start shrinking in the centre before working towards each of the ends. On completion the tubing should be fully shrunk and wrinkle free.

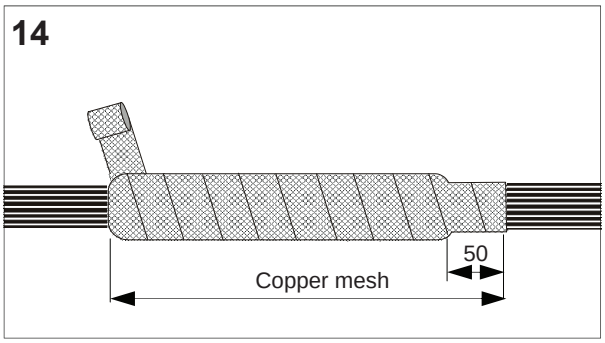


Position the black and red screened insulating sleeve centrally over the connector area and shrink in the following sequence.

a. Shrink the sleeve in the centre (1).
b. Ensure the tube is fully shrunk by twisting the ends and checking that the centre does not move.
c. Continue to shrink by working towards one side (2), stopping 50mm from the end before repeating the process on the other end (3).
d. Finally shrink both the remaining ends (4) and (5).
At the end of this process the sleeve should be fully shrunk with no ridges showing.



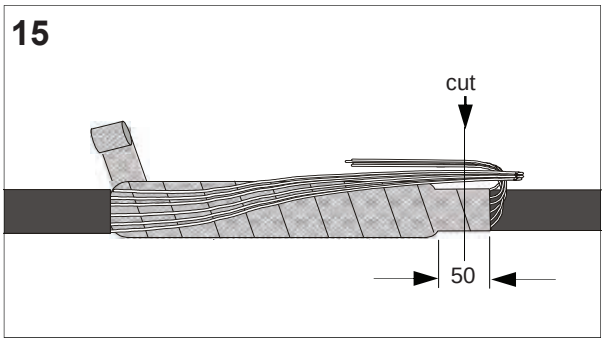
Wrap the completed joint with one half lap layer of copper mesh tape, starting with a 50mm overlap onto the oversheath of the cable, with the shortest copper wires screens.



Cable side with long copper wires:
Bend the copper wires back over the joint.

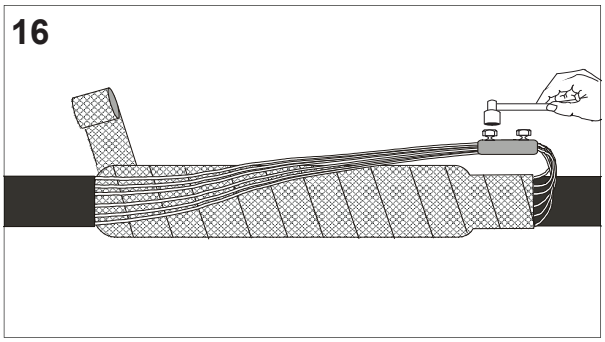
Cable side with the short copper wires:
Bend the shield wires back over the joint so they meet the long side copper wires over the copper mesh.

Gather the wires together and cut them centrally above the 50mm copper mesh overlap on the cable oversheath.

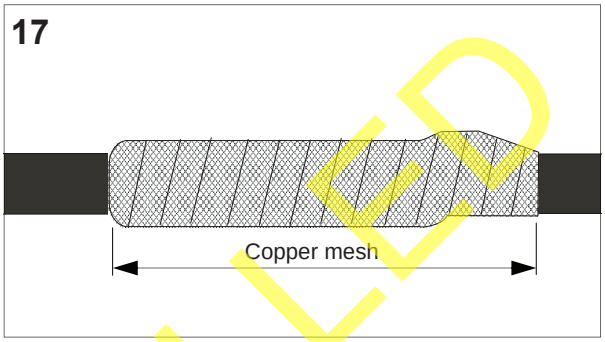


Form each bunch of copper wires into a conductor and insert them into both ends of the mechanical connector supplied.

Tighten the bolts until the heads shear off.

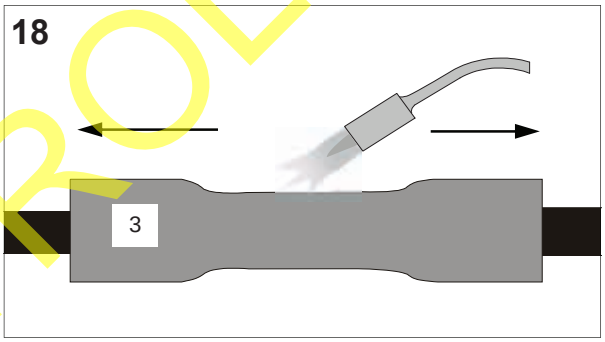


Wrap the complete joint with a second half lap layer of copper mesh tape, ensuring that the mechanical connector is fully covered.



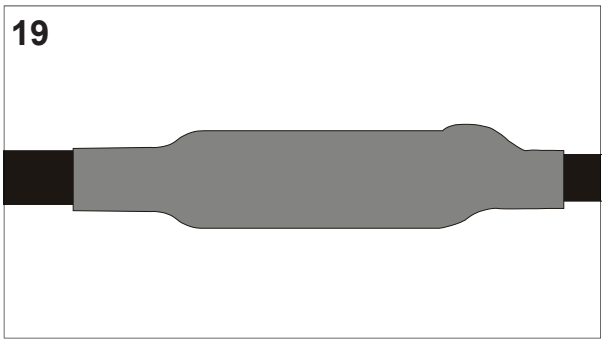
Clean and degrease the exposed cable oversheaths for a distance of 150mm.

Centre the black outer sleeve over the joint and start shrinking in the centre before working towards each end.



The Joint is now complete.

Allow it to cool before applying any mechanical strain or movement.



2.1.4 Single-Core Straight Joints with Similar Size Conductors (500 and 630mm²)

These are all heatshrink joints that contain both phase and copper wire screen connectors.

Cable Sizes in mm²		Joint Kit Description and Part Numbers	
Tyco Part Number		MXSU-6151-GB02	MXSU-6161-GB02
UK Power Networks Stores Code		02641Y	02642J
500	500	1 per Joint	
630	630		1 per Joint

2.1.5 Cable Preparation

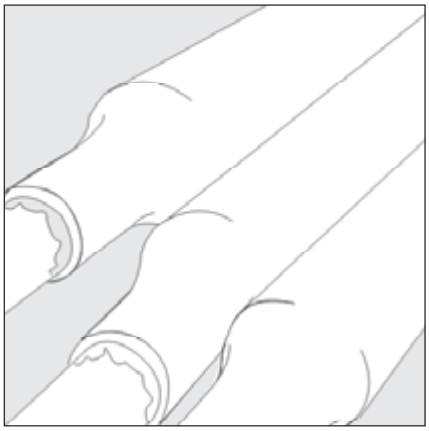
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.1.6 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.1 Single-Core Polymeric Straight Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.1 Single-Core Polymeric Straight Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.1 Single-Core Polymeric Straight Joints



Installation Instruction

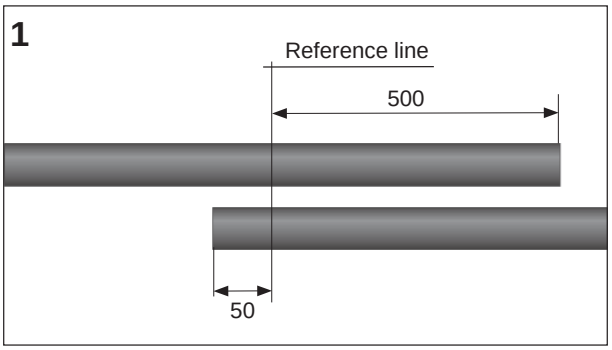
33kV Single Core Straight Joint for Single Core XLPE Cables

For Cable Size: 500mm²
MXSU-6151-GB-02
UK Power Networks Stores Code 02641Y

For Cable Size: 630mm²
MXSU-6161-GB-02
UK Power Networks Stores Code 02642J

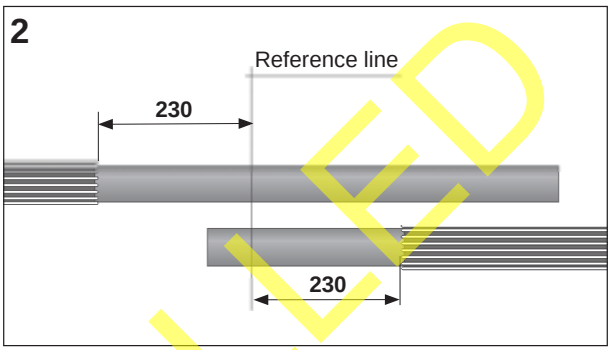
Cable Overlap

Overlap the cables to be jointed as shown in drawing and mark the reference line.



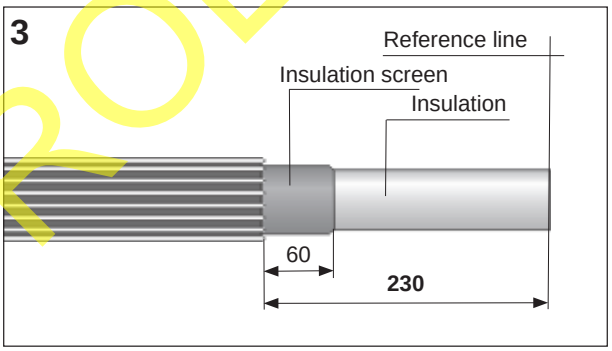
Cable Preparation

Remove the cable oversheath to the dimension shown in the drawing.
Clean the remaining oversheath for a distance of about 1 metre.
Bend the copper wire screen back onto the oversheath and PVC tape the ends of the cable.

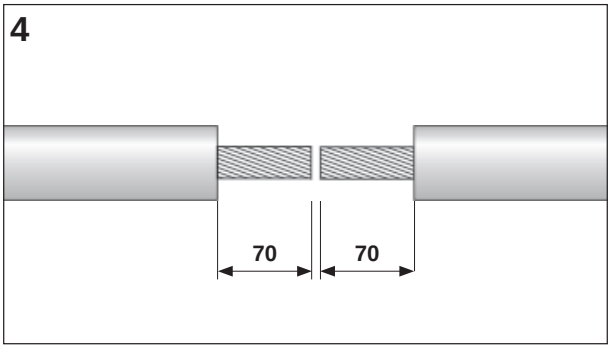


Cut the cores at the reference line using a hacksaw.
Remove the insulation screen to the dimensions given in the drawing, ensure that the insulation surface is left smooth and free from all traces of conductive material.

Clean and degrease the insulation.



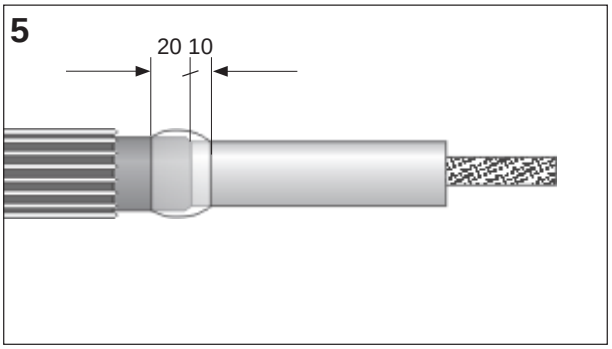
Remove the insulation on both cores to the dimension shown in the drawing.



Remove the yellow void filling mastic strip from the aluminium foil bag.

Remove the release papers from both sides of the strip and wrap it around the insulation screen cut starting 20mm from the end of the screen and contining onto the insulation for 10mm.

Stretch the strip to half of its original width and apply under tension to achieve a fine thin edge.



Slide the black stress control tube over the prepared insulation so that the end is level with the end of the insulation cut.

Shrink the tube down starting from the insulation cut back, before working towards the oversheath as shown in the drawing.

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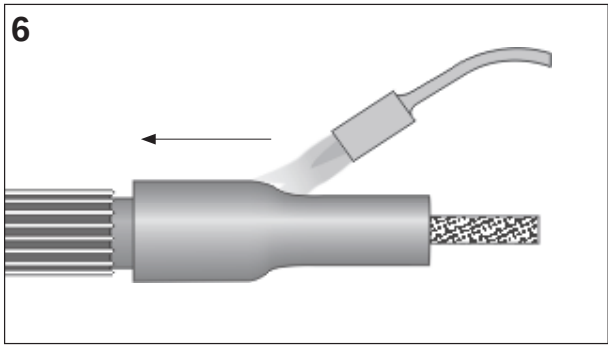
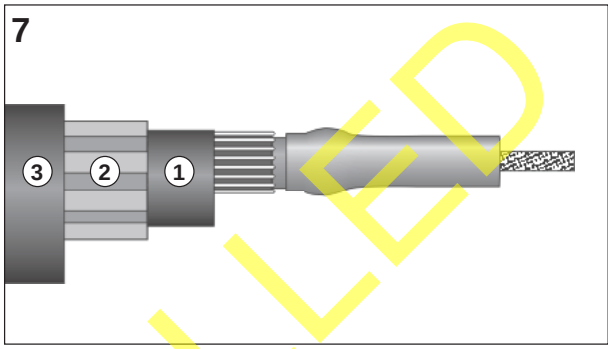


Completion of Joint

Slide each tube from the tubing set and the outer sleeve over one of the cable end. Use the plastic bag the tubing set came in to protect the tubes until they need to be installed.

1. Black Stress control tubing
2. Black and Red Screened insulation sleeve
3. Black Outer sleeve

7



Installation of the mechanical connector

Check before installation that the conductor can be inserted into the connector.

The core diameter should be no greater than 29.2mm.

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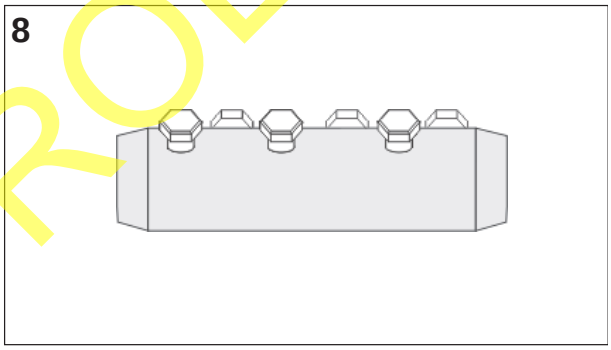

Clean and abrade the surface of the exposed conductors. Insert conductors so that the insulation butts up with the end of the connector. Hand tighten the shear bolts so that the connector stays in place.
For connectors using more than one shear bolt per side, tighten the bolts alternately and shear them off starting with the outer bolts (see also sequence shown in the drawing).

Note: When a cordless impact wrench is used it should only be used in 2 seconds intervals. To stop the core bending use an appoved connector holding tool.

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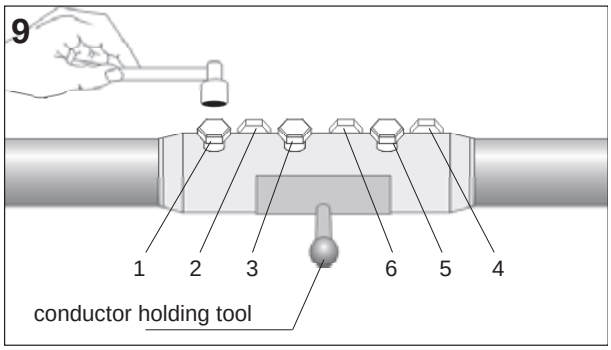
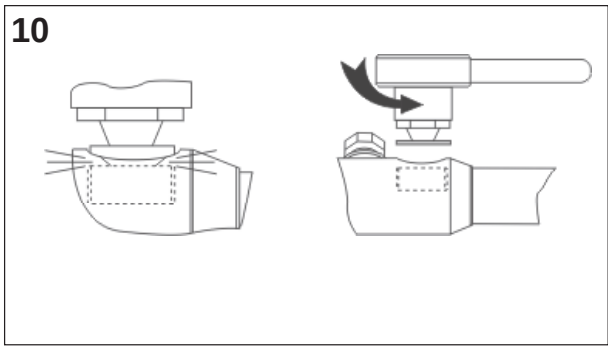


Once all the bolts have been sheared off remove any sharp edges of theprotruding bolts.

Clean and degrease the connector area and the insulation with a cleaning wipe.

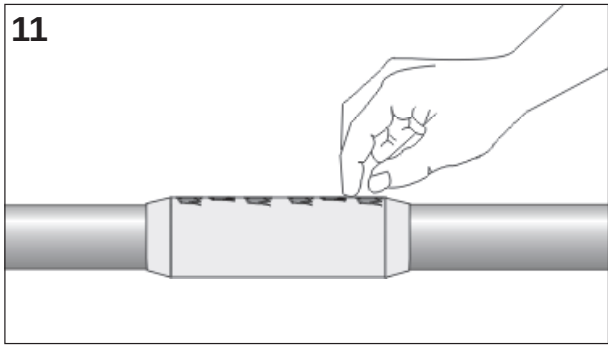
It when the bolt head shears off but the top is retained in the connector body. Unscrew the head of the bolt from the connector.

10



Clean and degrease the cable cores and the connector.

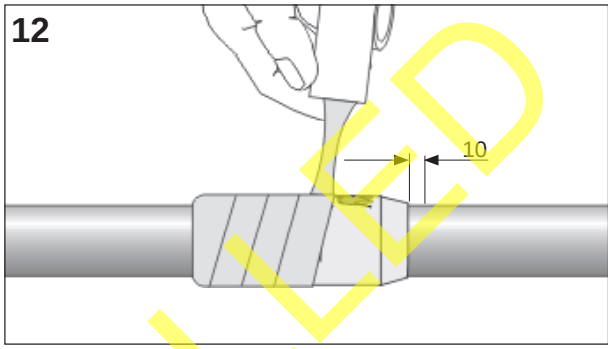
Fill the bolt holes with the clay supplied in the kit, to form a smooth finish.



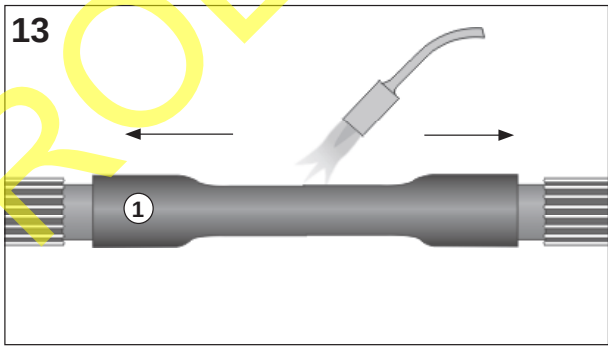
Remove one of the release papers from the yellow void filling tape. Apply the tape with a 50% overlap stretching it to half of its original width and applying it under tension.

Fill up the connector area continuing onto the insulation for not more than 10mm. Use the mastic to achieve a smooth transition from the connector onto the insulation.

Note: Do not use too much mastic, a maximum of 2mm over the connector



Pull the black stress control tubing from the inside of the tubing set and position it centrally over the connector. Start shrinking in the centre before working towards the ends. The tubing should be fully shrunk and wrinkle free.



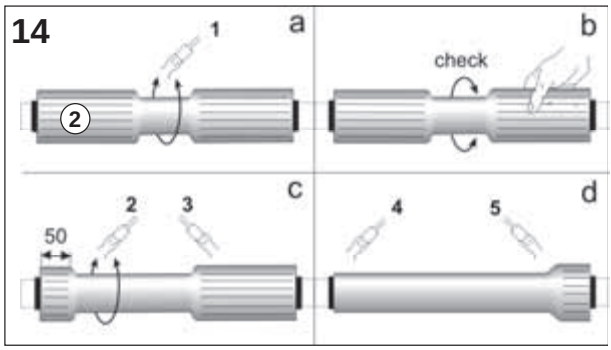
Position the black and red screened insulating sleeve centrally over the connector area and shrink in the following sequence.

a. Shrink the sleeve in the centre (1).

b. Check if fully shrunk by twisting the end.

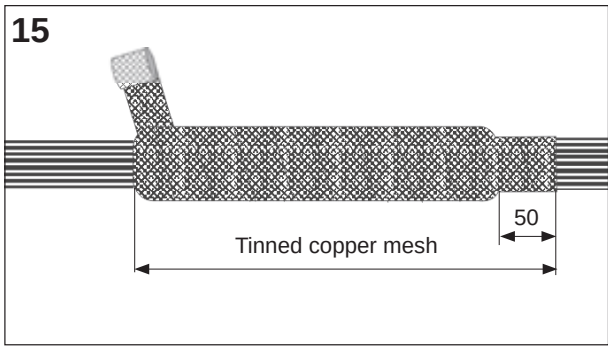
c. Continue to shrink by working towards one side (2), stopping 50 mm from the end, before shrinking the other half in the same way (3).

d. Shrink down the first end (4) and finally the second (5). **The sleeve should be fully shrunk without leaving an ridges.**



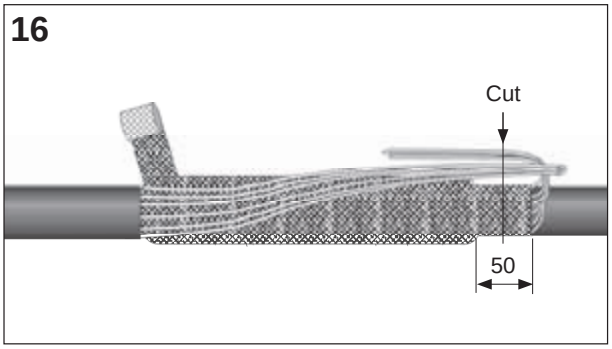
Wrap the completed joint with one half lap layer of tinned copper mesh tape.

Start with a 50mm overlap on to copper wire screen on the cable side with the short copper wires.

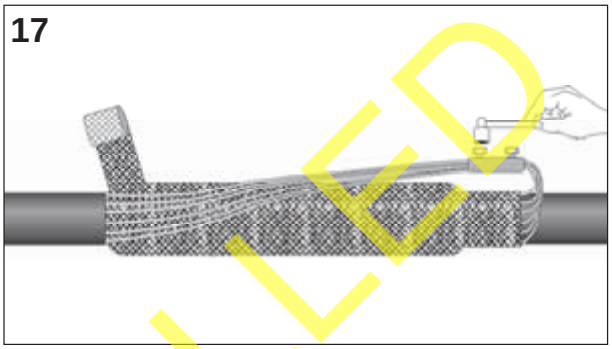


Cable side with long copper wire screen:
Bend the copper wires back over the joint.
Cable side with the short shield wires:
Bend the shield wires back over the joint area close to the copper mesh.

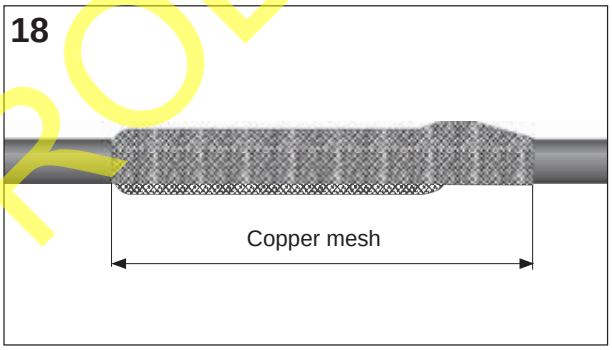
Gather the wires together and cut them centrally above the 50 mm copper mesh overlap on the cable oversheath.



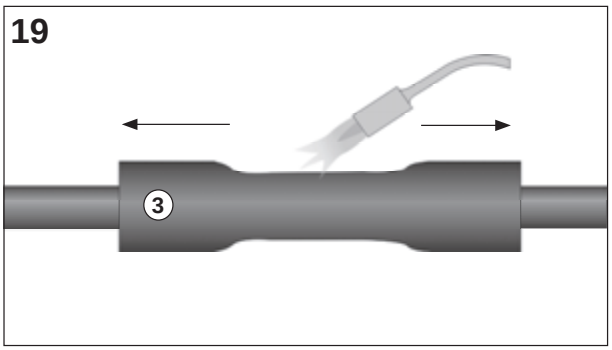
Form each bunch of wires into a conductor and insert them into the mechanical connector supplied.
Tighten the bolts until the heads shear off.



Wrap the complete joint with a second layer of tinned copper mesh with a 50% overlap. Check that the complete joint is covered including the mechanical connector.

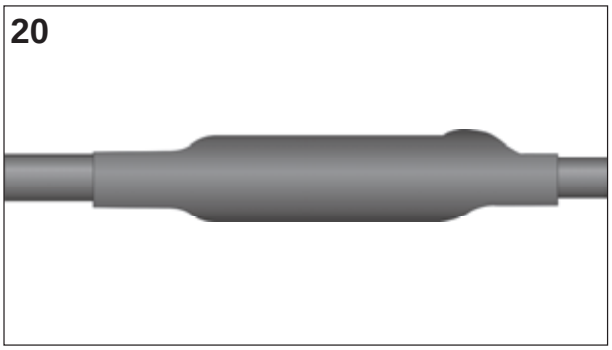


Clean and degrease the exposed ends of the oversheath for a length of about 150mm.
Centre the black outer sleeve over the joint and start shrinking in the centre before working towards each ends.



The joint is now complete.

Allow the joint to cool before applying any mechanical strain or movement.



2.1.7 Single-Core Straight Joints with Similar Size Conductors (800mm²)

These are all heatshrink joints that contain both phase and copper wire screen connectors.

Cable Sizes in mm²		Joint Kit Description and Part Numbers
Tyco Part Number		MXSU-6171-GB01
UK Power Networks Stores Code		02643T
800	800	1 per Joint

2.1.8 Cable Preparation

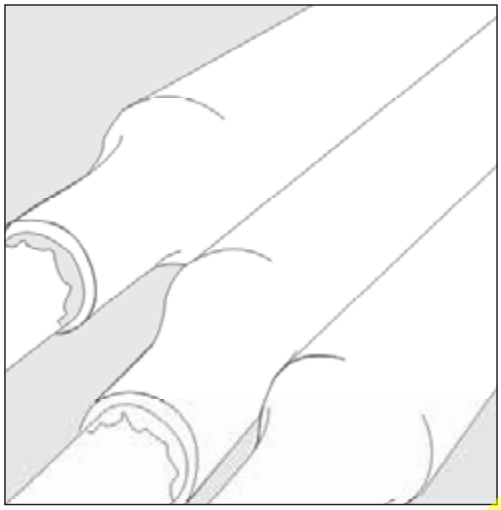
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.1.9 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.1 Single-Core Polymeric Straight Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.1 Single-Core Polymeric Straight Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.1 Single-Core Polymeric Straight Joints



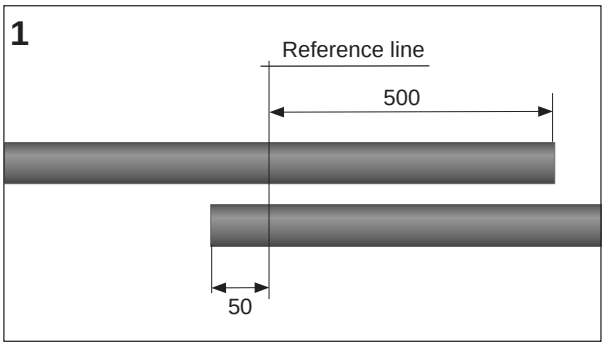
Installation Instruction

33kV Single Core Straight Joint for Single Core XLPE Cables

For Cable Size: 800mm²
MXSU-6171-GB-02
UK Power Networks Stores Code 02643T

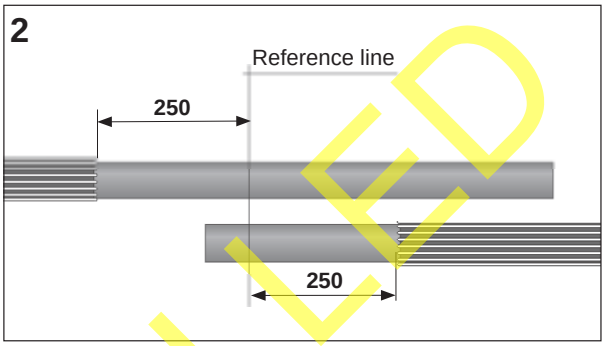
Cable Overlap

Overlap the cables to be jointed as shown in drawing and mark the reference line.



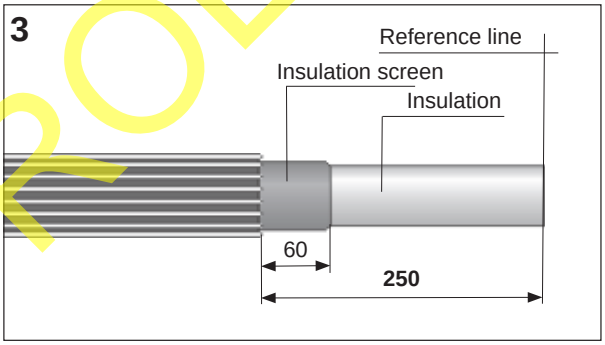
Cable Preparation

Remove the cable oversheath to the dimension shown in the drawing.
Clean the remaining oversheath for a distance of about 1 metre.
Bend the copper wire screen back onto the oversheath and PVC tape the ends of the cable.

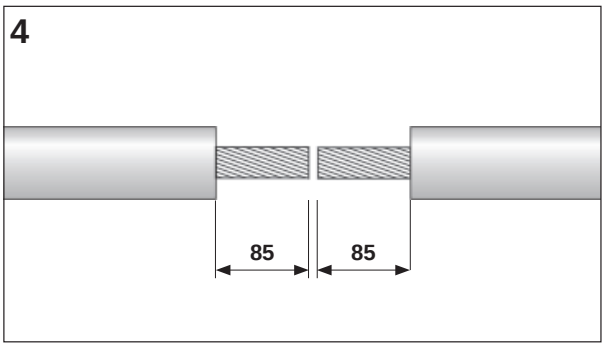


Cut the cores at the reference line using a hacksaw.
Remove the insulation screen to the dimensions given in the drawing, ensure that the insulation surface is left smooth and free from all traces of conductive material.

Clean and degrease the insulation.



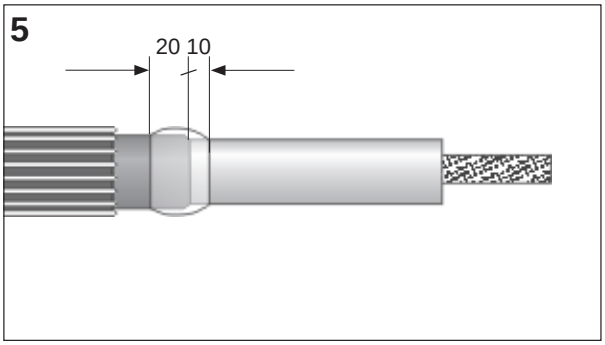
Remove the insulation on both cores to the dimension shown in the drawing.



Remove the yellow void filling mastic strip from the aluminium foil bag.

Remove the release papers from both sides of the strip and wrap it around the insulation screen cut starting 20mm from the end of the screen and contining onto the insulation for 10mm.

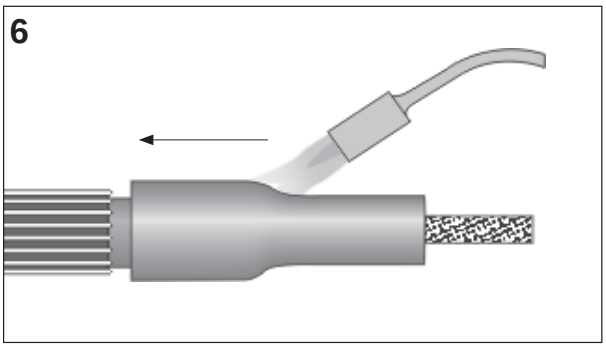
Stretch the strip to half of its original width and apply under tension to achieve a fine thin edge.



Slide the black stress control tube over the prepared insulation so that the end is level with the end of the insulation cut.

Shrink the tube down starting from the insulation cut back, before working towards the oversheath as shown in the drawing.

6

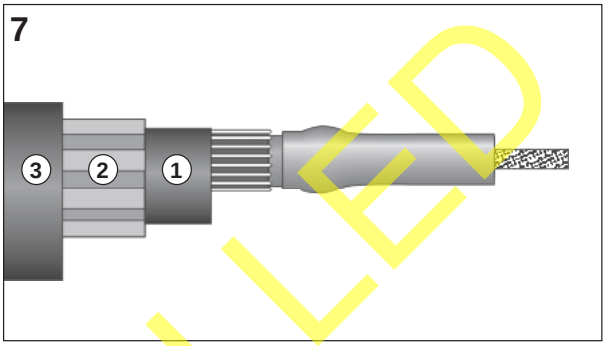


Completion of Joint

Slide each tube from the tubing set and the outer sleeve over one of the cable end. Use the plastic bag the tubing set came in to protect the tubes until they need to be installed.

1. Black Stress control tubing
2. Black and Red Screened insulation sleeve
3. Black Outer sleeve

7

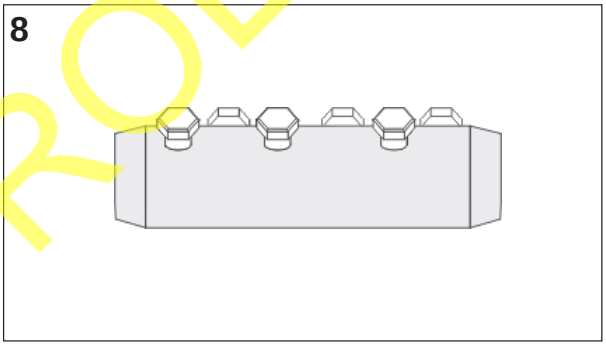


Installation of the mechanical connector

Check before installation that the conductor can be inserted into the connector.

The core diameter should be no greater than 29.2mm.

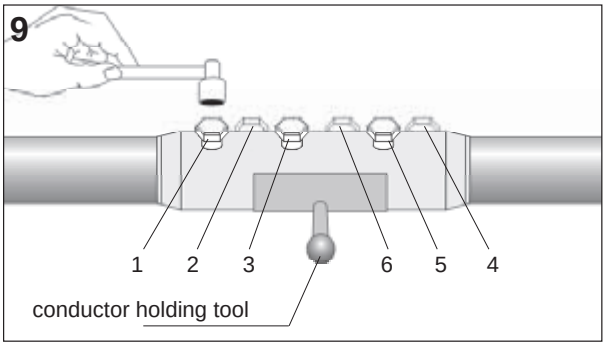
8



Clean and abrade the surface of the exposed conductors. Insert conductors so that the insulation butts up with the end of the connector. Hand tighten the shear bolts so that the connector stays in place.
For connectors using more than one shear bolt per side, tighten the bolts alternately and shear them off starting with the outer bolts (see also sequence shown in the drawing).

Note: When a cordless impact wrench is used it should only be used in 2 seconds intervals. To stop the core bending use an appoved connector holding tool.

9

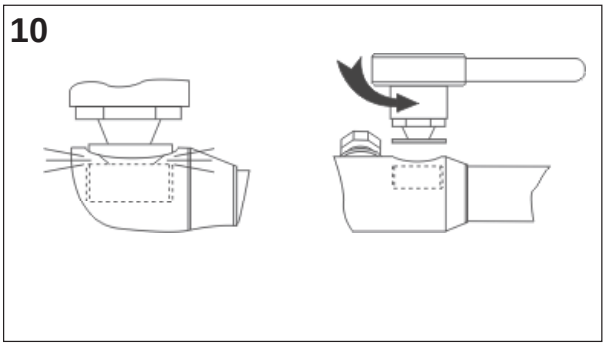


Once all the bolts have been sheared off remove any sharp edges of theprotruding bolts.

Clean and degrease the connector area and the insulation with a cleaning wipe.

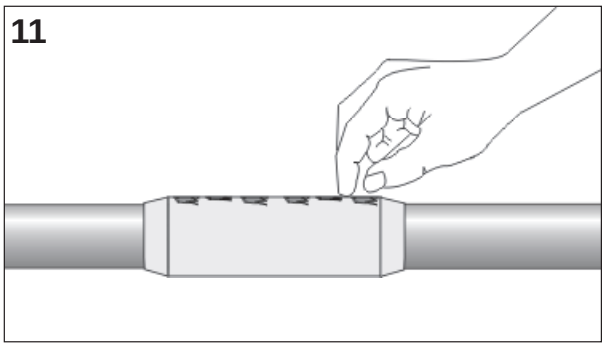
It when the bolt head shears off but the top is retained in the connector body. Unscrew the head of the bolt from the connector.

10



Clean and degrease the cable cores and the connector.

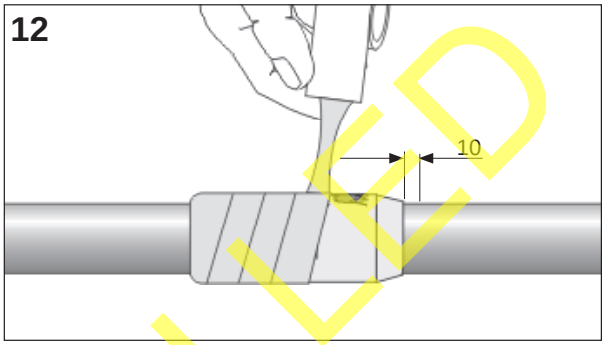
Fill the bolt holes with the clay supplied in the kit, to form a smooth finish.



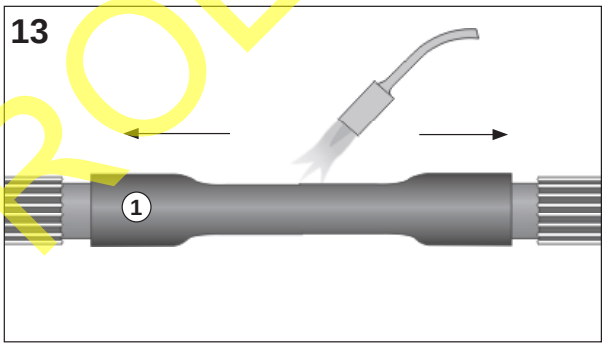
Remove one of the release papers from the yellow void filling tape. Apply the tape with a 50% overlap stretching it to half of its original width and applying it under tension.

Fill up the connector area continuing onto the insulation for not more than 10mm. Use the mastic to achieve a smooth transition from the connector onto the insulation.

Note: Do not use too much mastic, a maximum of 2mm over the connector



Pull the black stress control tubing from the inside of the tubing set and position it centrally over the connector. Start shrinking in the centre before working towards the ends. The tubing should be fully shrunk and wrinkle free.



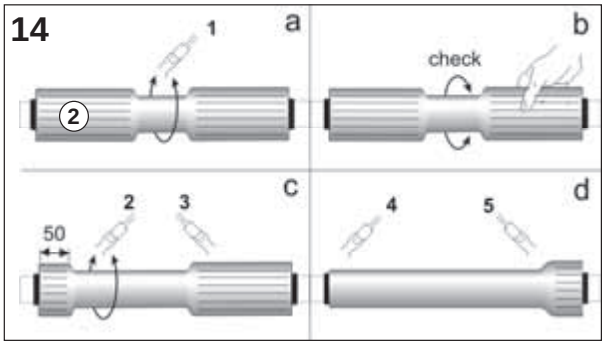
Position the black and red screened insulating sleeve centrally over the connector area and shrink in the following sequence.

a. Shrink the sleeve in the centre (1).

b. Check if fully shrunk by twisting the end.

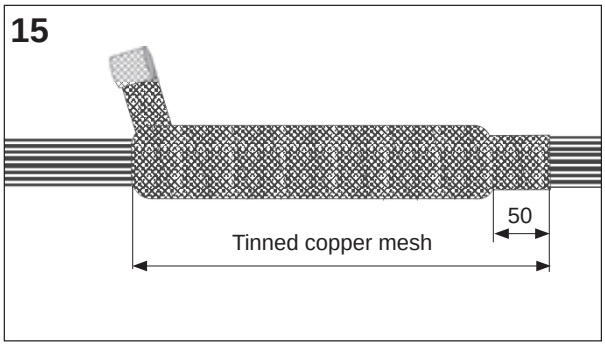
c. Continue to shrink by working towards one side (2), stopping 50 mm from the end, before shrinking the other half in the same way (3).

d. Shrink down the first end (4) and finally the second (5). **The sleeve should be fully shrunk without leaving an ridges.**



Wrap the completed joint with one half lap layer of tinned copper mesh tape.

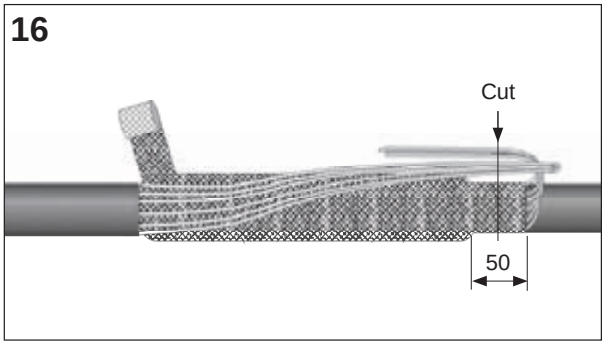
Start with a 50mm overlap on to copper wire screen on the cable side with the short copper wires.



Cable side with long copper wire screen:
Bend the copper wires back over the joint.
Cable side with the short shield wires:
Bend the shield wires back over the joint area close to the copper mesh.

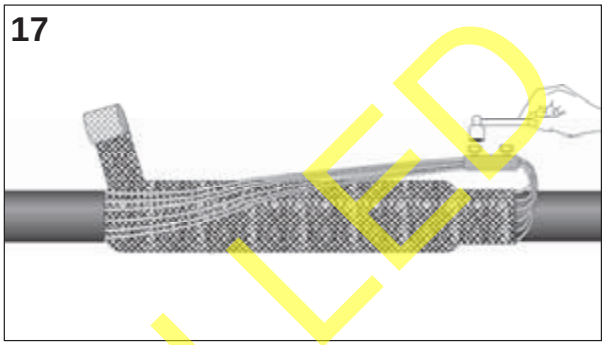
Gather the wires together and cut them centrally above the 50 mm copper mesh overlap on the cable oversheath.

16



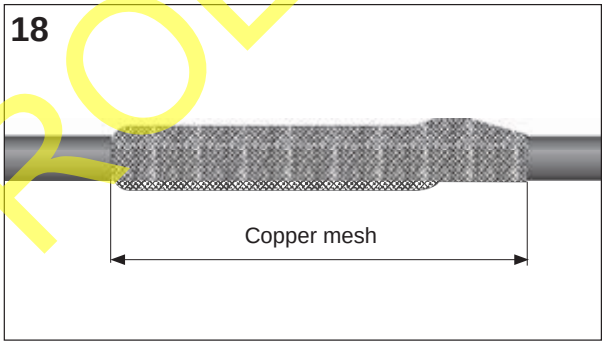
Form each bunch of wires into a conductor and insert them into the mechanical connector supplied.
Tighten the bolts until the heads shear off.

17



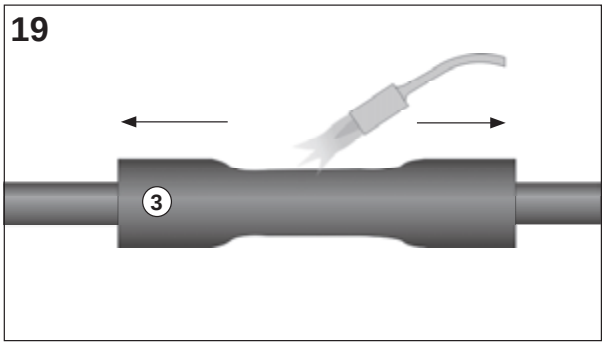
Wrap the complete joint with a second layer of tinned copper mesh with a 50% overlap. Check that the complete joint is covered including the mechanical connector.

18



Clean and degrease the exposed ends of the oversheath for a length of about 150mm.
Centre the black outer sleeve over the joint and start shrinking in the centre before working towards each ends.

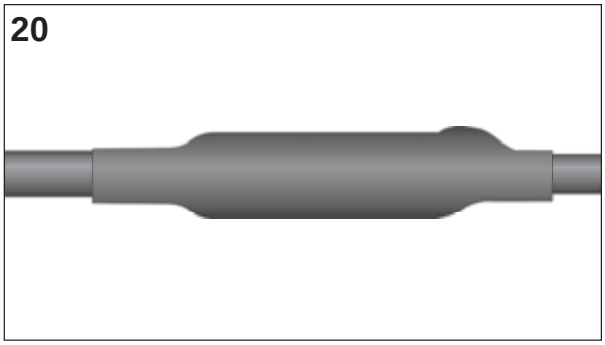
19



The joint is now complete.

Allow the joint to cool before applying any mechanical strain or movement.

20



2.1.10 Single-Core Straight Joints for XLPE Cables with Different Size Conductors

These are all heatshrink joints that are supplied without phase connectors (these come in a separate kit) but do contain copper wire screen connectors.

Cable Sizes in mm²		Joint Kit Description and Part Numbers		
Tyco Part Number		SXSU-6142-GB01	BSMB 185/400 - 500	BSMB 185/400 - 630
UK Power Networks Stores Code		02644D	02665F	02668K
185	400	1 per Joint	1 per Joint	
300	400	1 per Joint	1 per Joint	
400	400	1 per Joint	1 per Joint	
185	500	1 per Joint	1 per Joint	
300	500	1 per Joint	1 per Joint	
400	500	1 per Joint	1 per Joint	
185	630	1 per Joint		1 per Joint
300	630	1 per Joint		1 per Joint

2.1.11 Cable Preparation

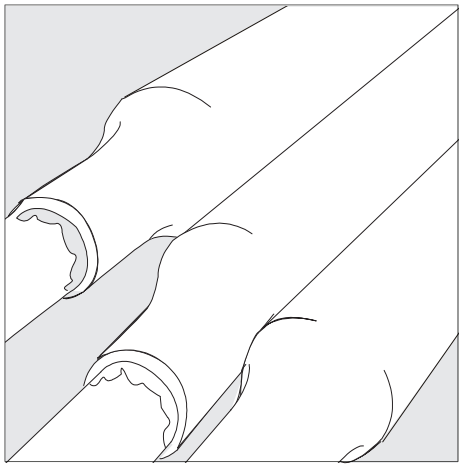
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.1.12 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.1 Single-Core Polymeric Straight Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.1 Single-Core Polymeric Straight Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.1 Single-Core Polymeric Straight Joints

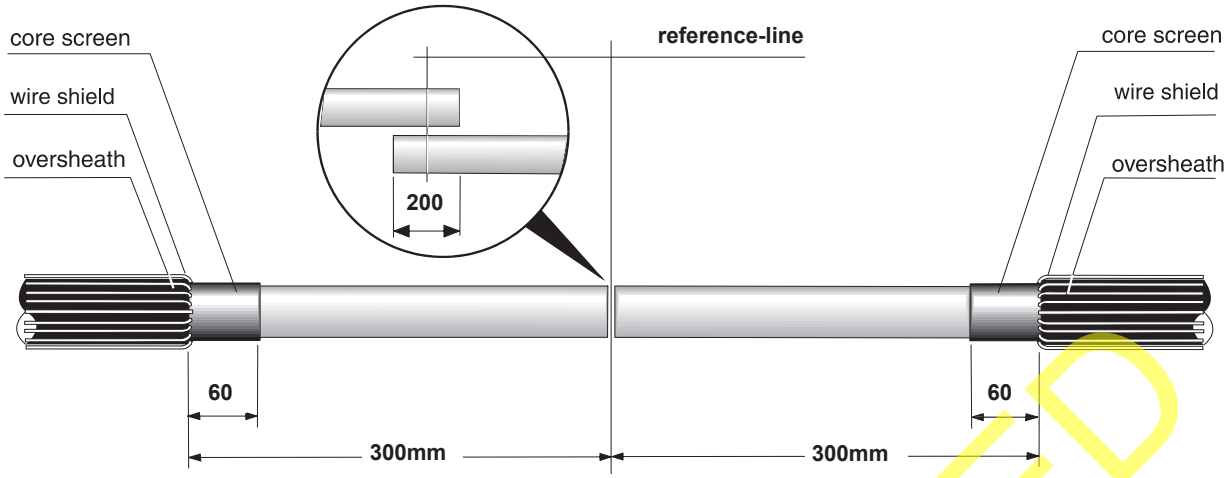


Installation Instruction

33kV Single Core Polymeric Straight Joint for Cables with different conductor sizes

For cable sizes 185/300mm^2 - 630mm^2
SXSU 6142 GB01
UK Power Networks Stores Code 02644D

Cable Preparation



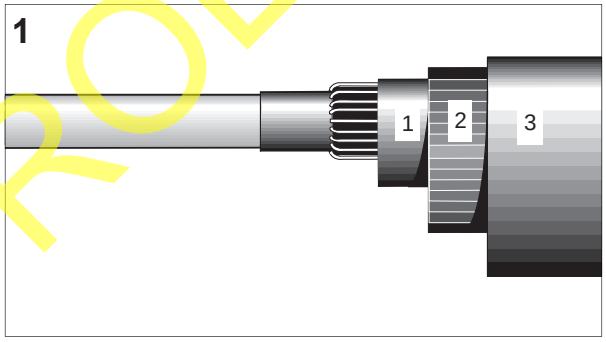
Overlap the cables to be jointed by approximately 200mm. Mark the reference line at the middle of the overlap. Remove the oversheaths to dimension shown in the figure above, measured from the reference line. Clean the remaining oversheath for at least 600mm. Bend the copper screen wires back onto the oversheath. Cover any sharp ends of wire with PVC tape. Cut the cores at the reference line. Thoroughly remove the black insulation screen to the dimension given in figure. The insulation surface should be damage free, smooth and polished, with all traces of conductive material removed at the end of this process.

Completion of Joint

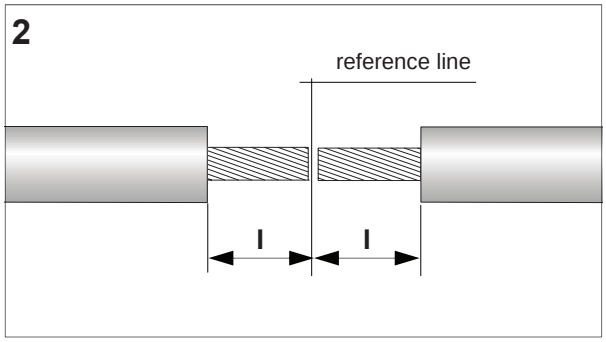
Slide the combined tubing set and the outer sleeve over one cable end. The plastic bag of the tubing set shall be used as additional protection by placing it under the tubing set.

1. Black stress control tubing.
2. Black and red screened insulating sleeve.
3. Black outer sleeve.

Note: In cases where the outer sealing sleeve does not fit over the screened insulating sleeve, slide it over the other cable end.



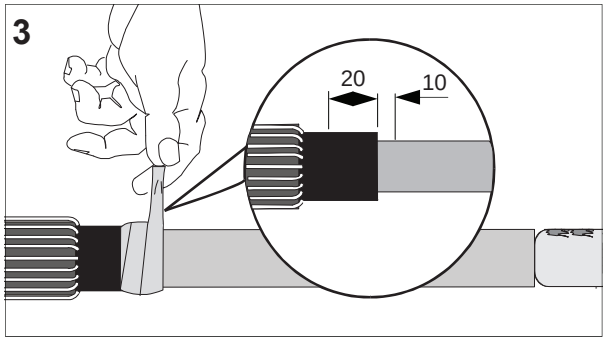
Measure the conductor bore depth of the connector and remove the insulation on all cores equal to the depth of the connector bore (Dimension I).



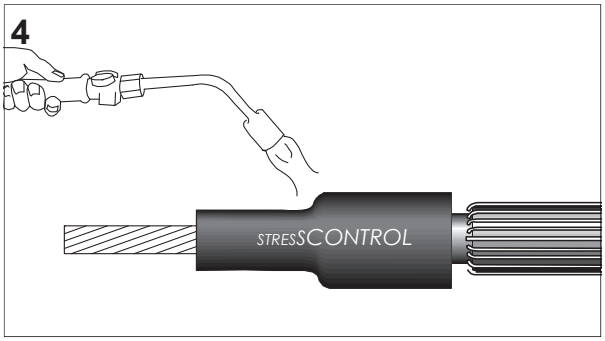
For cable sizes of 300mm^2 and below install the additional Stress Control Shim Tube. If not required move on to step 5.

Remove the yellow void filling mastic tape from the aluminium foil bag. On the small cable side, remove the release papers from both sides and wrap it around the core screen cut, starting 20mm from the end of the screen and continuing onto the insulation for 10mm.

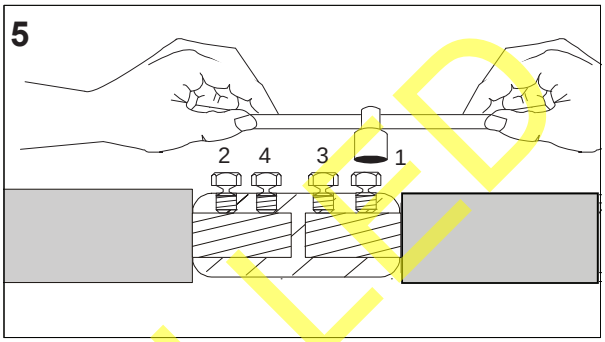
Stretch the tape to half of its original width to ensure that it is applied with the correct tension.



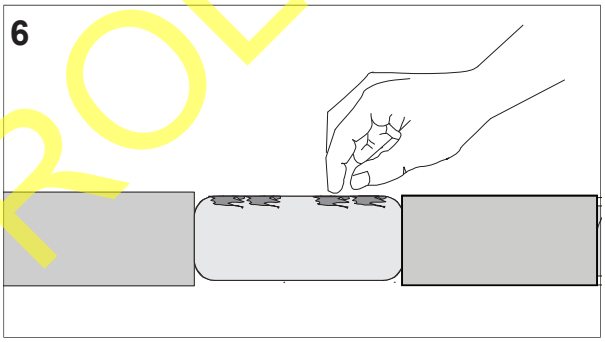
Position the short length of black stress control tubing level with the insulation cut. Shrink the tubing into position starting at the insulation cutback before working towards the oversheath as shown in Figure 4.



Fit the conductors into the connector. These should be no gap left between the connector and the insulation.
Take up the tension equally on all bolts (do not shear bolt heads at this stage).
Tighten the bolts, according to the order given in the drawing until the heads shear off.
In the case of a proud edge showing after removal of the bolts, this edge should be removed with a suited tool.
Realign cables if necessary.
Note: If required (for small cross sections) use a connector holding tool, to pick up the torque and stop the conductor bending.

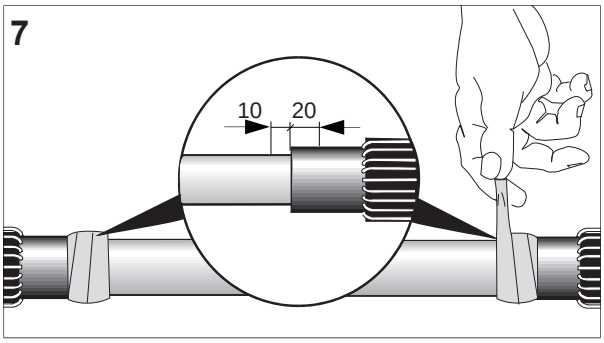


Clean and degrease the cable cores and the connector.
Fill the shear bolt holes in the connector with grey clay to leave a smooth finish.

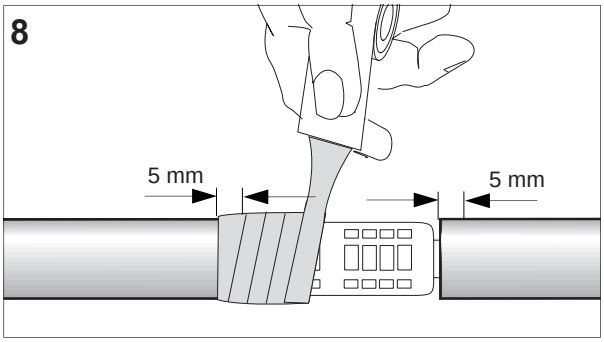


Open the small aluminium foil bag and remove one of the short yellow void filling strips with the pointed ends.
Remove the release paper from one side of the strip and wrap it around the insulation screen starting 20mm from the end of the screen and continue onto the insulation for 10mm.
Stretch the strip to half of its original width to ensure that a fine thin edge.

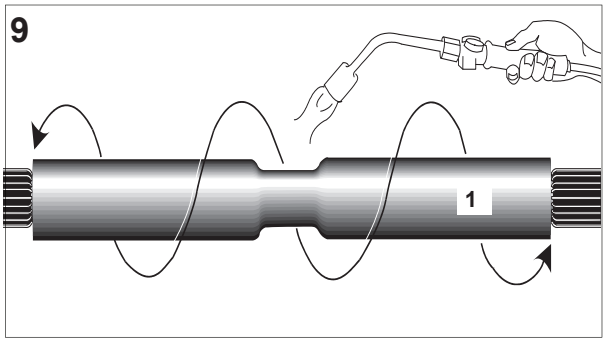
Note: Only apply the yellow void filing mastic to the end without the stress control shim tube, if the kit is being used with cables 300mm2 and below.



Open the large aluminium foil bag and remove one of the long yellow void filling tape strips.
Wrap it around the conductor with a 50% overlap, stretching it to about half of its original width.
Start by filling up the area over the connector area before continuing onto the insulation for not more than 5mm.
Note: Do not use too much void filling tape.
The final diameter should be only slightly greater than the core or connector diameter, whichever is larger, but check that the connector has a minimum coverage of 2mm.

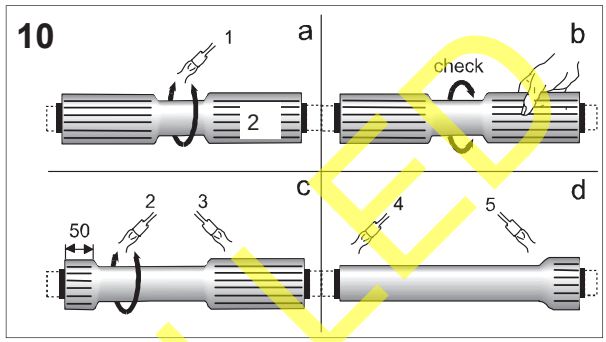


Pull the black stress control tubing from the inside of the tubing set and position it centrally over the connector.
Start shrinking in the centre before working towards the ends.
The tubing should be fully shrunk and wrinkle free.

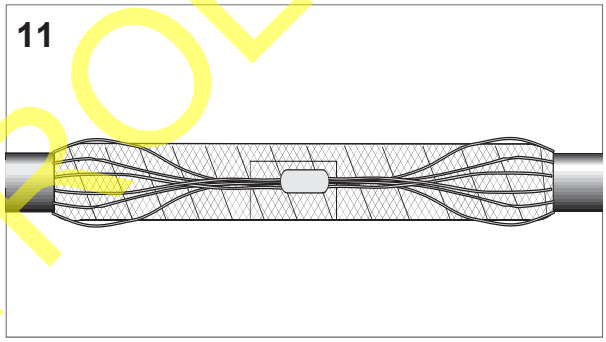


Position the black and red screened insulating sleeve centrally over the previously installed tubing.

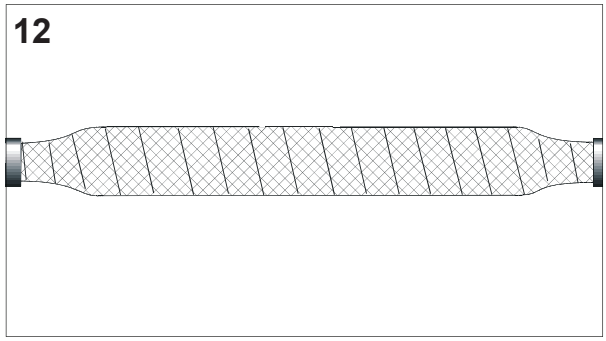
a. Start shrinking the sleeve in the centre (1).
b. Check if fully shrunk by twisting the end. The sleeve should not move if it has been shrunk correctly.
c. Continue shrinking by working towards one side (2), stopping 50 mm from the end. Shrink the other half in the same way (3).
d. Shrink down the first end (4) and finally the second (5). When fully shrunk all visible signs of the ridges should have disappeared.



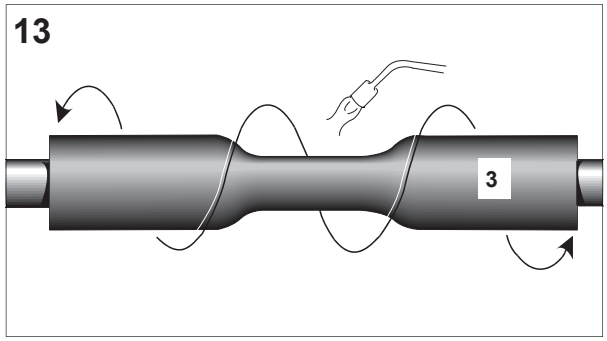
Wrap one layer of tinned copper mesh around the joint with a 50% overlap until the whole joint area is covered.
Bend the copper wires back over the joint and form them into two separate single conductors.
Joint the two conductors together using the mechanical connector provided in the kit.



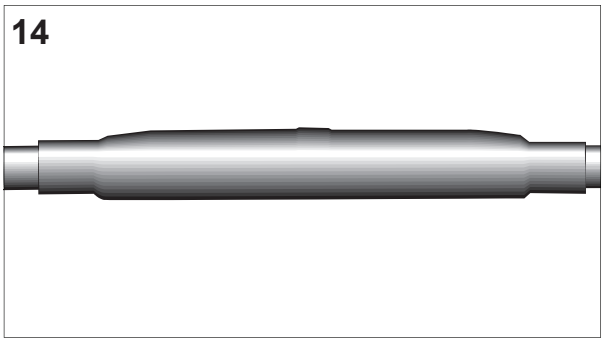
Wrap a second layer of tinned copper mesh a round the joint with a 50% overlap so that the whole joint is completely covered.



Clean and degrease the ends of the oversheath for a length of at least 150mm.
Centre the black outer sleeve over the joint and start shrinking in the centre, before working towards each end.



Joint complete.
Allow the joint to cool before applying any mechanical strain.



2.2 Single-Core Transition Straight Joints

2.2.1 Single-Core PILC (95 to 300mm²) to Single-Core Polymeric (185 to 500mm²)

These are all heatshrink joints that are supplied without phase connectors (these come in a separate kit).

Cable Sizes in mm²		Joint Kit Description and Part Numbers				
Tyco Part Number		EPKJ36C 1XU-1HL-GB06	EPKJ36D 1XU-1HL-GB03	BSMB 95-300GB	BSMB 185/400 - 500	SMOE 62191
UK Power Networks Stores Code		02647H	02648S	02671A	02665F	02651H
PILC	POLY					
95	185	1 per Joint		1 per Joint		1 per 3 Joints
95	300	1 per Joint		1 per Joint		1 per 3 Joints
120	185	1 per Joint		1 per Joint		1 per 3 Joints
120	300	1 per Joint		1 per Joint		1 per 3 Joints
150	185	1 per Joint		1 per Joint		1 per 3 Joints
150	300	1 per Joint		1 per Joint		1 per 3 Joints
185	185	1 per Joint		1 per Joint		
185	300	1 per Joint		1 per Joint		
185	400	1 per Joint			1 per Joint	
185	500	1 per Joint			1 per Joint	
240	185	1 per Joint			1 per Joint	
240	300	1 per Joint			1 per Joint	
240	400	1 per Joint			1 per Joint	
240	500	1 per Joint			1 per Joint	
300	185	1 per Joint			1 per Joint	
300	300	1 per Joint			1 per Joint	
300	400	1 per Joint			1 per Joint	
300	500	1 per Joint			1 per Joint	

2.2.2 Single-Core PILC (400 to 630mm²) to Single-Core Polymeric (185 to 630mm²)

These are all heatshrink joints that are supplied without phase connectors (these come in a separate kit).

Cable Sizes in mm²		Joint Kit Description and Part Numbers					
Tyco Part Number		EPKJ36C 1XU-1HL-GB06	EPKJ36D 1XU-1HL-GB03	BSMB 185/400-500	BSMB 500	BSMB 500-630	BSMB 630
UK Power Networks Stores Code		02647H	02648S	02665F	02666Q	02667A	02669U
PILC	POLY						
400	185	1 per Joint		1 per Joint			
400	300	1 per Joint		1 per Joint			
400	400	1 per Joint		1 per Joint			
400	500	1 per Joint		1 per Joint			
500	500		1 per Joint		1 per Joint		
500	630		1 per Joint			1 per Joint	
630	630		1 per Joint				1 per Joint

2.2.3 Cable Preparation

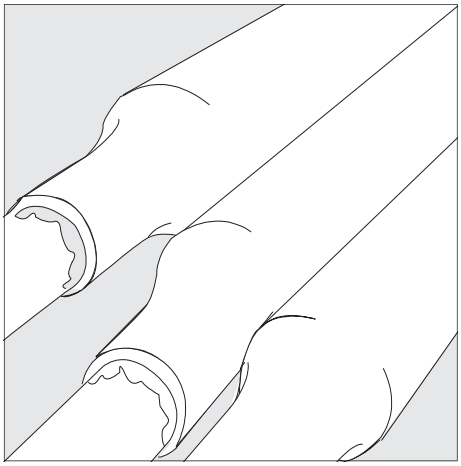
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Polymeric Cables
- 3.2 Single-Core Paper Insulated Cables

2.2.4 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.1 Single-Core Paper Insulated Cables in Transition Joints
- 4.1.7 Paper Insulation Shim Kit for 95mm² Cables
- 4.1.8 Paper Insulation Shim Kit for 120 and 150mm² Cables
- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.2 Single-Core Transition Straight Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.2 Single-Core Transition Straight Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.2 Single-Core Transition Straight Joints



Installation Instruction

33kV Single Core Transition Joint for Single Core PILC to Single Core XLPE Cables:

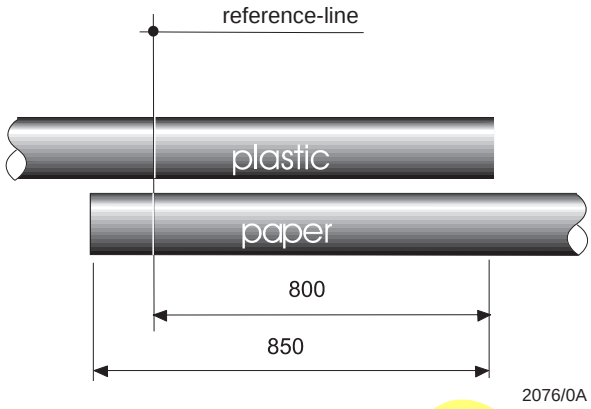
For Cable Sizes: 185 - 500mm^2
EPKJ 36C 1XU-1HL– GB06
UK Power Networks Stores Code 02647H

For PILC Cable Sizes 70 - 150 mm^2 use with PILC Cable Build Up Kit SMOE 62191
UK Power Networks Stores Code 02651H

For Cable Sizes: 500 - 630mm^2
EPKJ 36D 1XU-1HL– GB03
UK Power Networks Stores Code 02648S

Cable Overlap

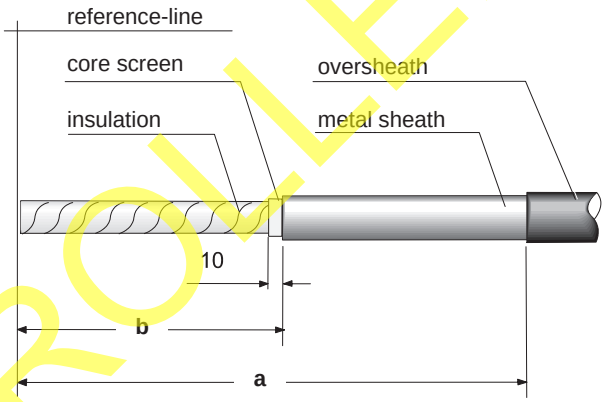
Overlap the cables to be jointed by about 850 mm.
Mark the reference-line.



Paper Cable Preparation

Cut the cores at the reference-line.
Remove the oversheath to dimension **a** in Table 1 .
Remove the lead sheath to dimension **b** in Table 1.
Remove the core screen to within 10mm of the metal sheath cut.

1



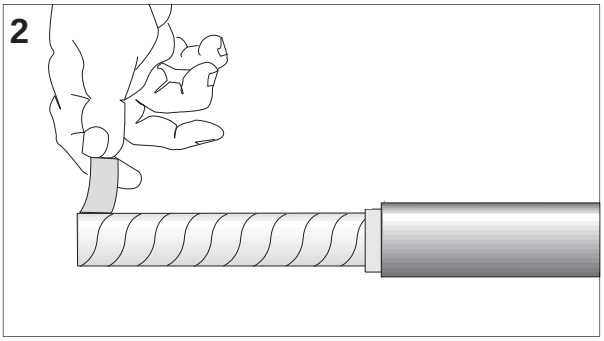
Dimensions in mm

Table 1

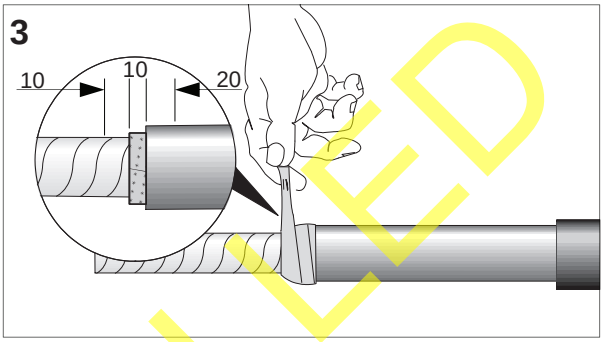
Kit Size	Cross Section mm²	a mm	b mm
C	185—400	490	250
D	500 - 630	490	270

Paper Cable Core Preparation

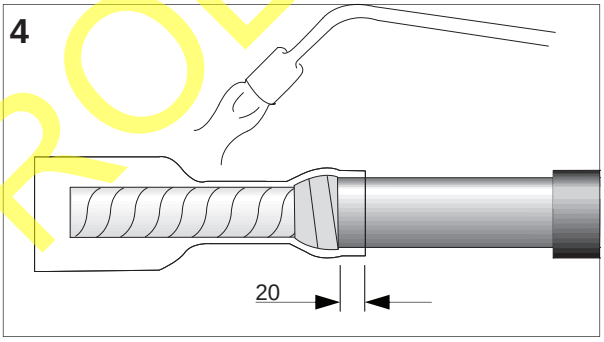
Remove the two top layers of the paper insulation.



Remove the release paper from the yellow void filling strip. Wrap it around the end of the screen starting 20mm from the metal sheath end and overlapping onto the insulation by 10mm.

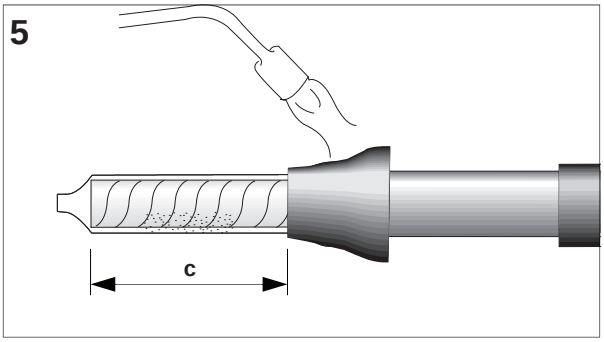


Position the transparent barrier tubing over the core overlapping onto the metal sheath by 20mm. Shrink down working from the metal sheath towards the core end.



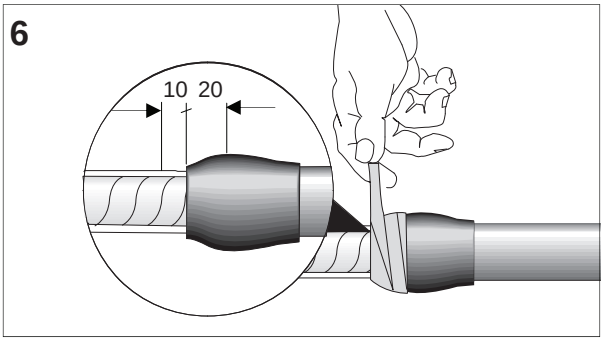
Position the short black conductive sleeve over the core according to dimension **c** in the table below. Shrink down working from the core end towards the metal sheath.

Kit Size	Cross Section mm²	c mm
C	185 - 400	220
D	500 - 630	240



Wrap one layer of yellow void filling mastic around the core at the end of the black conductive tubing.
Start 20mm along the conductive tubing and continue for 10mm onto the clear barrier tubing.
The tape should be stretched to half its original width before application and applied as a half lap layer.

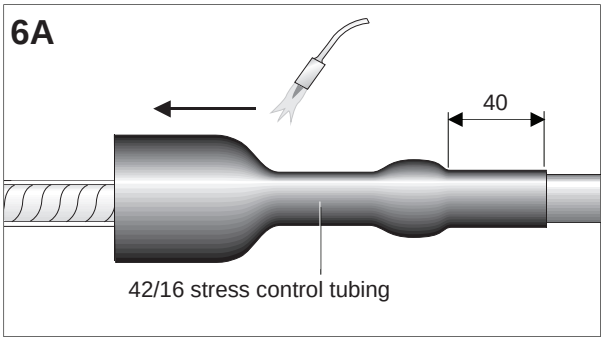
For PILC Cable Sizes Below 185mm^2 the additional build up tubes should be installed at this point.



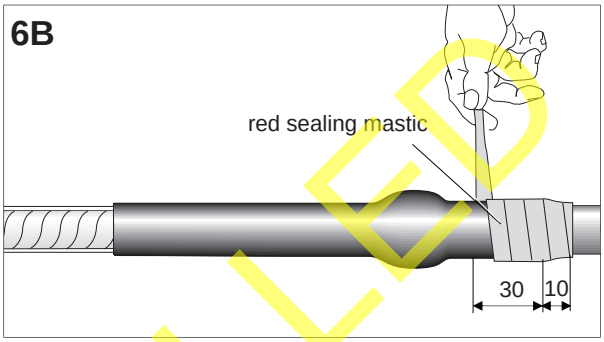
For cable sizes of 120 - 150mm^2 only apply the first build up tube form the kit.

Position a short length of the black 42/16 stress control tubing over each core, so it overlaps the conductive tubes and the yellow void filling mastic by 40mm.

Shrink the tube down starting from the crutch side of the cable.



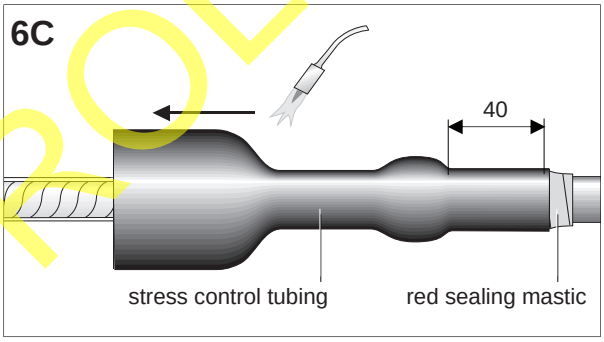
Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30 mm and the core for 10mm.



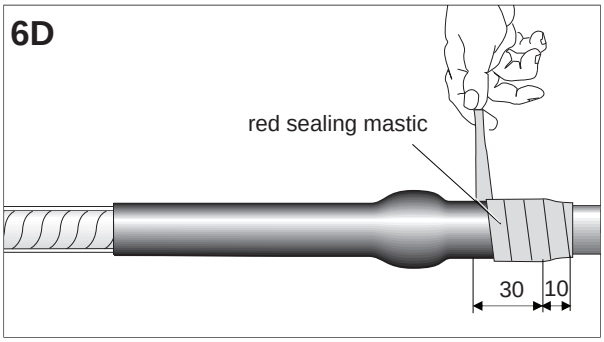
For cable sizes of between 70 and 95mm² apply the second build tube from the kit.

Position the short length of 54/24 black stress control tubing directly over the previously installed stress control tubes.

Shrink down starting from the crutch side of the cable.



Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30mm and the core for 10mm.

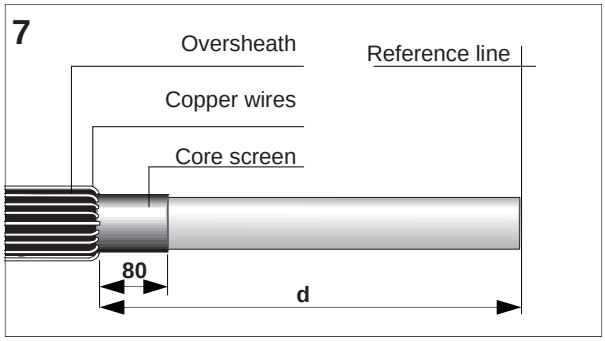


XLPE Cable Preparation

Cable with wire shield

Remove the oversheath to dimension d in the table below measured from the reference-line. Clean the remaining over-sheath for about 600mm. Bend back the shielding wires onto the oversheath. Cover the sharp wire ends with plastic tape. Cut the cores at the reference-line. Thoroughly remove the core screen to the dimensions given in table, so that the insulation surface is free from all traces of conductive material.

7



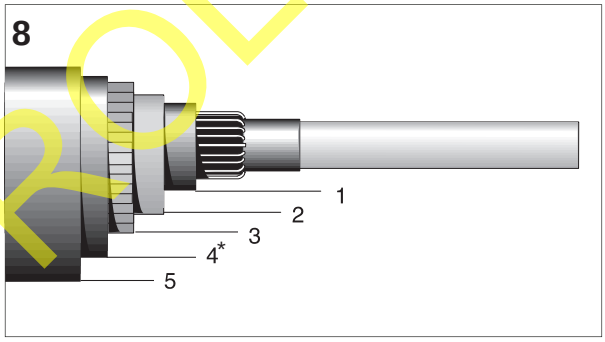
Kit Size	Cross Section	d
	mm²	mm
C	185 - 400	290
D	500 - 630	310

Slide the combined tubing set over the plastic cable core. The plastic bag from the tubing set can be used as additional protection by placing it under the tubing set.

1. Black Stress control tube.
2. Red Insulating tube.
3. Black and red Screened insulation sleeve.
4. Black Compression sleeve*.
5. Black Outer sealing sleeve.

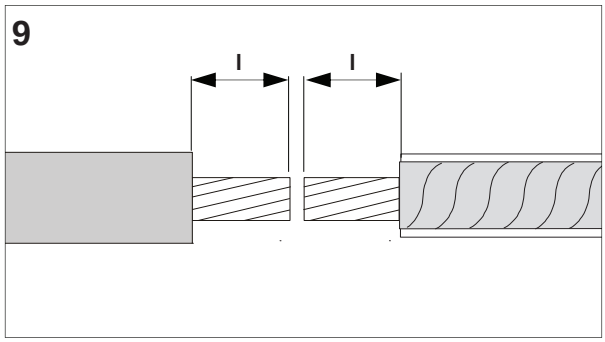
* Take care that the coated inside end of the compression sleeve points towards the centre of the joint.

8



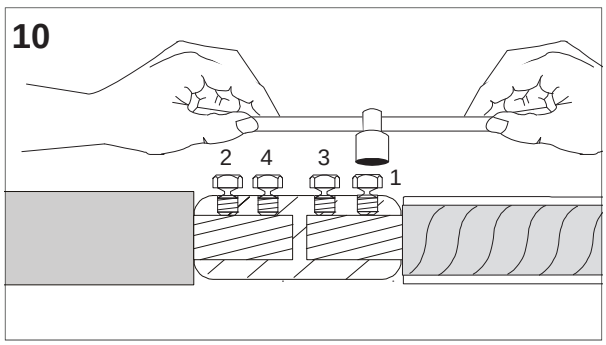
Measure the conductor bore depth of the connector (I) and then remove the insulation on all cores to this measurement.

9

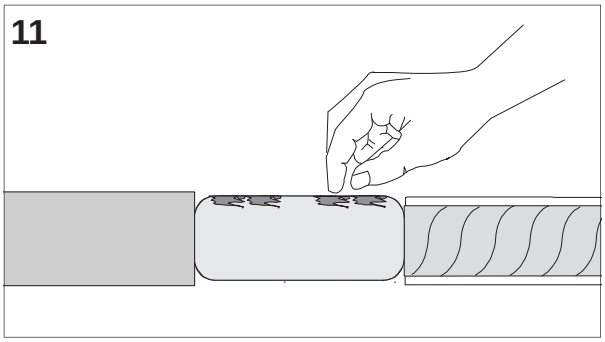


Fit the conductors into the connector. These should be no gap left between the connector and the insulation.
Take up the tension equally on all bolts but do not shear bolt heads at this stage.
Then continue to tighten each bolt until the head shears off in the sequence show in drawing.
If after all the bolts have been sheared off any part of the bolt remains above the body of the connector, this shall be filled down using a suited tool.
Realign cables if necessary.
Note: For small cross section cables it may be necessary to use a connector holding tool to stop the core bending.

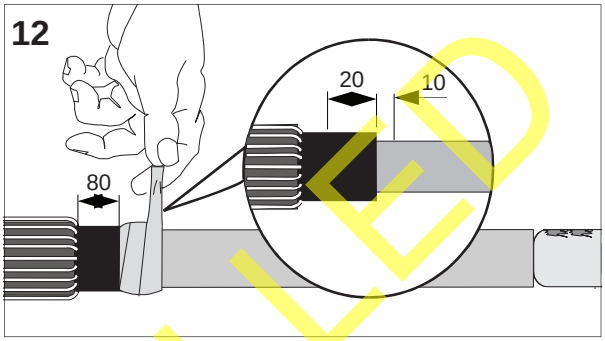
10



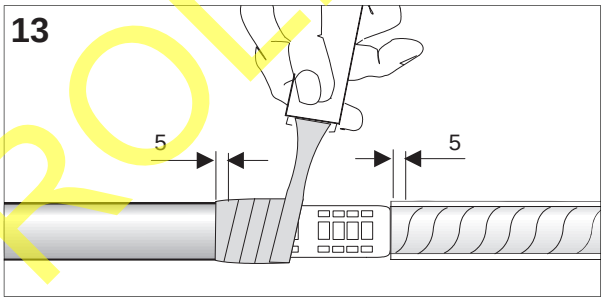
Clean and degrease the cable cores and the connector. Fill each bolt hole in the connector with grey clay until a smooth level profile finish is achieved.



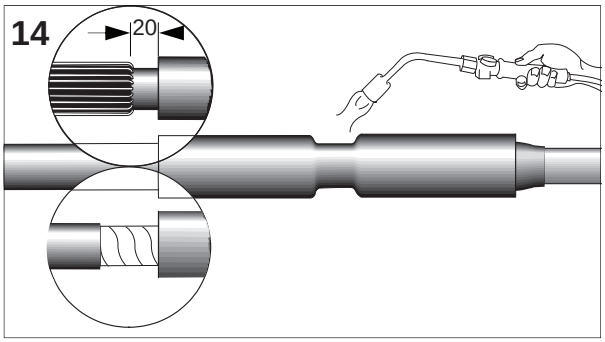
Plastic Cable Side
Remove the release papers from the yellow void filling mastic tape with the pointed ends.
Wrap the tape around the core screen starting 20mm from the insulation screen kit before continuing onto the insulation for 10mm.
The tape should be stretched to half its original width before application and applied as a half lap layer.



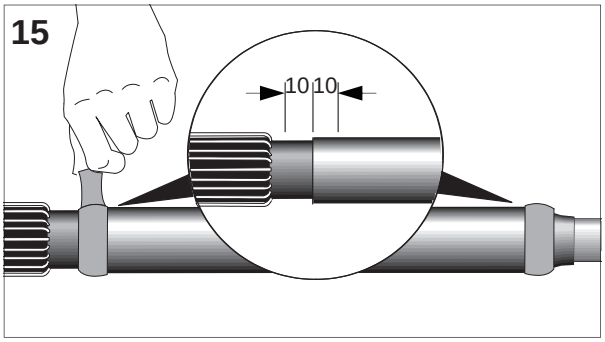
Remove the printed release paper from the yellow void filling tape and roll it up.
Wrap it around the conductor with a 50% overlap stretching it to about half of its original width.
Fill up the connector area continuing onto the insulation for not more than 5mm.
Note: Do not use too much void filing tape.
The final diameter should be only slightly greater than the core or connector diameter, whichever is larger.



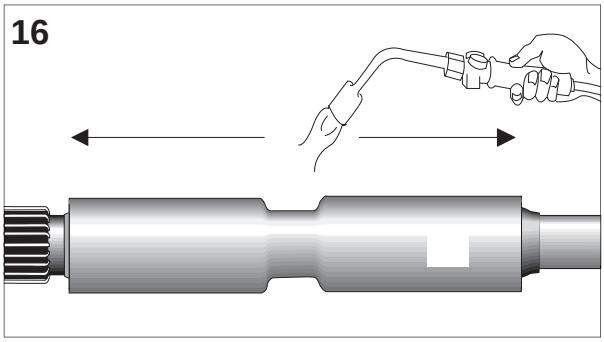
Pull the black stress control tubing from the inside of the tubing set and position it centrally over the connector. On the **plastic cable side** leave a 20mm gap between the oversheath and tubing end as shown in the drawing.
Start shrinking in the centre working towards the ends.
The tubing should be fully shrunk and wrinkle free.



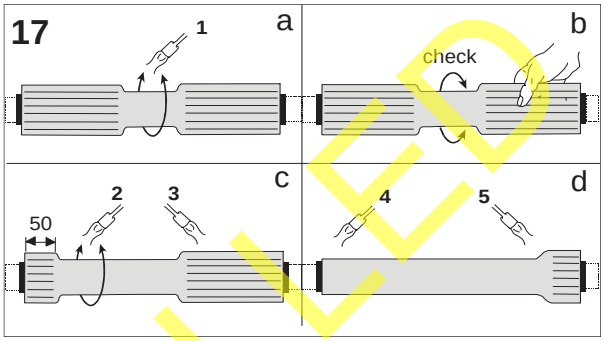
Remove one release paper from the red mastic tape and roll it up. Wrap the mastic with slight tension for 10mm around the end of the stress control tubing.
Plastic cable: cover 10mm of the core screen
Paper cable: cover 10mm of the conductive tubing.



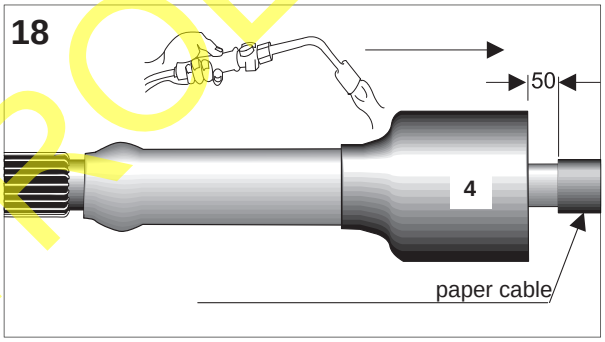
Pull the red insulating tubing from the inside of the tubing set and position it centrally over the stress control tubing. Start shrinking in the centre working towards the ends. The tubing should be fully shrunk and wrinkle free.
Note: Continue with the next step while the insulating tubing is still hot.



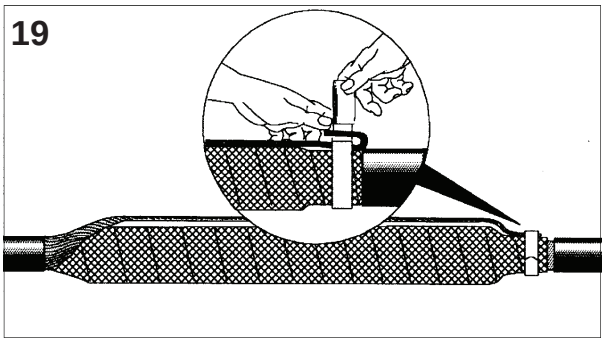
Position the black and red screened insulating tube centrally over the red insulating tubing whilst still hot.
Start shrinking in the centre. Check if fully shrunk by twisting the end. The tube should not move from its position.
Continue shrinking towards one end and stop about 50mm from the end.
Shrink the other half of the tube in the same way. Then shrink down the first and finally the second end.
Note: The sequence of numbers in the drawing indicates the shrink sequence.
On completion each tube should be fully shrunk and wrinkle free with no visible ridges.



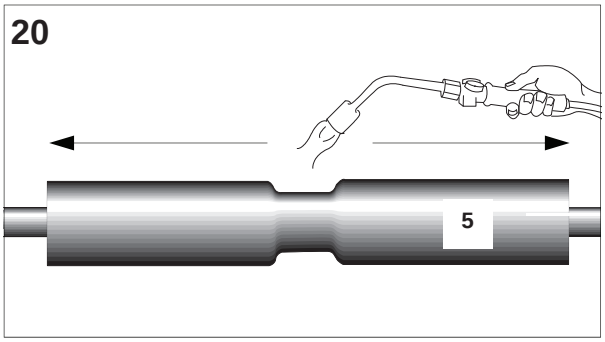
On the paper cable side position the compression sleeve (4) over the insulating sleeve and the metal sheath.
Leave approximately 50mm of the metal sheath exposed.
Start shrinking the tubing from the uncoated end working towards the oversheath.



Wrap two layers of tinned copper mesh around the joint with a 50% overlap so that the whole joint area is covered. Bend the copper wires back over the joint and form them into a conductor.
Connect the copper wires to the lead sheath using the roll spring provided. Cover the roll spring with two layers of PVC tape.



Clean and degrease the ends of the oversheath for a length of about 150mm.
Centre the outer sleeve over the joint area.
Start shrinking in the centre, before working towards the ends.



Joint completed.
Allow the joint to cool before applying any mechanical strain.

21

2.3 Three-Core Transition Straight Joints

2.3.1 Three-Core PILC (95 to 300mm²) to Single-Core Polymeric (185 to 500mm²)

These are resin filled heatshrink joints that are supplied without phase connectors (these come in a separate kit).

Cable Sizes in mm²		Joint Kit Description and Part Numbers			
Tyco Part Number		SMOE 63751	BSMB 95-300GB	BSMB 185/400-500	SMOE 62191
UK Power Networks Stores Code		02649C	02671A	02665F	02651H
PILC	POLY				
95 - 150	185 - 300	1 per Joint	3 per Joint		1 per Joint
185	185 - 300	1 per Joint	3 per Joint		
185 - 400	185 - 500	1 per Joint		3 per Joint	
400	500	1 per Joint		3 per Joint	
Resin Volume of each Joint is 32 Litres					

2.3.2 Cable Preparation

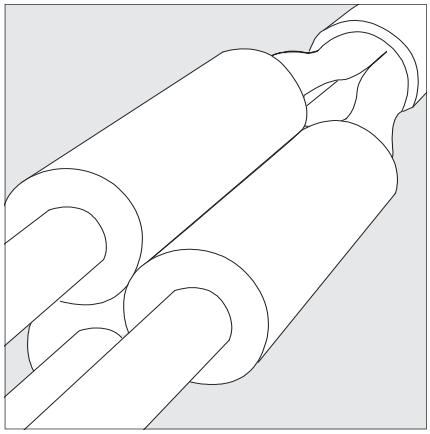
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables
- 3.3 Three-Core Paper Insulated Cables

2.3.3 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.3 Resin Filled Three-Core Transition Joints
- 4.1.7 Paper Insulation Shim Kit for 95mm² Cables
- 4.1.8 Paper Insulation Shim Kit for 120 and 150mm² Cables
- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.3 Resin Filled Three-Core Transition Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.3 Resin Filled Three-Core Transition Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.4 Resin Filled Three-Core Transition Joints



Installation Instruction

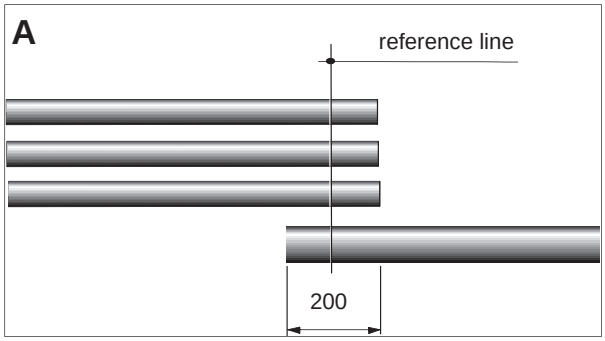
33kV Three Core Transition Straight Resin Filled Joint for Three Core PILC to Single Core XLPE Cables:

For PILC Cable Sizes 185 - 400mm^2 and XLPE Cable Sizes 185 - 500mm^2 XLPE
SMOE 63751
UK Power Networks Stores Code 02649C

For PILC Cable Sizes 70 - 150mm^2 use with PILC Cable Build Up Kit
SMOE 62191
UK Power Networks Stores Code 02651H

Preparation of Cables

Overlap the cable to be jointed by about 200mm.
Mark the reference line (middle of the overlap).



Paper Cable preparation

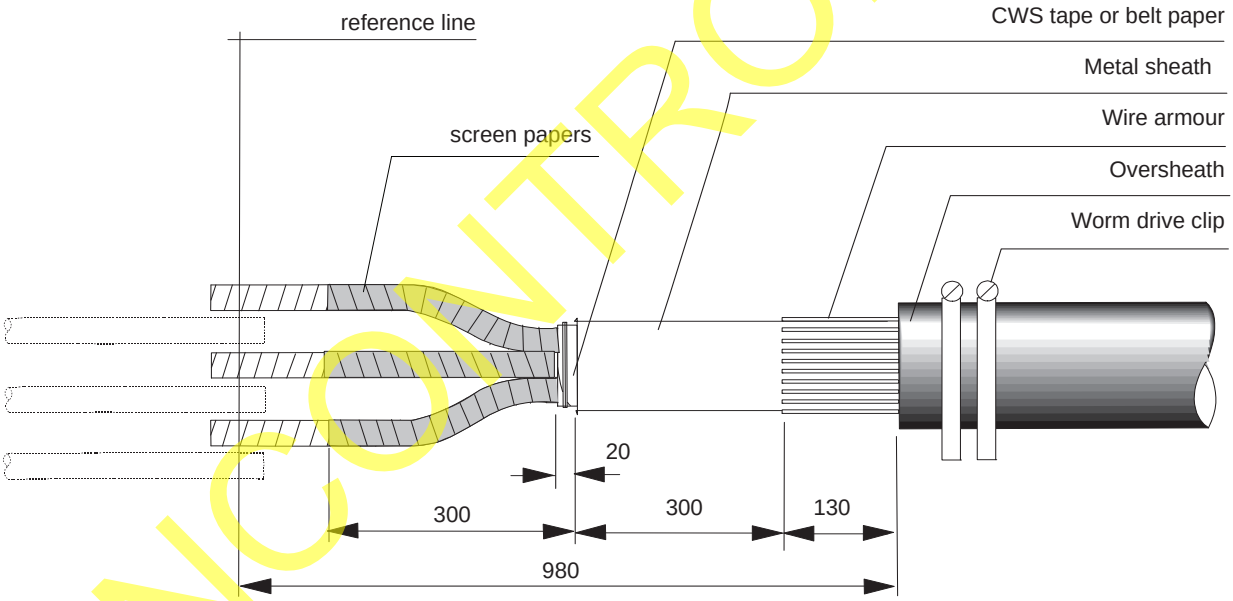
1.Remove the oversheath, armour and bedding according to the dimension given in drawing B.

2. Abrade, clean and degrease the lead sheath and armour.

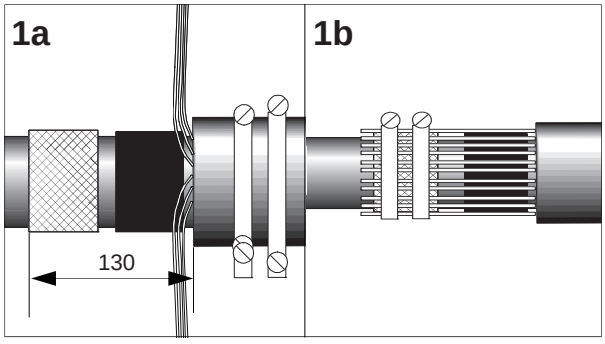
3. Remove the lead sheath according to the dimensions given in drawing B in such a way that a slight bell is formed at the end of the lead cut.

4. Unwrap the fabric tape and wrap two to three turns around the crutch of the cable securing it with a half hitch 20mm from the end of the lead sheath.

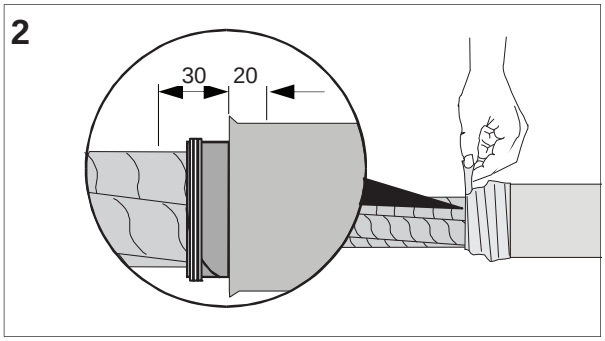
B



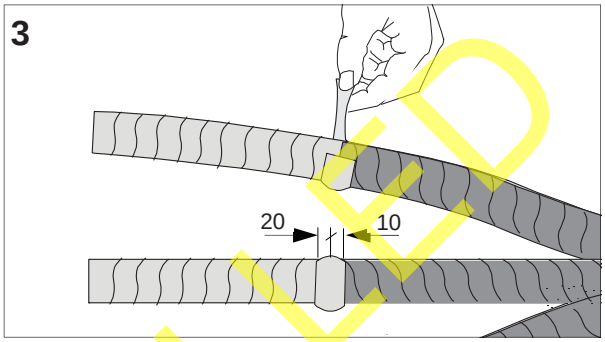
Lift the armour wires away from the lead sheath until they are in the vertical position.
Clean and de-grease the armour wires and the lead sheath.
Apply two layers of the black mastic sealant around the lead sheath butting up against the lifted armours.
Make a mark the lead sheath 130mm from the end of the oversheath.
Wrap the tinned copper mesh around the lead sheath level with the 130mm mark.
Lay the armours down tinned copper mesh and secure with the two worm drive clips.
Position the armour sealing sleeve 30mm past the cut end of the armours and shrink down.



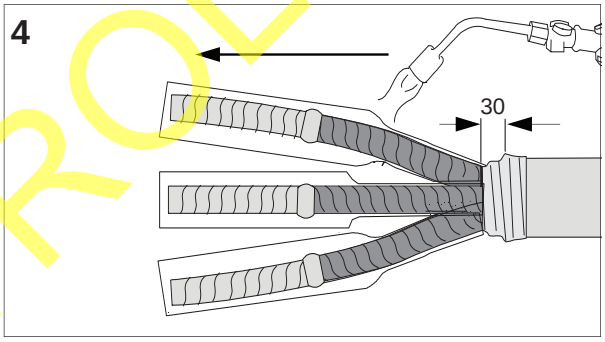
Screened Paper Cable
Protect the CWS tape or the belt papers with the nylon tape supplied in the kit. Start applying tape from 20mm on the lead sheath before extending 30mm onto the cores, tape should be applied
under tension.



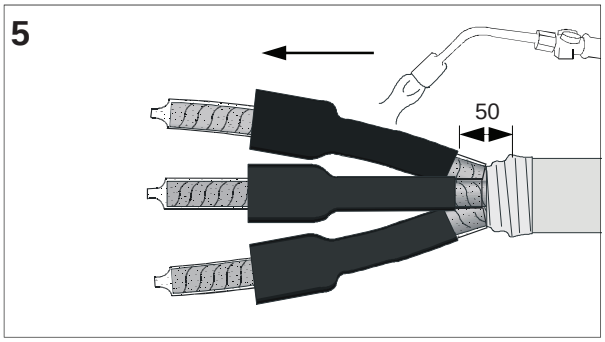
Carefully separate the cores so as not to damage the belt or core insulation papers.
Remove the screen papers to the dimension showing in drawing B.
Remove the top two layers of paper insulation , back to the screen paper removal point on all three cores.
At the screen cut wrap one piece of void filling yellow mastic tape around each core, overlapping the screen papers by 20mm and the insulation papers by 10mm.
The tape should be stretched to half its original width before application and applied as a half lap layer.



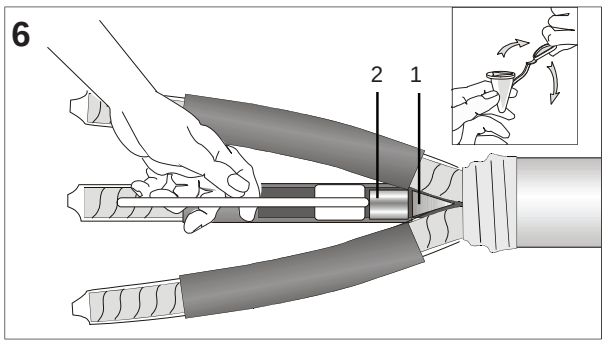
Slide a piece of clear barrier tubing over each core and position it so it finishes 30mm from the end of the metal sheath.
Shrink down the barrier tubing starting at the crutch before working towards the cable end. Check that the tubing is shrunk down evenly and is free from air and grease pockets.



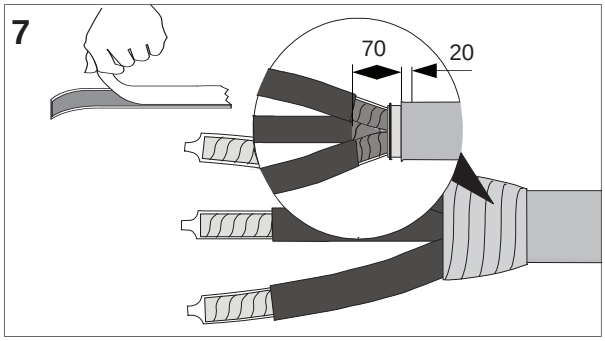
Slide a piece of black conductive tubing over the each core and position it so it finishes 50mm from the end of the metal sheath.
Shrink down the conductive tubing starting at the crutch and before working towards the cable end.



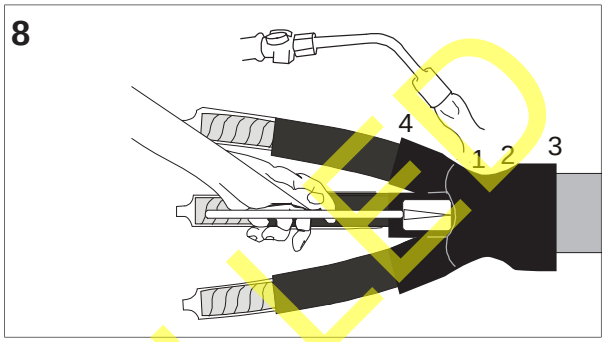
Remove the packaging of the small yellow mastic wedge.
Insert the wedge well into the crutch area of the cable using the installation tool (1).
Take the larger yellow mastic wedge out of the packaging case and insert it into the crutch area of the cable behind the previously installed smaller wedge (2).
Clean and degrease the cores.
Remove the nylon tape from the crutch area after inserting both wedges.



Remove the printed release paper from the yellow void filling mastic tape and roll up.
Apply the yellow void filling mastic tape to the crutch area of the cable starting 20mm on to the lead sheath, before continuing for a further 70mm onto the cable.
The tape should be stretched to half its original width before application and applied as a half lap layer.

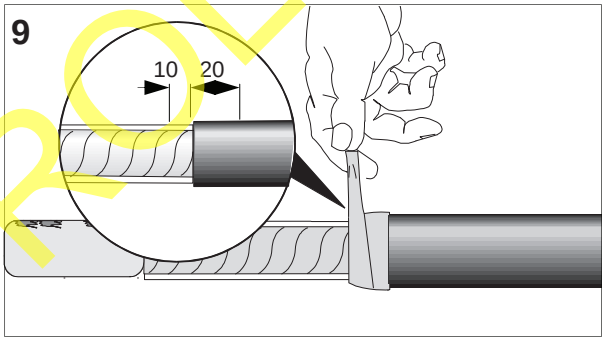


Push the conductive breakout over the cores and pull it well down into the crutch.
Shrink the conductive breakout into place starting at the centre (1), before working first towards the metal sheath (2) and (3) and then shrinking each turret onto each core (4).
The numbers in the drawing indicate the shrink sequence.



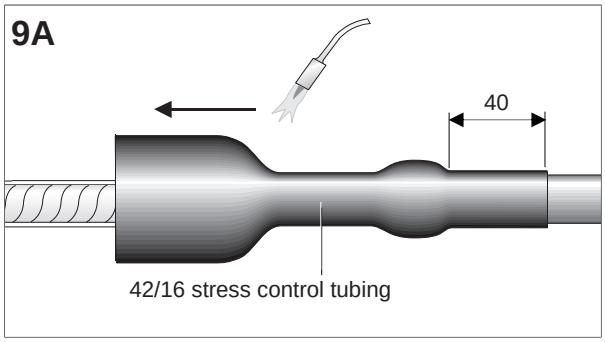
For cable sizes of 120 - 150mm^2 only apply the first build up tube from the kit. If not required move to Step 10.

Remove the release papers from the yellow void filling mastic tape with the pointed ends.
Wrap the tape around the end of the black conductive tube starting 20mm from the end before continuing onto the clear barrier tube for 10mm.
The tape should be stretched to half its original width before application and applied as a half lap layer.

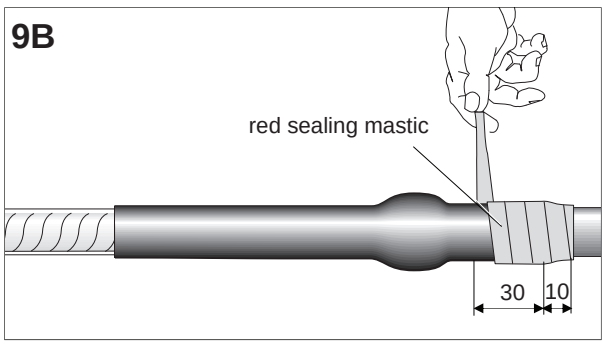


Position a short length of the black 42/16 stress control tubing over each core, so it overlaps the conductive tubes and the yellow void filling mastic by 40mm.

Shrink the tube down starting from the crutch side of the cable.



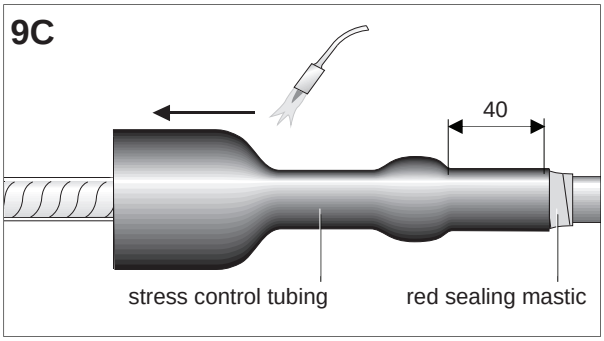
Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30mm and the core for 10mm.



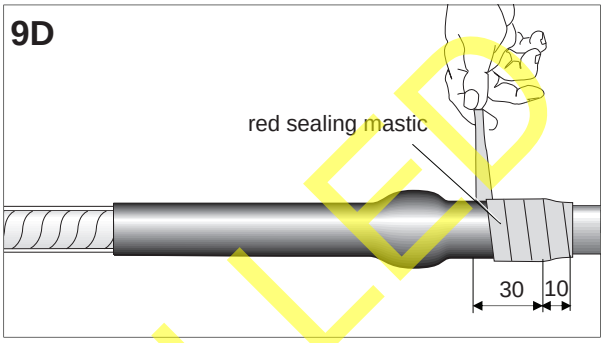
For cable sizes of between 70 - 95mm² apply the second build tube from the kit.

Position the short length of 54/24 black stress control tubing directly over the previously installed stress control tubes.

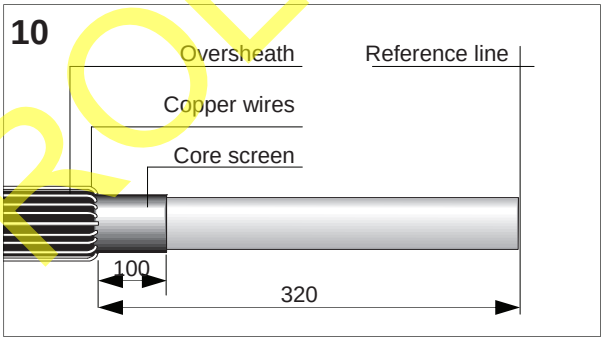
Shrink down starting from the crutch side of the cable.



Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30mm and the core for 10mm.

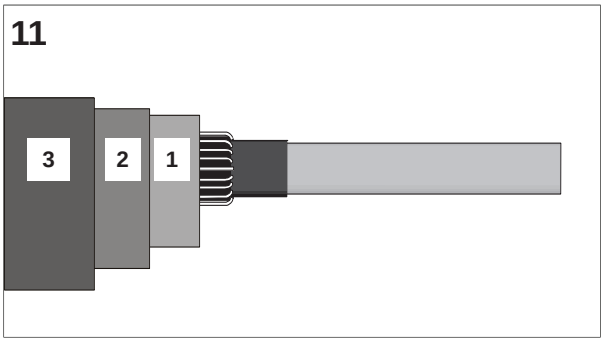


Clean the oversheath of the plastic cables for a length of 1m. Remove the oversheath for a distance of 320mm from the reference line. Bend back the copper screen wires on to the oversheath. Cut the cores to length at the reference line. Thoroughly remove the insulation screen to leave 100mm from the oversheath cut. The insulation surface shall be left clean, smooth and polished so it is free of all traces of conductive material. Clean and degrease the insulation. Fit the trifurcating end piece of the plastic joint shell and park it out of the way.

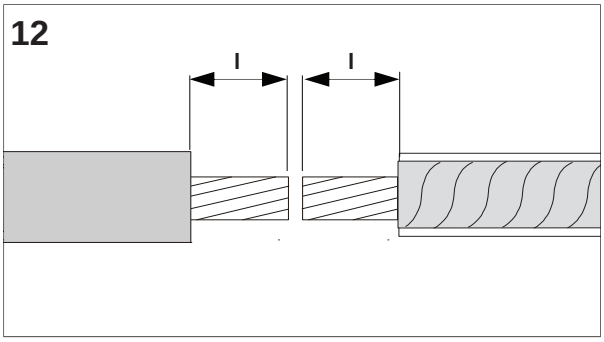


Slide a combined tubing set over each plastic cable core in the following order:

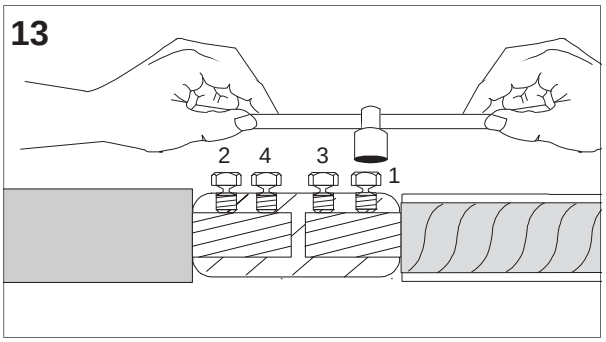
(1) Black Stress control tubing.
(2) Red insulating tubing.
(3) Red and black screened insulating tubing.



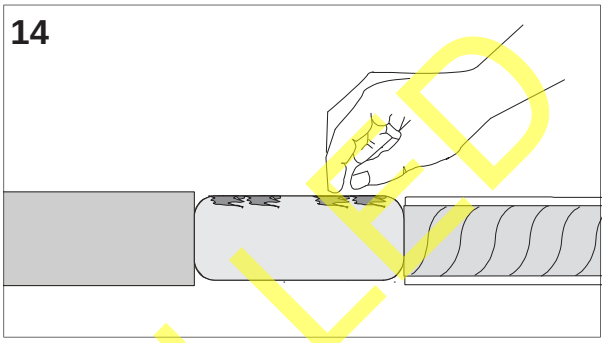
Measure the conductor bore depth of the connector (I) and then remove the insulation on all cores to this measurement



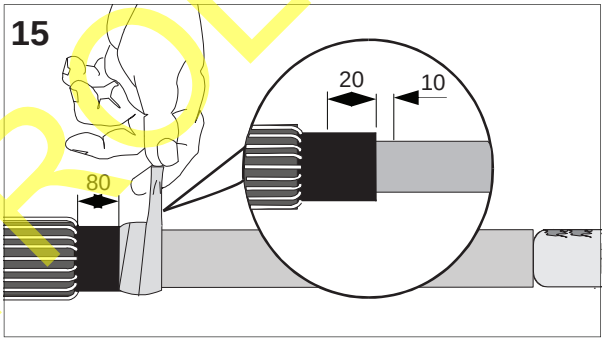
Fit the conductors into the connector. These should be no gap left between the connector and the insulation.
Take up the tension equally on all bolts but do not shear bolt heads at this stage.
Then continue to tighten each bolt until the head shears off in the sequence show in drawing.
If after all the bolts have been sheared off any part of the bolt remains above the body of the connector, this shall be filled down using a suited tool.
Realign cables if necessary.
Note: For small cross section cables it may be necessary to use a connector holding tool to stop the core bending.



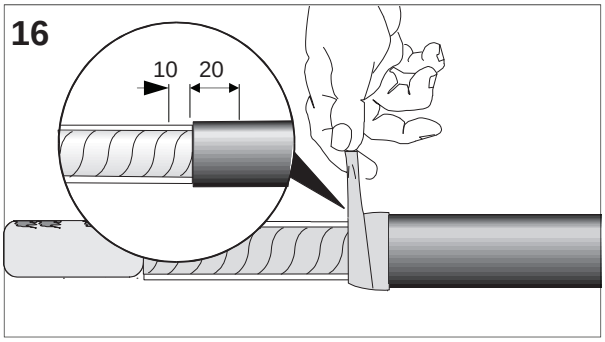
Clean and degrease the cable cores and the connector.
Fill each bolt hole in the connector with grey clay until a smooth level profile finish is achieved.



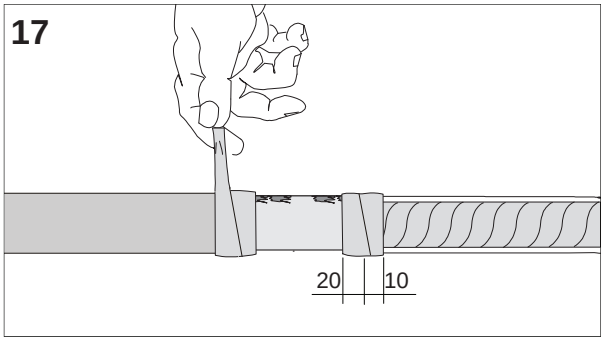
Plastic Cable Side
Remove the release papers from the yellow void filling mastic tape with the pointed ends. Wrap the tape around the core screen starting 20mm from the insulation screen kit before continuing onto the insulation for 10mm.
The tape should be stretched to half its original width before application and applied as a half lap layer, under tension to achieve a fine thin edge.



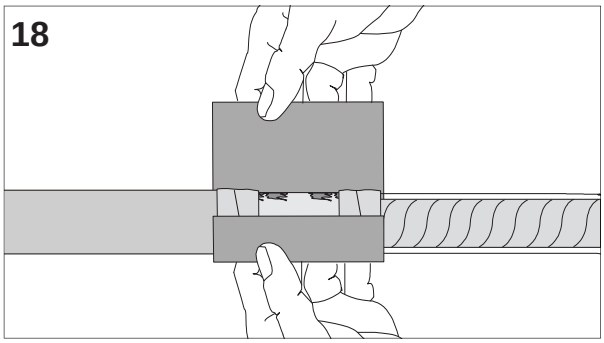
Paper Cable Side
Remove the release papers from the yellow void filling mastic tape with the pointed ends. Wrap the tape around the end of the black conductive tube starting 20mm from the end, before continuing for 10mm onto the transparent oil barrier tube. The tape should be stretched to half its original width before application and applied as a half lap layer, under tension to achieve a fine thin edge.



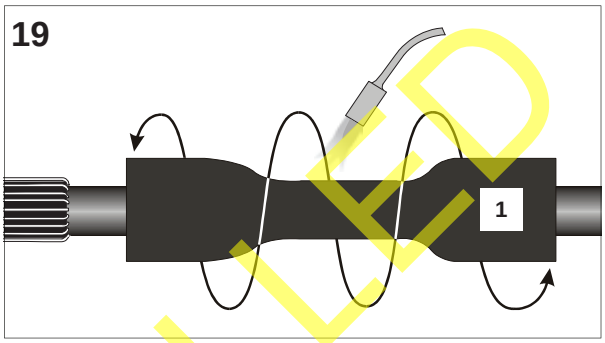
Wrap a piece of yellow void filling mastic tape around the ends of each connector to form a smooth profile.
Start from 10mm on the insulation before continuing onto the connector body for 20mm.
The tape should be stretched to half its original width before application and applied under tension as a half lap layer.



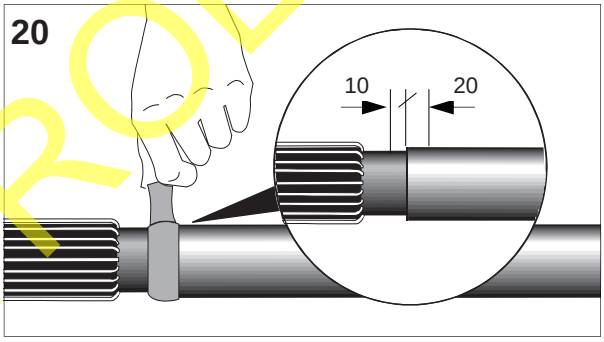
Remove the release paper from one side of the yellow mastic patch and wrap it centrally around the connector, with the release paper on the outside. Check that as the patch is applied no air voids are created in the material. When all three patches are in place remove the remaining release papers



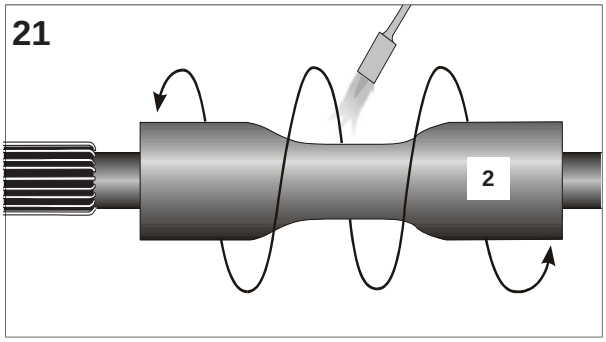
Pull the black stress control tubing from the inside of the tubing set and position it centrally over the connector.
Check that the overlap is equal over each taped screen cut.
Shrink the tube in place starting from the centre before working towards each end in turn.
On completion each tube should be fully shrunk and wrinkle free.



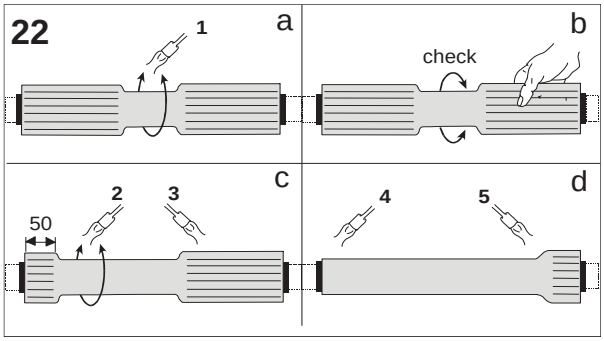
Remove one release paper from the red mastic tape and roll it up.
Wrap the tape around each end of the black stress control tubing for 20mm and overlapping onto the core for 10mm.



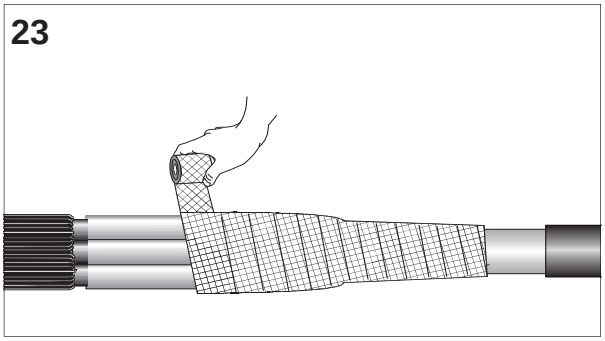
Pull the red insulating tubing from the tubing set and position it centrally over the connector.
Start shrinking at the centre before working towards each end in turn.
On completion each tube should be fully shrunk and wrinkle free.



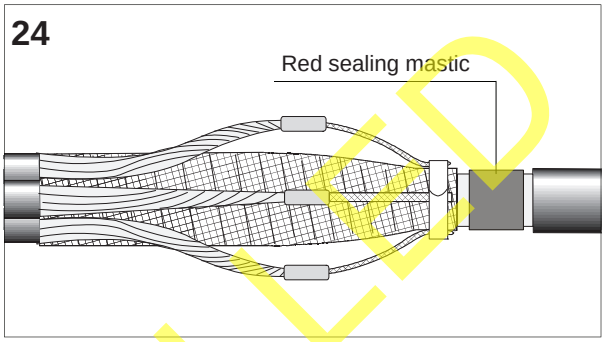
Position the black and red screened insulating tube centrally over the red insulating tubing whilst still hot.
Start shrinking in the centre. Check if fully shrunk by twisting the end. The tube should not move from its position.
Continue shrinking towards one end and stop about 50mm from the end.
Shrink the other half of the tube in the same way. Then shrink down the first and finally the second end.
Note: The sequence of numbers in the drawing indicates the shrink sequence.
On completion each tube should be fully shrunk and wrinkle free with no visible ridges.



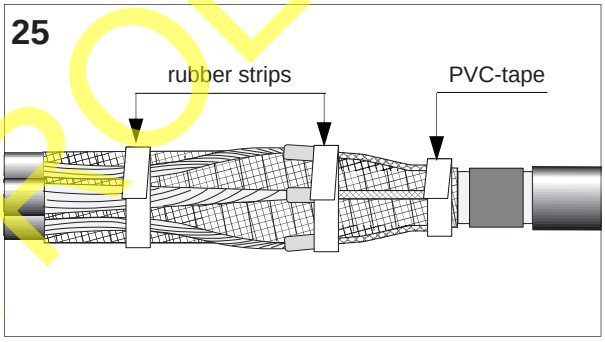
Relay the cores together and wrap one layer of tinned copper mesh around the joint with a 50% overlap.
Start from 30mm on the lead sheath on the paper cable side. Continue across the joint towards the plastic cables finishing close the copper wire screens.



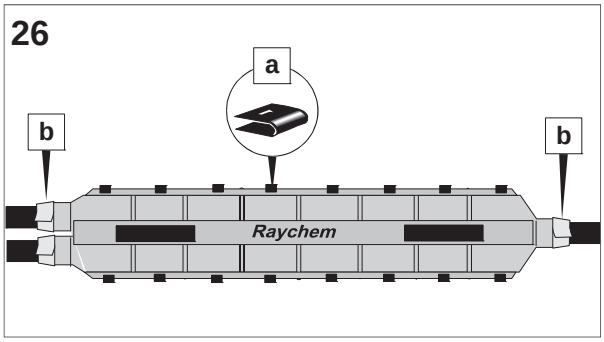
Form each of the bunches of copper wire screens form each cable into a separate conductor.
Connect the earth braids to the copper wires of the XLPE cable using the mechanical connectors included in the kit.
Connect the earth braids onto the lead sheath using the roll spring provided. Cover the roll spring with two layers of PVC tape.
Using the strips of the red sealing mastic, apply one layer half lap around the exposed lead sheath to provide a moisture seal.
Cover any sharp edges of the worm clip with PVC tape.



Degrease and abrade the plastic cable sheath for a distance of 100mm.
Trim the ends of the joint half shells to fit the paper cable oversheath diameter.
Place the bottom half of the joint shell under the joint and mark the positions of the stand off mouldings.
Wrap the rubber patch around the joint centrally over the markings and secure in place. The patch should be wrapped with the adhesive side outwards.



Support the bottom half of the joint shell under the joint and fit the trifurcating end piece.
Fit the top half shell to the bottom using the clips provided.
Fill any gaps around the cable entry holes as required.
Fill the joint with resin and allow the resin to cure before applying any mechanical strain.



2.3.4 Three-Core PILC (185 to 400mm²) to Single-Core Polymeric (500 to 630mm²)

These are all heatshrink joints that are supplied without phase connectors (these come in a separate kit).

Cable Sizes in mm²		Joint Kit Description and Part Numbers		
Tyco Part Number		SMOE 63752	BSMB 185/400 - 630	SMOE 62191
UK Power Networks Stores Code		02650X	02668K	02651H
PILC	POLY			
185	630	1 per Joint	3 per Joint	1 per Joint
240	630	1 per Joint	3 per Joint	1 per Joint
300	630	1 per Joint	3 per Joint	
400	630	1 per Joint	3 per Joint	

2.3.5 Cable Preparation

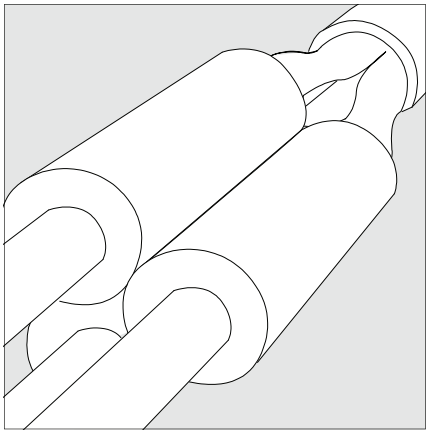
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables
- 3.3 Three-Core Paper Insulated Cables

2.3.6 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.4 Heatshrink Three-Core Transition Joints
- 4.1.7 Paper Insulation 'Shim' Kit for 95mm² Cables
- 4.1.8 Paper Insulation 'Shim' Kit for 120 and 150mm² Cables
- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.4 Heatshrink Three-Core Transition Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.4 Heatshrink Three-Core Transition Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.5 Heatshrink Three-Core Transition Joints



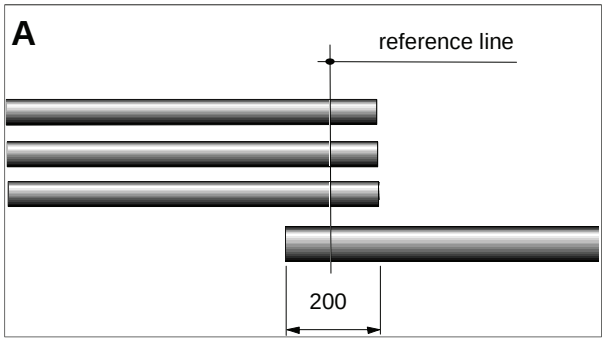
Installation Instruction
33kV All Heatshrink Three Core Transition Joint for 3 - Core PILC to Single Core XLPE Cables:

For PILC Cable sizes 300 - 400mm² and 630mm² XLPE
SMOE 63752
UK Power Networks Stores Code = 02650X

For PILC Cable sizes 185 - 240mm² use the base kit above with a PILC Cable Build Up Kit
SMOE 62191
UK Power Networks Stores Code = 02651H

Preparation of Cables

Overlap the cable to be jointed by about 200mm.
Mark the reference line (middle of the overlap).



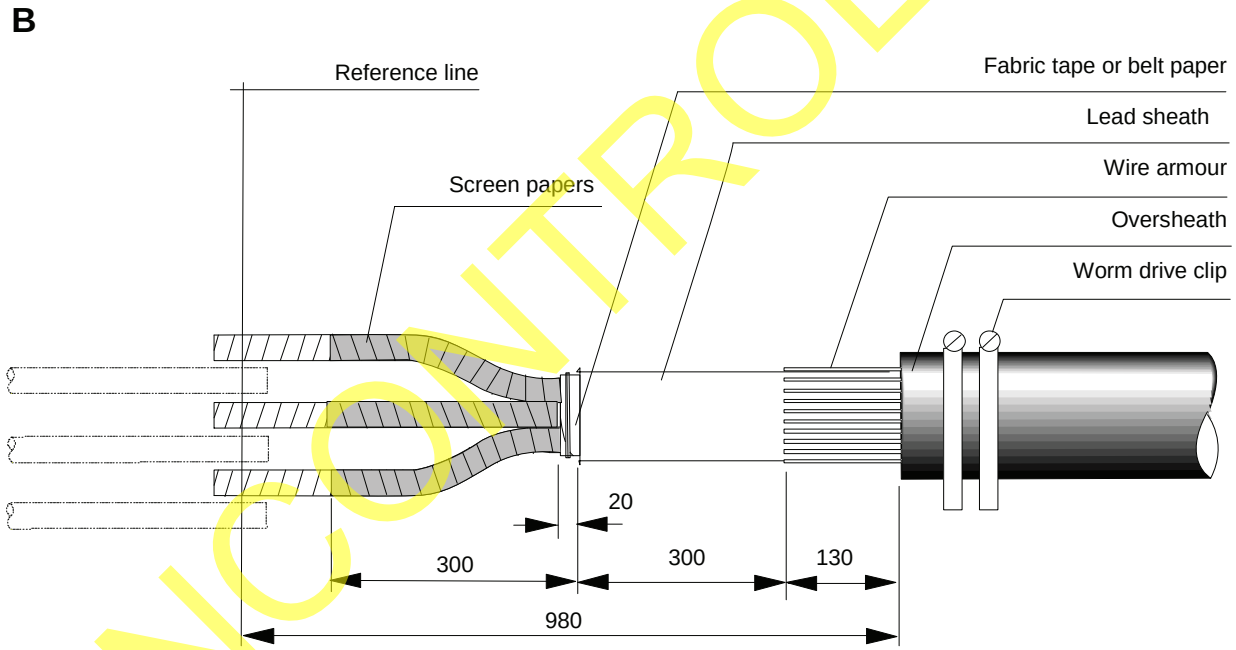
Paper Cable Preparation

1.Remove the oversheath, armour and bedding according to the dimension given in Figure B.

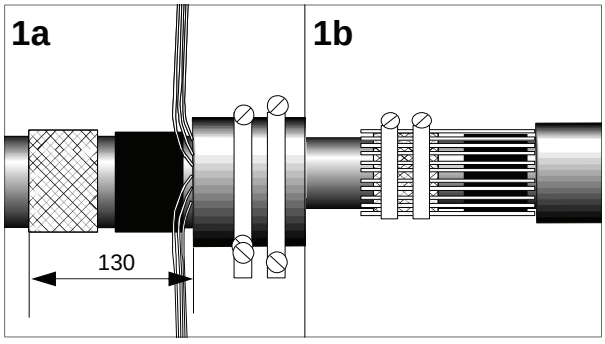
2. Abrade, clean and degrease the metal sheath and armour.

3. Remove the lead sheath according to the dimensions given in Figure B in such a way that a slight bell is formed.

4. Unwrap the fabric tape and wrap two to three turns around the crutch of the cable, securing it with a half hitch 20mm from the end of the lead sheath.

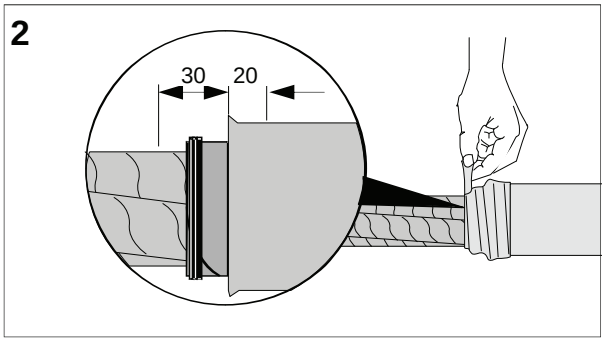


Lift the armour wires away from the lead sheath until they are in the vertical position.
Clean and de-grease the armour wires and the lead sheath.
Apply two layers of the black mastic sealant around the lead sheath butting up to the lifted armours.
Mark the lead sheath 130mm from the end of the oversheath.
Wrap the tinned copper mesh around the lead sheath level with the 130mm mark.
Lay the armours down onto the tinned copper mesh and secure with the two worm drive clips.
Position the armour sealing sleeve 30mm past the end of the armour and shrink down.

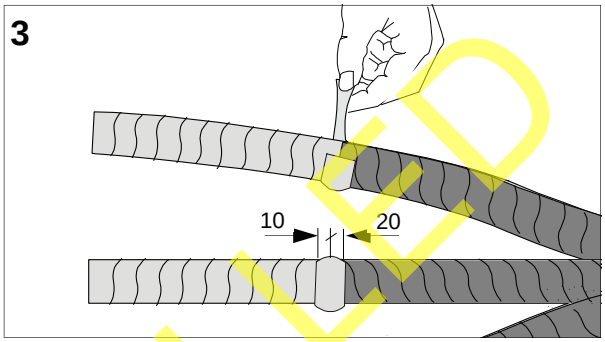


Screened Paper Cable

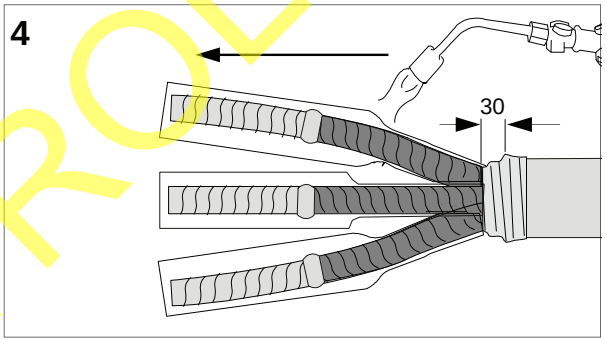
Protect the fabric tape with the nylon tape supplied in the kit. Start applying the tape from 20mm on the lead sheath before extending 30mm onto the cores. The tape should be applied under tension.



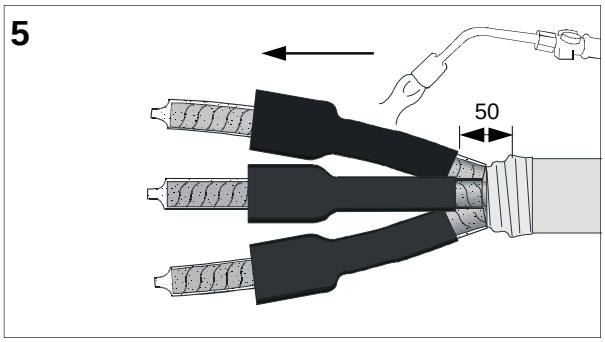
Separate the cores carefully so as not to damage the belt or core insulation papers.
Remove the screen papers to the dimension showing in Figure **B**.
Remove the top two layers of paper insulation, back to the screen cut removal point on all three cores.
At the screen cut wrap one layer of yellow void filling mastic around each core, overlapping the screen papers by 20mm and the insulation papers by 10mm.
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.



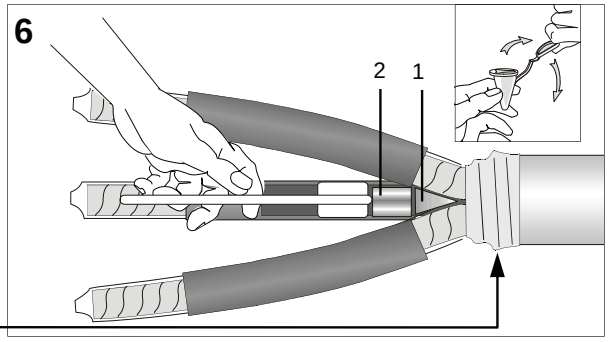
Slide a piece of clear barrier tubing over the cores and position it so it finishes 30mm from the end of the lead sheath.
Shrink down the barrier tubing, starting at the crutch before working towards the cable end. Check that the tubing is shrunk down evenly and is free from air and grease pockets.



Slide a piece of black conductive tubing over the cores and position it so it finishes 50mm from the end of the lead sheath.
Shrink down the conductive tubing starting at the crutch before working towards the cable end.

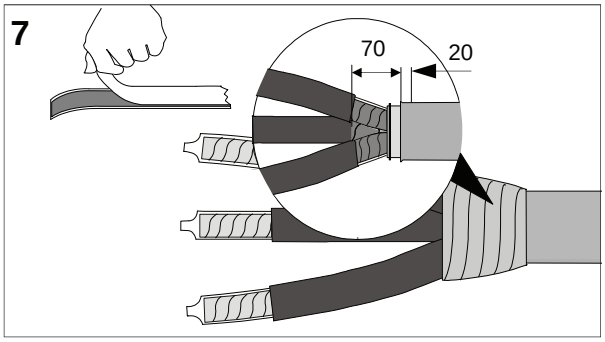


Remove the packaging of the small yellow mastic wedge.
Insert the wedge well into the crutch area of the cable using the insertion tool (1).
Take the larger yellow mastic out of the packaging case and insert it into the crutch area of the cable behind the previously installed smaller wedge (2).
Clean and degrease the cores.

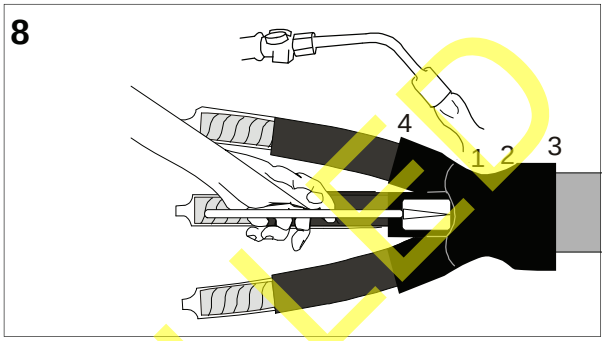


Remove the nylon tape from the crutch area after inserting the wedges.

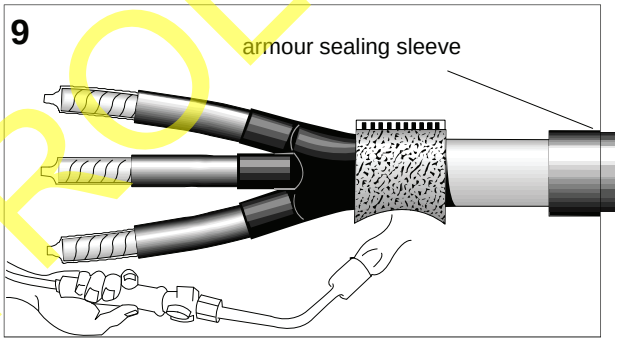
Remove the printed release paper from the yellow void filling tape and roll up the tape. Applying the void filling tape with a 50% overlap, stretching it to about half of its original width, tape up the outside of the crutch as shown.
Cover 20mm of the metal sheath and continue for 70mm until a cone shape is formed.



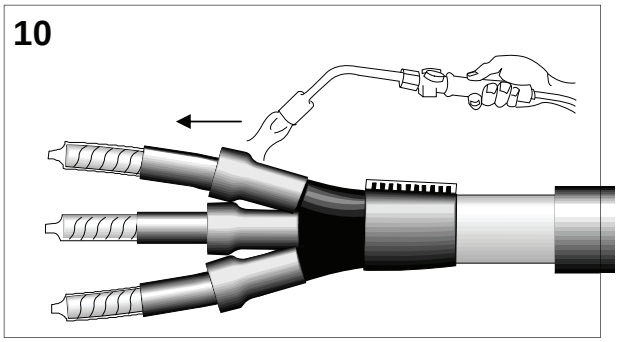
Pass the conductive breakout over the cores and pull it well down into the crutch.
Shrink the conductive breakout into place starting at the centre (1), before working towards the lead sheath (2) and (3) and then shrink the turrets onto each core (4).
The numbers in the drawing indicate the shrink-sequence.



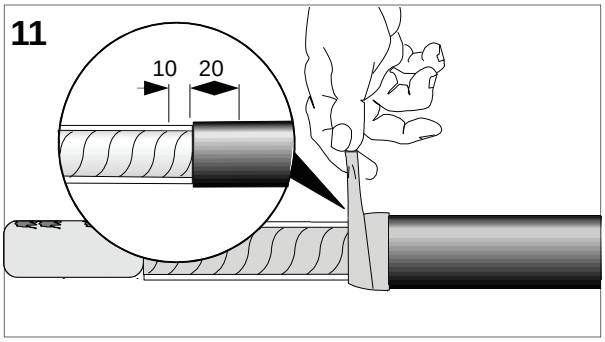
Position the wraparound sleeve over the paper cable, so that it covers both the lead sheath and the conductive breakout body. Leave a gap of approximately 160mm between the wraparound and the armour sealing sleeve.
Shrink the wraparound down starting from the middle. When the colour of the paint has completely changed to black gradually move towards the ends.
Note: Extra heat is required on the metal channel. Heat should be applied until the white marking line on the rails of the tube can be seen under the metal channels.



Position the black short sealing sleeves over the turrets of the breakout. Push the sleeves right into the crutch and shrink them into place.



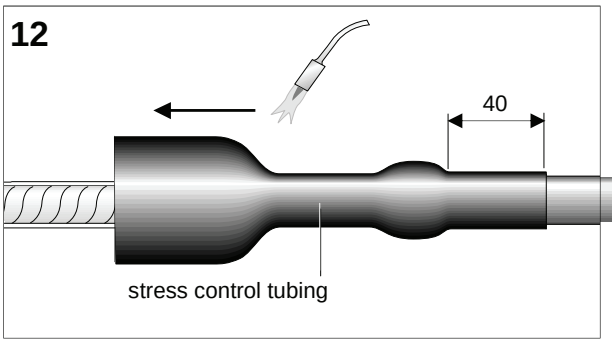
Remove the release papers from the yellow void filling mastic tape with the pointed ends.
Wrap the tape around the end of the black conductive tube starting 20mm from the end before continuing onto the clear barrier tube for 10mm.
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.



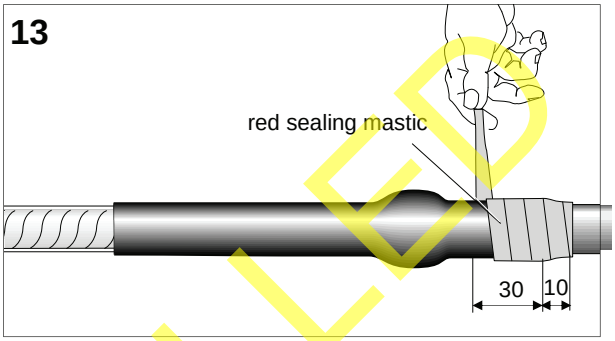
For PILC cable sizes below 300mm^2 the addditional build up tubes should be installed at this point. If not required move on to step 16.

Position a short length of the black 42/16 stress control tubing over each core, so it overlaps the conductive tubes and the yellow void filling mastic by 40mm.

Shrink the tube down starting from the crutch side of the cable.

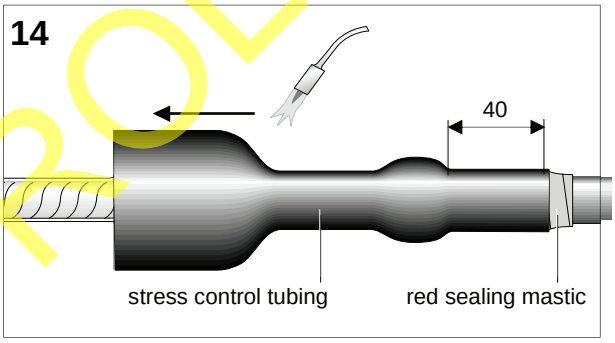


Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30mm and the core for 10mm.

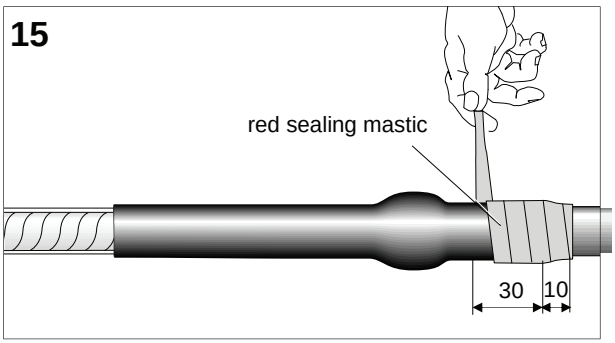


Position the short length of 54/24 black stress control tubing directly over the previously installed stress control tubes.

Shrink down starting from the crutch side of the cable.

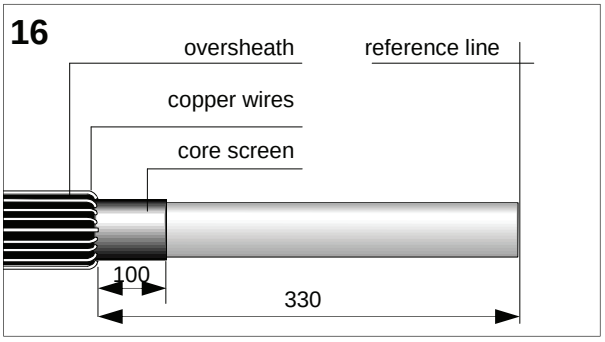


Apply one strip of the red mastic around each end of the stress control tubes, overlapping the tubing by 30mm and the core for 10mm.



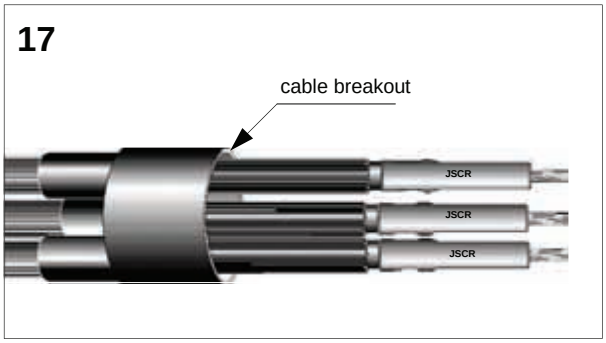
XLPE Cable Preparation

Clean the oversheath of the plastic cables for a length of 1m.
Remove the oversheath for a distance of 320mm from the reference line.
Bend back the copper wires on to the oversheath. Cut the cores to length at the reference line.
Thoroughly remove the core screen to the dimensions given in Figure 16. The insulation surface shall be left clean, smooth and polished so it is free of all traces of conductive material. Clean and degrease the insulation.



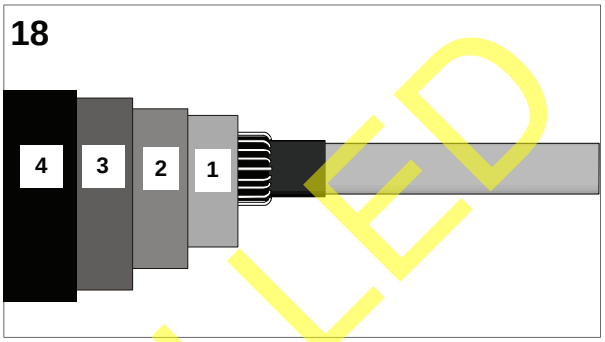
Slide the large cable breakout over the three single core XLPE cables.
Check the fingers of the cable breakout face away from joint.

Position the cable breakout away from the jointing area.

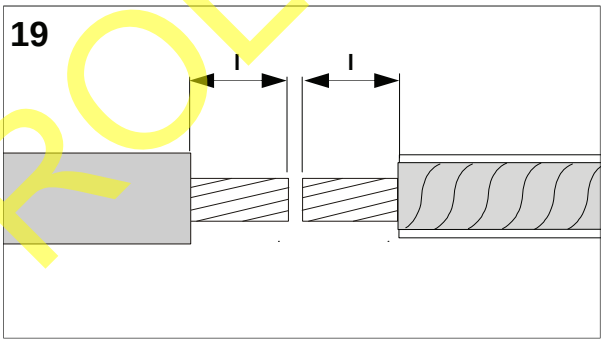


Completion of Joint
Slide a combined tubing set over each plastic cable core in the following order:

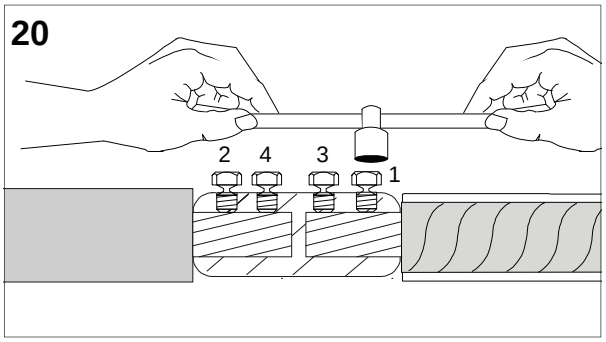
(1) Black stress control tubing.
(2) Red insulating tubing.
(3) Black and red screened insulating tubing.
(4) Black compression sleeve with uncoated end pointing towards the centre of the joint.



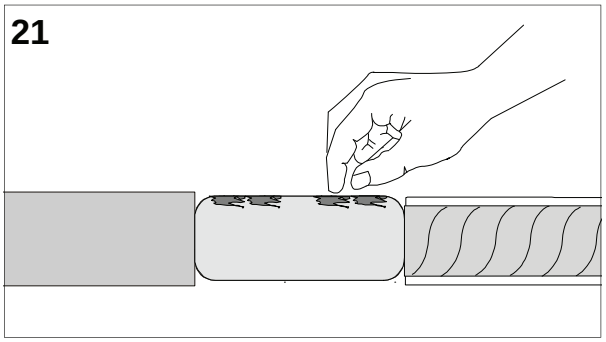
Measure the conductor bore depth of the connector (I) and remove the insulation on all cores to this measurement.



Fit the conductors into the connector. There should be no gap left between the connector and the insulation.
Take up the tension equally on all bolts but do not shear the bolt heads off at this stage.
Continue to tighten each bolt until the head shears off in the sequence shown in Figure 20.
If after all bolts have been sheared off, any part of the bolt remains above the body of the connector, this shall be filed down using a suitable tool.
Realign cables if necessary.
Note: For small cross section cables it may be necessary to use a connector holding tool to stop the core bending.

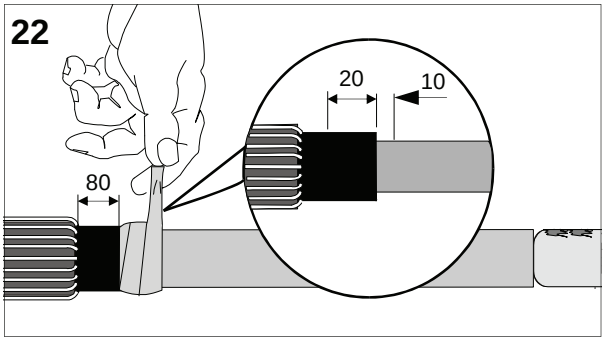


Clean and degrease the cable cores and the connector.
Fill each bolt hole in the connector with grey clay until a smooth level finish is achieved.



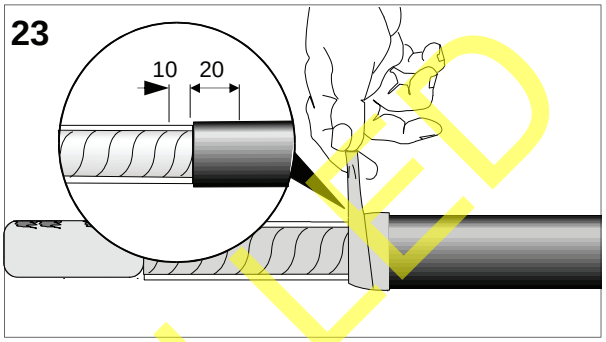
Plastic Cable Side

Remove the release papers from the yellow void filling mastic strip with the pointed ends.
Wrap the tape around the core screen starting 20mm from insulation screen cut before continuing onto the insulation for 10mm.
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.

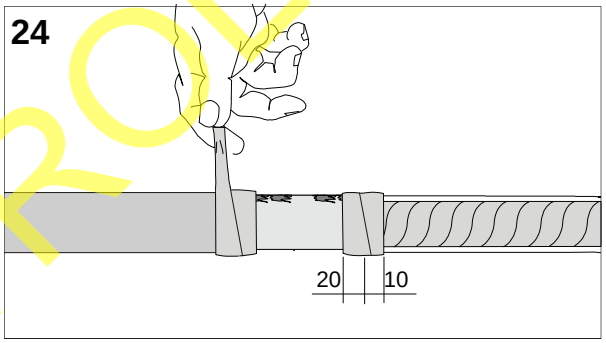


Paper Cable

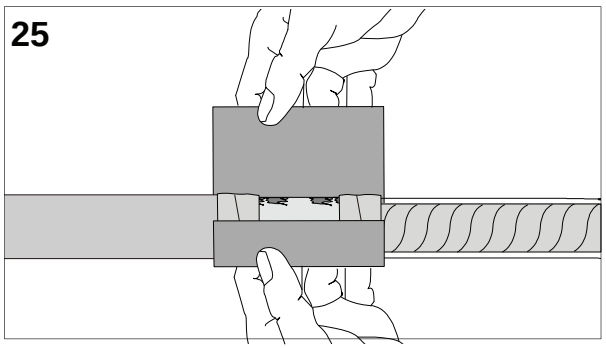
Remove the release papers from the yellow void filling mastic strip with the pointed ends.
Wrap the tape around the black conductive tubing, starting 20mm from the end, before continuing onto the clear oil barrier tubing for 10mm.
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.



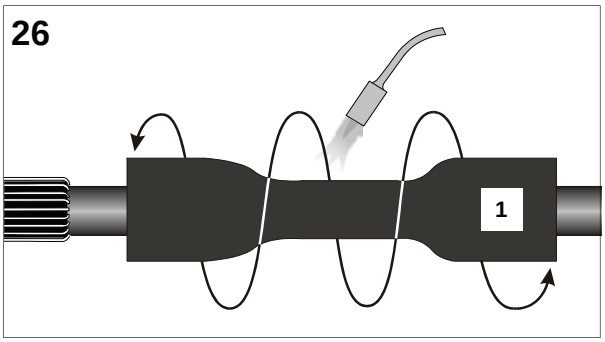
Wrap a piece of yellow void filling mastic tape around the ends of each connector to form a smooth profile.
Start from 10mm onto the insulation before continuing onto the connector body for 20mm.



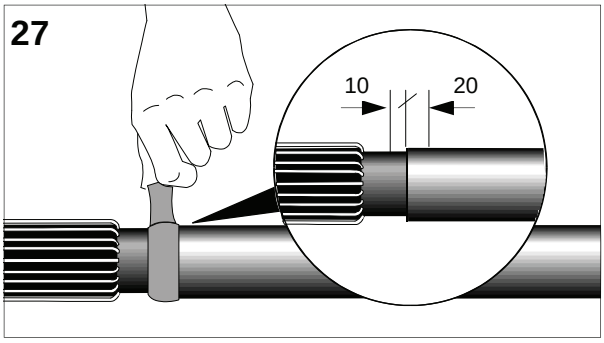
Remove the release paper from one side of a yellow mastic patch and wrap it around the connector.
Apply the patch centrally about the connector, taking care to exclude air voids as it is wrapped.
When all three patches are applied remove the remaining release papers.



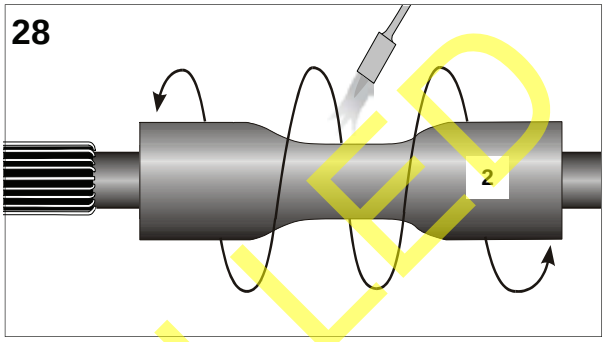
Pull the black stress control tubing from the inside of the Tubing set and position it centrally over the connector.
Ensure that the overlap is equal over each taped screen cut.
Shrink the tubing in place starting from the centre before working towards each end in turn.
On completion each tube should be fully shrunk and wrinkle free.



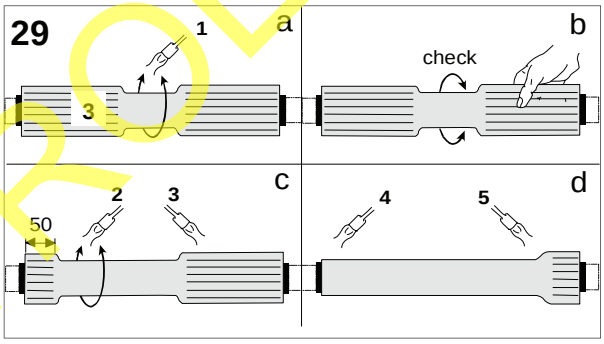
Remove one release paper from the red mastic tape and roll it up.
Wrap the tape around the end of each of the black stress control tubing for 20mm and onto the core for 10mm.



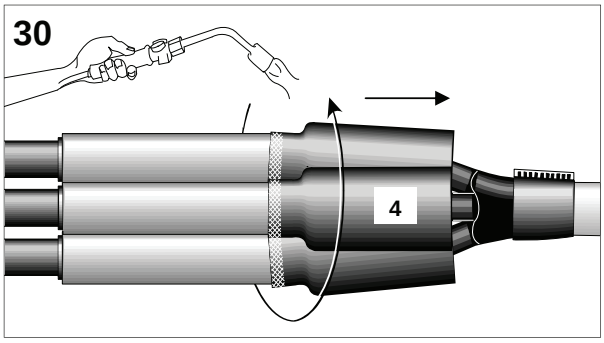
Pull the insulating tubing from the tubing set and position it centrally over the connector.
Start shrinking at the centre before working towards each end in turn.
On completion each tube should be fully shrunk and wrinkle free.



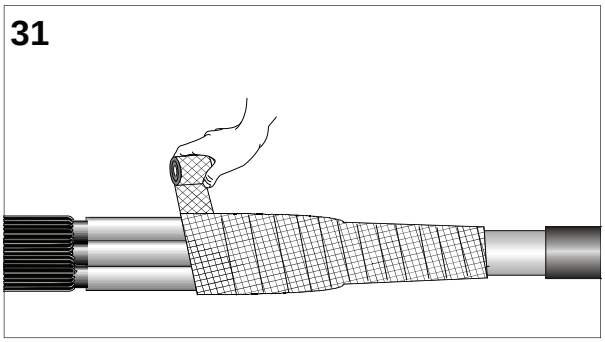
Position the black and red screened insulating tubes (3) centrally over the red insulating tubes whilst they are still hot. Start shrinking in the centre. Check if fully shrunk by twisting the ends. The tubes should not move from their position. Continue shrinking towards one end and stop about 50mm from the end. Shrink the other half of the tube in the same way. Then shrink down the first end and finally the second end.
Note: The sequence of numbers in the drawing indicates the shrink sequence.
On completion each tube should be fully shrunk and wrinkle free with no visible ridges.



Position the compression sleeves (4) over the PILC end of the joint, positioned equally over the red and black screened insulation tubes and PILC cable cores. The uncoated end should be pointing towards the centre of the joint.
Start shrinking the sleeves from the centre of the joint before working towards the breakout as indicated by the arrow in the drawing.



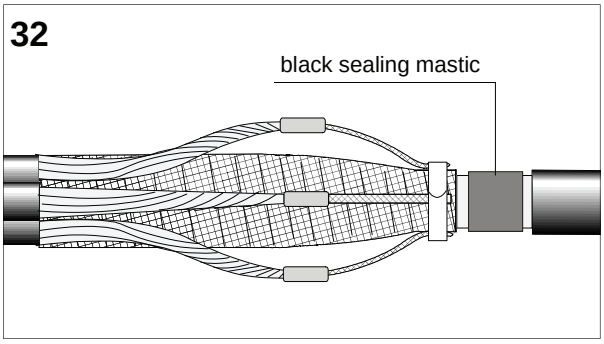
Relay the cores together and wrap one layer of tinned copper mesh around the joint with a 50% overlap.
Start from 30mm of the lead sheath on the paper cable side.
Continue across the joint towards the plastic cables finishing close to the copper wire screens.



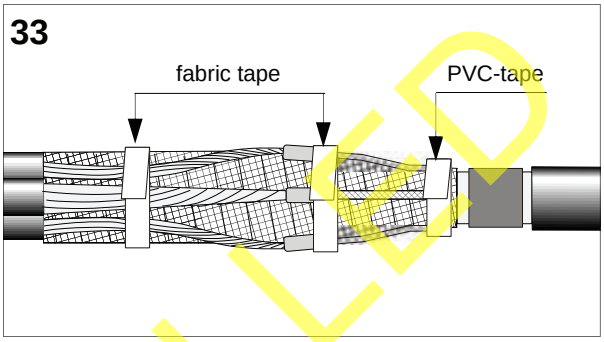
Plastic cable with wire sheath
Twist the wires together to form an earth conductor.
Connect the earth leads to the shielding wires of the plastic cable by using the mechanical connectors included in the kit or any other equivalent method.
Connect the earth leads onto the lead sheath using the roll spring provided. Cover the roll spring with two layers of PVC-tape.

Wrap one half lap layer of black mastic strip around the exposed lead sheath .

This is an important moisture seal. Do not leave out.



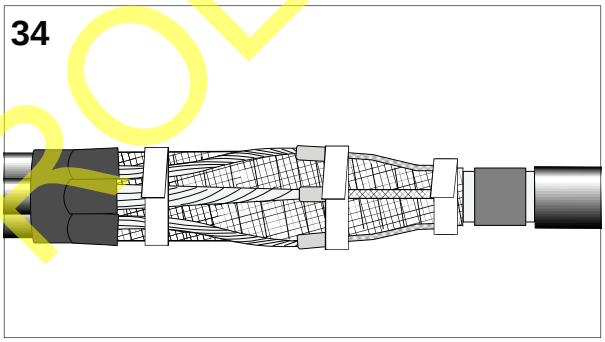
Degrease and flame brush the single core polymeric oversheaths.
Secure the copper wire shields and connectors using the fabric tape.



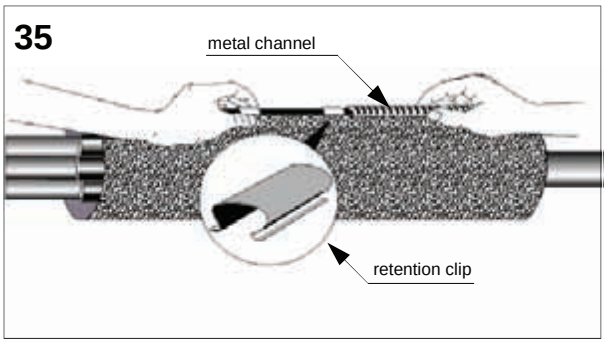
Clean, degrease and abrade the single core jackets for a distance of 75 mm.

Position the cable breakout over the joint, pulling the skirt as far as possible over the joint.

Shrink the breakout starting at the fingers working towards the joint.

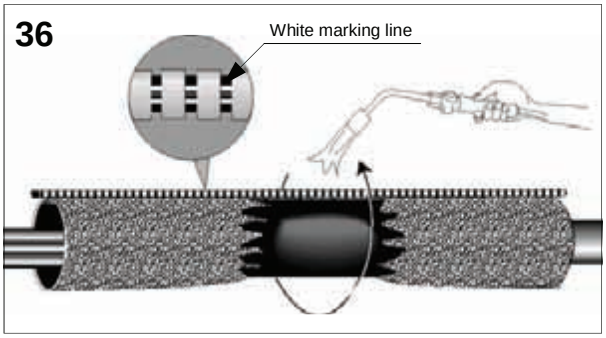


Position the wraparound joint sleeve centrally over the joint.
Press the retention clip over the rails of the wraparound to keep it in place.
Push the metal channels over the rails of the wraparound.
The ends of the metal channels should butt up and equally overlap the retention clips.
After all channels have been pushed on they should overlap the ends of the wraparound equally.



Shrink the wraparound sleeve into place starting at the middle of the joint. When the colour of the paint on the wraparound has completely changed to black, progressively move towards the ends of the sleeve.

Note: Extra heat should be applied to the metal channel, until the white marking line on the edges of the wraparound can be seen under the channels.



Allow the joint to cool before applying any mechanical strain.

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2.4 Three-Core HSL Transition Joints

2.4.1 Three-Core HSL PILC (95 to 300mm²) to Single-Core Polymeric (185 to 500mm²)

This is a resin filled joint that is supplied without phase connectors (these come in a separate kit).

Cable Sizes in mm²		Joint Kit Description and Part Numbers				
Tyco Part Number		SMOE 63751	BSMB 95-300GB	BSMB 185/400-500	SMOE 62191	SMOE 62909
UK Power Networks Stores Code		02649C	02671A	02665F	02651H	02553C
PILC	POLY					
95	185	1 per Joint	3 per Joint		1 per Joint	1 per Joint
95	300	1 per Joint	3 per Joint		1 per Joint	1 per Joint
120	185	1 per Joint	3 per Joint		1 per Joint	1 per Joint
120	300	1 per Joint	3 per Joint		1 per Joint	1 per Joint
150	185	1 per Joint	3 per Joint		1 per Joint	1 per Joint
150	300	1 per Joint	3 per Joint		1 per Joint	1 per Joint
185	185	1 per Joint	3 per Joint			1 per Joint
185	300	1 per Joint	3 per Joint			1 per Joint
185	400	1 per Joint		3 per Joint		1 per Joint
185	500	1 per Joint		3 per Joint		1 per Joint
240	185	1 per Joint		3 per Joint		1 per Joint
240	300	1 per Joint		3 per Joint		1 per Joint
240	400	1 per Joint		3 per Joint		1 per Joint
240	500	1 per Joint		3 per Joint		1 per Joint
300	185	1 per Joint		3 per Joint		1 per Joint
300	300	1 per Joint		3 per Joint		1 per Joint
300	400	1 per Joint		3 per Joint		1 per Joint
300	500	1 per Joint		3 per Joint		1 per Joint
400	500	1 per Joint		3 per Joint		1 per Joint
Resin Volume of each Joint is 32 Litres						

2.4.2 Cable Preparation

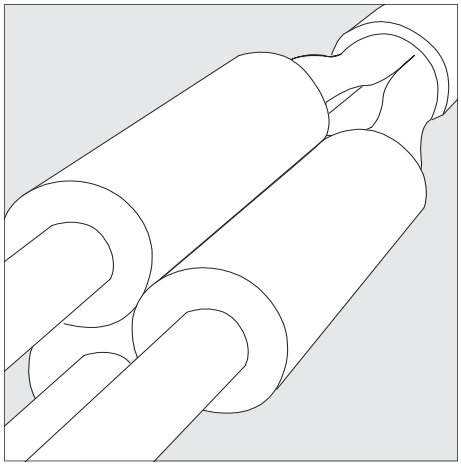
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables
- 3.4 Three-Core HSL Paper Insulated Cables

2.4.3 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.3 Resin Filled Three-Core Transition Joints
- 4.1.5 HSL Breakout Module
- 4.1.6 HSL Cable Core Preparation
- 4.1.7 Paper Insulation 'Shim' Kit for 95mm^2 Cables
- 4.1.8 Paper Insulation 'Shim' Kit for 120 and 150mm^2 Cables
- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.3 Resin Filled Three-Core Transition Joints
- 4.3 Installing Connector Stress Control and Heatshrink Insulation
- 4.3.3 Resin Filled Three-Core Transition Joints
- 4.3.5 HSL Transition Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.4 Resin Filled Three-Core Transition Joints
- 4.4.6 HSL Transition Joints



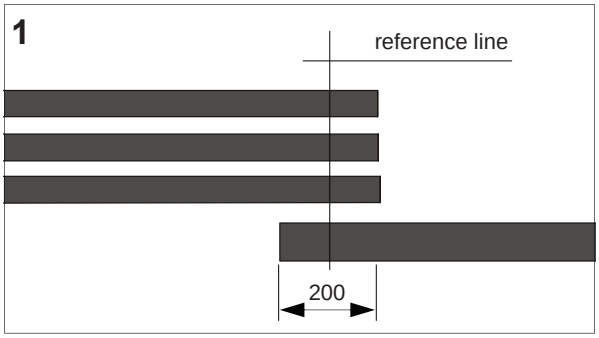
Installation Instruction

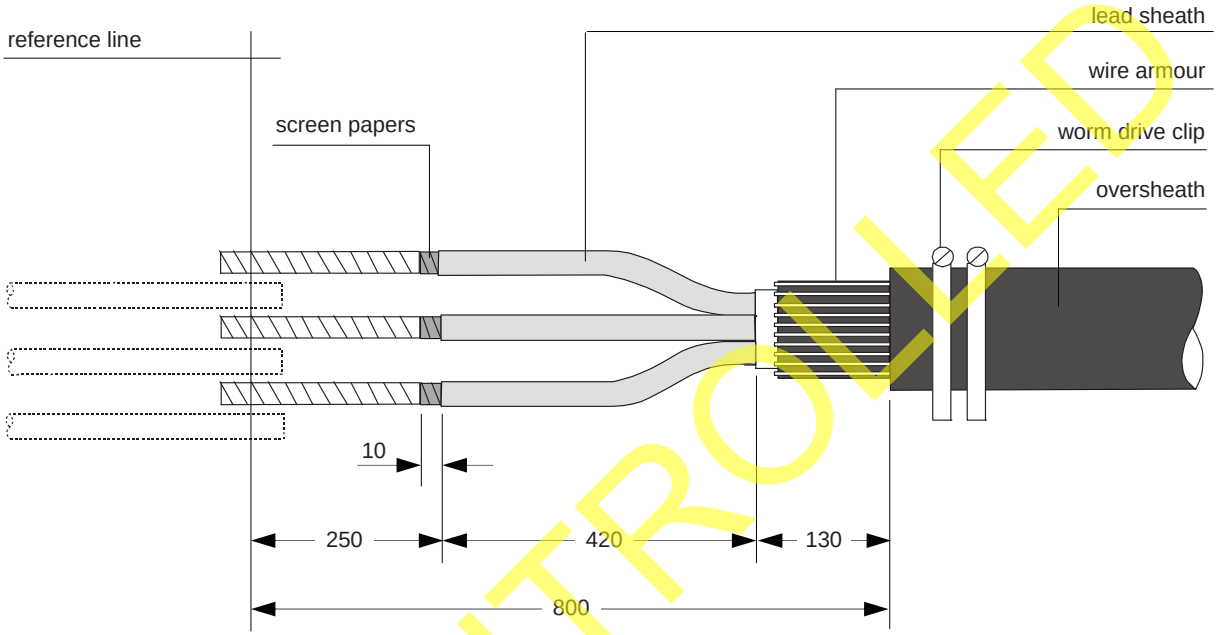
33kV Three Core Resin Filled Transition Straight Joint for Three Core H PILC to Single Core XLPE Cables

For PILC HSL Sizes 300 - 400mm^2 and XLPE Cable Sizes 185 - 500mm^2
Use Base kit: SMOE 63751
UK Power Networks Stores Code = 02649C
Plus
HSL Cable Module: SMOE 62909
UK Power Networks Stores Code = 02653C

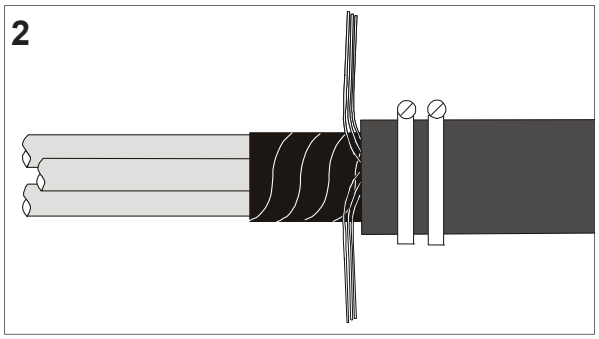
When used with 185 - 240mm2 PILC HSL Cable also use
PILC Cable build up kit: SMOE 62191
UK Power Networks Stores Code = 02651H

Preparation of Cables
Overlapping the cable to be jointed by about 200mm.
Mark the reference line (middle of the overlap).

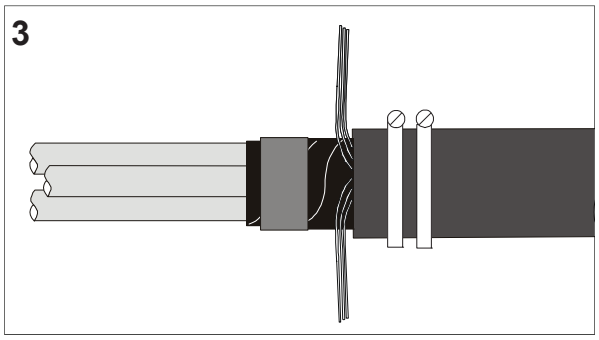




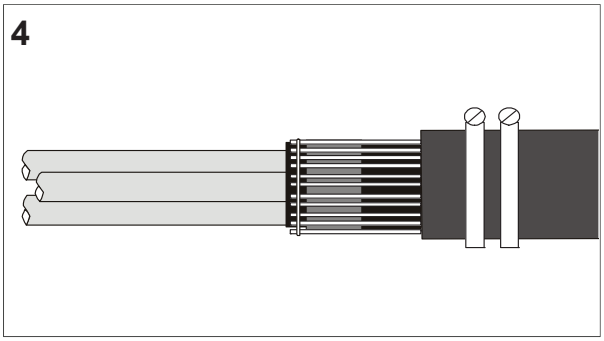
Paper Cable preparation
Remove the oversheath, armour and bedding according to the dimensions given in the drawing.
Abrade, clean and degrease the lead sheaths and the lifted armours.



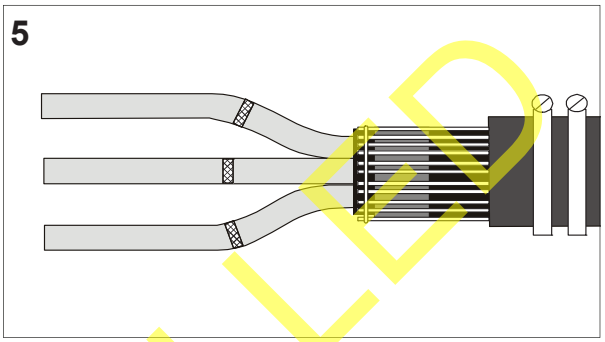
Build up the inner bedding to match the inside diameter of the support ring.
Position the ring 60mm from the uplifted armours.



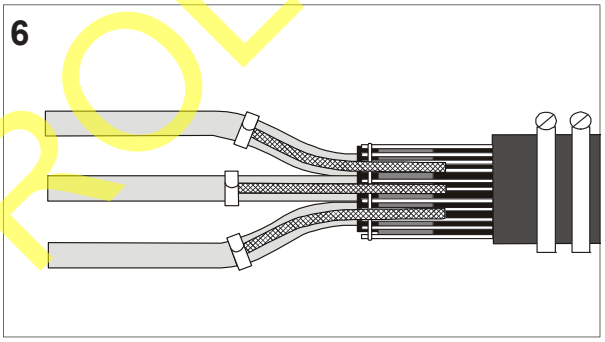
Wrap a length of the black mastic behind the support ring butts up against the armours.
Lay the armours down onto the ring and secure with a wire binder.



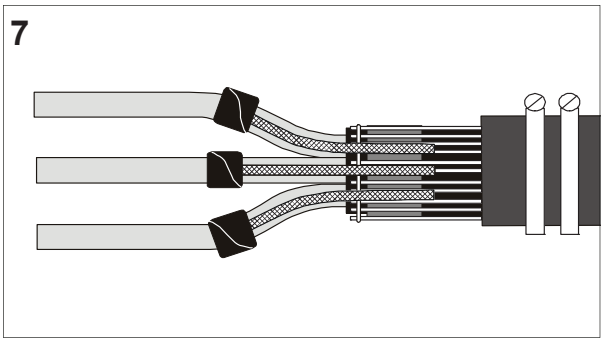
Make a mark on each lead sheath 100mm from the armours. Fold each short length of tinned copper mesh in half and wrap it around each of the lead sheaths centred on the 100mm marks.



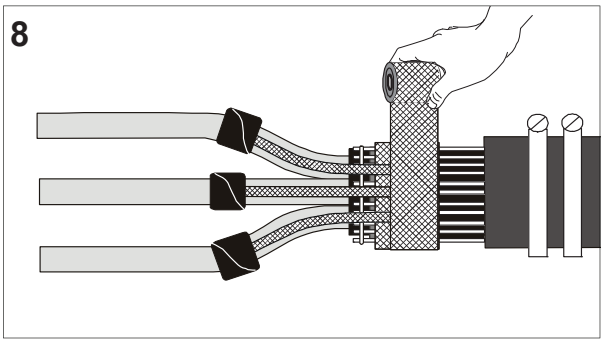
Fix a short length of tinned copper earth braid to each of the lead sheaths, using a roll spring, over the previously installed tinned copper mesh.



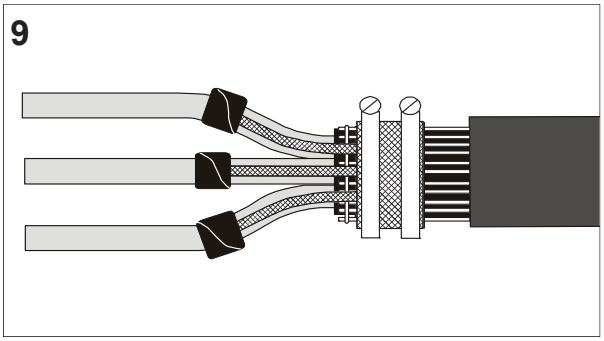
Cover each roll spring with two layers of PVC tape.



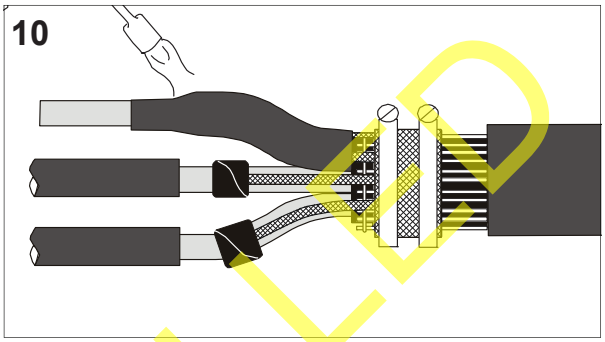
Secure the earth braids onto the support ring using a roll of tinned copper mesh sandwiching the braids between the layers of the mesh.



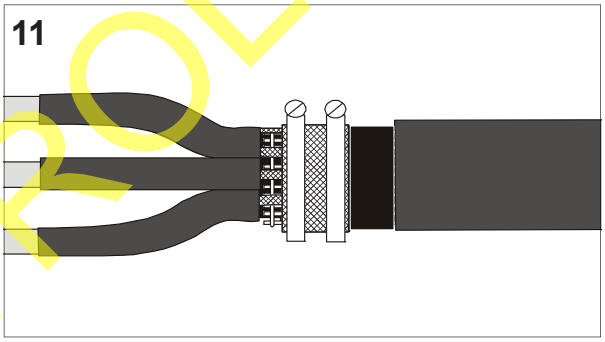
Secure the tinned copper mesh to the support ring using two worm drive clips on either side of the ridge.



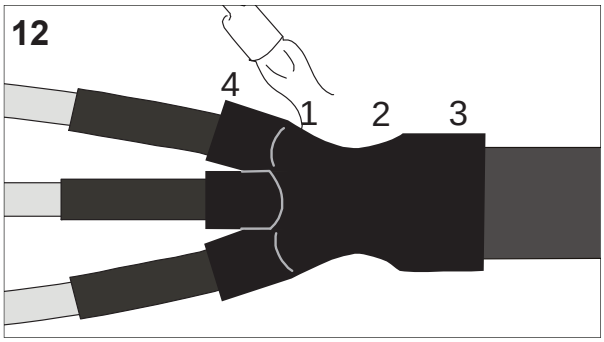
Position a sealing sleeve over each of the earth lead connections, up to the support ring and shrink in place.



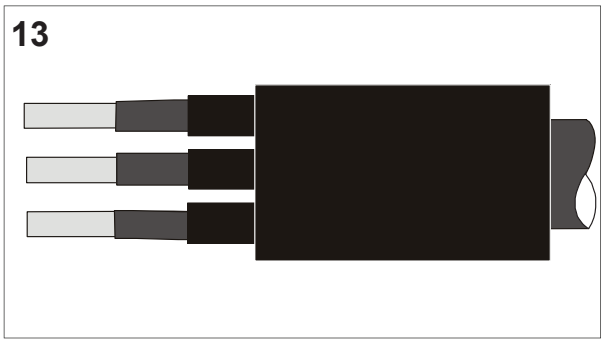
Wrap a second strip of black mastic over the armour wires directly behind the support ring connection and over the first layer of black mastic underneath the armour wires.



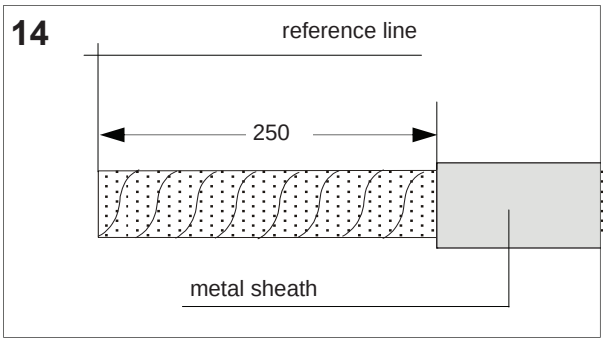
Slide the breakout over the sealing sleeves into the crutch and shrink into place, starting around the mould line (1), before working along the body (2 and 3) and finally along the turrets (4).



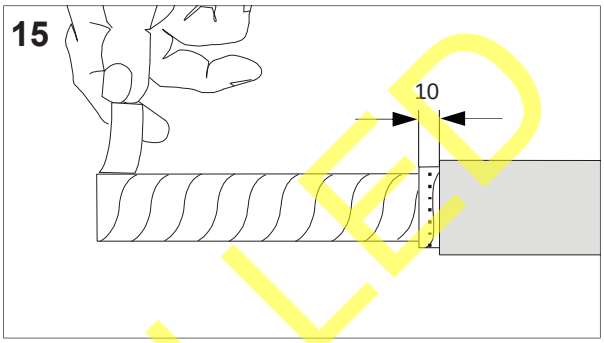
Position the large sealing sleeve centrally over the armour bond and oversheath cutback position.



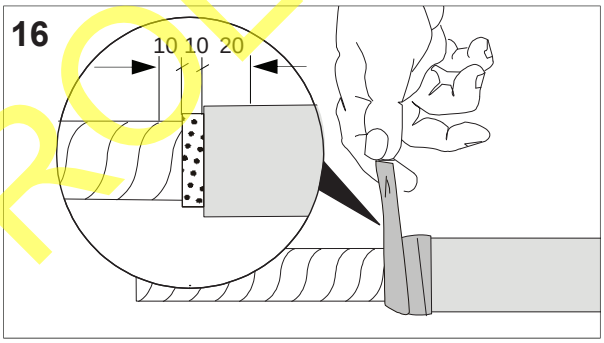
Paper Cable Core Preparation
Cut the cores at the reference line making allowance for half the depth of the water block in the mechanical connector.
Remove the lead sheaths to the dimension in the Figure 14.



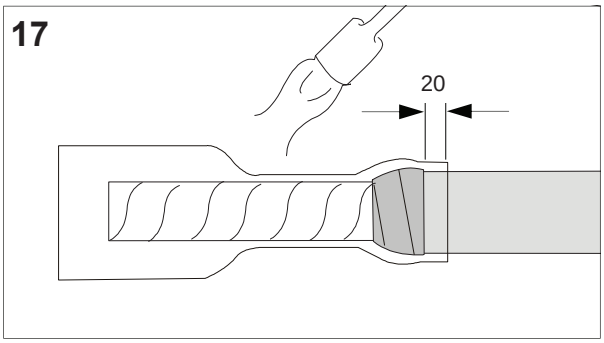
Remove the screen papers and two layers of the insulation papers to within 10mm of the end of the lead sheaths.



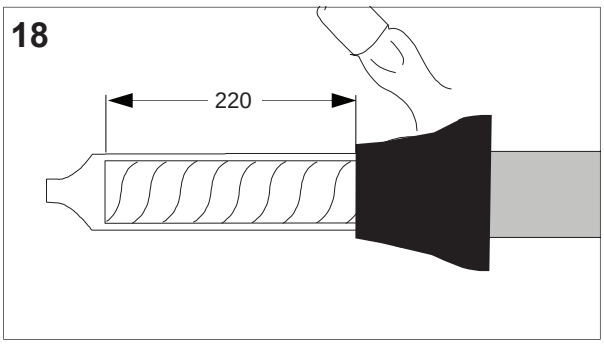
Remove the release paper from one side of the medium length of yellow void filling strip with the pointed ends.
Wrap it around the lead sheath cut. The mastic should cover 20mm of lead sheath, the exposed 10mm of screen paper and overlap the paper insulation by another 10mm.
Stretch the yellow void filling mastic to half of its original width and apply under tension to achieve a fine thin edge and a smooth profile.
Repeat this process for all three cores.



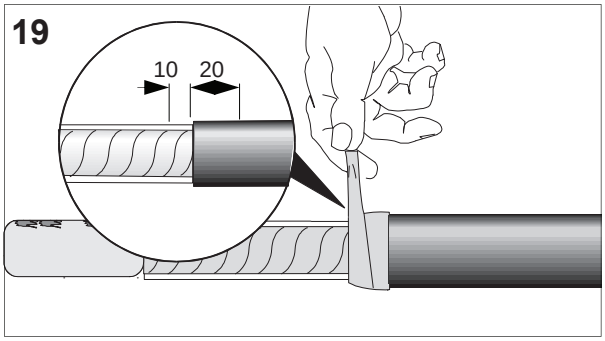
Position the length of transparent oil barrier tubing over the core so it covers the yellow void filling mastic and overlaps the lead sheath by a further 20mm.
Shrink the tube in place, working from the lead sheath towards the end of the core.
Repeat this process for all three cores.



Position the short black conductive sleeve over the core to the dimensions in Figure 18.
Shrink the tube in place starting from the core end before working towards the lead sheath.
Repeat this process for all three cores.



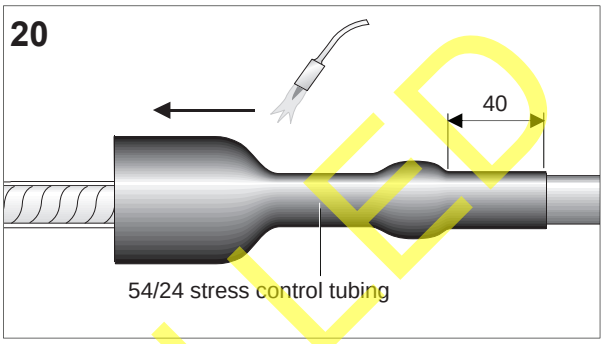
For HSL cable sizes between 185mm^2 and 240mm^2 use the following components from the PILC cable build up kit and the methods in steps 19 - 21.
Otherwise move on to step 22.
Remove the release papers from the yellow void filling mastic tape with the pointed ends.
Wrap the tape around the end of the black conductive tube starting 20mm from the end before continuing onto the clear barrier tube for 10mm.
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.



Position a short length of the black 54/24 stress control tubing over each core, so it overlaps the conductive tube and yellow void filling mastic and the lead sheath by 40mm.

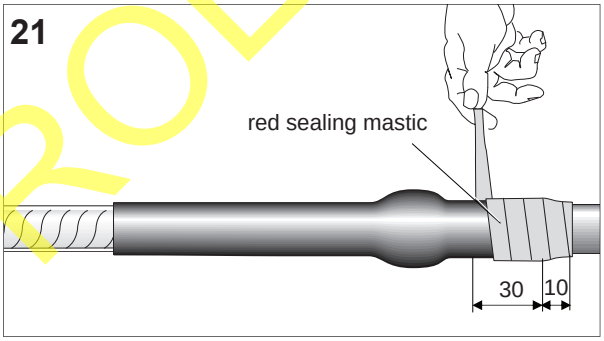
Shrink the tube down starting from the crutch side of the cable.

Repeat this process for all three cores.

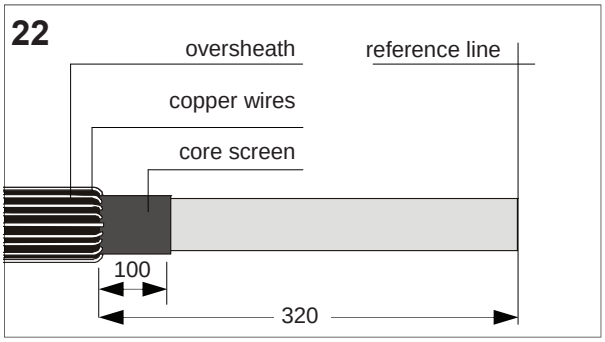


Apply one strip of the red sealant mastic tape around the end of the stress control tube, closest to the cable crutch, overlap the stres control tube by 30mm and the lead sheath by 10mm.

Repeat this process for all three cores.

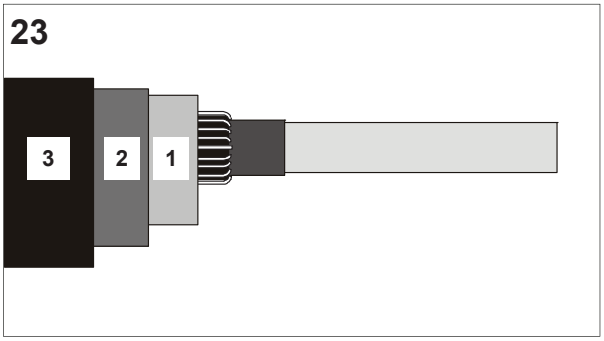


Clean the oversheaths of the plastic cables for a length of 1m. Remove the oversheaths for a distance of 320mm from the reference line.
Bend the copper wire screens back over the oversheaths.
Cut the cores to length at the reference line allowing for half the depth of the block in the mechanical connector.
Thoroughly remove the black core screen to leave 100mm from the oversheath cut. The insulation surface shall be left clean, smooth and polished, so it is free of all traces of conductive material.
Clean and degrease the insulation. Fir the trifurcating piece of the plastic joint shell and park it out of the way.

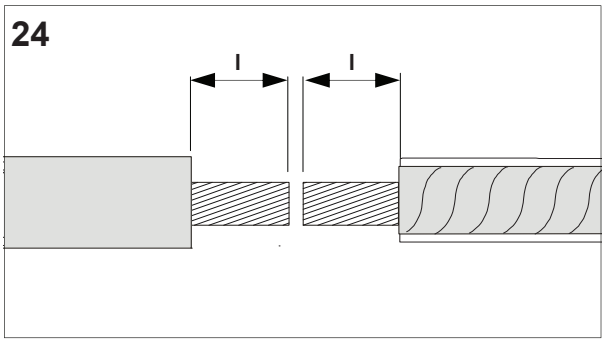


Remove the combining tubing sets from their protective plastic bags and slide the bags over the copper wires to protect the tubing sets. The tube sets should be installed in the following order:

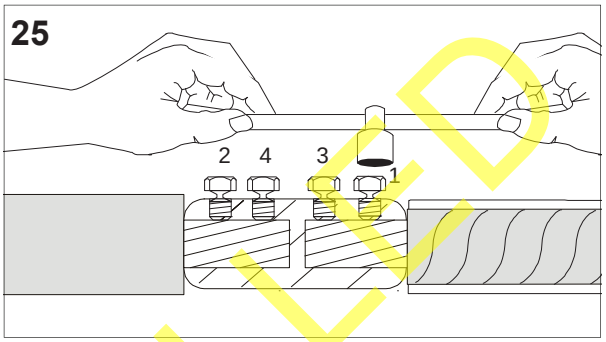
(1) Black stress control tubing.
(2) Red insulation tubing.
(3) Black and red screened insulating tubing.



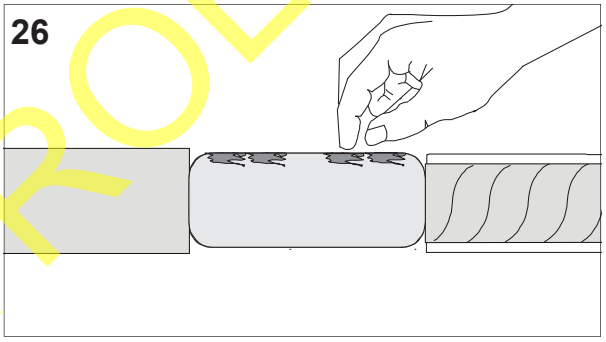
Measure the bore of the connector (I) and then remove the insulation from all of the cores to this measurement.



Fit the conductors into the connector, leaving no gap between the connector and the insulation, at both ends.
Take up the tension equally on all bolts but do not shear the bolt heads off at this stage.
Continue to tighten each bolt in turn until the head shears off in the sequence shown in Figure 25.
If after all the bolts have been sheared off, any part of the bolt remains above the surface of the connector body, remove the excess metal using a suitable tool.
Realign the cables if necessary.
Note: For small cross section cables it may be necessary to use a connector holding tool to stop the cores bending.

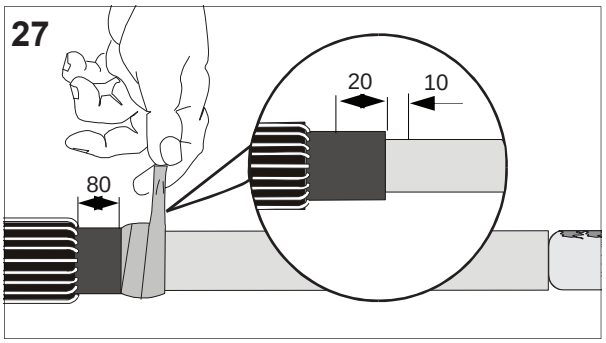


Clean and degrease the cable cores and the connector.
Fill each bolt hole in the connector with the grey clay provided until a smooth level profile is achieved.



Plastic Cable Side
Remove the release papers from the yellow void filling mastic tape with the pointed ends. Wrap the tape around the core screen cut starting from 20mm on the black insulation screen before continuing onto the insulation for 10mm.

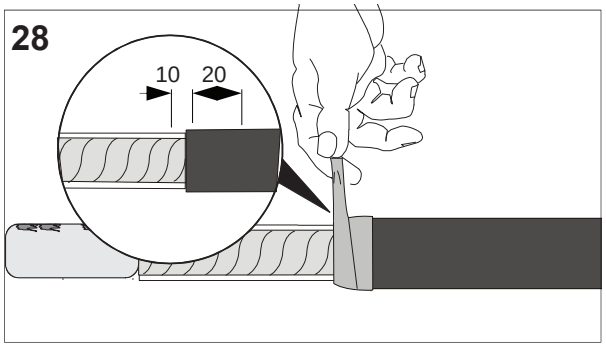
The tape should be stretched to half its original width and applied under tension, as a half lap layer to achieve a smooth fine edge.



Paper Cable Side
Remove the release papers from the yellow void filling mastic tape with the pointed ends.

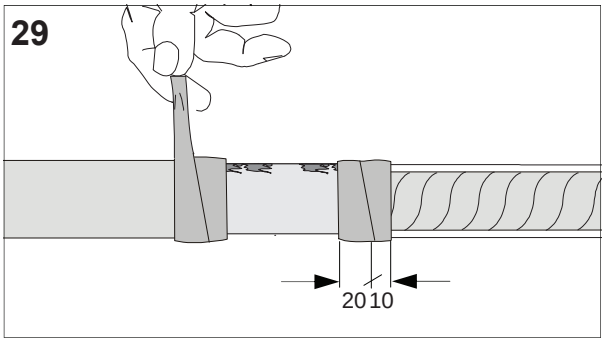
Wrap the tape around the end of the black conductive tube starting 20mm from the end, before continuing onto the clear barrier tube for 10mm.

The tape should be stretched to half its original width and applied under tension, as a half lap layer to achieve a smooth fine edge.

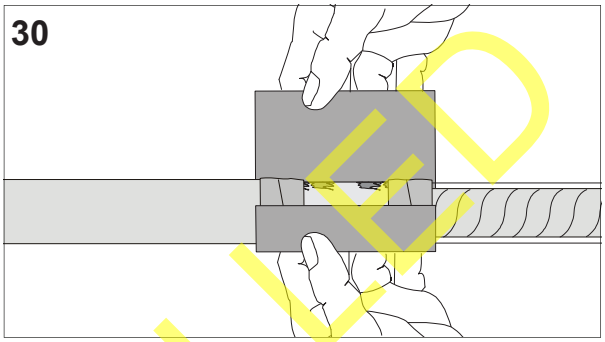


Wrap a piece of yellow void filling mastic tape around the ends of each connector to form a smooth profile.
Start from 10mm onto the insulation before continuing onto the connector body for 20mm.

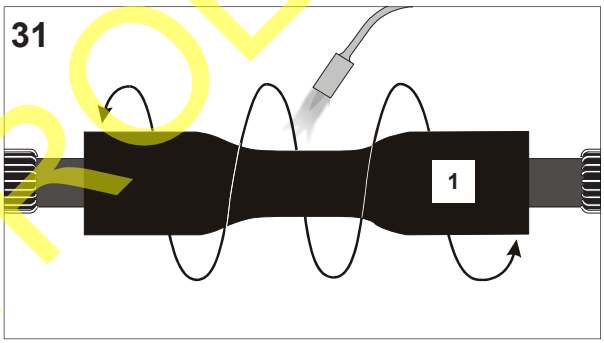
The tape should be stretched to half its original width before application and applied under tension, as a half lap layer.



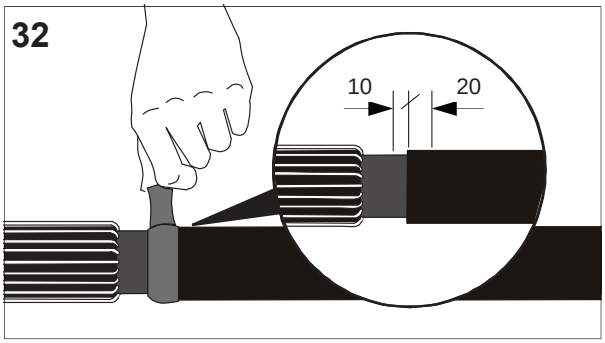
Remove the release paper from one side of a yellow void filling mastic patch and position it centrally over the connector with the other release paper on the outside.
Check that as the patch is applied no air voids are created in the material.
When all three patches are applied remove the remaining release papers.



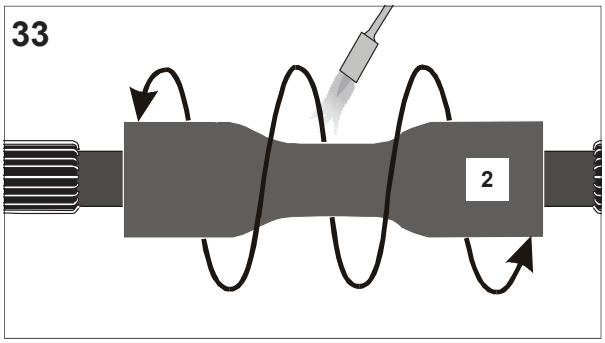
Pull the black stress control tubing from the inside of the Tubing set and position it centrally over the connector.
Check that the overlap is equal over each taped screen cut.
Shrink the tubing in place starting from the centre before working towards each end in turn.
On completion each tube should be fully shrunk and wrinkle free.



Remove one release paper from the red mastic sealant tape and roll it up.
Wrap the tape around the end of each of the black stress control tubing for 20mm and overlap onto the core for 10mm.



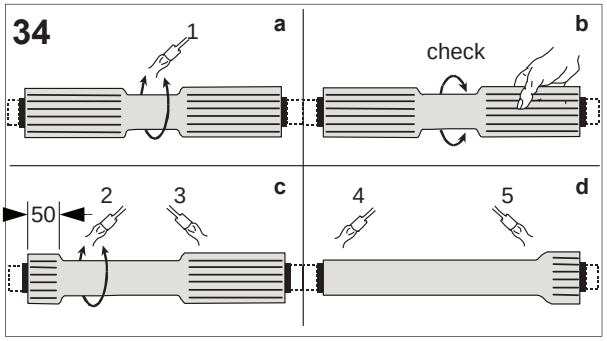
Pull the red insulating tubes from the tubing sets and position them centrally over the connectors.
Start shrinking at the centre before working towards each end it turn.
On completion each tube should be fully shrunk and wrinkle free.



Position the black and red screened insulating tubes (3) centrally over the red insulating tubes whilst they are still hot. Start shrinking in the centre. Check if fully shrunk by twisting the ends. The tubes should not move from their position. Continue shrinking towards one end and stop about 50mm from the end. Shrink the other half of the tube in the same way. Then shrink down the first end and finally the second end.

Note: The sequence of numbers in the drawing indicates the shrink sequence.

On completion each tube should be fully shrunk and wrinkle free with no visible ridges.



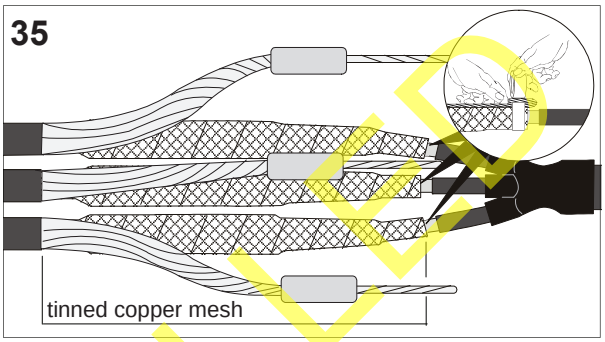
Wrap one layer of the tinned copper mesh with a 50% overlap over each core of the joint. Starting on the lead sheath of the paper cable, 50mm from the sealing sleeve and continue up to the oversheath cut on the plastic cable.

Form the copper wire screens from each of the plastic cables in to a conductor and connect to an earth braid, using a brass tunnel connector. Attach each braid to each lead sheath using a roll spring.

Apply one half lap layer of red sealant mastic to the exposed 50mm of lead sheath on each core.

This is an important moisture seal. Do not leave it out.

Cover the roll springs with two layers of PVC tape.

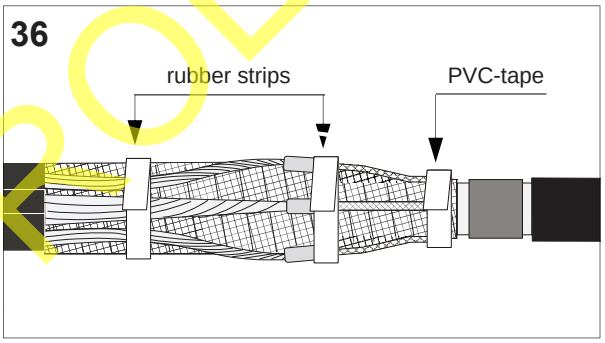


Degrease and abrade the plastic cable sheath for a distance of 100mm.

Trim the ends of the plastic joint shells to accommodate the paper cable oversheath diameter.

Place the bottom half of the joint shell under the joint and mark the positions of the stand off mouldings.

Wrap the rubber patch around the joint centrally over the markings and secure in place. The patch should be wrapped with the adhesive side outwards.

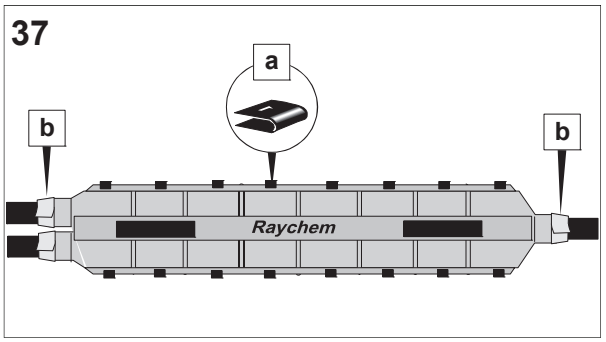


Support the bottom half of the joint shell under the joint and fit the trifurcating end piece.

Fit the top half of the shell to the bottom using the clips Provided (a).

Fill any gaps around the cable entry holes as required (b).

Fill the joint with resin and allow it to cure before applying any mechanical strain.



2.5 Single-Core Polymeric Pot End Joints

2.5.1 Single-Core Polymeric Pot End Joints (185 to 630mm²)

These are all heatshrink joints containing all the required components.

Cable Sizes in mm²	Joint Kit Description and Part Numbers	
Tyco Part Number	EPKE 36C 1XU GB01	TBC
UK Power Networks Stores Code	02645N	02646X
185	3 per Joint	
240	3 per Joint	
300	3 per Joint	
400	3 per Joint	
500		3 per Joint
630		3 per Joint

2.5.2 Cable Preparation

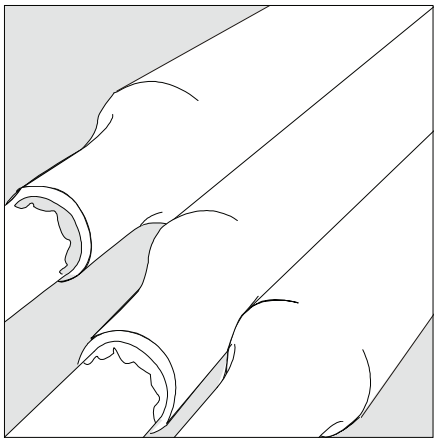
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.5.3 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.2 Single-Core Polymeric Pot End Joints
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.3 Single-Core Polymeric Pot End Joints

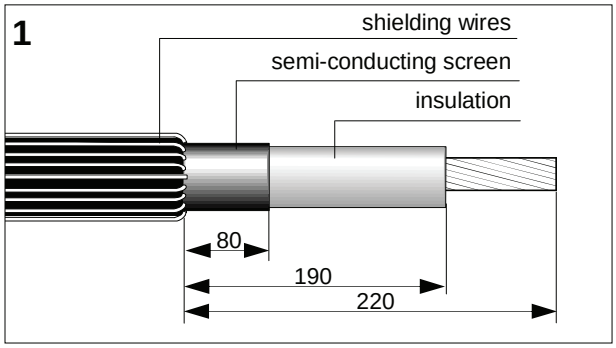


Installation Instruction

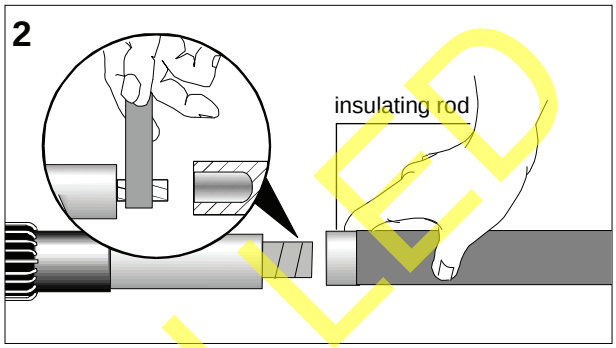
33kV Single Core Pot End Joints

For Cable Sizes 185 to 400mm^2
EPKE 36C 1XU GB01
UK Power Networks Stores Code 02645N

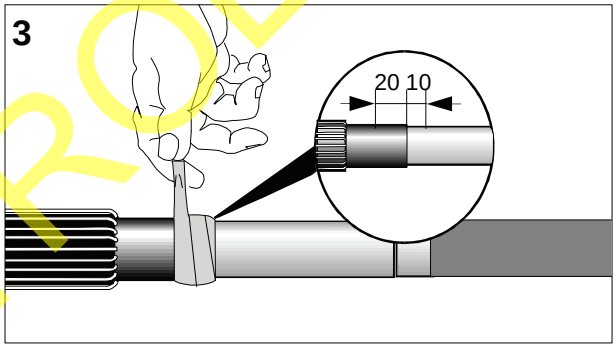
Remove the oversheath to the dimensions shown in the drawing**.**
Clean and degrease the remaining oversheath for 150 mm.
Bend the copper wire screens back onto the oversheath.
Remove the semi-conducting insulation screen and the insulation to the dimensions in the drawing. .
Note: The insulation should be clean, damage free and polished at the end of this process.



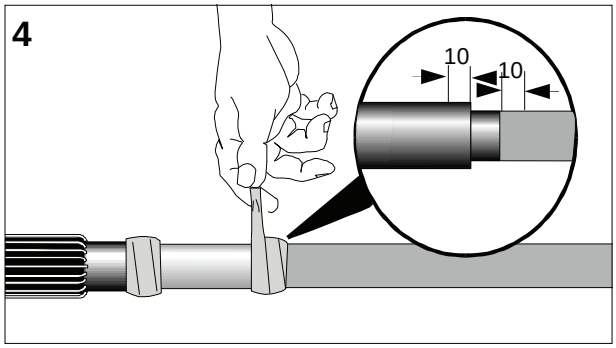
Wrap the black conductive tape around the conductor stretching it to about 50% of its original width.
The tape should be applied until wrapped conductor fits tightly into the insulating rod..
Push the insulating rod onto the conductor until it butts up to the cable insulation.



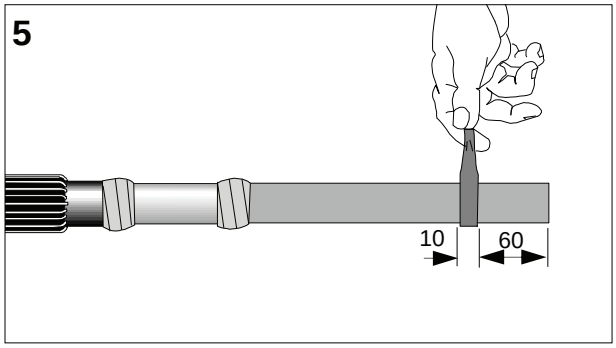
Remove one of short lengths of yellow void filling mastic with the pointed ends from the small aluminium bag..
Remove the release papers from one side and wrap it around the insulation screen cut starting 20 mm in from the end of the screen before continuing onto the insulation for 10 mm.
During this process stretch the strip to about half of its original width to achieve a fine, thin edge on the insulation.



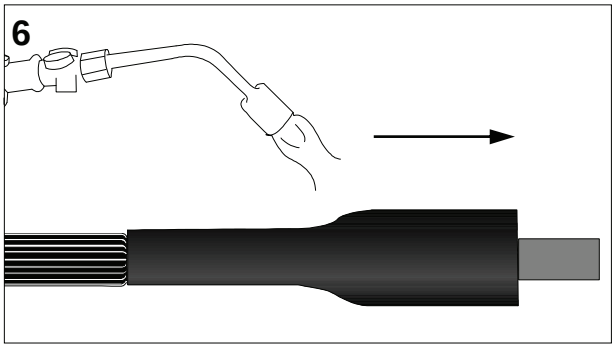
Remove one of the long lengths of yellow void filling mastic from the aluminium bag.
Remove the release paper from one side and wrap it around the joint between insulation and the insulating rod.
Start 10 mm from the cutback of the insulation, before continuing on the insulating rod so it covers all of the painted area and at least 10 mm on to the rod insulation.
Only use as much of the strip as is required to fill the step as shown in the drawing.
During this process stretch the strip to about half of its original width to achieve a fine, thin edge on the insulation.



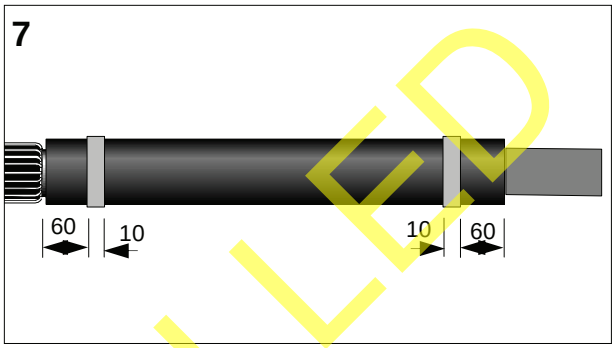
Wrap one layer of red mastic moisture sealing tape around the end of the insulating rod to the dimensions shown in the drawing.



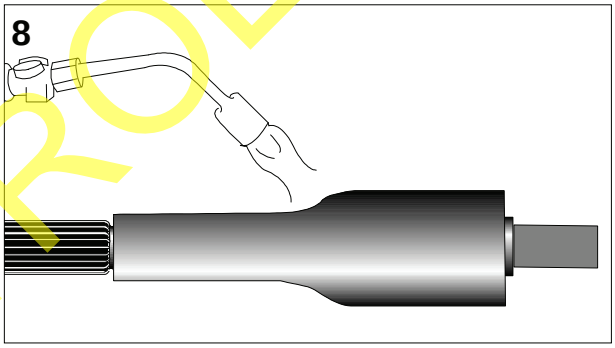
Position the black stress control tubing over the joint so that it butts up against the oversheath cut.
Start shrinking the tube at the oversheath before working towards the other end.



Wrap one layer of red mastic tape with slight tension around the ends of the stress control tubing to the dimensions shown in the drawing.

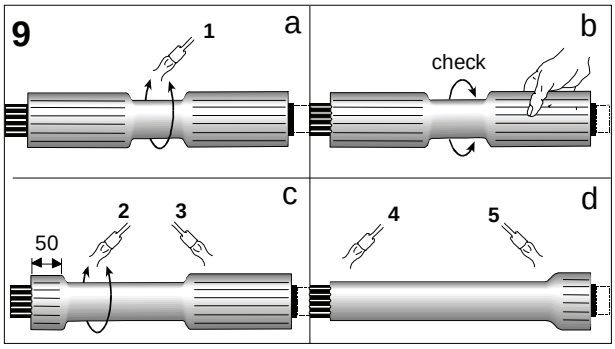


Position the red insulating tubing over the joint so that the end is level with the end of the stress control tubing on the oversheath cut end. Start shrinking at the oversheath end before working towards the other end.

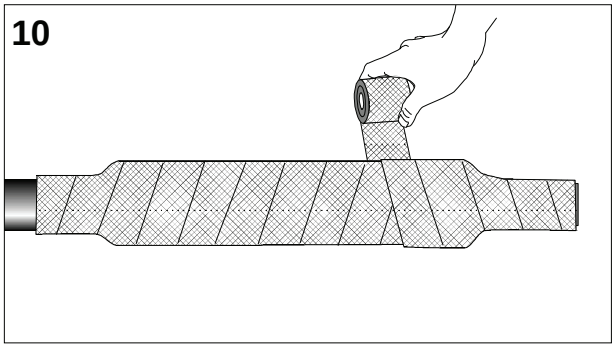


Position the red and black screened insulating sleeve so that the end on the cable side coincides with the end of the red insulating tubing.

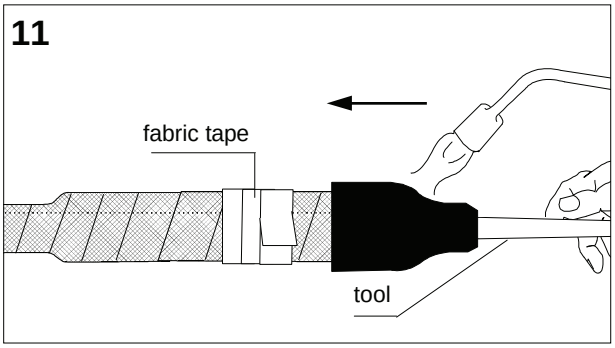
a. Start shrinking the sleeve in the centre (1).
b. Check if fully shrunk by twisting the end. The **sleeve should not move** when from its position.
c. Continue shrinking by working towards one side (2), stopping 50 mm from the end.
Shrink the other half in the same way (3).
d. Shrink down the first end (4) and finally the second (5).
The sleeve should be fully shrunk without leaving any ridges.



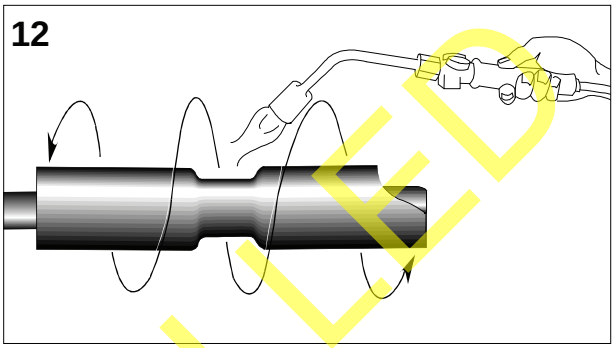
Bend the copper wire screens back onto the screened insulating sleeve. Wrap the tinned copper mesh over the length of the joint with a 50% overlap.. Start from the Cable oversheath end and continue until the whole joint is covered.
Note: The stress control tubing and the rod end must be earthed with this tinned copper mesh.



Cover the ends of the copper wire screen below the tinned copper mesh with fabric tape.
Place the heatshrink end cap over the insulating rod end of the joint.
Shrink the cap into place, starting at the closed end before working towards the cable.
During shrinking process apply force to the end of the cap to ensure that it doesn't move..



Clean and degrease the cable oversheath for a length of about 150 mm past the oversheath cut
Position the outer heatshrink sleeve over the joint so that it lines up with the end of the end cap.
Start shrinking in the centre before working towards each end.



Pot end completed.
Allow to cool before applying any mechanical strain.

2.6 Indoor and Outdoor Terminations

2.6.1 Indoor and Outdoor Single-Core Polymeric Cable Terminations (185 to 800mm²)

These are outdoor heatshrink termination kits supplied in sets of three without phase conductor or copper wire screen lugs (these are supplied in a separate kit). For indoor terminations use the same kits but reduce the number of sheds from four to two.

Cable Sizes in mm²	Joint Kit Description and Part Numbers					
Tyco Part Number	EPKT 36D 1XO-GB03	EPKT 36E 1XO-GB02	EPKT 36F 1XO-GB01	33kV Lug Kit 185-400	33kV Lug Kit 500-630	33kV Lug Kit 800
UK Power Networks Stores Code	02660G	02661R	02662B	02675P	02676Y	02677J
185	1 per Set			1 per Set		
300		1 per Set		1 per Set		
400		1 per Set		1 per Set		
500		1 per Set			1 per Set	
630			1 per Set		1 per Set	
800			1 per Set			1 per Set

For a complete outdoor termination assembly use the above kits with the following materials

Description	Tyco Part No.	UK Power Networks Stores Code	No. Required
Outdoor Support Bracket	EPPA-031	02680Y	1
33kV Surge Arrester	OCP2-30M-NFF	09435U	1 set of 3

2.6.2 Cable Preparation

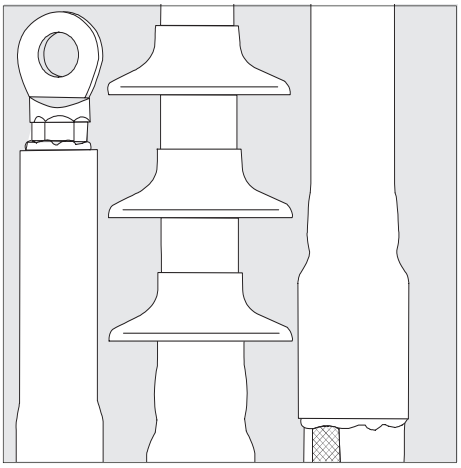
Refer to the following sections of this manual for details of the preparation of each type of cable:

- 3.1 Single-Core Copper Wire Screened Cables

2.6.3 Installation of Heatshrink Materials and Components

Refer to the following sections of this manual for the installation of heatshrink materials and other components:

- 4.1 Installing Stress Control and Insulation Materials
- 4.1.9 Single-Core Polymeric Terminations (Indoor and Outdoor)
- 4.2 Installing Mechanical Connectors and Lugs
- 4.2.6 Mechanical Lugs for Indoor and Outdoor Terminations
- 4.4 Installing Mechanical Earth Bonds and Associated Components
- 4.4.7 Connection of Copper Wire Screens on Indoor and Outdoor Terminations



Installation Instruction

33kV Indoor and Outdooor Terminations

For cable sizes up to 185mm^2
EPKT36D 1XO GB03
UK Power Networks Stores Code 02660G

300 - 500mm^2
EPKT36E 1XO GB02
UK Power Networks Stores Code 02661R

630 - 800mm^2
EPKT36F 1XO GB01
UK Power Networks Stores Code 02662B

Cable Preparation

Stripping Dimensions

Cut the cable to the required length allowing for a sufficient length of copper wire screens to connect to HV Earth on the pole.
Remove the oversheath to the dimension L + K in Table 1.
Clean and degrease the oversheath for the length of the strip plus 100mm.

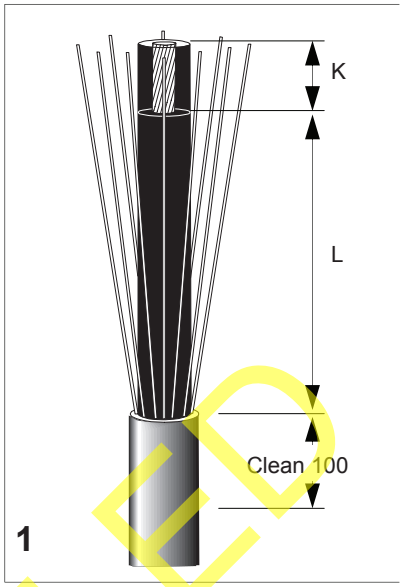


Table 1

Indoor Terminations

L (mm)	**370**
K (mm)	**Depth of the mechanical lug barrel**

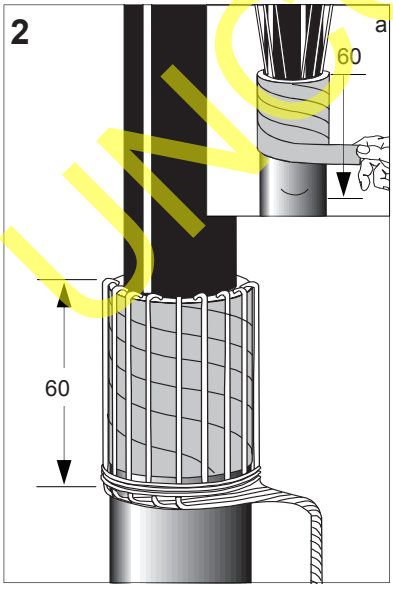
Outdoor Terminations

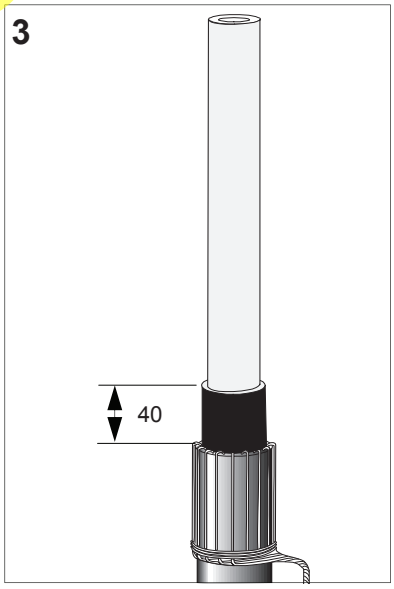
L (mm)	**500**
K (mm)	**Depth of the mechanical lug barrel**

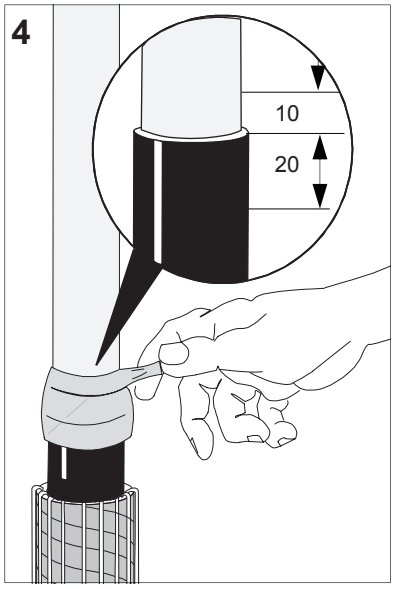
Wrap one layer of red sealant tape with a small overlap and slight tension around the end of the oversheath for a distance of 60mm.
Bend the copper wires back onto the oversheath without crossing the individual wires. Fix the wires in place with a wire binder 60mm from the end of the oversheath. Gather the copper wires together to form an earth conductor.

Thoroughly remove the insulation screen to within 40mm of the oversheath cut. The surface of the insulation should be free from all traces of conductive material and shall be smooth and polished with no detectable irregularities.

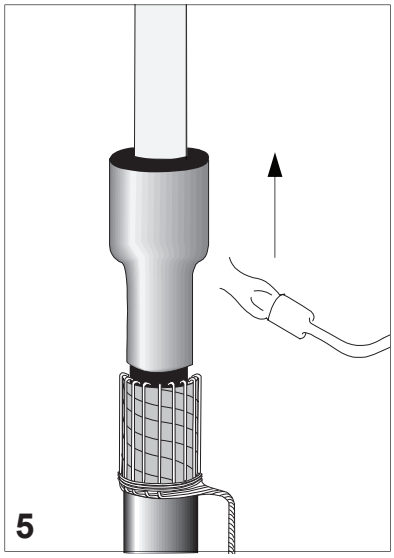
Remove one of the release papers from the yellow void filling mastic and wrap it around the end of the insulation screen cut. Stretch the strip to half of its original width and apply under tension.
Ensure that 20mm of the insulation screen and 10mm of the insulation are covered.



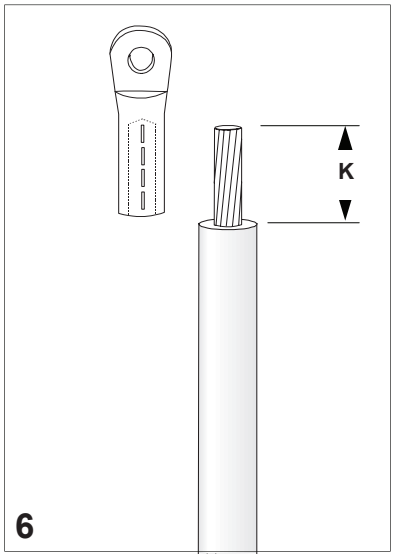




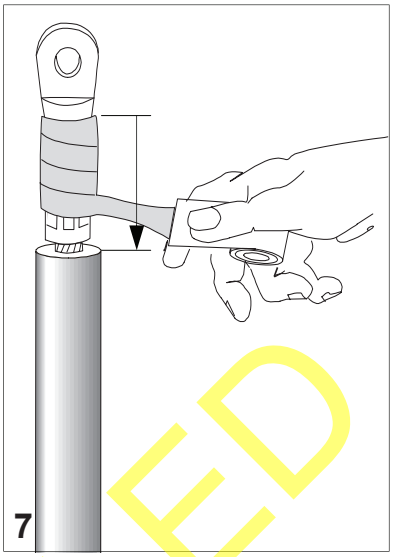
Completion of the Termination



Place the black stress control tubing over the core and position it so that it is level with the oversheath cut. Shrink the tubing down starting at the bottom, before working towards the end of the core.



Remove the insulation according to dimension **K = the depth of the mechanical cable lug barrel hole.**
Install the cable lug.
Clean and degrease the insulation and the lug.



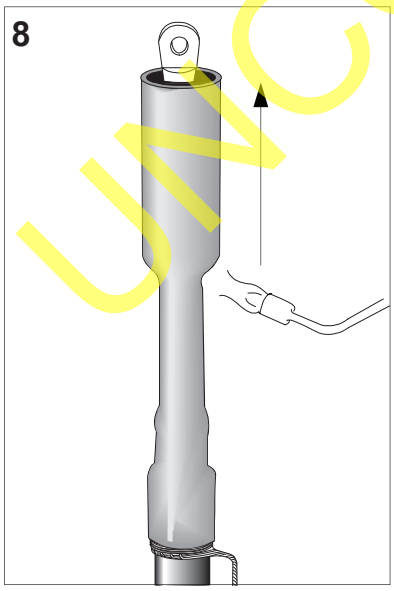
Wrap the red sealant tape around the barrel of the cable lug.
Stretch the tape to half of its width and applying with half lap layer overlap.
Note: Use the remaining red sealant to fill any remaining gap between the core insulation and the cable lug.

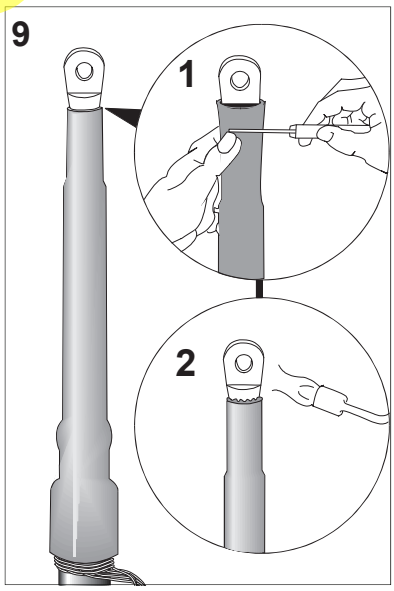
Remove the release paper from the red anti-track tubing.
Place the tubing with the sealant coated end over the termination level with the wire binder.
Shrink the tubing down starting at the oversheath end, before working towards the cable lug.

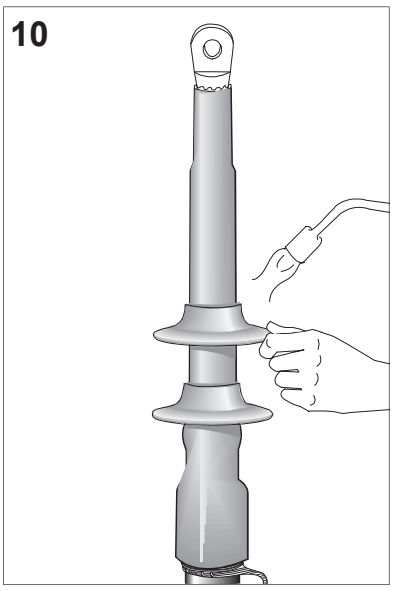
Cut the tubing back onto the cable lug barrel if necessary.
Note: Post heat the palm of the cable lug until a bead of sealant appears around the top of the tubing.

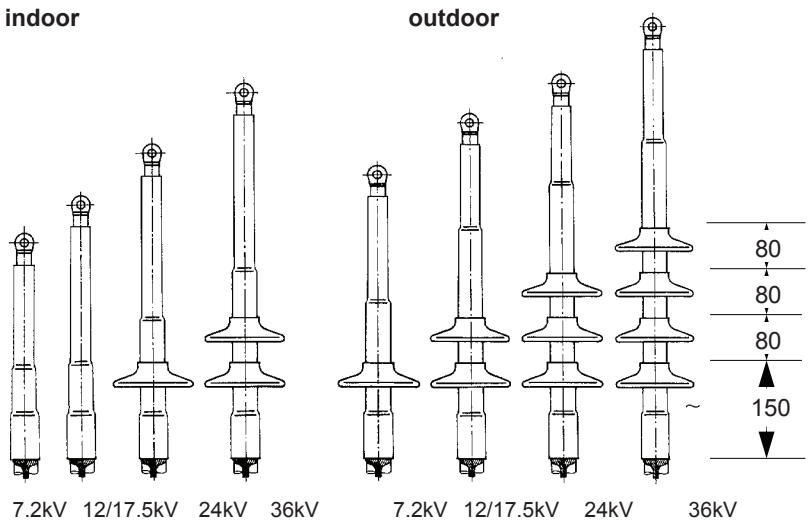
For indoor and outdoor terminations shrink the sheds into place at the positions shown in the drawing on the next page.

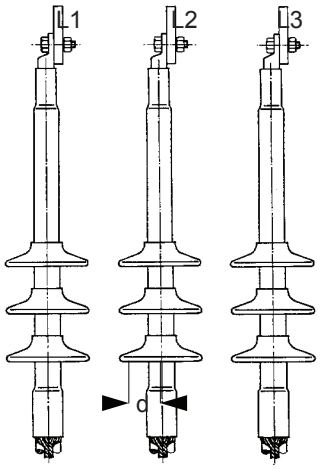
Indoor = 2 sheds
Outdoor = 4 sheds

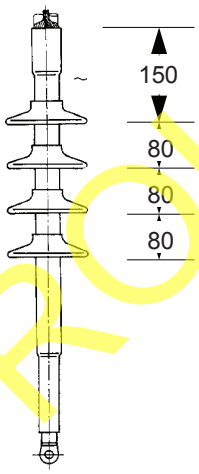




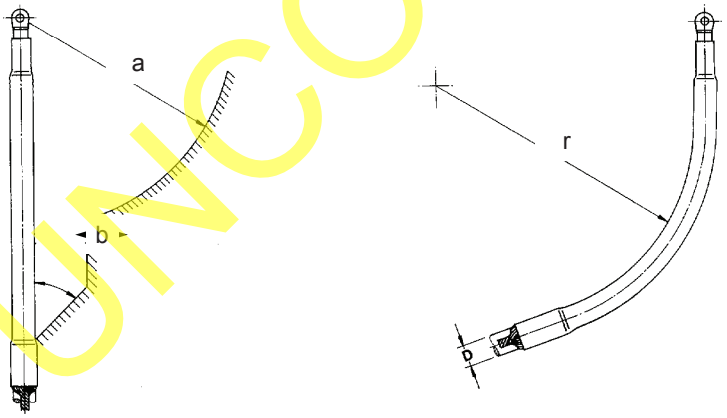








skirt position
for reversed
installation



Minimum clearances			Max. system voltage (kV)
			36
a	air clearance		as per local specifications
b	Phase to ground	[mm]	35
d	between skirts	[mm]	25
r	min. bending radius = 15xD, before bending heat cable up to approx. 70□C		