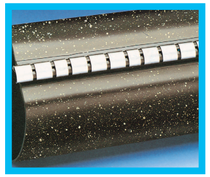
RWSM - Wrap-Around/Zipper Tube



RWSM Zipper Tube is a Cross-Linked Polyolefin Heatshrink 'Tube' which is folded around the cable, zipped up with a stainless steel channel and then shrunk.

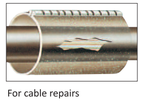
- Cable repair without cutting the cable
- Ideal for in situ field installation
- Jointing in tight areas
- Re-entering a joint with minimal disruption, unlike epoxy joint
- 100% waterproof and low water absorption
- Quick start up time, after completing joint
- Repair of unpressurised pipes
- Non meltable
- Resistant to decay, chemicals, corrosion

Installation recommendations are virtually the same as for SMDW. When applying heat, check that carbonisation or crazing does not occur and do not apply heat directly onto the stainless steel channel. When shrinkage has been completed, the stippled effect on the tube surface will not be noticeable since thermochroic paint has changed colour.

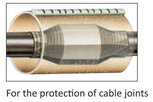
Catalogue No.	Pre Shrink (mm)	D After Shrink (mm)	W After Shrink (mm)	L Std Lengths (m)
RWSM36/10TK	38	9	2.4	1
RWSM55/13TK	57	13	2.5	1
RWSM85/20TK	85	20	3.0	1
RWSM108/27TK	110	27	3.0	1
RWSM136/30TK	138	30	3.2	1

Techincal Data

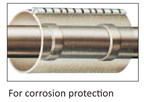
Conformant Standards	IEC; VDE; DIN
Material	Cross-linked polyolefin with hot melt adhesive lining & stainless steel channel
Continuous Operating Temp	-40°C to +65°C
Tensile Strength	17 MPa (excluding channel)
Elongation at Break Point	350% (excluding channel)
Longitudinal Shrinkage	10%
Breakdown Voltage	12 kV/mm wall thickness
Volume Resistivity	1.0 x 10^{12} ohm cm/min
Water Absorption	0.5% max
Flammability	Do not use in flame prone areas
UV Resistance	Passed - ISO 1408



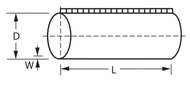
For cable repairs



For the protection of cable joints



For corrosion protection

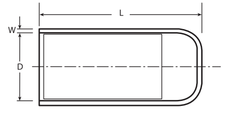


CEC - Heatshrink End Caps

CABRICAL's End Caps are used for sealing cable ends during installation or storage. They are made from cross-linked polyolefin and have a hot melt glue liner that bonds the cap to the cable jacket.

- Quick reliable seal of cable ends
- Watertight and unlimited storage life
- Highly resistant to ultraviolet rays, aggressive soils, chemicals and corrosion

The CEC cap should be shrunk onto the cable end starting the shrinkage process from the closed end. Once shrink is complete glue should extrude from the edges of the cap.



Catalogue No.	Inner Diameter D Pre Shrink (mm)	After Shrink (mm)	Cable Rangde O.D. (mm)	Recovered Wall Thickness W (mm)	Length L (mm)
CEC25/8	25	8.5	10-20	2.8	68
CEC40/16	40	16.0	18-32	3.3	83
CEC55/26	55	26.0	28-48	3.5	103
CEC75/36	75	36.0	45-68	4.0	120
CEC100/52	100	52.0	55-90	4.0	140
CEC120/60	120	60.0	65-110	40	150
Smaller and Larger Sizes Available on Request					

Techincal Data

Conformant Standards	IEC: ASTM
Material	Cross-linked polyolefin with thermoplastic mastic sealant
Continuous Operating Temp	-55°C to +110°C
Shrinkage Temp (min)	120°C
Tensile Strength	12 MPa
Elongation at Break Point	> 400%
Longitudinal Shrinkage	10%
Dielectric Strength	> 15 kV/mm wall thickness
Volume Resistivity	1.0 x 1014 ohms cm
Flammability	Do not use in flame prone areas
UV Resistance	Good

Heatshrink Tubing Selection

These charts below are useful for selection of heatshrink. The 'lay flat' dimension of heatshrink is commonly used with large diameter heatshrink tubes, where the heatshrink is measured flattened out, and the flat dimension measured. The table below is used to convert this into a diameter as used by CABRICAL.

The bus bar table is useful to work out heatshrink requirements for bus bars. It is important to allow for bends, and use one size up if the bar has many bends. This makes it easier to get the heatshrink onto the bar.

Bus Bars Heatshrink Selection

Bus Bar Recommended Heatshrink for Bus Bar Width (mm)									
Thickness (mm)	12	19	25	38	51	76	102	125	152
3.2	XLP13	XLP20	XLP25	XLP38	XLP51	XLP76	XLP102	XLP102	XLP125
4.8	XLP13	XLP20	XLP25	XLP38	XLP51	XLP76	XLP102	XLP102	XLP125
6.4		XLP20	XLP25	XLP38	XLP51	XLP76	XLP102	XLP102	XLP125
9.5				XLP38	XLP51	XLP76	XLP102	XLP102	XLP125
12.7					XLP51	XLP76	XLP102	XLP102	XLP125

Note: If bar has bends you may have to use a larger diameter heatshrink.

Metric vs. Imperial

Metric (mm)	Imperial (inch)
1.6	1/16
3.2	1/8
4.8	3/16
6.4	1/4
8.0	5/16
9.5	3/8
12.7	1/2

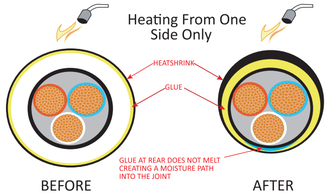
Lay Flat To Circular

Heatshrink Internal Conversion to Lay Flat Dimension	
Internal Diameter (mm)	Lay Flat (mm)
5	8
7	11
10	16
13	20
16	25
20	31
25	39
32	50
38	60
51	80
76	120
102	160
125	196

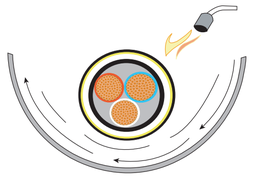
Joint Failure - Most Common Causes

Heatshrink Joint Failure

Unequal Heating - The most common failure of a heatshrink joint is caused by shrinking tube from one side only. The glue in glue lined heatshrink is heat activated, and is designed to melt at a point below the shrinkage point for the tubing. It is possible to shrink a tube on to a cable jacket without applying heat right around the joint.



Heating the Rear of a Joint
The best way to heat the rear of a joint, if you can not get access to it, is to use a heat deflector. This can simply be a curved piece of tin plate. This deflects the heat around the rear of the joint and makes the heatshrink shrink all around the joint.



When shrinking heatshrink in confined spaces, or where you cannot apply heat directly to the rear of the joint, use a heat deflector with your heatgun or soft yellow flame, to heat the rear of the joint.

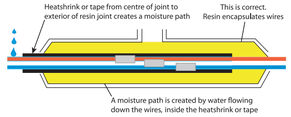
Unprepared Cable Jacket - It is essential that the cable jacket is clean and grease free, and has been roughened. Ensure the following steps are taken:

- Roughen the outer jacket of the cable for a distance of approximately five cable diameters at each end with coarse sand paper, typically 60 to 80 grit, or a fine rasp.
- Clean the roughened area with an alcohol wipe, or methylated spirits and a clean rag.
- Warm the joint area before you start the shrinkage process. This drives off any moisture, and if using a flame, flame wipe the joint area, as this creates an oxide layer for better adhesion.

Over Heating - If using a flame, use a soft yellow flame and move it the whole time. Do not hold on one spot. If the heatshrink becomes a chalky grey colour and texture, is has been over heated.

Cast Resin Joints

Heatshrink and Resin – The most common failure of resin joints is caused by the combination of heatshrink and resin. What happens is the person creates a joint, and shrinks individual heatshrink tubes on each internal wire, and then shrinks a heatshrink sheath, non glue lined over all the wires. (Alternatively they tape the wires in a bundle.) They then seal this into a resin joint, leaving the end of the heatshrink tube outside the joint. This, in effect, creates a moisture path to the centre of the joint from outside. The essence of a resin joint is to splay the wires and connections, with minimal to no insulation, and encapsulate these in resin. Best practice is to leave the individual conductors bare and "birdcage" them which creates a total moisture block from water travelling down the conductor.



Failure mode caused by creating a moisture path into the joint

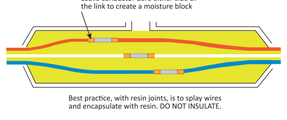
Resin and Moisture, Cold or Mixing

Cold – Resins do not cure rapidly in temperatures below 20ºC. Either raise the ambient temperature or warm the joint, or use the following procedure.

- Thermally insulate the joint shell using cloth or newspaper and warm if possible. Warming the cable is easiest.
- Mix the resin rapidly, and wait a short while until you feel the heat being generated by the resin hardening process, generally a few minutes maximum.

Moisture - Resins do not like water, and you must ensure that all mixing equipment and moulds are moisture free. If not, the resins can foam, particularly if water is mixed into the resin. Often failure occurs after time because the resin is porous.

Mixing - Resins need lots of mixing. Do not combine the ingredients and give them a quick swirl, they must be thoroughly mixed.



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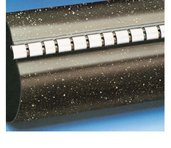


Heatshrink

CABRICAL

CABRICAL Heatshrink Tubing Range

Catalogue No.	Main Characteristics	Main Use	Shrink Ratio (Nominal)	Shrink Temperature °C	Operating Temperature °C	Application Range Dia. (mm)
Thin Wall						
XLP	Thin Wall, Flame Retardant UV Stabilised	Insulation Colour Coding	2:1	>100	-55 to 135	0.75 to 110 General Purpose
XDW	Glue Lined, Thin Wall, High Shrink	Cord Ends	3:1	80 to 125	-45 to 125	0.6 to 34 Mechanical Protection
Medium Wall						
SMDW	Glue Lined, Medium Walled Waterproof	Joints and Terminations	up to 3.5 :1	120	-55 to 110	3 to 110 General Purpose
Thick Wall						
STDW	Thick Walled, Glue Lined, High Stick and Mechanical Strength	Joints and Terminations	4 :1	120	-55 to 110	3 to 65 Critical Areas, Super Waterproof

XLP Heatshrink Thin Wall

Flame Retardant & UV Stabalised - General Purpose

XLP Tubing is a Chemically Cross-Linked Tubing. It will withstand -55°C to 135°C for normal operating conditions and 250°C for short intervals. The tubing can easily be shrunk with a heat gun or a heat tunnel. All tubings in this range are flame retardant except clear, which is flammable.

- Highly flexible
- Flame retardant
- Abrasion and impact resistant
- For use in all electrical and electronic applications
- Full range 1.5mm to 125mm diameter with 2:1 shrink ratio
- Available in most colours on reels.

XLP tubing has numerous uses in the electrical and associated industries, including insulation, colour coding and mechanical protection.

Catalogue No.	Pre-Shrink Diameter (mm)	After Shrink Diameter (mm)	Recovered Wall Thickness (mm)	Standard Reel Qty (m)
XLP1.5	1.6	0.8	0.40	200
XLP2.5	2.4	1.20	0.48	200
XLP3	3.2	1.6	0.48	200
XLP5	4.8	2.4	0.48	200
XLP7	6.4	3.2	0.56	200
XLP10	9.5	4.8	0.62	100
XLP13	12.7	6.4	0.62	100
XLP20	19.0	9.5	0.68	100
XLP20	25.4	12.7	0.87	50
XLP38	38.0	19.0	1.00	50
XLP51	50.8	25.4	1.10	50
XLP76	76.2	38.1	1.20	50
XLP102	102.0	50.8	1.35	30
XLP125	125.0	63.5	1.40	15

Lengths and Colours Available

Colour	Suffix	Reel	4ft
Black	BK	Yes	Yes
Red	RD	Yes	Yes
White	WH	Yes	Yes
Blue	BL	Yes	Yes
Green	G	Yes	Yes
Yellow	Y	Yes	Yes
Clear	CL	Yes	Yes
Yellow/Green	YG	Yes	Yes

Note:

- Reels of Yellow/Green are available in XLP2.5, 3, 5, 7, 10, 13, 20, 25
- XLP125 available on request
- XLP125 is a special product and certain colours may be available only on special order.

Techincal Data

Compliant Standards	UL224 VW1 File No. E204071
Material	Chemically cross-linked, thermally stabilised fl ame retardant polyolefin
Continuous Operating Temp	-55°C to +135°C
Shrinkage Temp	> 100°C
Longitudinal Shrinkage	< 5%
Tensile Strength	14 MPa
Breakdown Voltage	25 kV/mm wall thickness
Volume Resistivity	1.0 x 1014 ohm cm
Elongation at Break Point	600%
Water Absorption	0.15% max
Flammability	Passed
UV Stability	Black Only
Voltage Rating	600V

Low Voltage Joint Kits - Armoured & UnArmoured

CABRICAL offers a comprehensive range of low voltage heat shrink cable joint kits, offering double sleeve configurations for use on 2 to 4 core 600/1000 Volt and 3,3kV cables. All of the tubing used is coated internally with a hot meltable adhesive to ensure good environmental sealing. An added advantage is that the low voltage heat shrink joint kit has an indefinite shelf life.

The range of joints covers all cable sizes (armoured and unarmoured) from 1.5mm2 - 300mm2 Due to the range taking capabilities of the heat shrink tubing used, one size of joint is utilised, from 2 to 4 core cables. Special joint applications are also available for multicore cables covering from 7 up to 37 cores.

Test	Requirement	Result
Initial Insulation Resistance	> 50 M	Complied
Initial Voltage Withstand 4kV 1min	No Breakdown	Complied
Impact Test	No cracks or damage	Complied
Insulation Resistance After Impact Test	> 50 M	Complied
Load Cycling Test 100 cycles @ 85 °C	No Breakdown	Complied
AC Voltage Withstand 4kV 15min	No Breakdown	Complied
Insulation Resistance Immersed	> 50 M	Complied

Double Sleeve	
Part Number	Cable Size
LVJA 1	1,5 - 4 mm²
LVJA 2	6 - 16 mm²
LVJA 3	25 - 50 mm²
LVJA 4	70 - 150 mm²
LVJA 5	185 - 300 mm²

XDW - Thin Wall - Glue Lined

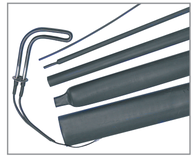
XDW is a Thin Walled Heatshrink Tube with a Glue Lined inner surface. It is made from a dual extrusion of polyolefin and adhesive. It is commonly referred to as 'dual walled'.

- Highly flexible
- Very high shrink ratio 3:1
- Flame retardant
- Good mechanical adhesion

This is a material with many applications in the electrical and mechanical protection areas. Since the glue holds the tubing in place it is commonly used for brake and fuel pipe protection in the automotive industry. Typical electrical applications are strain relief on cords, and insulation repair. In general the tube is not recommended for waterproofing since the glue layer is primarily a mechanical adhesion and is thin. Use SMDW for fail safe waterproof joints.

Catalogue No.	Pre-Shrink Diameter (mm)	After Shrink Diameter (mm)	Recovered Wall Thickness (mm)	Standard Length (m)
XDW3BK	3.2	0.6	1.0	1.2
XDW5BK	4.8	1.5	1.1	1.2
XDW7BK	6	2.0	1.2	1.2
XDW10BK	9	3.0	1.3	1.2
XDW13BK	12	4.0	1.7	1.2
XDW20BK	19	6.0	2.0	1.2
XDW25BK	24	8.0	2.2	1.2
XDW38BK	40	13.0	2.5	1.2
XDW51BK	50	19.0	2.5	1.2

Note: Wall thickness includes the glue liner.



Techincal Data

Meets Sony Standard	SS-00259,RoHS
Conformant Standards	UL 125°C VW-1 600V File No. E20401
Material	Dual wall, flexible, flame retardant (Except Clear)
Continuous Operating Temp	-45°C to +125°C
Shrinkage Temp (min)	Starts at 80°C - 125°C Fully Recovered
Tensile Strength	10.4 MPa
Elongation at Break Point	200%
Longitudinal Shrinkage	0 to -10%
Breakdown Voltage	20 kV/mm wall thickness
Volume Resistivity	1.0 x 1014 ohm cm
Water Absorption	< 0.5%
Flammability	All tubing flame test: pass
Voltage Rating	600 V

SMDW - Glue Lined Heatshrink

Glue Lined

SMDW is a Medium Walled Cross-Linked Polyolefin Heatshrink Tube which is used primarily for waterproof jointing and sealing cable terminations. The TK version of the tube has a hot melt glue liner which melts as the tube is shrunk and creates a strong bond between the cable jacket and the tube. The joint can then be directly buried or even submerged in water. The tubing can also be supplied unlined for insulation and mechanical protection.

- Cost effective and quick waterproof jointing
- High shrink ratio
- High rigidity and tensile strength once shrunk
- Resistant to decay, chemicals and corrosion

For waterproof applications the preparation of the cable jacket is critical to ensure good adhesion of the glue. Ensure that the cable jacket is free of grease and is roughened with emery paper. The tubing should be shrunk with a heat gun or a soft yellow gas flame. Shrinkage should be done from the centre out, moving the heat source continually to ensure no localised overheating. With TK glue lined tubing the glue should extrude from both ends once shrinkage is complete.

Note: A common cause of joint failures is not heating the heatshrink all around the joint. If you are in a trench for example, and heat only the top half of the joint, the heatshrink only shrinks on the top, and the meltable glue sealant does not melt and seal on the rear of the joint. It is essential to heat ALL ROUND the joint in particular the rear, by using a heat deflector.

Catalogue No.	Pre-Shrink Diameter (mm)	After Shrink Diameter (mm)	Recovered Wall Thickness (mm)	Standard Length (m)
SMDW12/3TK	12	3	2.0	1.2
SMDW22/6TK	22	6	2.5	1.2
SMDW33/8TK	33	8	2.5	1.2
SMDW40/12TK	40	12	2.5	1.2
SMDW55/16TK	55	16	2.7	1.2
SMDW65/19TK	65	16	3.8	1.2
SMDW75/22TK	75	22	3.0	1.2
SMDW95/25TK	92	25	3.0	1.2
SMDW115/34TK	115	34	3.0	1.2
SMDW140/42TK	140	42	3.0	1.2

Note: Catalogue number shown in this table is glue lined (TK) material. For unlined substitute 'U' on suffix i.e. SMDW12/3U

Techincal Data

Conformant Standards	IEC: VDE: ASTM
Material	Cross-linked polyolefin with thermoplastic mastic sealant Note: Unlined tube may be ordered (without sealant)
Continuous Operating Temperature	-55°C to +110°C
Shrinkage Temperature	Fully Recovered 120°C
Tensile Strength	> 14 MPa
Elongation at Break Point	400%
Longitudinal Shrinkage	0 to -10%
Dielectric Strength	> 20 kV/mm wall thickness
Volume Resistivity	> 1014 ohm cm
Water Absorption	< 0.15% - polyolefin < 0.2% - adhesive
Flammability	Do not use SMDW in flame prone areas
UV Resistant	

HL 1610 S - General Purpose Heatgun (1600W)

HL 1910 E - General Purpose Heatgun (2000W)

STDW - Thickwall Heatshrink

Thickwall Glue Lined

CABRICAL's STDW Heatshrink, has a much thicker wall than SMDW, and is used in cable joints, repairs and terminations in critical areas. The basic logic in cable repairs and jointing is that one should replace the original thickness of insulation. The "recovered" thickness in the table below is the free shrink maximum thickness, which gives a guide to the wall thickness after shrink.

Features

- High shrink ratio of 4:1, allows you to use one piece of shrink to cover a huge range
- Wall thickness is more than SMDW giving much better insulating and protection properties
- Rigidity is much greater than SMDW tubing, with a higher overall abrasion and impact strength
- The adhesive is polyamide, which is hand applied, and sticks very well to most surfaces. There is also more adhesive in this tube than in SMDW so the overall sealing capabilities are much better.

For waterproof applications the preparation of the cable jacket is critical to ensure good adhesion of glue. Ensure the jacket is free of grease and roughened with emery paper. Tubing should be shrunk with a large heat gun or a soft yellow gas flame. Shrinkage should be done from the centre out, moving the heat source continually to ensure no localised overheating. The polyamide glue should extrude from both ends once the shrinkage is complete.

Note: A common cause of joint failures is not heating the heatshrink all around the joint. If you are in a trench for example, and heat only the top half of the joint, the heatshrink only shrinks on the top, and the meltable glue sealant does not melt and seal on the rear of the joint. It is essential to heat ALL AROUND the joint in particular the rear, by using a heat deflector

Catalogue No.	Pre-Shrink Diameter (mm)	After Shrink Diameter (mm)	Recovered Wall Thickness (mm)	Standard Length (m)
STDW105/30PA	105	30	4.3	1.2
STDW130/36PA	130	36	4.3	1.2
STDW160/50PA	160	50	4.3	1.2

Techincal Data

Conformant Standards	IEC: VDE ASTM
Material	Cross-linked Polyolefin
Continuous Operating Temp	-55° to 110°C IEC216
Shrinkage Temp	130°C IEC216
Tensile Strength	> 12 N/mm2 ASTMD638
Elongation	> 400% ASTMD638
Longitudinal Shrinkage	< 10% ASTMD2671
Dielectric Strength	> 15 KV/mm ASTMD149
Volume Resistivity	> 1 x 1012 ohm cm ASTMD257
Flammability	Not self extinguishing ASTMD867
Thermal Shock	No damage ASTMD2671-746

* Available on request.

Constructing a Heatshrink Joint

Best Practice - Straight Through Joints for 0.6/1KV

Outer and Inner Tube Selection

- ***Size Selection*** - Choose a heatshrink tube size that recovers (smallest shrink dimension) approx. 20% smaller than the O.D. of cable jacket.
- ***Tube Length Selection***

- Outer - Allow for approximately 5 x O.D. of cable jacket as free sealing length on cable jacket at each end of joint. This means the outer tube will be 10 x O.D. of the cable plus the exposed joint length.
- Inner - Allow the length of the link plus two times the cable O.D. at each end. This means the tube will be 4 x O.D. plus the link length.

- ***Tube Type Selection***

- Outer - Essentially you should replace the insulation thickness that was removed from the cable. For most joints SMDW tubing will be acceptable, but for cables with thick insulation, or double insulated or in high mechanical load areas, we recommend STDW tubing.
- Inner - XLP (thinwall general purpose) tubing is sufficient, but for good practice we recommend short lengths of SMDW glue lined tubing.

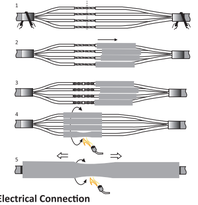
Length of Heatshrink Tubing Required

- The length of a joint is controlled by a number of factors.
- ***Inner Heatshrink Tube Length*** - This is controlled by the length of the links on the conductors. Aluminium links tend to be longer than copper. The inner tube length should be the length of the link, plus 2 x (minimum) the O.D. of the wire, to allow for free shrinkage at the end.
- ***Asymmetric Joint*** (see diagram) - The shortest joint can be created if all the links are crimped at one spot, and you create an asymmetric joint. The problem with this is if the links and their heatshrink insulation are much larger than the insulation of the inner conductors, you end up with a large "lump" in the middle of the joint. The exposed length of this joint, will be approximately 3 x the inner tube length.
- ***Staggered (Symmetric) Joint*** - Where the link O.D. is much larger than the insulation of the inner wires, CABRICAL recommends a staggered joint. This creates a much neater joint, with better electrical integrity, because all links are not lying in the same plane. The exposed length of these joints will be approximately 5 x the inner tube length.
- ***Access to Crimp Tools*** - Crimp tools need space to work, and the cores need to be separated so that tools can gain access.

Cable Preparation

Figure 1 and 2

- Remove cable jacket outer sheath and expose core wires.
- Cut the core wires, and strip insulation to suit the links off the ends.
- Clean the cable before sliding over the heatshrink tubing. An alcohol wipe or methylated spirits on a clean rag is very effective.
- Roughen jacket insulation on both end with abrasive cloth or sandpaper of 60-80 grit.
- Slide inner heat shrink insulation sleeves over cores, and outer heatshrink sleeve over cable jacket.



Installation of Electrical Connection

Figure 3

- Connect the conductors, and remove all sharp edges with a file or abrasive cloth.

Figure 4 and 5

- Pre-heat all insulation that is to be covered with heatshrink to approx. 80ºC
- If using a gas burner adjust to a soft, yellow flame.
- Start shrinking all sleeves from the middle of the sleeve.
- Slide the inner heat shrink insulation sleeve in the middle over the connectors and shrink, whilst ensuring equal overlapping.
- Ensure that you heat right around the heatshrink, heating the rear as well as the front. This is one of the greatest points of failure of a heatshrink joint, when unequal heating is applied.
- (Optional) Create a secondary water barrier by taping both ends of the joint with mastic tape wrapping about 25mm width on the cable outer jacket and move inward onto the cable cores with about 40mm.
- (Optional) Re-connect any screens or armouring, by directly connecting, or using flexible copper braid and a suitable clamping mechanism.
- Slide the outer heat shrink jacket sleeve over the exposed cores and shrink (pay attention to equal overlapping at both ends).
- Pay attention to regular heating and avoid overheating. Shrinkage is finished when shrinkable tubing fits firmly, fold-free and adhesive appears on the ends.

Putting into Operation

- After the joint has cooled down to about 30ºC, the joint can be loaded electrically and mechanically.