

## INSTALLATION INSTRUCTIONS

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EPP-2232-4/22

**PHVX-145-A-D**

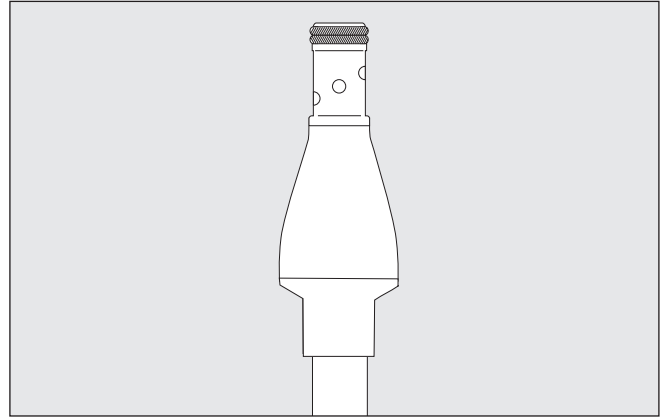
**Switchgear/Transformer Termination  
Dry Version for Polymeric Cables  
with Al-Wire Armour  
Plug-In Unit**

**up to 170 kV**

**SIZE 1**

**TE's Raychem Cable Accessories**

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Please dispose of all waste according to environmental regulations.



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**For more information: [te.com/energy](https://te.com/energy)**

**Tyco Electronics Raychem GmbH**  
a TE Connectivity Ltd. Company  
Finsinger Feld 1  
85521 Ottobrunn/Munich, Germany  
Tel: +49-89-6089-0  
Fax: +49-89-6096-345

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, TE Connectivity has no control over the field conditions which influence product installation.

It is the user's responsibility to determine the suitability of the installation method in the user's field conditions.

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# General Instructions

## Before Starting

- Check the kit label and the title of the installation instructions to prove that the cable accessory you are going to use matches the cable.
- Make sure the cable is properly sealed.
- Make sure the cable is in the final installation position.
- Make sure the cable is straight at the jointing position.
- Check the position of the cables to be in alignment to the final position of the accessories.
- Make sure the joint bay/installation area provides adequate space for the cable components to be parked on either cable for later use during the installation.
- The joint bay/Installation area must be kept clean and dry during installation. For outdoor installation use tent or other appropriate shelter.
- Carefully read and follow the steps in the installation instructions. Components or working steps may have been changed/improved since you last installed this product.
- All tools, PPE and apparatus used must be kept clean during the installation.
- Obey relevant and local security and safety rules during the installation.

## Shrinking Heat-Shrink Tubing

- Use a propane (preferred) or butane gas torch.
- Ensure the torch is always used in a well-ventilated environment.
- Adjust the torch to obtain a soft blue flame with a yellow tip. Pencil-like blue flames should be avoided.
- Keep the torch aimed in the shrink direction to preheat the material.
- Keep the flame moving continuously to avoid scorching the material.
- Clean and degrease all parts that will come into contact with adhesives.
- If a solvent is used follow the manufacturer's handling instructions.
- Start shrinking the tubing at the position recommended in the instructions.
- Ensure that the tubing is shrunk smoothly all around before continuing along the cable.
- Tubing should be smooth and wrinkle free with inner components clearly defined.

## Stripping the Cable

Use appropriate stripping tools for smooth and even insulation diameter.

Adjust the stripping tool to the thickness of the semi-conductive layer. Avoid removing too much of the insulation. Polish the stripped surface by hand using the supplied abrasive paper beginning with the lowest grid size, or by an appropriate sanding machine and abrasive paper and grades. The surface of the insulation must be even and free of all traces of conductive material.

## Cables with Segmented Conductors

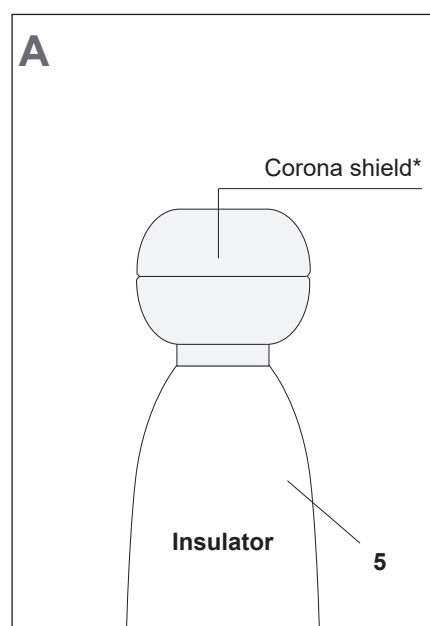
All cut back dimensions and information given in this instructions document refer to cables with non-segmented conductors only. In case of cables with segmented conductors, all insulation or conductive materials have to be removed from the conductor. If the removal of these materials require a longer cut back of the cable insulation, this length needs to be added to the cable cut back dimensions mentioned in the instructions.

### **NOTE**

**Special instructions for segmented conductors are available on request.**

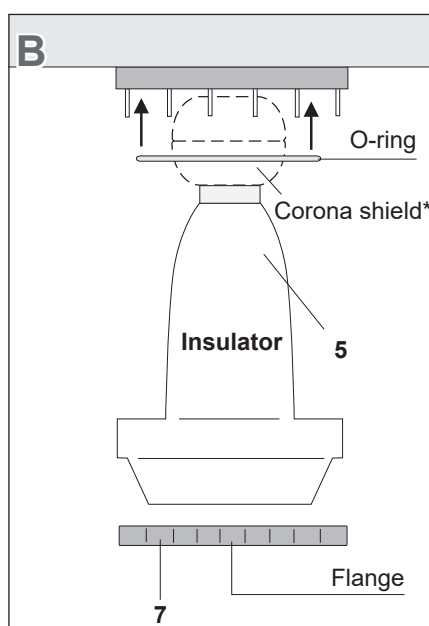
## Installation of the Epoxy Insulator into the Switchgear/Transformer Housing

The epoxy insulator (5) should be installed under supervision of the switchgear/transformer manufacturer.



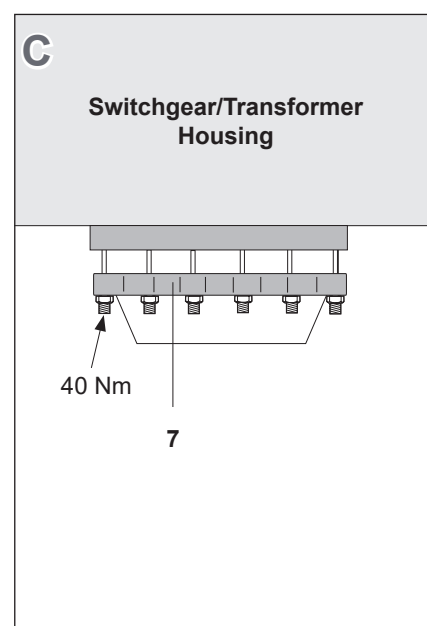
Bolt the lower part of the corona shield to the insulator electrode. Apply the top part of the corona shield.

\*Corona shield for transformer termination only (not for switchgear).



Put the O-ring (supplied by the switchgear/transformer manufacturer) into the sealing groove of the switch gear. Clean and degrease the epoxy insulator (5). Keep it free from dust and dirt.

\*Corona shield for transformer termination only (not for switchgear).



Insert the epoxy insulator (5) into the switchgear/transformer housing. Apply the fixing ring (7). Bolt the flange evenly to the switchgear/transformer housing.

### NOTE

Bolt the flange with a torque of 40 Nm.

### NOTE

Enter the fixing torque in the installation protocol.

**A. Straightening and Heating of the Cable**

Before starting the cable preparation, train the cable end in the straight installation position and fix it.

The cable needs to be heated and straightened for the length of complete Installation.

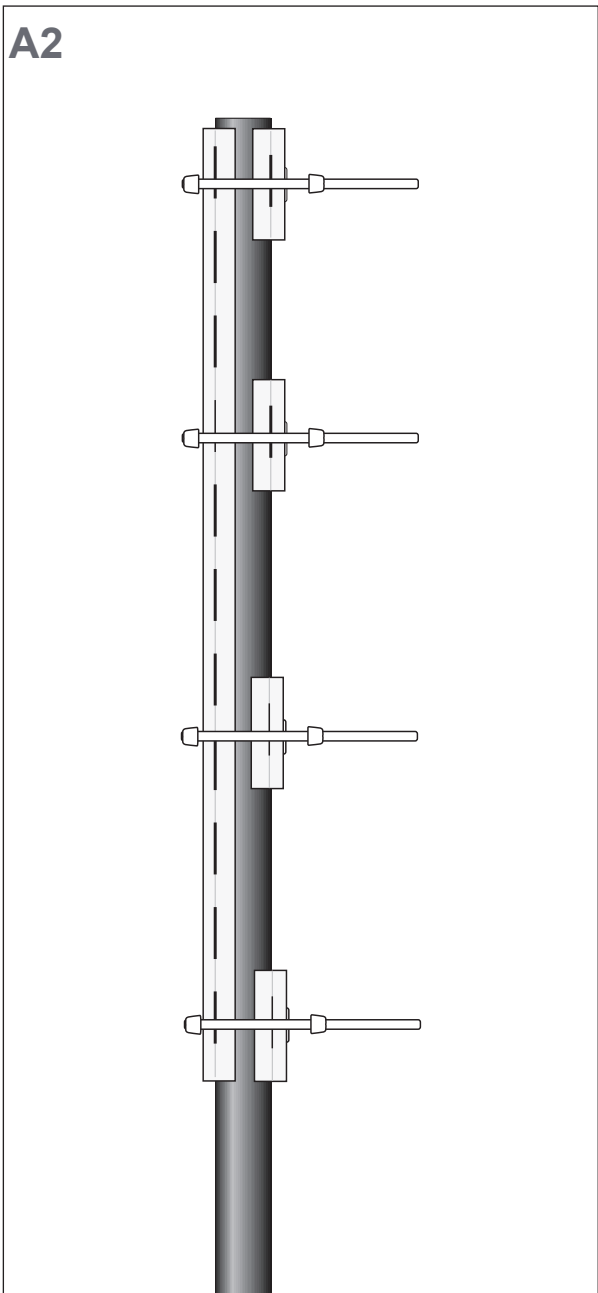
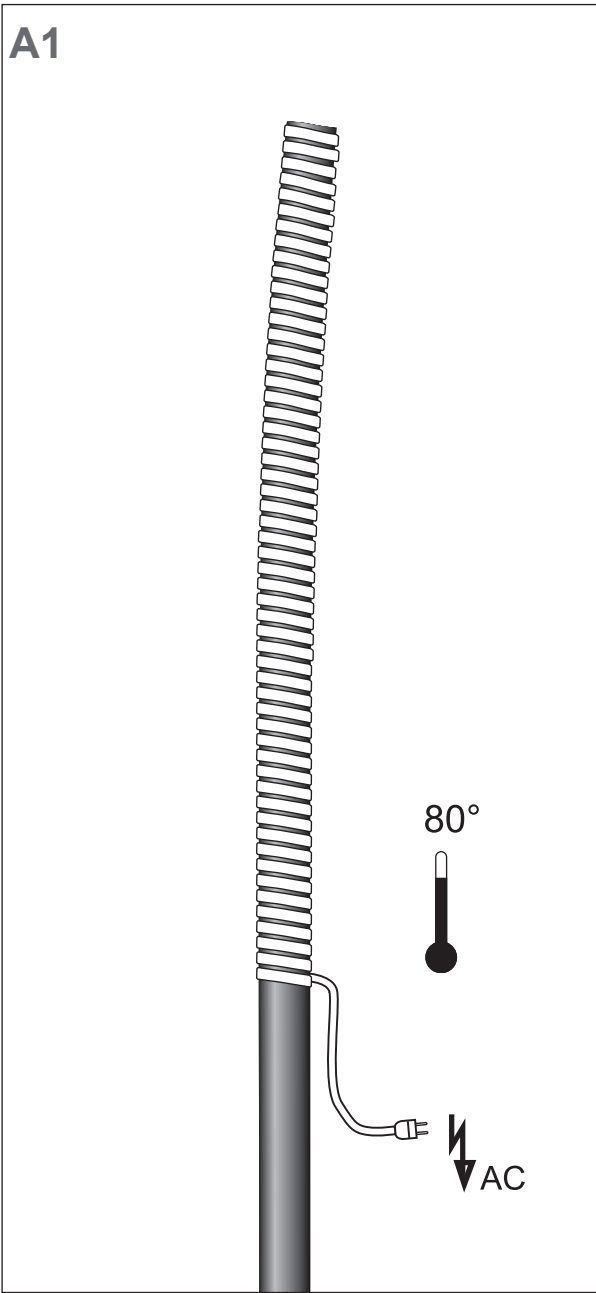
In case of graphite coating cover the cable with one layer of crepe paper.

Degrease and clean the oversheath.

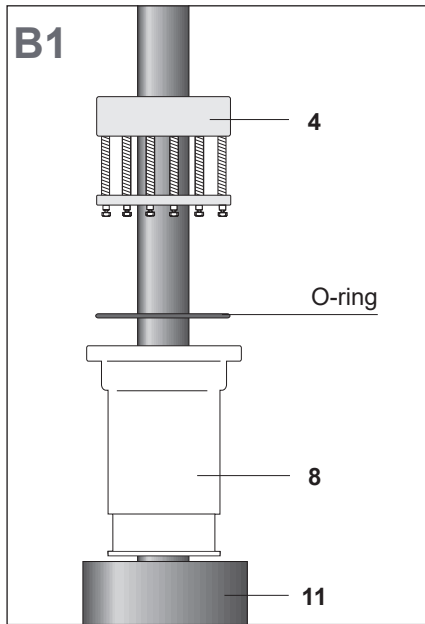
Heat the cable by applying a heating device to the oversheath as shown in the TABLE BELOW.

Before stripping to the required dimensions, the cable needs to be cooled down to ambient temperature using slide rails.

Cable Cross Section	Heating Time/ Temperature
up to 400 mm²	4 h / 80 °C
up to 1200 mm²	5 h / 80 °C
up to 2500 mm²	6 h / 80 °C

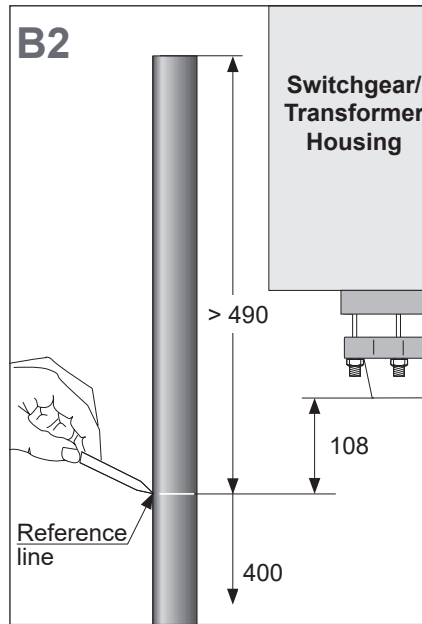


## B. Marking Reference Line



Move the heat shrinkable thick wall tubing (11), cable gland (8), O-ring and compression device (4) down the cable jacket as shown in the drawing.

Make sure enough room is left for the installation of the plug-in unit.



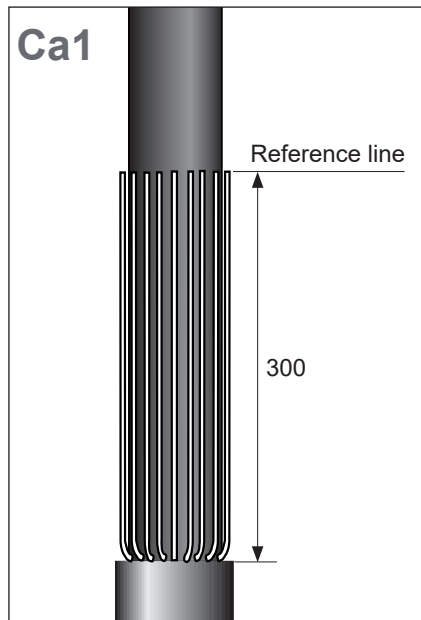
Mark the reference line on the cable 108 mm below the transformer switchgear housing as shown.

**This is the reference line for all further installation procedures. Make sure the remaining cable length above the reference line is at least 490 mm.**

Remove the graphite coating or semiconductive layer, if any, up to 400 mm below the reference line.

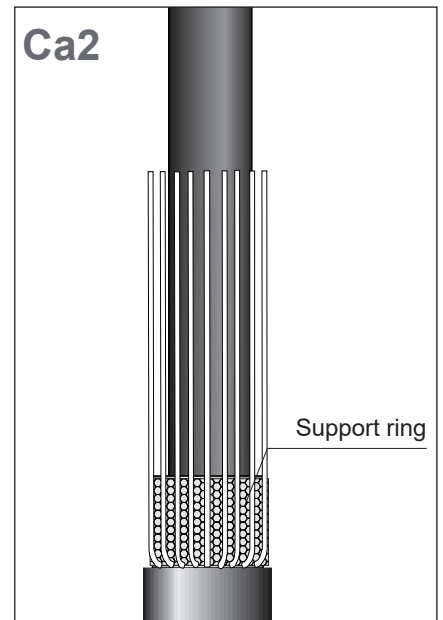
## C. Removing the Outer Jacket

### a. Cable without Metal Foil



Remove the oversheath and bedding up to 300 mm below the reference line.

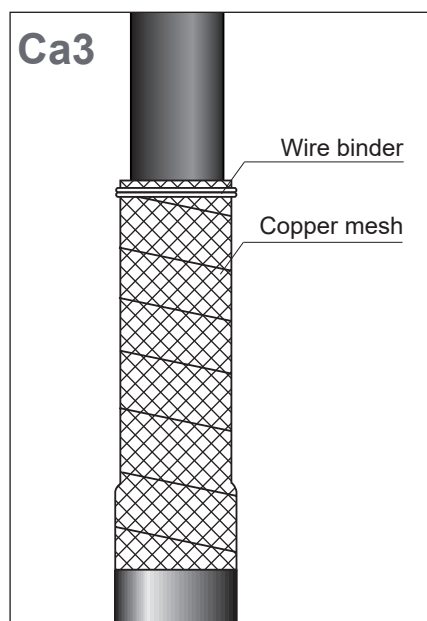
Cut the Aluminium wires at the reference line.



Slide the support ring under the Al-wires.

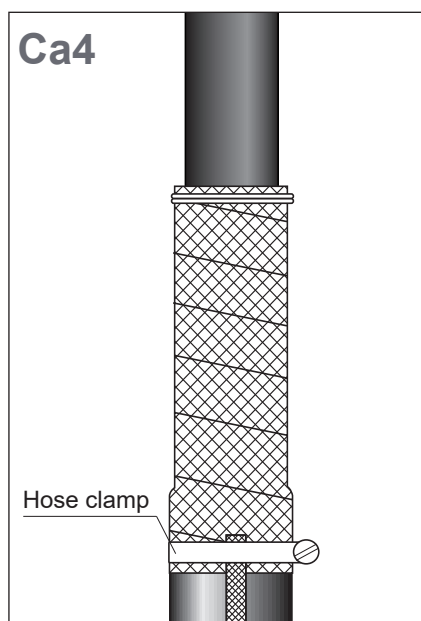
Apply 3 layers of copper mesh on the Al-wires.

Fix the ends of the Al wires and the Cu-mesh with a wire binder onto the cable.



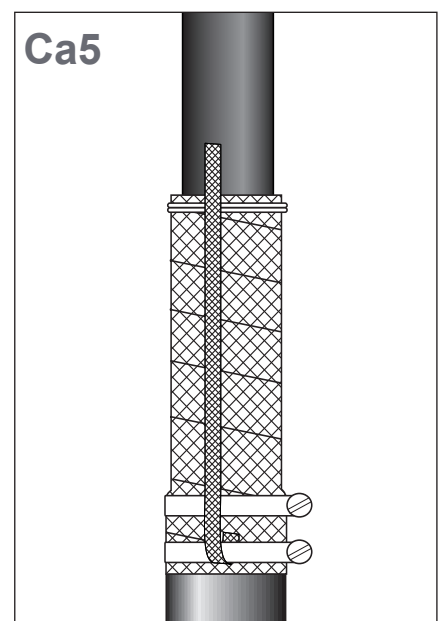
Apply the copper braids on the Al-wires equally on the circumference.

Fix the braids with one of the supplied hose clamps over the support ring as shown in the drawing.

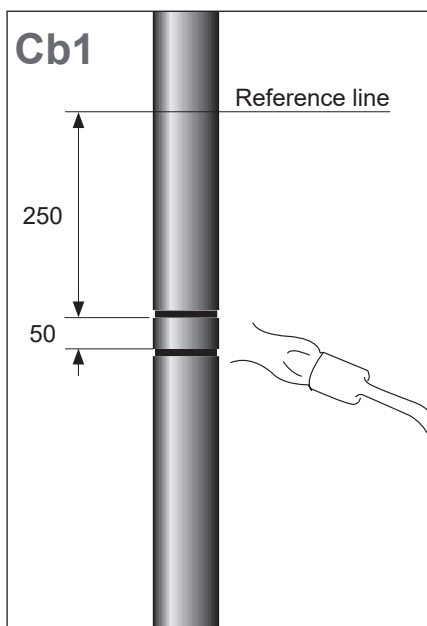


Bend the braids back towards the cable cut.

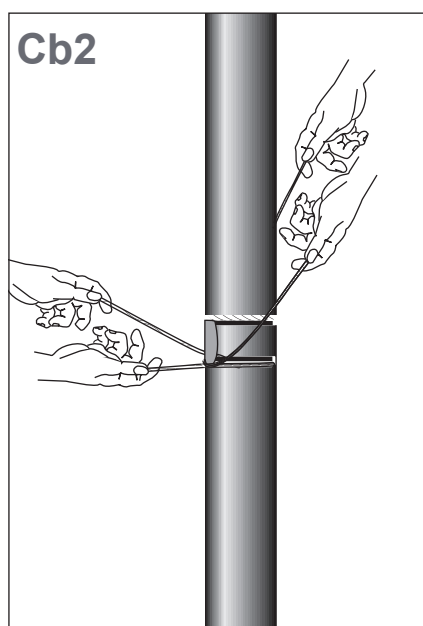
Fix the braids with the 2<sup>nd</sup> hose clamp.



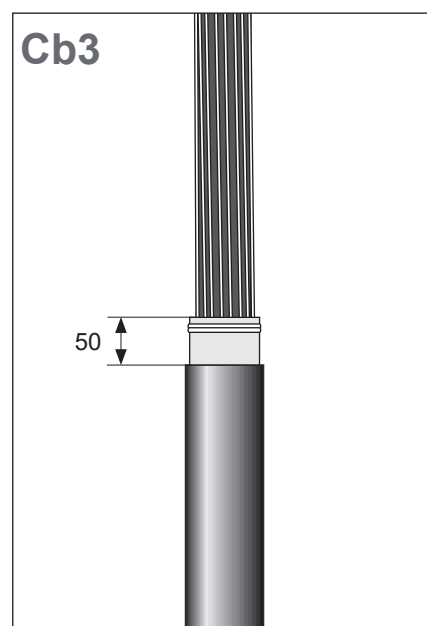
## b. Cable with Metal Foil



Heat the cable oversheath 250 mm below the reference line. Soften approx. 50 mm of the surface.



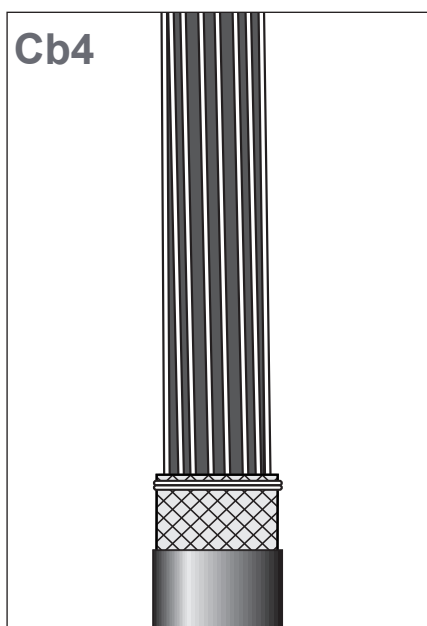
Cut through the oversheath with the supplied string. Remove the outer jacket from the Al-foil by slicing segments away with the string as shown in the picture.



Fix the Al-foil with a wire binder. Clean the Al-foil from traces of the outer jacket (if any). Remove the oversheath, foil and bedding from the remaining cable end.

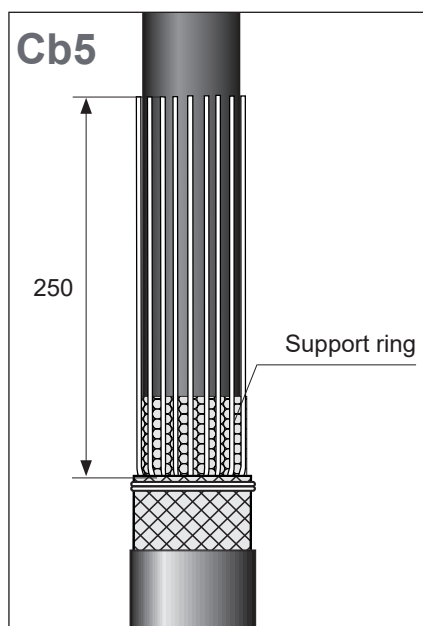
Smooth out the surfaces of the metal foil with a very fine grinding cloth.

Wrap 3 layers of Cu-mesh over the metal foil.



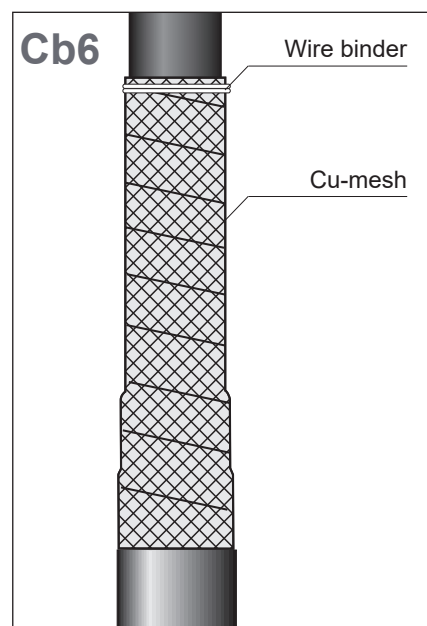
Cut the Al-wires 250 mm from the Al-foil cut.

Slide the support ring under the Al-wires.

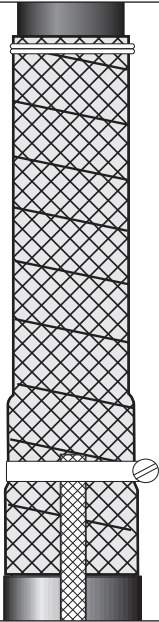


Apply 3 layers of Cu-mesh onto the Al-wires.

Fix the end of the Al-wires and the Cu-mesh with a wire binder at the top.



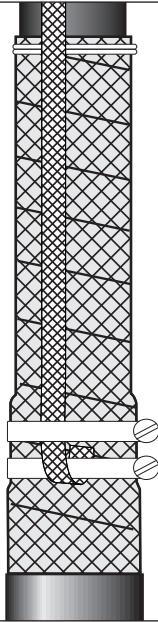
**Cb7**



Equally apply the braids on the Al-wires around the circumference.

Fix the braids with one of the supplied hose clamps over the support ring as shown in the drawing.

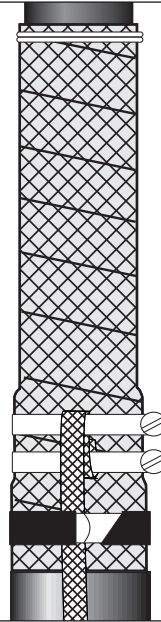
**Cb8**



Bend the braids back towards the cable cut.

Fix the braids with the 2<sup>nd</sup> hose clamp.

**Cb9**



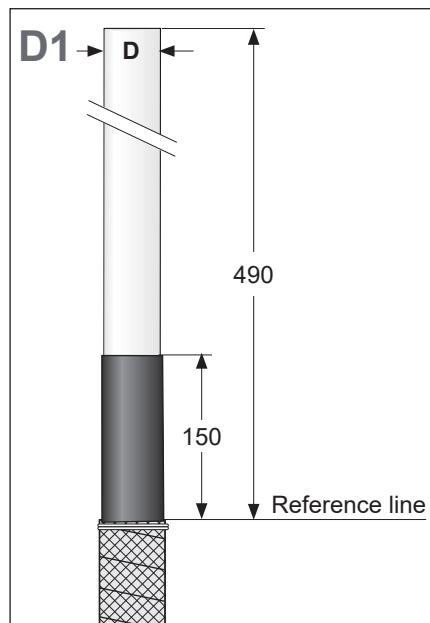
Bend the braids back onto the cable and fix them onto the metal foil using a roll spring.

Fix the roll spring with a twisting action.

Protect the roll spring with 3 layers of PVC-tape.



## D. Stripping the Outer Semicon Layer



Thoroughly remove the outer semicon layer to within 150 mm above the reference line until the diameter of the insulation is **D** (see **Table 1**).

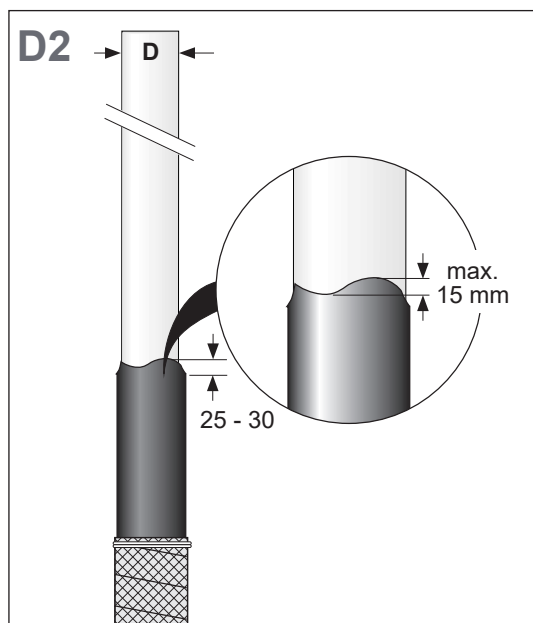
### NOTE

**Smooth the insulation as requested on page 2 (General Instructions).**

Cut the cable core exactly 490 mm above the reference line. The cut must be right-angled.

### NOTE

**Do not damage the insulation.**



**Chamfer the outer semicon layer** in between 25 to 30 mm.

Polish the insulation up to 250 mm from the outer semicon layer cut. Check the dimensions **D** as given in **table 1**.

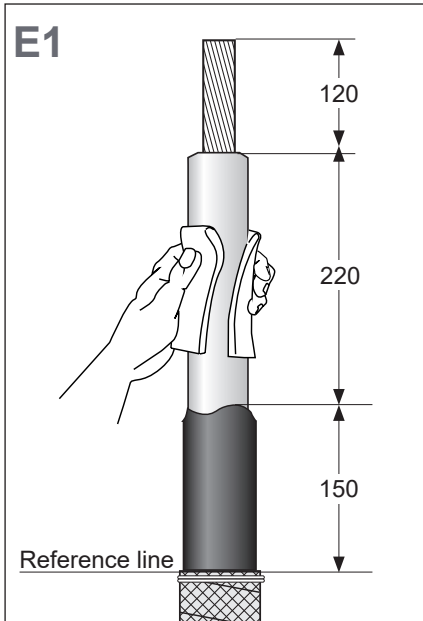
**D** must keep the values within the given tolerances.

Make sure the transition from the outer semicon layer to the insulation transition corresponds in terms of shape and max. height with the wave shown in the detail.

**Table 1**

Stress Cone ref. #	Application range D (mm)
HVCA-PHVX145-SCONE-42/47	42 ... 47
HVCA-PHVX145-SCONE-46/51	46 ... 51
HVCA-PHVX145-SCONE-50/57	50 ... 57
HVCA-PHVX145-SCONE-56/61	56 ... 61
HVCA-PHVX145-SCONE-60/66	60 ... 66
HVCA-PHVX145-SCONE-65/71	65 ... 71
HVCA-PHVX145-SCONE-70/74	70 ... 74
HVCA-PHVX145-SCONE-73/78	73 ... 78

## E. Preparing the Conductor



Remove 120 mm of the cable insulation as shown.

### **NOTE**

**Adhere to the dimensions in the drawing.**

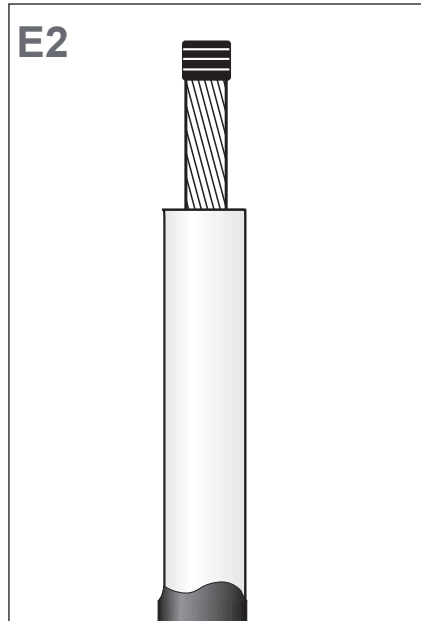
Check the dimension of 220 mm.

Chamfer the insulation and deburr the edges with sandpaper.

Clean the cable insulation thoroughly using the supplied cable cleaner.

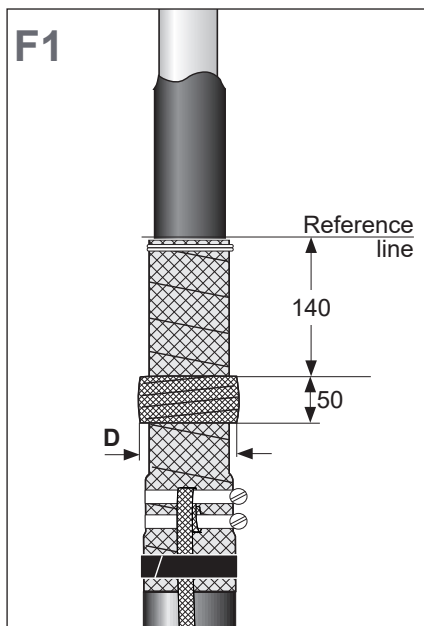
### **NOTE**

**Enter the dimensions of the prepared cable in the installation protocol.**



Protect the conductor with PVC tape as shown.

## F. Preparing for the Cable Gland

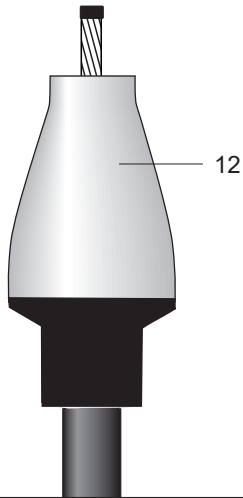


**140 mm below the reference line**  
apply a 50 mm wide packing of cotton  
cloth tape.

**D** = Inner diameter of the gland.

## G. Installing the Stress Cone and Connector

G1



### Installing the silicone stress cone.

Before installing the silicone stress cone (12), check it for damages, failure or defects.

Clean the stress cone and protect it against any conterminations or damages.

If any, remove the PVC protection tape.

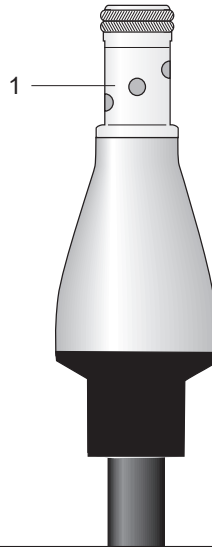
Clean the cable insulation and the silicone stress cone bore with alcohol.

Thoroughly lubricate the cable insulation and the silicone stress cone bore with silicone oil.

Push the silicone stress cone onto the cable core until the insulation levels with the stress cone top.

Clean silicone surplus with alcohol.

G2

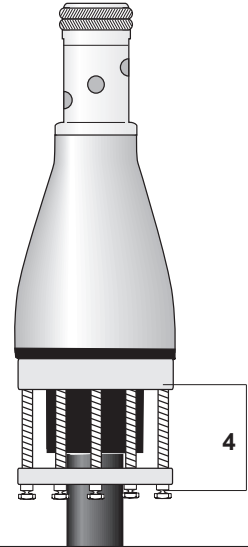


Remove the PVC tape from the conductor.

Place the the connector barrel (1) onto the conductor and butt it to the insulation cut.

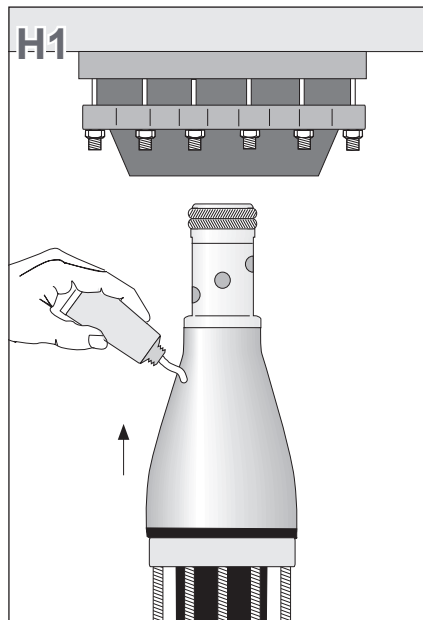
Tighten the shear-off bolts firmly by hand in the sequence shown in the detail.

G3



Push the compression device (4) firmly against the silicone stress cone.

## H. Installing the Plug-in Part



Remove the temporary protection from the connector stud. Clean and degrease the gray cover part of the silicone stress cone (12) with alcohol.

### NOTE

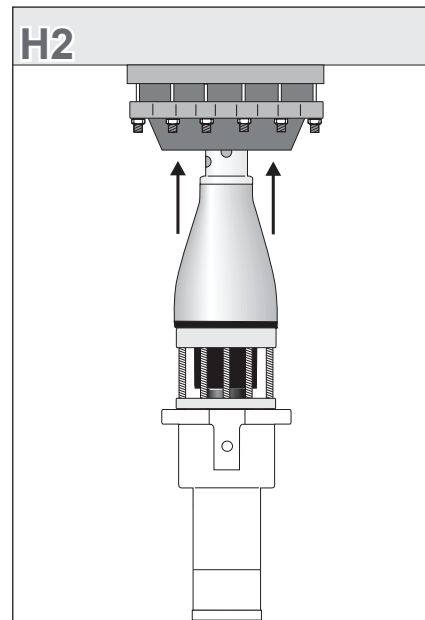
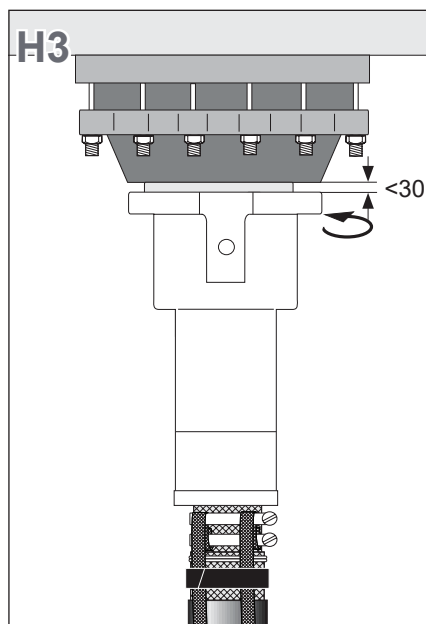
**Do not touch the conductive part with any solvent.**

Clean the female part of the epoxy insulator (5) with Shell-Sol D60 or equivalent means. Remove Shell-Sol D60 remnants with alcohol. Grease the silicone stress cone with silicone grease.

Push it until the distance between the top of the cable gland (8) and the bottom of the epoxy insulator (5) is 30 mm.

**Make sure the cable gland and plug-in unit are moved vertically into position.**

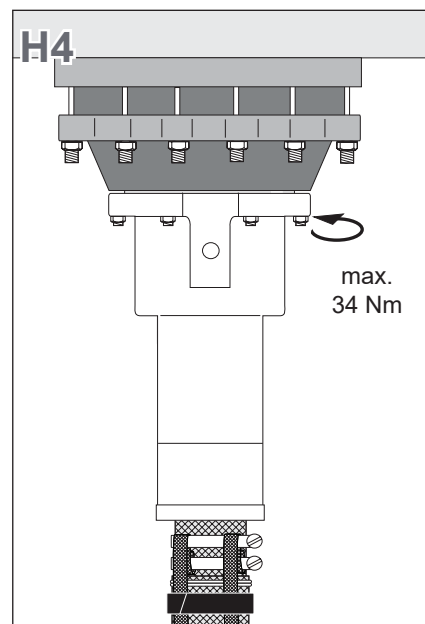
**Make sure the O-ring is in position.**



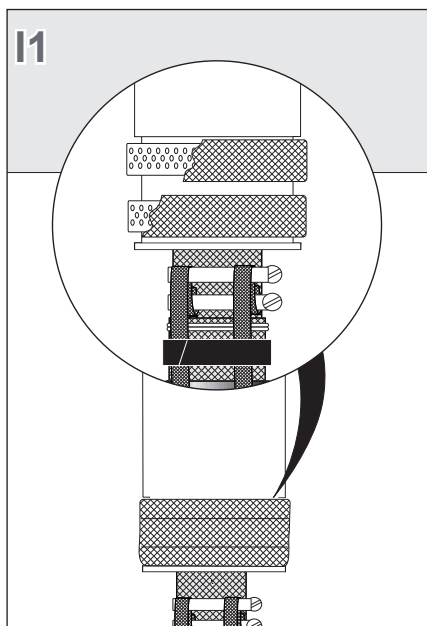
Push the cable with the male plug-in unit in a straight line into the epoxy insulator (5).

Bolt the cable gland (8) to the epoxy insulator (5) with the defined torque of maximally 34 Nm.

Fasten the bolts of the cable entry lid in such a way that they level up with the lid surface.

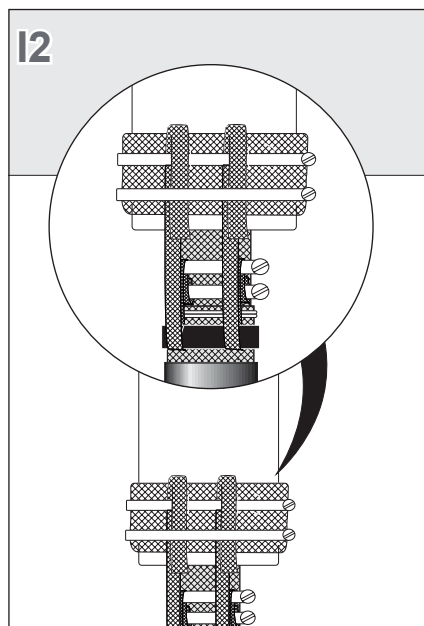


## I. Earthing the Cable Screen



Abrade, degrease and clean the cable outer jacket and the cable gland.

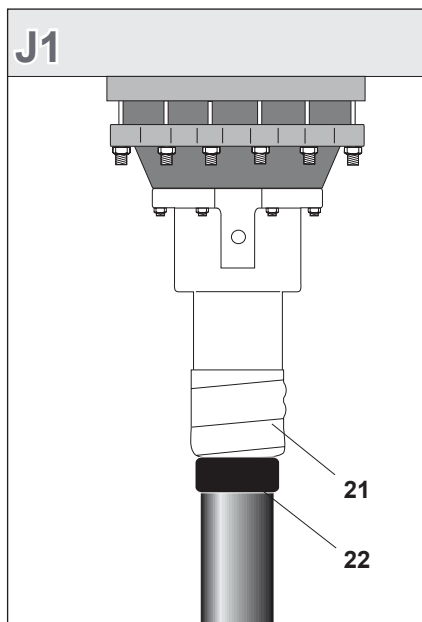
Wrap two contact bands around the cable gland and fix them with three layers of copper mesh tape.



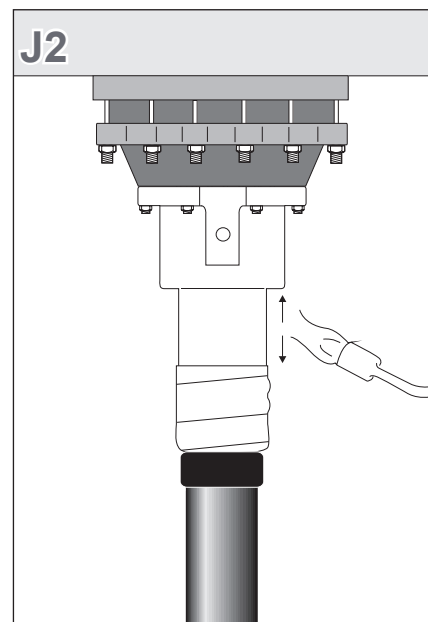
Fold up the copper braids onto the gland and fix them with the copper hose clamp.

Bend the copper braids down again and fasten them on the gland with the second hose clamp as shown in the drawing.

## J Sealing the Cable Gland

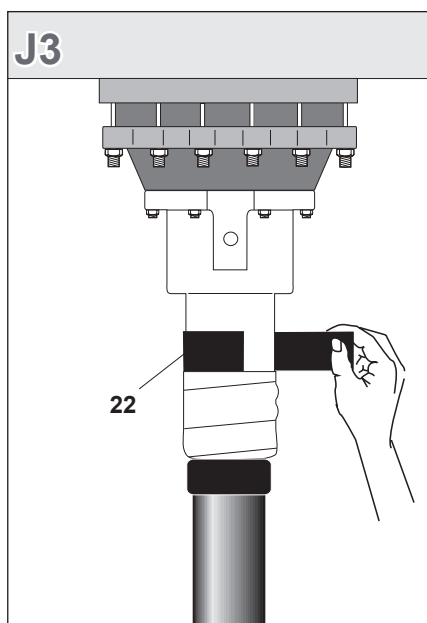


Cover the armour clamps with textile tape (21).  
Wrap one layer of black mastic tape (22) around the outer jacket cut.

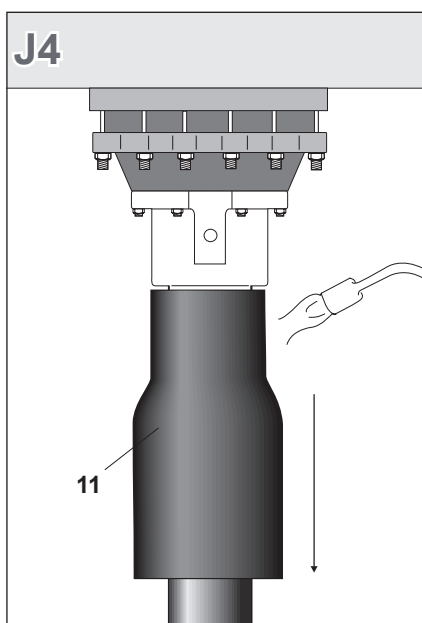


Preheat the cable gland stud.

Wrap 1 layer of black mastic (22) around the gland above the textile tape.



Position the heat shrinkable thick wall tubing (11) on the gland stud and shrink it into place.  
Start shrinking at the top, then move downwards.



The tubing is fully shrunk when the outer surface is smooth, has a glossy appearance and a flow of sealant is visible at each open end. Intimate surface contact should be made along the whole tubing length, conforming to the profile of the components underneath. The tubing should be smooth and wrinkle free with inner components clearly defined.  
Connect the ground lead to the substation ground according to local requirements (6 x M10).

