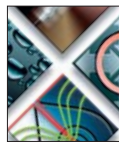




## Power Cable Accessories





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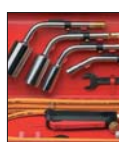
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# Introduction



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### TE Connectivity



TE Connectivity is a global, \$14 billion company that designs and manufactures approximately 500 000 products that connect and protect the flow of power and data inside the products that touch every aspect of our lives. Our nearly 100 000 employees partner with customers in virtually every industry – from consumer electronics, energy and healthcare, to automotive, aerospace and communication networks – enabling smarter, faster, better technologies to connect products to possibilities.

About 7 500 engineers in 19 global engineering centres use their knowledge for the development of new materials and products, which results in more than 20 000 patents. TE invests over \$ 700 million annually for Research and Development resulting in 19 % of sales for the products introduced in the last three years. Manufacturing in approximately 25 countries and strong local sales presence brings the advantage to the customers.

### TE Energy



TE Energy, a TE Connectivity operating unit, is a global supplier to power utilities and power industry customers, equipment manufacturers, and transport systems, with nearly 4 000 employees. Home to Raychem and a number of other trusted product brands, our group offers a wide variety of products that provide reliable connectivity from generation to the end user. TE Energy has sales representatives in more than 80 countries and the manufacturing sites in five continents.

#### Product lines

TE Energy product range includes:

- Cable Accessories
- Connectors and Fittings
- Insulators
- Insulation and Wildlife Protection
- Surge Arresters
- Power Measurement and Control
- Distribution Components
- Street Lighting

#### Research & Development

Systematic research and development is carried out at 14 outstanding scientific and engineering research facilities around the world. The majority of R&D projects for cable accessories are handled in Ottobrunn / Germany where a fully equipped high-voltage test lab, material labs and the modelshop are located. Electrical, chemical and mechanical scientists and engineers are working in cross functional teams focused on new technologies and product developments and improvements. For short-term and long-term material and product testing, multiple labs are available.

#### Global expertise

50 years excellent performance of Raychem accessory systems is TE Energy strength and competitive advantage. Features of Raychem materials have been demonstrated and well proven by many installations in some of the most severe service conditions and confirmed the reliability under high electrical, thermal and environmental stress.

### Raychem cable accessories



Raychem products, from TE Connectivity, are known for their high quality, reliability, and breadth of industry-leading electrical products that include cable accessories, insulators, surge arresters, and insulation & animal protection products. However, to be your partner on the power grid, it takes more than that. Raychem's decades-long dedication to innovation, a desire to create products that endure, and a global network of dedicated TE Connectivity professionals willing to do what it takes to keep your grid operating efficiently is also at the core of who we are. Raychem products along with TE Connectivity's ability to connect products to possibilities equal "your power grid partner".

#### Cable accessories in different technologies

TE Energy offers a comprehensive range of Raychem cable accessories for nearly all cable types up to high voltage applications. The most innovative utilities and industries around the world, including mining, marine, offshore and nuclear, use Raychem power cable accessories. Designed to withstand environmental extremes and high pollution levels over long operating lifetimes, our products maintain service reliability in both overhead and underground installations.

The product line includes indoor and outdoor terminations, inline, branch and transition joints as well as universal insulation, sealing and repair systems for use in the cable networks. Tailored for the applications we offer different technologies such as heat-shrink, push-on, pre-expanded, resins and gels. Based on our experience in the materials and design of cable accessories we can provide a product, which can be easily installed and is perfectly adapted to the application in local cable technologies, network systems and installation processes.

#### Test and qualification

TE Energy cable accessories are designed and tested to meet the international standards IEC, CENELEC and IEEE as well as the local specifications *BS, CSN, GOST, MSZ, PN, STN, STR, VDE* etc. as far as applicable.

The currently relevant international standards tested to are:

- EN 50393:2006 - Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV.
- HD629.1.S2:2006 - Test requirements on accessories for use on power cables of rated voltages from 3,6/6 (7,2) kV up to 20,8/36 (42) kV.  
Part 1: Cables with extruded insulation.
- HD629.2.S2:2006 - Test requirements on accessories for use on power cables of rated voltages from 3,6/6 (7,2) kV up to 20,8/36 (42) kV.  
Part 2: Cables with impregnated paper insulation.
- EN 61442:2006 - Test methods for accessories for power cables with rated voltages from 6 kV ( $U_m = 7,2$  kV) up to 36 kV ( $U_m = 42$  kV).

#### Voltage definition

$U_O/U (U_m)$  as referred to in IEC and CENELEC standards:

$U_O$  is the rated power-frequency voltage between phase conductor and earth or metallic screen for which the cable accessory is designed,

$U$  is the rated power-frequency voltage between phase conductors for which the cable accessory is designed,

$U_m$  is the maximum value of the 'highest system voltage' for which the cable accessory may be used.

#### Voltage ranges

To cover all typical voltages in distribution networks, TE Energy tests cable accessories to the highest sets of rated voltages: 3,8/6,6 (7,2) kV; **6,35/11 (12) kV**; 8,7/15 (17,5) kV; **12,7/22 (24) kV**; 19/33 (36) kV; **20,8/38,5 (42) kV** and higher voltages.



## General

### Customer Support



### Seminars, Trainings

Even the best technology can be applied in a wrong way. To avoid such situations, TE has established a technical support service to provide technical information and application guidelines for its customers, such as cable fitters, project and maintenance engineers, constructors, equipment manufacturers as well as specification and purchasing engineers.

A sound and practice oriented range of customer support is provided:

- presentations and seminars,
- technical papers focusing on new industry trends and products,
- training in cable preparation, installation techniques and product selection for engineers and installers,
- practical demonstrations and field installations,
- individual solutions to specific customer's problems.

### Installation



No special tools are required for the cable preparation. The installation of the Raychem cable accessory is easy and independent from the used technology. The Raychem accessories can be put into operation immediately after their installation. The cable accessory is supplied in a kit with all necessary components including installation instruction in a local language.

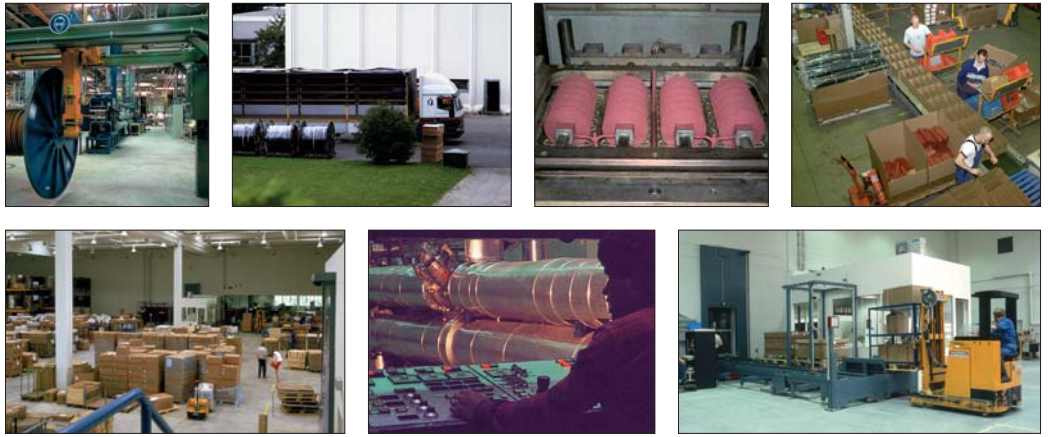
For instance, upon delivery of a heat-shrink accessory kit all individual parts are stretched such far that they can be easily slid over the prepared cable end. They shrink, when sufficiently heated, and firmly enclose the cable and protect it against moisture, while the adhesive melts and fills all grooves and voids. Raychem heat-shrink cable accessories are constructed in a similar way to the cables themselves and can, like these, be bent in narrow spaces.

Terminations are designed for simple upside-down installations by turning the heat-shrinkable sheds.



## General

### Manufacturing and Logistics



#### Global manufacturing and Efficiency

TE Energy with its manufacturing sites around the world produces to global requirements and global manufacturing systems. TE Energy sites combine economical and in-time manufacturing with high quality products.

#### Availability

To improve the availability of products TE Energy continuously monitor delivery performance and lead times, look for opportunities to shorten cycle times and enhance services. This constant worked on process is directed towards our goal: complete customer satisfaction.

#### Kit content

All Raychem cable accessory kits contain the necessary components for the installation like electrical insulation materials, installation instructions and a bill of material. The mechanical cable lugs and the connectors are included in the kits unless otherwise stated, solderless earth connections are either included in the kits or can be ordered separately.

### Quality Standards, Environment, Health and Safety



#### ISO 9001, ISO 14001

The quality standards of all materials throughout the entire manufacturing process beginning with the raw materials and continuing through to the packaged product are continuously monitored and documented. Materials as well as complete Raychem accessories are regularly re-qualified. As a result of our well established Quality Management System including quality assurance, TE Energy continuously achieves re-certification according to ISO 9001 and also to ISO 14001.

#### RoHS, REACH

TE is committed to compliance with all applicable environmental, health and safety laws also to the protection of our employees and the environment. These efforts have been driven by directives as the "Restriction of Hazardous Substances" (RoHS) and "Registration, Evaluation and Authorization of Chemicals" (REACH), which requires the substantial elimination of lead, cadmium, hexavalent chromium, brominated flame retardants and mercury from the products. We have been one of the first companies which implement the RoHS and the REACH directives into the manufacturing process.

#### Reduction of packaging material

The usage of only ecologically sound and recyclable components, the continuously reduction of packaging materials and saving energy are other initiatives to support the effort of environmental protection.

### Heat-shrink Technology



#### General

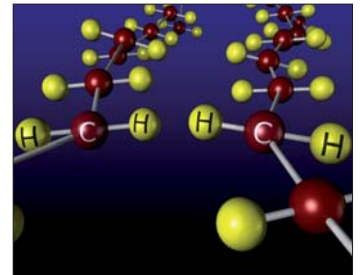
Heat-shrinkable products are supplied in the expanded form to a customer in a kit together with all other components needed for successful installation of the cable accessory. During an installation the tubing shrinks down to a cable construction underneath and builds up a high pressure resulting in very good sealing and excellent electrical behavior.

#### Properties of Raychem products

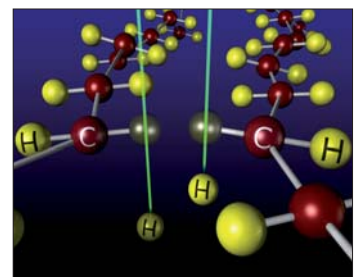
The Raychem heat-shrink technology is based on specially formulated thermoplastic polymer materials. The compounds for these materials are designed, selected and mixed in TE own compounding factories. Sophisticated process controls during extrusion, cross-linking and expansion ensure uniform wall-thickness before and after installation. TE cross-linked materials show mechanical and chemical resistance as well as exceptional electrical and weathering performance. Other advantages of our heat-shrinkable products are the excellent ageing characteristics and the unlimited shelf life.

#### Cross-linking process

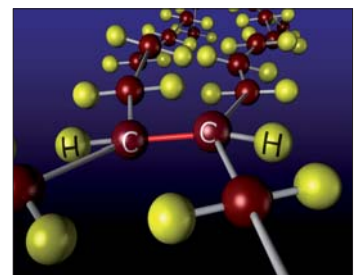
Thermoplastic polymer materials are composed of extremely long, very thin molecules in a random arrangement. The strength of such a material depends upon the distance between its molecules and the crystalline nature of its molecular structure. As the material is heated, these crystals disappear. The molecules can then slip past each other easily and the material flows. While in this heated condition the material may be formed into almost any desired shape. Then, when the material is subsequently allowed to cool, the crystals reform and again provide substantial strength to retain the polymeric in the shape in which it has been formed.



With the introduction of atomic energy, the important discovery was made that the exposure of some polymeric materials to high-energy electron beams can cause the permanent cross-linking, or intermolecular joining, of adjacent molecules. This cross-linking results in the chemical bonding of the polymeric structure into a new three-dimensional system.



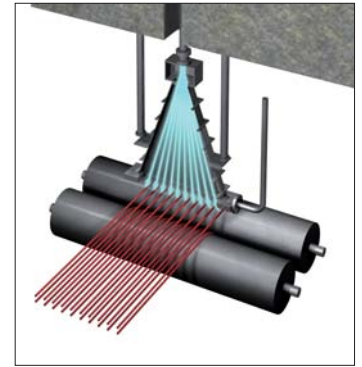
Once the material has been cross-linked, it will not melt or flow at any temperature. When the material is heated, the crystals still disappear as before, but it will no longer flow or change shape because the cross-links act as ties between the molecules. The cross-linked structure, however, is elastic. Thus, when it is heated to a temperature where the crystals have melted, the material behaves like rubber.



## Technologies

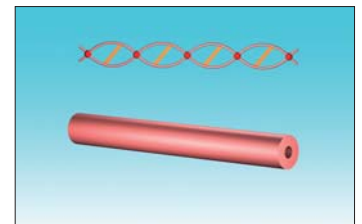
### Cross-linking with electron-beam

Cross-linking by electron-beam was pioneered by Raychem and is still the most commonly employed method. Other methods are cross-linking with a radioactive source like Cobalt or with chemicals. Not being properly controlled they could cause harm for people, environment and material based on the aggressive ingredients which are responsible for the cross-linking process.

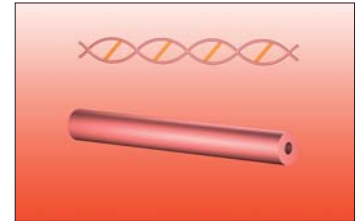


### Expansion process

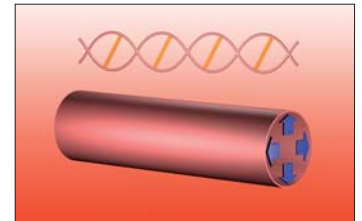
Beaming the tubing causes permanent cross-linking of adjacent molecules. The graphic is an enlarged schematic view of a very small cross-linked section of extremely long molecules and an end view of a piece of heat-shrinkable tubing.



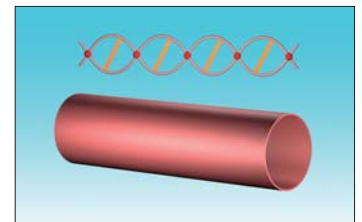
Once the tubing has been cross-linked, the next step in imparting shape memory is to heat the compound above its crystalline melting point. The molecules are then tied together only by the cross-links.



While hot, the tubing is deformed by applying pressure, thus stretching the cross-linked molecule. Long-term experience in process know-how is required to avoid eccentricity and longitudinal shrinkage of the tubing.

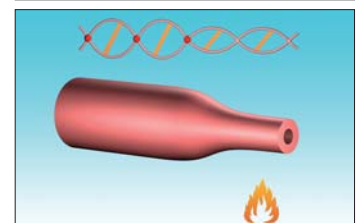


While in this deformed position, the tubing is cooled; the crystals then reappear, thereby locking the structure together in this deformed condition indefinitely. This is the form in which tubing is supplied to customers and can be stored without shelf life limitations.

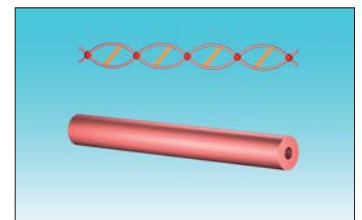


### Shrinking process

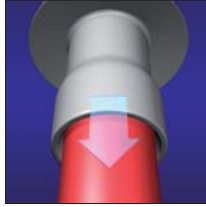
During installation the tubing is heated, melting the crystals. The cross-links allow the material to return to its original shape.



After cooling, the crystals reform and the tubing is locked in its recovered form.



### Push-on



#### General

Products of this technology are stored and supplied unexpanded. These products are pushed on a prepared cable during their installation. Sometimes special tools might be required for this action. Being pushed and installed materials stay expanded. Different silicones and more rigid EPDM are employed for push-on technology. The more flexible material is used, the installation becomes easier and the application range becomes wider. Materials used for this technology are susceptible for mechanical damage.

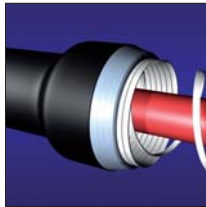
#### Properties of Raychem products

The art combining high flexibility with split & tear and weathering performance were utilized in TE Energy push-on materials. TE Energy produces push-on cable accessories of a cross-linked, highly-flexible silicone body, which ensures easy and tool-free installation. Raychem products are designed to ensure no slippage from the cable during the all operation conditions. The accessories have exceptional electrical and weathering performance and they are resistant to UV-light, contamination, track and erosion.

Raychem push-on cable accessories have the unlimited shelf life and do not required any special tools for their installation, which should be performed at ambient temperature above 0 °C. The accessory body is pushed onto the prepared cable up to the correct position and builds up a high pressure for a reliable sealing, stable positioning and of course excellent electrical behavior after the installation.



### Pre-expanded



#### General

Pre-expanded technology is similar to the push-on technology with the difference that the elastomeric body is pre-expanded on a holdout. Due to the required higher expansion rates more flexible materials with high tear resistance are needed. Silicone materials with different softness and the more rigid EPDM are used for pre-expanded technology.

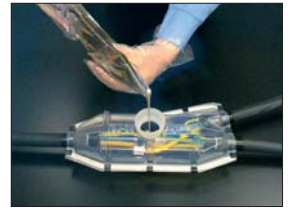
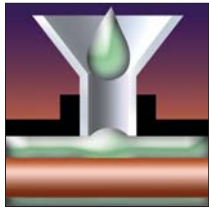
All materials exhibit tension set (less shrinkage behavior) over time, which limits the application range and the storage time. To ensure sufficient pressure for electrical and mechanical sealing purposes, the tension set must be considered when the application range is defined.

#### Properties of Raychem products

The cross-linked, high flexible silicone body is expanded on a robust holdout, which prevents the products from premature deform and collapse. Long-term performance of this type of cable accessory depends on its correct positioning, which is easily controllable and adjustable during the installation within TE products. The installation itself should be performed at ambient temperature above 0 °C. Raychem accessories are designed to be used with mechanical connectors and lugs and are adapted for all commonly employed cable screens. The accessories have exceptional electrical and weathering performance and they are resistant to UV-light, contamination, track and erosion. Raychem pre-expanded cable accessories have a shelf life of 24 months after manufacturing.



## Resin



### General

Filling materials consist of two resin components supplied separately from each other e.g. in bags or cans. During an installation the components are mixed together and poured into joint's housing for curing.

Polyurethane or epoxy materials, emerge by cross-linking of a resin with a reactive isocyanate or polyamine hardener, were very often used in the past. The exothermal hardening process produces heat and the materials could be dangerous and hazardous for the health and the environment due to included isocyanates or bisphenols. After cross-linking most mixtures become a solid plastic material.

### Properties of TE Energy GUROFLEX material

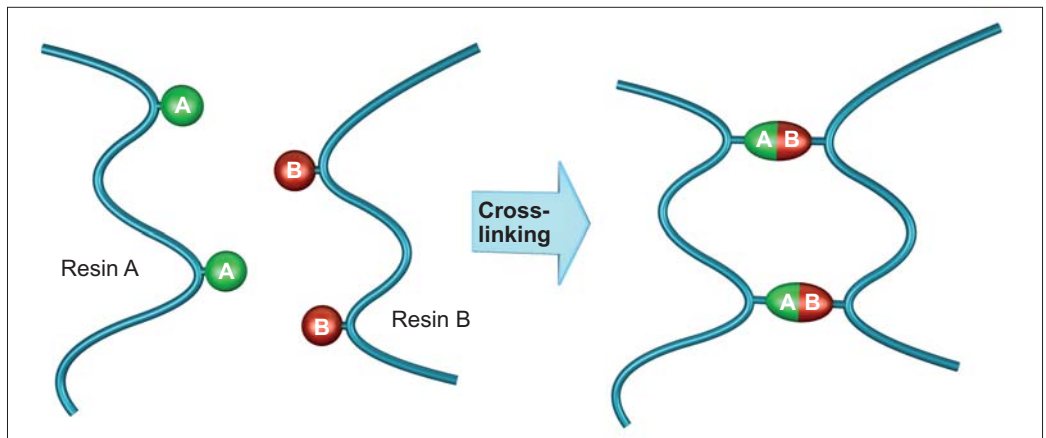
To reduce a health risk and allow installations at low temperatures TE Energy has developed the GUROFLEX casting material consisting of 2 isocyanate-free resin components. Upon mixing the two components are cross-linked with each other by a non-exothermal process. Cross-linked GUROFLEX resin adheres to nearly all cable materials and stays elastic.

The material exhibits excellent insulation properties and also accommodates thermal expansions of insulated cables. GUROFLEX resin covers and adheres to metal components, protects them from corrosion and is re-enterable after the installation.

The installation of GUROFLEX resin is possible at the temperatures as low as -10 °C and in service it is resistant to the temperatures below -20 °C.

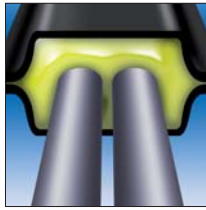
GUROFLEX resin is easy to handle because it is not subject to any safety classification during use, transportation or disposal. The material is environmentally friendly, non-toxic and non-hazardous but has, like all other resin materials, a shelf life of 24 months after manufacturing.

### GUROFLEX non-exothermal cross-linking



## Technologies

### Gel

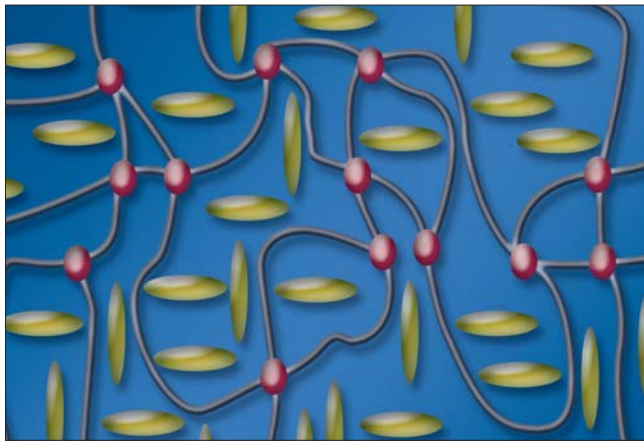


### General

Gel technology is used in low voltage applications. The housing of supplied accessory is filled with the gel already from a factory. The cable connection area is positioned in the middle of the opened joint housing and slightly pressed into the gel together with appropriate connectors. The installation is completed by closing of the housing. The installed accessory can be put immediately into the service.

### Properties of Raychem PowerGel

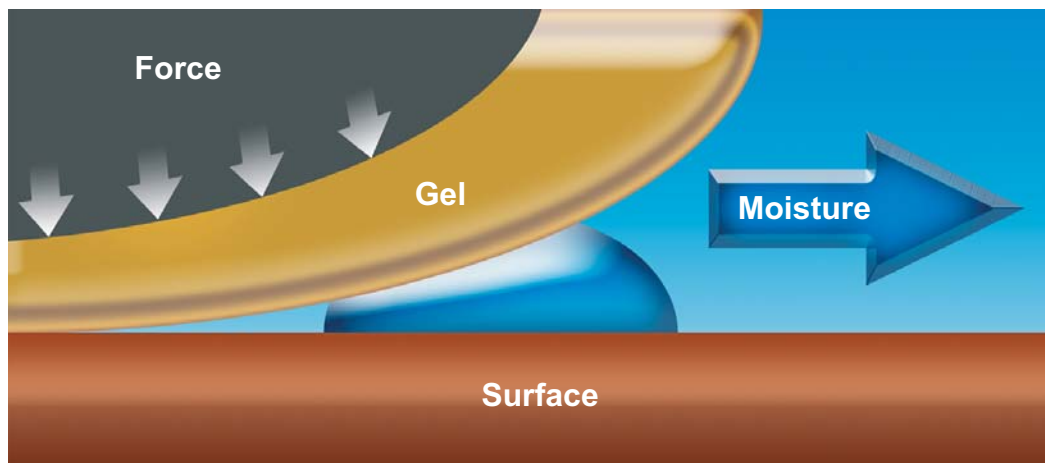
Raychem PowerGel is especially developed for electrical applications from  $-40\text{ }^{\circ}\text{C}$  to  $+90\text{ }^{\circ}\text{C}$  continuous temperature. PowerGel consists of silicone oil embedded in a cross-linked silicone matrix, which combines the advantages of solid (elastic memory) and liquid (wetting and conforming to a surface) sealing materials.



Excellent insulation properties, thermal and UV stability also halogen-freeness are features of Raychem PowerGel just like the unlimited shelf life, the excellent dielectric properties and the extremely high elongation and elasticity. Raychem accessories using PowerGel are suitable for polymeric cables in indoor or outdoor applications with possibility of underground, direct buried or immersion in water.

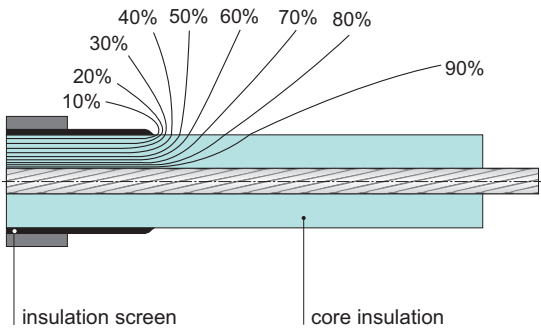
### Moisture displacing

Raychem PowerGel displaces possible moisture, wets and prevents the metal surface from corrosion by applying a thin layer of silicone oil on it.



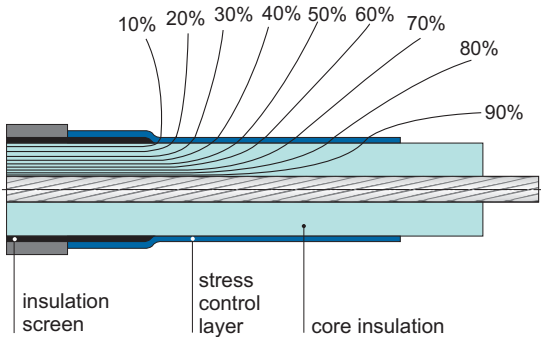
## Electrical stress control in cable accessories

### Uncontrolled electrical field at the end of the cable



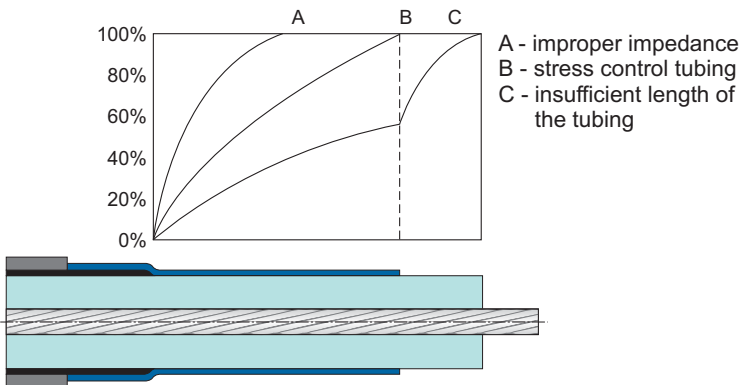
The outer conductive layer of the cable is removed at the cable's end and forms a sharp edge resulting in a high electrical stress indicated by the narrow equipotential lines. If this area is not treated with an effective stress control system then it will lead to electrical discharges with material ageing. Also voids inside or in between insulating materials can cause such discharges. These "partial" discharges cause a failure of the dielectric well before its intended service life has been reached. In addition, the stress at the screen end is high enough that even the smallest notch can cause a breakdown.

### Electrical field with a stress control system (tubing or coating)



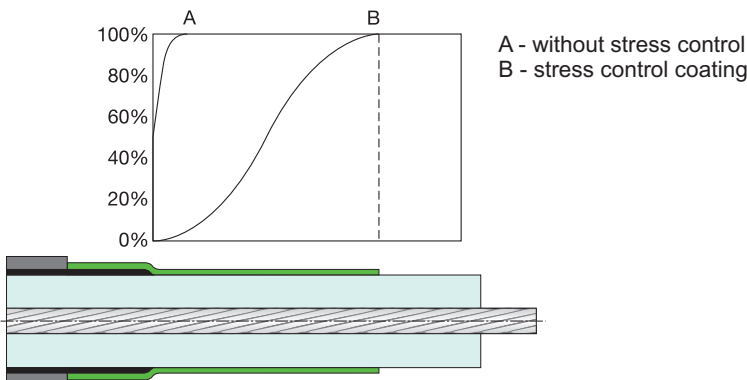
Raychem medium voltage cable accessories include stress control coatings or tubing with a carefully controlled volume resistivity and permittivity to smooth out the high stress. The electrical field strength at the end of the screen cut is reduced to a level well below the upper limit for long term operation. This slim stress control system can be used on a variety of cable types, including paper cables, and accommodates variations of cable dimensions.

### Technology of semi-conductive stress control material



The non-linear impedance of the stress control tubing avoids an increase of the amplitude. The stress is distributed over a longer control area (B). This is based on the interaction between the resistive components of the applied coating and the capacity of the cable insulation. By an improper selection of the materials the impedance would lead to an unacceptable steep voltage rise at the screen end (A). Reducing the length or wrong positioning results in discharge at the tubing end (C). All Raychem cable accessories take these effects into account.

### Technology of non-linear stress control material



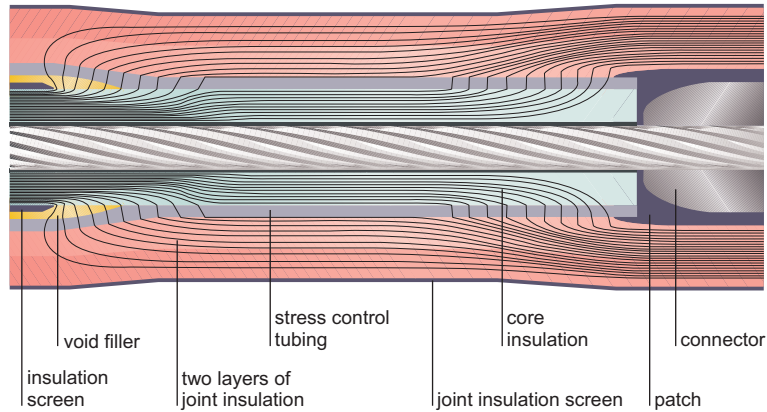
The stress control base material is enriched with zinc oxide (ZnO) and it has insulating characteristics up to a specific voltage. The material behaves similar to a varistor and becomes conductive if the field strength is higher than a certain switching point. The resulting voltage distribution allows a short termination length while the electrical stress at the screen end area is kept low. Higher voltage load does not result in higher amplitude of the electrical field strength but only the control area will become longer.



## Material Properties

### Stress distribution inside Raychem joint

The stress control tubing contacts and overlaps the screen at each end of the joint and controls the stress at these areas in the same way as in terminations. Together with the high permittivity yellow void filler, the stress control tubing distributes the equipotentials thus reducing the electrical stresses at the end of the connector. The two layers of insulation bonded to the outer conductive layer have a thickness designed to the rated voltage of the joint and prevents any interfacial discharge. The stress control system and the selected materials of this joint makes it unnecessary to chamfer the cable insulation or to use a connector with specially profiled shape.



## Weathering and ageing resistivity

### Properties

The performance of Raychem cable accessories is the result of the interaction between material formulations, product design, the manufacturing process and correct selection for the application. The excellent behaviour of Raychem insulation materials for low, medium and high voltage cable accessories is achieved by the special formulation adapted to product and application. Chemical components included in the material work as fire extinguisher and avoid the building of tracking. Raychem materials for outdoor applications resist weathering processes like contamination, UV-light, dust and have long time stability even in the most severe environments.

### Testing

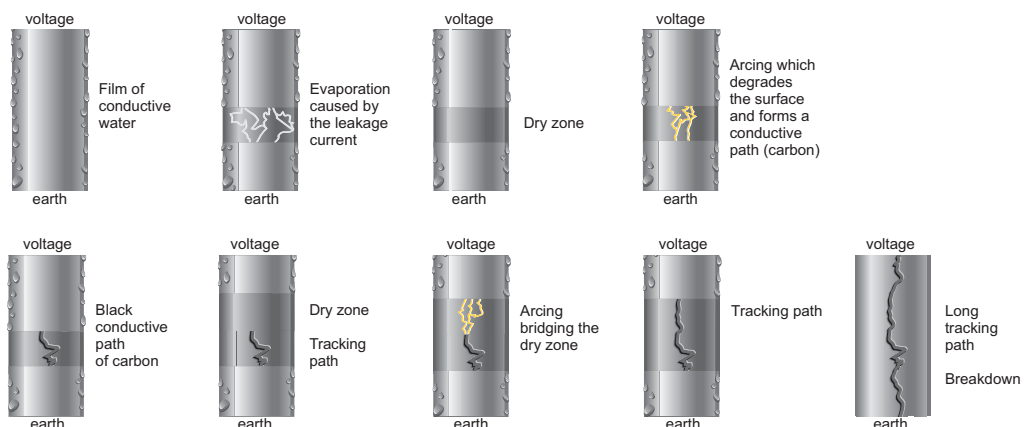
To evaluate the lifetime performance of different materials and designs TE Energy regularly perform listed tests:

- Tracking and Erosion Resistance Test (TERT) according to IEC 60587
- Humidity Test according to IEC 61442
- Salt fog Test according to IEC 61109
- UV resistance test according to ISO 4892

The Tracking and Erosion Resistance Test (TERT) show the appearance of tracking or erosion on material samples by periodically increased contamination and voltage. In the other tests the complete products are stressed with humidity, salt fog or intensive UV light and tested afterwards.

### Tracking and Erosion

Tracking or erosion can occur when leakage currents are developed in wet conditions on contaminated material. Under certain environmental conditions, these leakage currents can deteriorate the surface of the outer material by building tracking paths or by erosion. Both would finally lead to a failure of the product by breakdown, in which tracking is a fast process (minutes) and erosion is a slow process (years).



The graphics describe the appearance of tracking. The appearance of erosion is similar but instead of a path the erosion reduces the material.

### Raychem Low Voltage Jointing System

The Raychem low voltage jointing system for mechanical or crimp connectors is widely used and acknowledged as a highly dependable and easy-to-install jointing method for 3- and 4-core paper cables and also for 4- and 5-core polymeric insulated cable types.

The principle of the construction and the simple way of installation are described on a joint for 0,6/1,0 (1,2) kV polymeric insulated cables.

#### Installation

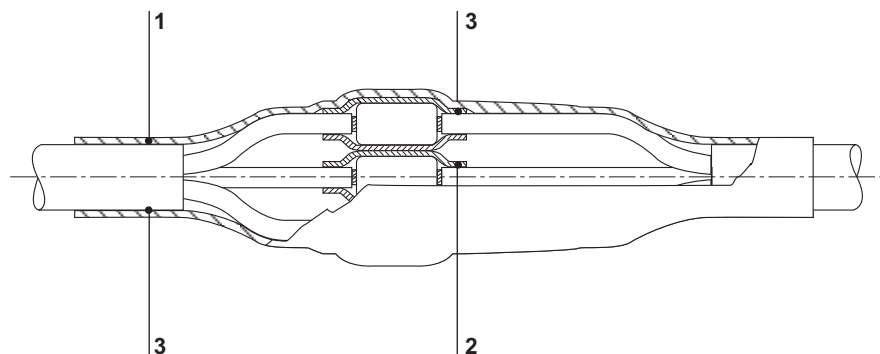
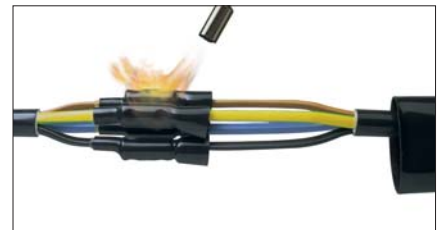
The cable ends are prepared according to the installation instruction, the smaller inner tubing and the outer tubing are slipped over the cores and the conductors are connected with mechanical or crimp connectors. All joints are designed to allow crossing of the cable cores.

The inner tubing are positioned over the connectors and shrunk down. They fit tightly and the wall thickness is adapted to the core insulation even over bulky mechanical connectors. The adhesive in the pre-coated tubing seals out moisture and corrosion and conforms to the thermal expansion of the cable.

The mechanical and sealing functions of the oversheath are assured by a thick-wall tubing positioned over the jointing area and shrunk. A durable and repeatable seal is produced by means of a hot-melt adhesive pre-applied to the entire length of the tubing.

The joint is complete and can be put into operation immediately.

Joints for paper insulated cables with steel tape armour have a similar design as joints for polymeric insulated cables. The kits include additional solderless earth connections for the lead sheaths and a neutral connection system if required.



#### Construction

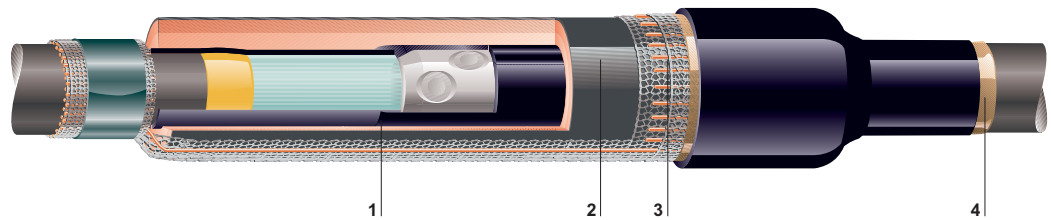
**1 Outer tubing:** Thick-wall protection against mechanical stresses and against moisture by sealing onto the oversheath.

**2 Inner tubing:** Thick wall tubing providing electrical insulation and protection of the connection area against moisture inside the cable.

**3 Hot-melt adhesive:** Perform a durable and repeatable sealing.

### Raychem Medium Voltage Jointing System

The design of a single-core joint for a polymeric insulated cable is described here. The same design principles are used for 3-core cables. For transition joints, special oil barrier tubing are used to transform a draining oil (MI) as well as non draining oil (MIND) paper insulated cable into a quasi polymeric insulated cable with a radial field.



#### Product design

##### 1. Electrical stress control

The stress control tubing and the patch have a precisely defined impedance characteristic which smooths the electrical field over the connector and cable screen ends. During the installation of 12 kV and 24 kV joints, the special void filling yellow tape will be compressed by the two stress control tubing. The patch over the connector will be compressed by the high shrink force of the triple extruded joint body. For the design of a 42 kV joint only the special yellow void filling tape is used, which is compressed by one stress control tubing. It is not necessary to chamber the cable insulation or to use a connector with specially profiled shape.

##### 2. Insulation and screen

The triple extruded joint body provides the correct thickness of insulation (red) in one installation step. The insulation screen is provided by the outer wall of the tubing, which is of heat-shrinkable conductive polymer (black). This technique saves installation time and ensures a flawless bond between joint insulation and screen, even up to 42 kV.

##### 3. Metallic shielding

Copper mesh and roll springs ensure the correct screen connection across the joint area and make electrical contact with the outer screen of the joint. The design passed tests up to 11 kA short circuit and up to 400 A currents simulating ground fault situation.

##### 4. Outer sealing and protection

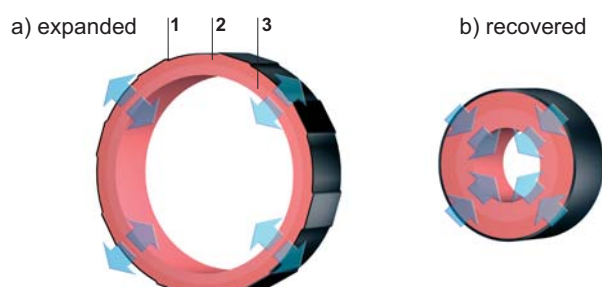
The heat used to shrink the outer tubing causes the pre-coated adhesive to melt and flow, resulting in a lasting moisture and corrosion barrier on the cable oversheath. The outer tubing provides mechanical impact and chemical resistance as expected from cable oversheaths. For armoured cables, Raychem joints incorporate either a quick to install galvanised steel joint case or steel tape or fibre glass reinforced heat-shrink wraparound.

#### Installation procedure

The elastomeric joint component and the outer sealing tubing are slid over the prepared cable end. The screen ends are electrically smoothed with void filling compound and stress control tubing are shrunk over the cable ends. By simply tightening the bolts of the mechanical connector, the conductors are jointed and then covered with a stress control patch. The elastomeric component is quickly shrunk over the connection area. Roll springs and copper mesh rebuild the cable shield and the oversheath is replaced by an adhesive-coated sealing tubing. All kits are supplied with illustrated step by step instructions.

#### Triple extruded elastomeric technology

The triple extruded joint body, supplied in an expanded form, consists of 3 bonded layers, see picture a) below. The two heat-shrinkable outer layers (1. black conductive, 2. red insulating) hold the inner elastomeric layer (3. red insulating) at full diameter. Application of the heat causes the outer layers to shrink, allowing the elastomeric, insulating layer to contract at the same time and closely fit on the jointing cable. Elastomers typically experience a reduction of the contraction force after storage and at cold temperatures. By applying heat this effect is overcome thus allowing an unlimited storage time and installations at low temperatures. The rubber-like characteristics of the insulation material combined with the rigid outer heat-shrinkable wall enable the joint to follow the thermally induced dimensional changes of the cable insulation.

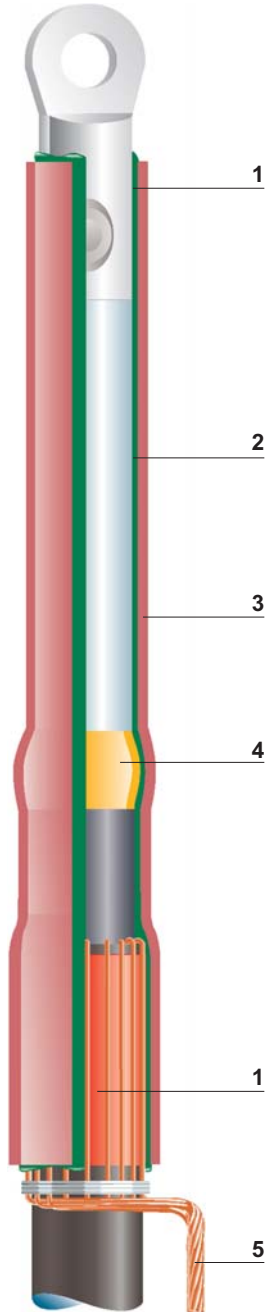


### Raychem Medium Voltage Termination System

Raychem accessories provide a universal system of indoor and outdoor terminations for paper or polymeric insulated cables, for single or three core cables, for cables with round or sector shaped conductors and most types of screening or armouring. The termination's materials possess exceptional resistance to prolonged electrical stress and weathering, but are also capable of being shrunk down quickly to fit and seal a cable.

#### Product design

The typical modules of a modern medium voltage termination:



#### 1. Moisture sealing

Durable sealing is achieved by special Raychem sealants on the inside of non-tracking, weather-resistant components. By applying heat on the components, the shrinking action of the tubing causes the hot-melt sealant to flow into place.

In case of three core cables, a sealant-lined heat-shrinkable breakout installed over the cores and cable crutch provides a sealed and weather-resistant surface from the terminating lugs to the cable oversheath.

#### 2. Compact and versatile stress control

To meet the need for space-saving, flexible termination design, adaptable to different types of compact equipment, TE Energy has developed a material with carefully controlled non-linear impedance based on ceramic semiconductor technology (ZnO), applied as coating inside the tubing. The stress control coating is softened by the applied heat and conforms and bonds to even irregular insulation surfaces to ensure a void free contact.

#### 3. Non-tracking insulation tubing

The superior non-tracking characteristics and long-term erosion resistance of Raychem terminations have been exhaustively demonstrated in comparative tests at major independent laboratories and TE Energy's own extensive development facilities. These results are borne out by the continuing performance of over a million units installed in tropical, desert, arctic and industrially polluted climates, confirming that Raychem terminations do not track even in severe service conditions and verifying their exceptional erosion resistance and reliability.

#### 4. Stress grading void filler

The void filler is easily applied in form of a short adhesive tape. It ensures that, independent of the type of semi-conductive screen or removal method, no air voids can cause discharges in the high stress area of the screen end.

#### 5. Earthing

Earthing wires or braids are imbedded in the sealing mastic to prevent any corrosion by moisture ingress. For cables with tape screen or metal sheaths with armour solderless earthing systems are either provided within the termination kit or can be ordered separately.

### Raychem Medium Voltage Connection System

The Raychem connection systems fulfil all major requirements for MV gas-insulated switchgears and transformers used in modern substations and industry facilities. With several decades of experience in the field, the systems are watertight and guarantee uninterrupted operation, even under extreme operation conditions with severe pollution. TE Energy is able to supply a connection system for different voltages, rated currents, for cables with either paper or polymeric insulation and for outer cones as well as for the inner-cone bushing system.

#### Bushing types

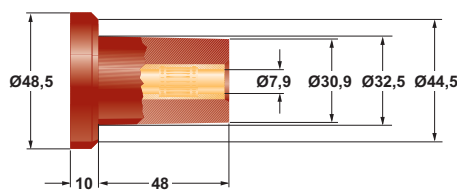
In the most cases switchgears of varied suppliers and some transformers are connected into the network through the outer cone bushing profile according to CENELEC HD 506S1, EN 50180 and EN 50181 type C<sub>1</sub> or C<sub>2</sub> (630 A or 1250 A), type B (400 A) and type A (250 A).

Only few primary types of switchgear in the market are equipped with inner cone bushings.

#### EN 50181 bushing type A (250 A)

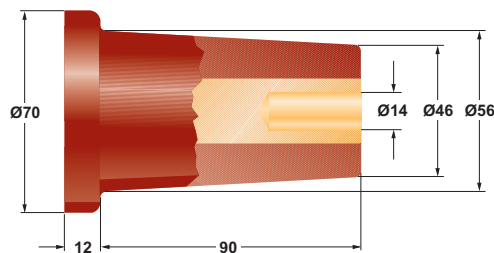
The RSES-52xx and RSSS 52xx screened connection systems with 250 A current-carrying capacity is a push-on termination for polymeric insulated cables, designed for the connection between the switchgear and the transformer.

All dimensions in mm



#### EN 50181 bushing type B (400 A)

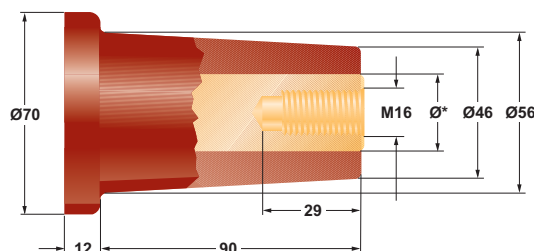
The RSES-64xx screened separable elbow connection system with mechanical lugs are designed to connect 1- and 3-core polymeric cables to medium voltage gas insulated switchgear and other equipment using bushing type B, specified for 400 A, up to 42 kV.



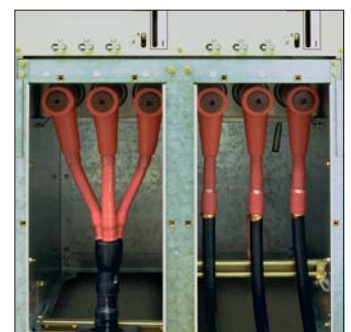
#### EN 50181 bushing type C<sub>1</sub> (630 A) or C<sub>2</sub> (1250 A)

The RICS and RCAB insulating adapters designed for bushing of both C types are compatible with all Raychem terminations and can thus be used to connect any type of cable up to 24 kV, irrespective of whether it is paper or polymeric insulated or has one or three cores.

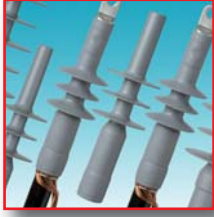
The RSTI screened connection system is designed to connect single- and three-core polymeric insulated cables on to switchgear's bushing of both ratings C<sub>1</sub> and C<sub>2</sub> up to 42 kV.



\* = 22 for type C<sub>1</sub>  
= 32 for type C<sub>2</sub>



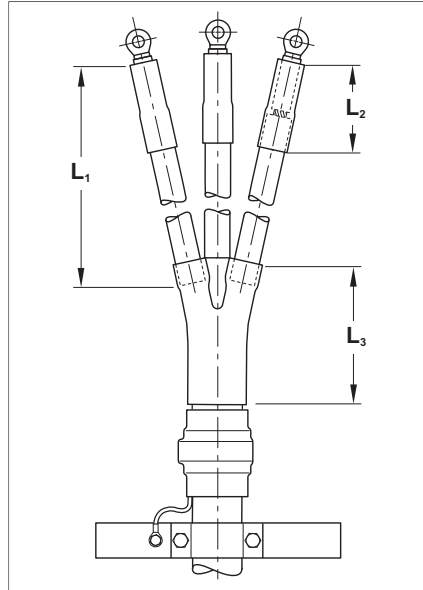
# Terminations



## Terminations – Low and Medium Voltage

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## Terminations for polymeric insulated cables 1 kV



Dimensions  $L_2$ ,  $L_3$  see table on the next page;  $L_1$  depends on the requirement of a relevant installation

### Cable

The terminations are designed for 3-, 4- and 5-core polymeric insulated cables with or without armour. For example: AYKY, CYKY, N(A)YC(W)Y, NA2X2Y, E-A2X2Y.

### Design of terminations

The cable crutch is sealed by an adhesive lined heat-shrinkable breakout, which is installed over the cores and the end of the oversheath. Heat-shrinkable tubing seal between the cable lug and the end of the core insulation. For single core cables only a lug sealing tubing is needed. All materials are resistant to UV-light and weathering.

A solderless earth connection system consisting of a roll spring and an earth braid is included in terminations for armoured cables.

In case UV-light protection of the core insulation is required, the EN-CGPT insulating tubing can be ordered separately. All terminations can be ordered as complete kits or as components.

Kits with the modification code -L12 include mechanical lugs with a busbar connection hole for M12 connection bolts.



## Terminations for polymeric insulated cables 1 kV

### Complete terminations for polymeric insulated cables including mechanical lugs

Cross section (mm <sup>2</sup> )	Ordering description cables without armour	cables with tape armour	Dimensions (mm)	
			L <sub>3</sub>	L <sub>2</sub>
<b>3- and 4-core polymeric insulated cables</b>				
25 - 70	EPKT-0031-L12	EPKT-0031-L12-CEE01	165	100
50 - 150	EPKT-0047-L12	EPKT-0047-L12-CEE01	215	100
120 - 240	EPKT-0063-L12	EPKT-0063-L12-CEE01	220	150
<b>5-core polymeric insulated cables</b>				
35 - 70	POLT-01/5X 35- 70-L12	POLT-01/5X 35- 70-L12-CEE01	165	100
70 - 120	POLT-01/5X 70-120-L12	POLT-01/5X 70-120-L12-CEE01	215	100
150 - 240	POLT-01/5X150-240-L12	POLT-01/5X150-240-L12-CEE01	220	150

**Note:** For 3-core cables the concentric neutral wires are sealed with sealing tape S1052-1-500 (length needed per termination approximately 50 mm) and insulated with MWTM tubing. Sealing tape S1052 and MWTM tubing have to be ordered separately.

### Complete terminations for polymeric insulated cables without lugs

Cross section (mm <sup>2</sup> )	Ordering description cables without armour	cables with tape armour	Dimensions (mm)	
			L <sub>3</sub>	L <sub>2</sub>
<b>3- and 4-core polymeric insulated cables</b>				
4 - 35	EPKT-0015	EPKT-0015-CEE01	95	50
25 - 70	EPKT-0031	EPKT-0031-CEE01	165	100
70 - 150	EPKT-0047	EPKT-0047-CEE01	215	100
150 - 400	EPKT-0063	EPKT-0063-CEE01	220	150
<b>5-core polymeric insulated cables</b>				
10 - 35	POLT-01/5X 10- 35*	POLT-01/5X 10- 35-CEE01*	95	50
35 - 70	POLT-01/5X 35- 70	POLT-01/5X 35- 70-CEE01	165	100
70 - 120	POLT-01/5X 70-120	POLT-01/5X 70-120-CEE01	215	100
150 - 240	POLT-01/5X150-240	POLT-01/5X150-240-CEE01	220	150

\* Kit include 4-core breakout; other kits include 5-core breakout.

**Note:** For 3-core cables the concentric neutral wires are sealed with sealing tape S1052-1-500 (length needed per termination approximately 50 mm) and insulated with MWTM tubing. Sealing tape S1052 and MWTM tubing have to be ordered separately.

### Breakout and tubing components for polymeric cable terminations

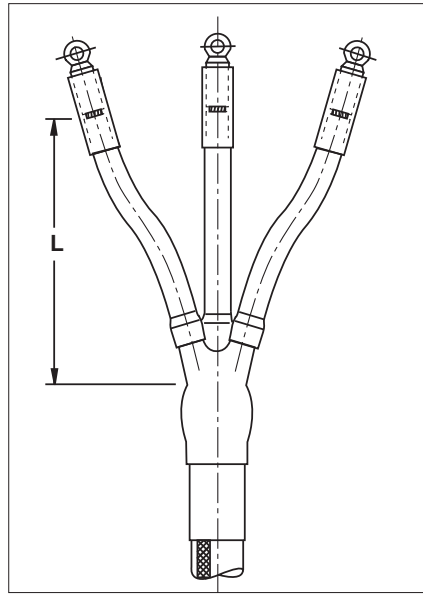
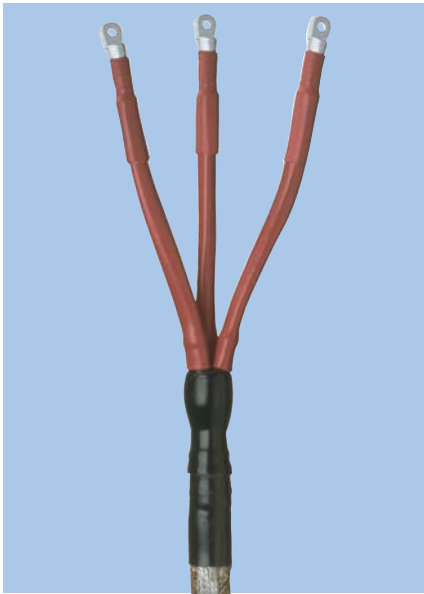
Cross section (mm <sup>2</sup> )	Ordering description		Cross section (mm <sup>2</sup> )	Ordering description Lug sealing tubing	Dimensions (mm)	
	Breakout	Insulating tubing*			L <sub>3</sub>	L <sub>2</sub>
<b>4-core polymeric insulated cables</b>						
1,5 - 10	502S013/S	EN-CGPT 9/ 3-0	1,5 - 10	MWTM-10/ 3- 50/S	60	50
4 - 35	502K033/S	EN-CGPT 12/ 4-0	4 - 35	MWTM-16/ 5- 50/S	95	50
25 - 95	502K046/S	EN-CGPT 18/ 6-0	25 - 70	MWTM-25/ 8-100/S	165	100
50 - 150	502K016/S	EN-CGPT 24/ 8-0	70 - 150	MWTM-35/12-100/S	215	100
120 - 400	502K026/S	EN-CGPT 39/13-0	150 - 400	MWTM-50/16-150/S	220	150
<b>5-core polymeric insulated cables</b>						
35 - 95	603W035/S	EN-CGPT-18/ 6-0	25 - 70	MWTM-25/ 8-100/S	180	100
50 - 150	603W040/S	EN-CGPT-24/ 8-0	70 - 150	MWTM-35/12-100/S	180	100
120 - 240	603W040-R01/S	EN-CGPT-39/13-0	150 - 240	MWTM-50/16-150/S	180	150

\* For outdoor terminations the cores can be protected against weathering and UV-light with the insulating tubing EN-CGPT.

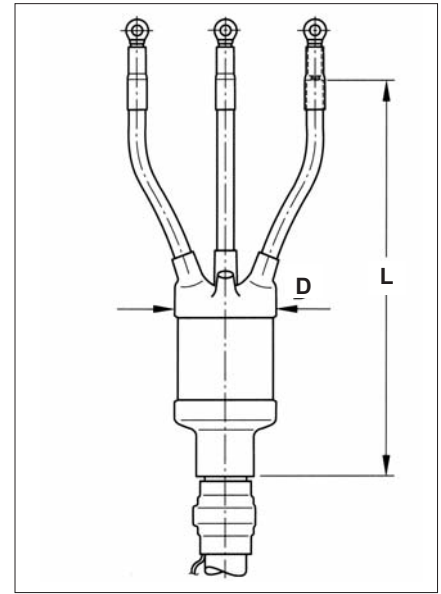
Tubing lengths depend on the local installation requirements, technical and ordering details of MWTM and EN-CGPT tubing see the chapter "Insulation tubing and repair tape". For single core cables only a lug sealing tubing is needed.

Terminations and components for other cable types are available on request.

## Indoor terminations for belted, paper insulated cables (MI and MIND) with one common metal sheath 6 kV and 10 kV



Dimension L see table (L min = 450 mm)



EPKT Termination only for MI cables

### Cable

The indoor termination is designed for 6 kV and 10 kV three core belted, paper insulated (MI, MIND) cables.

For example: SB, ASB, SAAB, AABY, ASBY, AABY, ASBY, СБ2лГ, АСБ2лГ, СБнГ, АСБнГ, АивВГ, ПвПГ, Кпу, КпFтly, АкпFтА, АкпFтy, АНКОР, АНКОРV, CNKOY, CNKODY, IPO 13, IPO 14, NPO 13, NPO 14, N(A)KBA, N(A)KLEY

### Design of termination

The paper cores are covered with oil barrier tubing. The crutch is filled with an oil resistive yellow mastic and is sealed

with an adhesive lined, conductive breakout which is installed over the cores and the end of the metal sheath. Yellow stress control mastic is laid around the ends of breakout fingers and the cores are covered with red, non-tracking tubing. The end of the termination is sealed either to the cable lug or to the solid conductor with a sealing boot. The kit includes a solderless earth connection. Kits with the modification code -L12 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -L16 for M16 bolts (note: M16 not available for kits with cross section 25–50 mm<sup>2</sup>).

### Design of oil filled terminations for MI cables

The cores are covered with brown, pressure-resistant oil-barrier tubing. A transparent oil pot with heat-shrinkable moulded parts seals onto the oil barrier tubing and the metal sheath. The pot has to be filled with regular cable oil (not supplied with the termination). Adhesive coated sealing boots ensure an oil tight sealing to the cable lug. Solderless earth connections can be ordered separately.

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description with cable lug*		Dimension L (mm)
			without cable lug**	
3,5/6 and 6/10	25– 50	GUST-12/ 25- 50/ 450-L12	GUST-12/ 25- 50/ 450	450
		GUST-12/ 25- 50/ 800-L12	GUST-12/ 25- 50/ 800	800
		GUST-12/ 25- 50/1200-L12	GUST-12/ 25- 50/1200	1200
	70–120	GUST-12/ 70-120/ 450-L12	GUST-12/ 70-120/ 450	450
		GUST-12/ 70-120/ 800-L12	GUST-12/ 70-120/ 800	800
		GUST-12/ 70-120/1200-L12	GUST-12/ 70-120/1200	1200
	150–240	GUST-12/150-240/ 450-L12	GUST-12/150-240/ 450	450
		GUST-12/150-240/ 800-L12	GUST-12/150-240/ 800	800
		GUST-12/150-240/1200-L12	GUST-12/150-240/1200	1200

\* For terminations with mechanical lugs for M16 bolts use modification code -L16 (not available for kits with cross section 25–50 mm<sup>2</sup>).

\*\* Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

**Note:** One termination kit includes material for 3 phases.

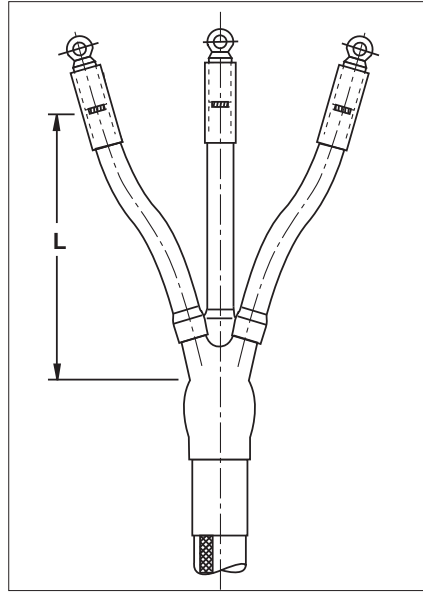
The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 450 mm.

### Termination only for MI cables

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description by length		Dimension D (mm)	Solderless earth connection
		L = 550 mm	L = 900 mm		
3,5/6	16– 35	EPKT-4541	EPKT-4543	101	EAKT-1668-DE01
	50–120	EPKT-4547	EPKT-4549	101	EAKT-1669-DE01
	150–240	EPKT-4559	EPKT-4561	125	EAKT-1670-DE01
	300–400	EPKT-4565	EPKT-4567	125	EAKT-1671-DE01
6/10	16– 35	EPKT-4541	EPKT-4543	101	EAKT-1668-DE01
	50– 95	EPKT-4547	EPKT-4549	101	EAKT-1669-DE01
	120–185	EPKT-4559	EPKT-4561	125	EAKT-1670-DE01
	240–300	EPKT-4565	EPKT-4567	125	EAKT-1671-DE01

**Note:** Longitudinally sealed cable lugs are not part of the kit and can be ordered separately. The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 550 mm. Solderless earth connection must be ordered separately, it consists of 2 roll springs, earth lead, protection tubing and sealing adhesive.

# Outdoor terminations for belted, paper insulated cables (MI and MIND) with one common metal sheath 6 kV and 10 kV



Dimension L see table  
 (L min = 450 mm for  $U_o/U = 3,5/6$  kV)  
 (L min = 800 mm for  $U_o/U = 6/10$  kV)

## Cable

The outdoor termination is designed for 6 kV and 10 kV three core belted, paper insulated (MI, MIND) cables.

For example: SB, ASB, SAAB, ASBY, AABY, AABY, ACBY, Kny, KnFtly, AknFtA, AknFty, ANKOP, ANKOPV, CNKOOY, CNKODY, ANKOY, IPO 13, IPO 14, NPO 13, NPO 14, N(A)KBA, N(A)KLEY

## Design of termination

The paper cores are covered with oil barrier tubing. The crutch area is filled with oil resistive yellow mastic and is sealed with an adhesive lined, conductive breakout which is installed over the cores and the end of the metal sheath. Yellow stress control mastic is laid around the ends of breakout fingers and the cores are covered with red, non-tracking tubing. The end of the termination is sealed

either to the cable lug or to the solid conductor with a sealing boot. The kit includes a solderless earth connection. Kits with the modification code -L12 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -L16 for M16 bolts (note: M16 not available for kits with cross section 25–50 mm<sup>2</sup>).

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description with cable lug*	with out cable lug**	Dimension L (mm)
3,5/6	25– 50	GUST-12/ 25- 50/ 450-L12	GUST-12/ 25- 50/ 450	450
		GUST-12/ 25- 50/ 800-L12	GUST-12/ 25- 50/ 800	800
		GUST-12/ 25- 50/1200-L12	GUST-12/ 25- 50/1200	1200
	70–120	GUST-12/ 70-120/ 450-L12	GUST-12/ 70-120/ 450	450
		GUST-12/ 70-120/ 800-L12	GUST-12/ 70-120/ 800	800
		GUST-12/ 70-120/1200-L12	GUST-12/ 70-120/1200	1200
150–240	GUST-12/150-240/ 450-L12	GUST-12/150-240/ 450	450	
	GUST-12/150-240/ 800-L12	GUST-12/150-240/ 800	800	
	GUST-12/150-240/1200-L12	GUST-12/150-240/1200	1200	
6/10	25– 50	GUST-12/ 25- 50/ 800-L12	GUST-12/ 25- 50/ 800	800
		GUST-12/ 25- 50/1200-L12	GUST-12/ 25- 50/1200	1200
	70–120	GUST-12/ 70-120/ 800-L12	GUST-12/ 70-120/ 800	800
		GUST-12/ 70-120/1200-L12	GUST-12/ 70-120/1200	1200
	150–240	GUST-12/150-240/ 800-L12	GUST-12/150-240/ 800	800
		GUST-12/150-240/1200-L12	GUST-12/150-240/1200	1200

\* For terminations with mechanical lugs for M16 bolts use modification code -L16 (not available for kits with cross section 25–50 mm<sup>2</sup>).

\*\* Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

**Note:** One termination kit includes material for 3 phases.

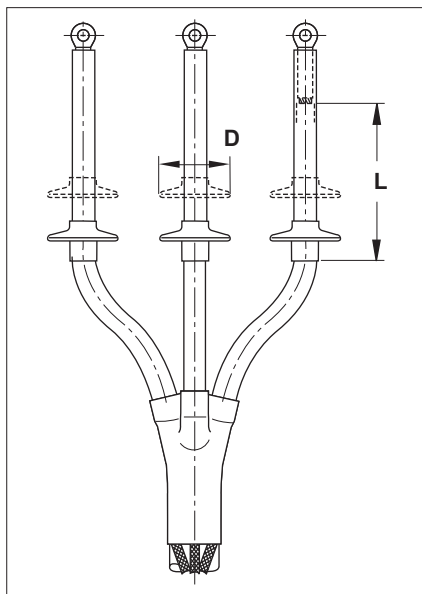
The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 450 mm for  $U_o/U = 3,5/6$  kV and 800 mm for  $U_o/U = 6/10$  kV.

Explanation of MI and MIND:

**MI** = Mass Impregnated = cable impregnated with draining compound

**MIND** = Mass Impregnated Non Draining = cable impregnated with non draining compound

## Indoor terminations for screened, paper insulated cables (MIND) with one metal sheath per phase 10 kV, 20 kV and 35 kV



Dimensions L, D see table

### Cable

The indoor termination is designed for 10 kV, 20 kV and 35 kV screened three and single core paper insulated cables (MIND) with one metal sheath per phase. For example: ЦАОСБУ, HAKnFtA, HAKNY, HknFty, AMKTQYPVsp., AMKTOYPVsp., AOSB, NPZO 13, NPZOP 13, NPZO 23.

### Design of termination

Yellow, oil resistant void filling tape is laid around the end of the metal sheath and the paper cores are completely covered with oil barrier tubing. An oil resistant sealing boot ensures a pressure tight seal to the cable lug. Short conductive tubing rebuilds the screen from the metal sheath to the covered paper core.

Yellow stress grading mastic is laid around the end of the conductive tubing and a stress control tubing is shrunk over the conductive tubing and the covered paper insulation. The end of the cores and the stress control tubing are insulated with non-tracking insulating tubing. Additional skirts are installed onto the tubing (see table). Solderless earth connections can be ordered separately.

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)		No. of skirts
			L	D	
6/10	35– 70	EPKT-24B1MI-CEE01	330	85	3 x 1
	95–240	EPKT-24C1MI-CEE01	330	95	3 x 1
12/20	35– 50	EPKT-24B1MI-CEE01	330	85	3 x 1
	70–185	EPKT-24C1MI-CEE01	330	95	3 x 1
	240–300	EPKT-24D1MI-CEE01	330	115	3 x 1
20/35	50– 95	EPKT-36C1MI-CEE01	430	95	3 x 2
	120–185	EPKT-36D1MI-CEE01	430	115	3 x 2
	240–500	EPKT-36E1MI-CEE01	430	115	3 x 2

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

### Solderless earth connection

Cross section (mm <sup>2</sup> )	Ordering description three core cables including breakout	single core cable with lead sheath	single core cable with AL sheath
		35–150	EAKT-1678
70–150	EAKT-1678	EAKT-1668-DE01*	SMOE-61832*
150–240	EAKT-1679	EAKT-1669-DE01*	SMOE-61832*

\* 3 Earth connection kits have to be ordered per termination kit.

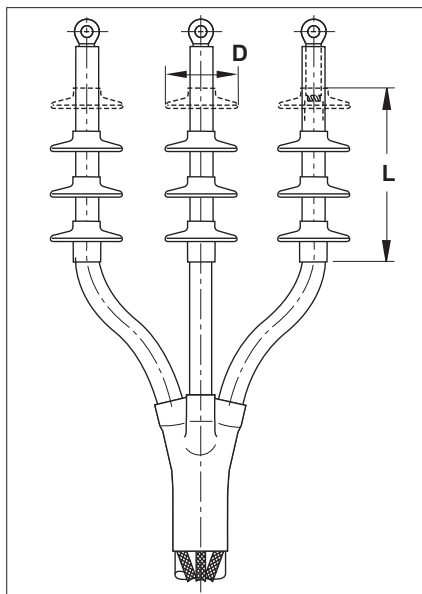
**Note:** The solderless earth connection kit must be ordered separately. The EAKT kit includes roll springs, earth leads, protection tubing and for three-core cables also heat-shrinkable breakout. The SMOE kit includes a Ligarex connection system (see also the chapter "Tools and Accessories").

Explanation of MI and MIND:

**MI** = Mass Impregnated = cable impregnated with draining compound

**MIND** = Mass Impregnated Non Draining = cable impregnated with non draining compound

## Outdoor terminations for screened, paper insulated cables (MIND) with one metal sheath per phase 10 kV, 20 kV and 35 kV



Dimensions L, D see table

### Cable

The outdoor termination is designed for 10 kV, 20 kV and 35 kV screened three and single core paper insulated cables (MIND) with one metal sheath per phase. For example: ЛАОСБУ, HAKnFtA, HAKNY, HknFty, AMKTQYPVsp., AMKTOYPVsp., AOSB, NPZO 13, NPZOP 13, NPZO 23.

### Design of termination

Yellow, oil resistant void filling tape is laid around the end of the metal sheath and the paper cores are completely covered with oil barrier tubing. An oil resistant sealing boot ensures a pressure tight seal to the cable lug. Short conductive tubing rebuilds the screen from the metal sheath to the covered paper core.

Yellow stress grading mastic is laid around the end of the conductive tubing and stress control tubing is shrunk over the conductive tubing and the covered paper insulation. The end of the cores and the stress control tubing are insulated with non-tracking insulating tubing. Additional skirts are installed onto the tubing (see table). Solderless earth connections can be ordered separately.

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)		No. of skirts
			L	D	
6/10	35–70	EPKT-24B1MO-CEE01	410	85	3 x 3
	95–240	EPKT-24C1MO-CEE01	410	95	3 x 3
12/20	35–50	EPKT-24B1MO-CEE01	410	85	3 x 3
	70–185	EPKT-24C1MO-CEE01	410	95	3 x 3
	240–300	EPKT-24D1MO-CEE01	410	115	3 x 3
20/35	50–95	EPKT-36C1MO-CEE01	560	95	3 x 4
	120–185	EPKT-36D1MO-CEE01	560	115	3 x 4
	240–500	EPKT-36E1MO-CEE01	560	115	3 x 4

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

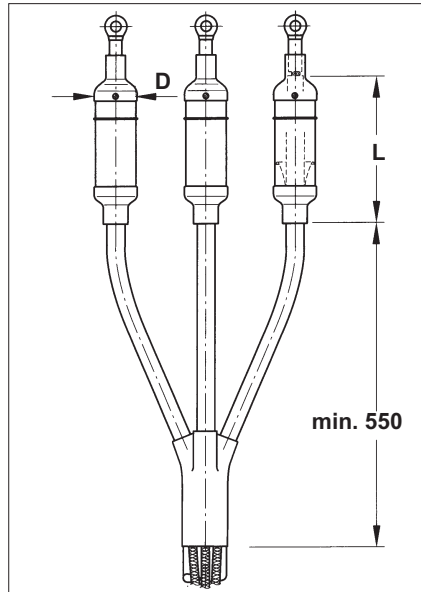
### Solderless earth connection

Cross section (mm <sup>2</sup> )	Ordering description three core cables including breakout	single core cable with lead sheath	single core cable with AL sheath
		35–150	EAKT-1678
70–150	EAKT-1678	EAKT-1668-DE01*	SMOE-61832*
150–240	EAKT-1679	EAKT-1669-DE01*	SMOE-61832*

\* 3 Earth connection kits have to be ordered per termination kit.

**Note:** The solderless earth connection kit must be ordered separately. The EAKT kit includes roll springs, earth leads, protection tubing and for three-core cables also heat-shrinkable breakout. The SMOE kit includes a Ligarex connection system (see also the chapter "Tools and Accessories").

# Indoor terminations for screened, paper insulated cables (MI) with one metal sheath per phase 10 kV and 20 kV



Dimensions L, D see table

## Cable

The indoor termination is designed for 10 kV and 20 kV screened three and single core paper insulated cables (MI) with one metal sheath per phase.

For example: AOUSZB, ЦАОСБУ, АОСБГУ, ОСБУ, АНКООУ, CNKOOY, ANKTOY-Vsp., ANKTOYP, AOUSZB, IPZO 13, IPZOP 13, IPZO 23, N(A)KLEY, N(A)HEKBA, N(A)EKBA.

## Design of termination

A metallic stress control cone is fixed with binding wire to the end of the metal sheath and screen cut. A transparent oil pot with heat-shrinkable moulded parts seals onto the cable lug and the metal sheath. The pot has to be filled with regular cable oil (not supplied with the termination). Solderless earth connections can be ordered separately.

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	50*	IDST-5121-E11	300	71
	70*	IDST-5121-E12	300	71
	70**	IDST-5121	300	71
	95	IDST-5121	300	71
	120–185	IDST-5122	300	71
	185–300	IDST-5123	300	71
12/20	50*	IDST-5121-E11	300	71
	70*	IDST-5121-E12	300	71
	70**	IDST-5121	300	71
	95–150	IDST-5122	300	71
	150–240	IDST-5123	300	71

\* Only for cables with Cu conductor (95 mm<sup>2</sup> crimp cable lugs and reduction tubing are included in the kit).

\*\* Only for cables with aluminium conductor.

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately. The terminations can be filled with regular cable oil (not included). For filling funnels and cable oil see the chapter "Tools and Accessories".

## Solderless earth connection

Cross section (mm <sup>2</sup> )	Ordering description three core cables including breakout	single core cable with lead sheath	single core cable with AL sheath
		35–150	EAKT-1678
70–150	EAKT-1678	EAKT-1668-DE01*	SMOE-61832*
150–240	EAKT-1679	EAKT-1669-DE01*	SMOE-61832*

\* 3 Earth connection kits have to be ordered per termination kit.

**Note:** The solderless earth connection kit must be ordered separately. The EAKT kit includes roll springs, earth leads, protection tubing and for three-core cables also heat-shrinkable breakout. The SMOE kit includes a Ligarex connection system (see the chapter "Tools and Accessories").

Explanation of MI and MIND:

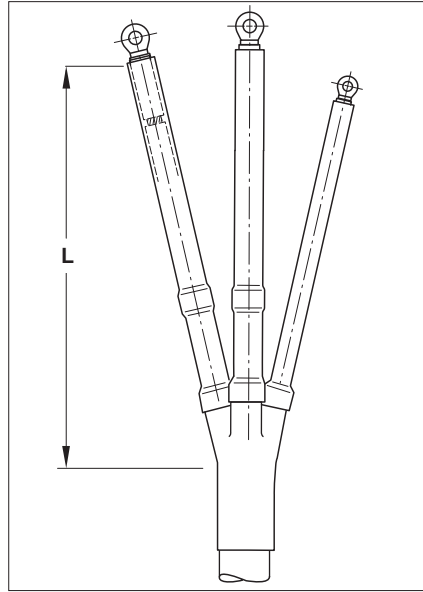
**MI** = Mass Impregnated = cable impregnated with draining compound

**MIND** = Mass Impregnated Non Draining = cable impregnated with non draining compound

Long term testing of 10 kV paper cables accessories type GUSJ and GUST at Raychem products development laboratories



# Indoor terminations for flexible, screened, rubber insulated cables 6 kV



Dimension L see table

## Cable

The termination is designed for 6 kV screened, flexible, rubber insulated cables with one or three earth cores.  
 For example: NTSC, КГЭ, КГЭТ, Ogb, Ogc-G, CHCU, CBVU, EpN 64i65, EpN (BN) 64i74, EpN (BN) 76i78, EpN (BN) 78/53.

## Design of termination

### For cables with up to 2 earth cores and adjustable core lengths.

Stress grading mastic is wrapped around the area of the screen cut. All phase cores are covered with non-tracking insulating tubing, which is supplied within the kit in one piece of total length 1500 mm. Thus the length of phase cores can be selected between 500 mm each or staggered with individual minimum core length 300 mm up to total sum of 1500 mm. The earth cores are covered by insulating tubing and sealed by mastic. The area between the end of the oversheath and the cores is sealed and protected by a 4-finger black breakout. The cores remain flexible and can be bent like the cable.

### For cables with 1 or up to 3 earth cores.

Stress grading mastic is wrapped around the area of the screen cut. All cores are covered with non-tracking insulating tubing. The area between the end of the oversheath and the cores is sealed and protected by a 6- or 4-finger red breakout. The cores remain flexible and can be bent like the cable.

## For cables with 1 or up to 3 earth cores

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description by length adjustable*	Ordering description by length	
			L = 450 mm**	L = 1200 mm**
3,5/6	<b>Cables with 1 earth core</b>			
	10/10 – 70/70		EMKT-7A4IH2	EMKT-7A4IH5
	95/95 – 185/185		EMKT-7B4IH2	EMKT-7B4IH5
	<b>Cables with up to 2 earth core</b>			
	50 – 95	EMKT-6I/50-95		
	<b>Cables with 3 earth cores</b>			
25/10 – 70/16		EMKT-7E6IH2	EMKT-7E6IH5	
95/16 – 185/35		EMKT-7F6IH2	EMKT-7F6IH5	

\* The core lengths L can be selected between 500 mm each or staggered with minimum core length 300 mm.

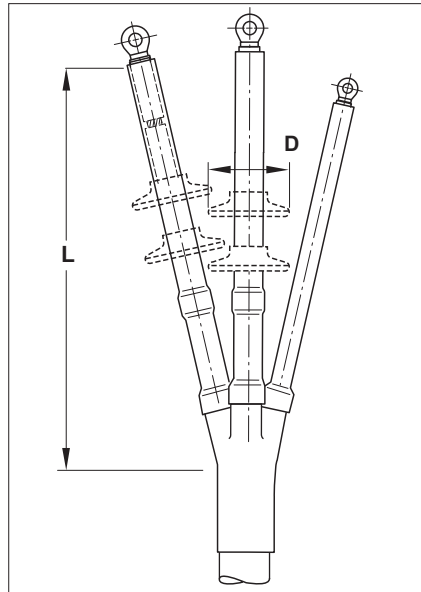
\*\* The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 300 mm.

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

Terminations for other voltages or core lengths are available on request.



## Outdoor terminations for flexible, screened, rubber insulated cables 6 kV



Dimensions L, D see table

### Cable

The termination is designed for 6 kV screened, flexible, rubber insulated cables with one or three earth cores.

For example: NTSC, КГЭ, КГЭТ, Ogb, Ogc-G, CHCU, CBVU, EpN 64i65, EpN (BN) 64i74, EpN (BN) 76i78, EpN (BN) 78/53.

### Design of termination

#### For cables with up to 2 earth cores and adjustable core lengths.

Stress grading mastic is wrapped around the area of the screen cut. All phase cores are covered with non-tracking insulating tubing, which is supplied within the kit in one piece of total length 1500 mm. Thus the length of phase cores can be selected between 500 mm each or staggered with individual minimum core length 450 mm up to total sum of 1500 mm. The earth cores are covered by insulating tubing and sealed by mastic. The area between the end of the oversheath and the cores is sealed and protected by a 4-finger black breakout. Outdoor terminations include in addition 2 sheds per phase. The cores remain flexible and can be bent like the cable.

#### For cables with 1 or up to 3 earth cores.

Stress grading mastic is wrapped around the area of the screen cut. All cores are covered with non-tracking insulating tubing. The area between the end of the oversheath and the cores is sealed and protected by a 6- or 4-finger red breakout. Outdoor terminations include in addition 2 sheds per phase. The cores remain flexible and can be bent like the cable.

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description by length adjustable*		D (mm)	No. of skirts
		L = 450 mm	L = 1200 mm**		
3,5/6	<b>Cables with 1 earth core</b>				
	10/10 – 70/70	EMKT-7A4OH2	EMKT-7A4OH5	76	3 x 2
	95/95 – 185/185	EMKT-7B4OH2	EMKT-7B4OH5	85	3 x 2
	<b>Cables with up to 2 earth core</b>				
	50 – 95	EMKT-6O/50-95		76	3 x 2
	<b>Cables with 3 earth cores</b>				
25/10 – 70/16	EMKT-7E6OH2	EMKT-7E6OH5	76	3 x 2	
95/16 – 185/35	EMKT-7F6OH2	EMKT-7F6OH5	85	3 x 2	

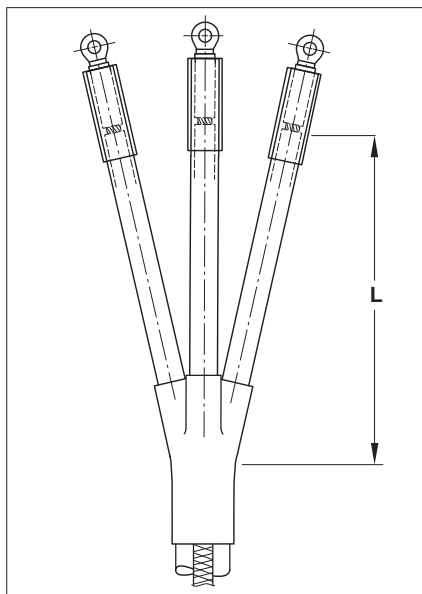
\* The core lengths can be selected between 500 mm each or staggered with minimum core length 450 mm.

\*\* The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 450 mm.

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

Terminations for other voltages or core lengths are available on request.

## Indoor terminations for unscreened, 3-core polymeric insulated cables 6 kV and 10 kV



Dimension L see table

### Cable

The indoor termination is designed for 6 kV and 10 kV unscreened three core polymeric insulated cables with armour or copper earth shield.

For example: АПВГ, YAKYFtly, YKYFoY, YAKYFpy, AYKCY, CYKCY, CHKCE-R, NAYFGY, PP 41-(A), PP 44-(A), PP45-(A), N(A)YFGY.

### Design of termination

The cores are covered with non-tracking insulating tubing. The area between the end of the oversheath and the cores is sealed and protected by a non-tracking insulating breakout.

Solderless earth connections can be ordered separately.

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm) L
	16– 50	EPKT-2041	450
		EPKT-2042	650
		EPKT-2043	800
		EPKT-2044	1200
3,5/6 and 6/10	70– 120	EPKT-2051	450
		EPKT-2052	650
		EPKT-2053	800
		EPKT-2054	1200
	150– 240	EPKT-2061	450
		EPKT-2062	650
		EPKT-2063	800
		EPKT-2064	1200

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately. The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 250 mm (450 mm for 10 kV).

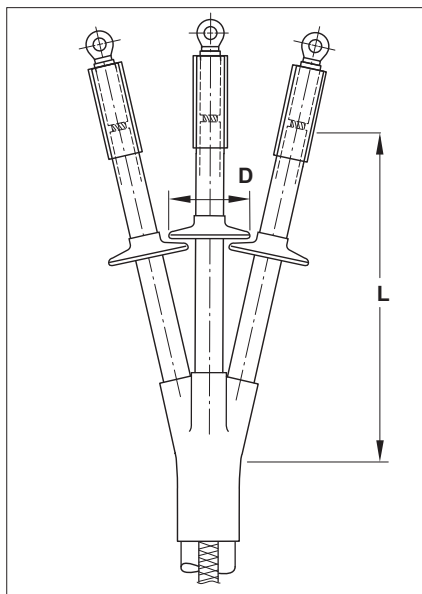
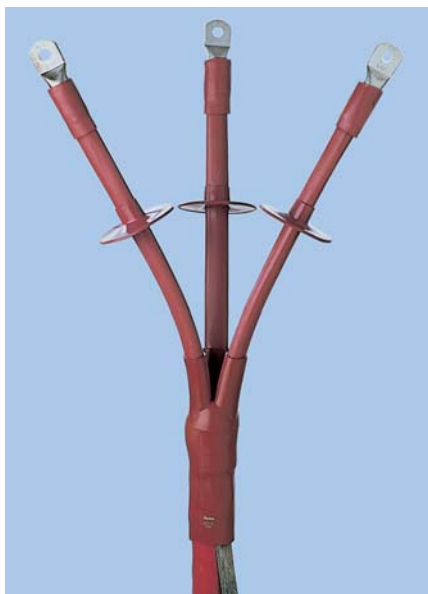
### Solderless earth connection for cables with armour or copper tape shield

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description
3,5/6	16– 95	SMOE-60805
	120– 300	SMOE-60873
6/10	16	SMOE-60805
	25– 95	SMOE-60873
	120– 300	SMOE-62176

**Note:** The solderless earth connection kit must be ordered separately. It includes a roll spring and an earth lead.

**Terminations for motor connection boxes are available on request.**

## Outdoor terminations for unscreened, 3-core polymeric insulated cables 6 kV and 10 kV



Dimensions L, D see table

### Cable

The outdoor termination is designed for 6 kV and 10 kV unscreened three core polymeric insulated cables with armour or copper earth shield.

For example: АПВГ, YAKYFtly, YKYFoy, YKYFtly, AYKCY, CYKCY, CHKCE-R, NAYFGY, PP 41-(A), PP 44-(A), PP45-(A), N(A)YFGY.

### Design of termination

The cores are covered with non-tracking insulating tubing. The area between the end of the oversheath and the cores is sealed and protected by a non-tracking insulating breakout. Additional skirts are installed onto the tubing (see table). Solderless earth connections can be ordered separately.

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)		No. of skirts
			L	D	
3,5/6 and 6/10	16– 50	EPKT-2292	650	76	3 x 1
		EPKT-2294	1200	76	3 x 1
	70–120	EPKT-2302	650	95	3 x 1
		EPKT-2304	1200	95	3 x 1
	150–240	EPKT-2312	650	95	3 x 1
		EPKT-2314	1200	95	3 x 1

**Note:** One termination kit includes material for 3 phases. Longitudinally sealed cable lugs are not part of the kit and can be ordered separately. The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 450 mm.

### Solderless earth connection for cables with armour or copper tape shield

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description
3,5/6	16– 95	SMOE-60805
	120–300	SMOE-60873
6/10	16	SMOE-60805
	25– 95	SMOE-60873
	120–300	SMOE-62176

**Note:** The solderless earth connection kit must be ordered separately. It includes a roll spring and an earth lead.

## Indoor terminations for screened, 3-core polymeric insulated cables 10 kV, 20 kV and 35 kV



### Cable

The indoor termination is designed for 10 kV, 20 kV and 35 kV screened three core polymeric insulated cables with or without armour or copper tape shield. For example: N(A)YSEY, NA2XSY, N2XSEY, NA2XS2Y, АпвБ, АпвБШв, АХЕКVCY, АХЕКVCEY, N(A)2XSY, XHP 81, EpHP 81, PHP 48, PHP 84, XHP 48.

### Design of termination

The cable is transformed to quasi 3 single core cables which allow crossing the cores even in confined connection spaces. The cores are covered with conductive tubing from the crutch area close to the screen end. The crutch area is sealed and protected with an adhesive lined, conductive breakout which is installed over the cores and the end of the oversheath.

Yellow stress grading mastic is laid around the end of the screen cut. A non-tracking insulating tubing coated with stress control and sealing mastic is installed between the end of the conductive tubing and the cable lug.

Solderless earth connections for cables with tape shield or armour have to be ordered separately.

Kits with the modification code -13 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -17 for M16 bolts.

Nominal voltage $U_0/U$ (kV)	Terminations with mechanical lugs			Terminations without lugs**		
	Cross section (mm <sup>2</sup> )	Ordering description by length		Cross section (mm <sup>2</sup> )	Ordering description by length	
		L = 450 mm	L = 1200 mm		L = 450 mm	L = 1200 mm
6/10	25– 35	POLT-12B/3XIH1-ML-1-13	POLT-12B/3XIH4-ML-1-13	16– 35	POLT-12B/3XIH1	POLT-12B/3XIH4
	25– 70	POLT-12C/3XIH1-ML-1-13	POLT-12C/3XIH4-ML-1-13	25– 70	POLT-12C/3XIH1	POLT-12C/3XIH4
	70– 150	POLT-12D/3XIH1-ML-2-13	POLT-12D/3XIH4-ML-2-13	95–240	POLT-12D/3XIH1	POLT-12D/3XIH4
	95–240	POLT-12D/3XIH1-ML-4-13	POLT-12D/3XIH4-ML-4-13			
	240–300	POLT-12E/3XIH1-ML-5-13	POLT-12E/3XIH4-ML-5-13	240–500	POLT-12E/3XIH1	POLT-12E/3XIH4
12/20	25	POLT-24B/3XIH1-ML-1-13	POLT-24B/3XIH4-ML-1-13	10– 25	POLT-24B/3XIH1	POLT-24B/3XIH4
	25– 70	POLT-24C/3XIH1-ML-1-13	POLT-24C/3XIH4-ML-1-13	25– 50	POLT-24C/3XIH1	POLT-24C/3XIH4
	70– 150	POLT-24D/3XIH1-ML-2-13	POLT-24D/3XIH4-ML-2-13	70– 185	POLT-24D/3XIH1	POLT-24D/3XIH4
	95– 185	POLT-24D/3XIH1-ML-4-13	POLT-24D/3XIH4-ML-4-13			
	185–300	POLT-24E/3XIH1-ML-5-13	POLT-24E/3XIH4-ML-5-13	185–400	POLT-24E/3XIH1	POLT-24E/3XIH4
20/35	50– 120	–	POLT-42D/3XIH4-ML-2-13	50– 120	–	POLT-42D/3XIH4
	150–300	–	POLT-42E/3XIH4-ML-5-13	150–300	–	POLT-42E/3XIH4
	400	–	POLT-42F/3XIH4-ML-6-13*	400–500	–	POLT-42F/3XIH4

\* The termination is also available with mechanical lugs for busbar connection by M20 bolts (modification code -21).

\*\* Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

**Note:** The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 320 mm for  $U_0/U = 6/10$  kV, 360 mm for  $U_0/U = 12/20$  kV and 600 mm for  $U_0/U = 20/35$  kV.

For terminations with mechanical lugs for M16 bolts use modification code -17.

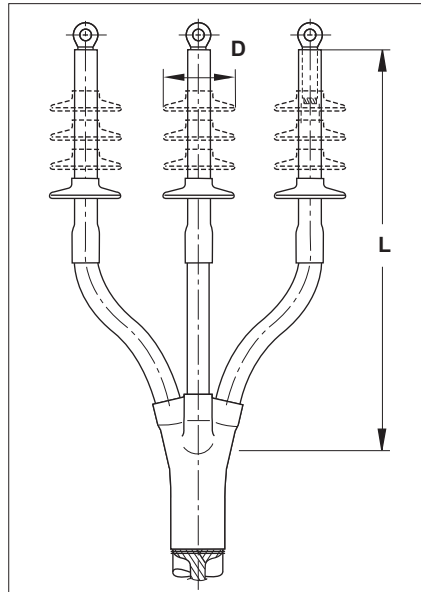
Solderless earth connections for cables with tape shield have to be ordered separately.

### Solderless earth connection for copper tape shielded cables with or without armour

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables with tape shield		
		without armour	with tape armour	with wire armour
6/10	10– 50	EAKT-1655	–	–
	35– 120	EAKT-1656	EAKT-1675-CEE01	EAKT-1656 + EAKT-1642
	95– 240	EAKT-1657	EAKT-1676-CEE01	EAKT-1657 + EAKT-1643
	240– 500	EAKT-1658	EAKT-1677-CEE01	EAKT-1658 + EAKT-1645
12/20	25– 70	EAKT-1656	EAKT-1675-CEE01	–
	50– 150	EAKT-1657	EAKT-1676-CEE01	EAKT-1657 + EAKT-1643
	120– 400	EAKT-1658	EAKT-1677-CEE01	EAKT-1658 + EAKT-1645
20/35	50– 150	EAKT-1658	EAKT-1677-CEE01	EAKT-1658 + EAKT-1644
	50– 300	EAKT-1658	EAKT-1677-CEE01	EAKT-1658 + EAKT-1645
	300– 500	EAKT-1659	–	–

**Note:** The solderless earth connection kit must be ordered separately. It includes 3 roll springs and 3 earth leads, for cables with tape armour in addition one larger roll spring. For cables with wire armour, the kit includes clamping rings, an earth lead and a sealing tubing.

# Outdoor terminations for screened, 3-core polymeric insulated cables 10 kV, 20 kV and 35 kV



## Design of termination

The design and installation is the same as for indoor terminations. In addition skirts are installed onto the tubing (see table). Solderless earth connections for cables with tape shield or armour have to be ordered separately.

Kits with the modification code -13 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -17 for M16 bolts.

Dimensions L, D see table

### Terminations including mechanical lugs

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description by length		D (mm)	No. of skirts
		L = 450 mm	L = 1200 mm		
6/10	25– 70	POLT-12C/3XOH1-ML-1-13	POLT-12C/3XOH4-ML-1-13	85	3 x 1
	70–150	POLT-12D/3XOH1-ML-2-13	POLT-12D/3XOH4-ML-2-13	95	3 x 1
	95–240	POLT-12D/3XOH1-ML-4-13	POLT-12D/3XOH4-ML-4-13	95	3 x 1
	240–300	–	POLT-12E/3XOH4-ML-5-13	115	3 x 1
12/20	25– 70	POLT-24C/3XOH1-ML-1-13	POLT-24C/3XOH4-ML-1-13	85	3 x 3
	70–150	POLT-24D/3XOH1-ML-2-13	POLT-24D/3XOH4-ML-2-13	95	3 x 3
	95–185	POLT-24D/3XOH1-ML-4-13	POLT-24D/3XOH4-ML-4-13	95	3 x 3
	185–300	–	POLT-24E/3XOH4-ML-5-13	115	3 x 3
20/35	50–120	–	POLT-42D/3XOH4-ML-2-13	95	3 x 4
	150–300	–	POLT-42E/3XOH4-ML-5-13	115	3 x 4
	400	–	POLT-42F/3XOH4-ML-6-13*	135	3 x 4

\* The termination is also available with mechanical lugs for busbar connection by M20 bolts (modification code -21).

**Note:** The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 320 mm for  $U_o/U = 6/10$  kV and 460 mm for  $U_o/U = 12/20$  kV and 800 mm for  $U_o/U = 20/35$  kV.

For terminations with mechanical lugs for M16 bolts use modification code -17.

Solderless earth connections for cables with tape shield have to be ordered separately, see table on the previous page.

### Terminations without lugs

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description by length		D (mm)	No. of skirts
		L = 450 mm	L = 1200 mm		
6/10	10– 16	POLT-12A/3XOH1	POLT-12A/3XOH4	76	3 x 1
	25– 70	POLT-12C/3XOH1	POLT-12C/3XOH4	85	3 x 1
	95–240	POLT-12D/3XOH1	POLT-12D/3XOH4	95	3 x 1
	240–500	–	POLT-12E/3XOH4	115	3 x 1
12/20	10– 25	POLT-24B/3XOH1	POLT-24B/3XOH4	76	3 x 3
	25– 50	POLT-24C/3XOH1	POLT-24C/3XOH4	85	3 x 3
	70–185	POLT-24D/3XOH1	POLT-24D/3XOH4	95	3 x 3
	185–400	–	POLT-24E/3XOH4	115	3 x 3
20/35	50–120	–	POLT-42D/3XOH4	95	3 x 4
	150–300	–	POLT-42E/3XOH4	115	3 x 4
	400–500	–	POLT-42F/3XOH4	135	3 x 4

**Note:** The core lengths can be reduced to the requirements at the place of installation, the minimum core length is 320 mm for  $U_o/U = 6/10$  kV, 460 mm for  $U_o/U = 12/20$  kV and 800 mm for  $U_o/U = 20/35$  kV.

Longitudinally sealed cable lugs are not part of the kit and can be ordered separately.

Solderless earth connections for cables with tape shield have to be ordered separately, see table on the previous page.

## Indoor terminations for screened, 1-core polymeric insulated cables 10 kV, 20 kV and 35 kV



### Cable

The indoor termination is designed for 10 kV, 20 kV and 35 kV screened single core polymeric insulated cables.  
For example: АПВВ, ПвП, УНАКXS, ХУНАКXS, УНКС, АХЕКVСУ, АХЕКVСЕУ, СХЕКVСЕУ, N(A)2XSУ, SZAQkrKM, SZAXRkKM, XHE 49, XHP 48, EHP 48, N(A)2XS(F)2У, АНХАМК-W, NF C 33-223.

### Design of termination

The screen wires or the earth lead are embedded in sealing mastic. Yellow stress grading mastic is laid around the end of the screen cut. A non-tracking, insulating tubing coated with stress control and sealing mastic insulates and seals between the end of the oversheath and the cable lug.  
Solderless earth connections can be ordered separately.  
Kits with the modification code -13 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -17 for M16 bolts.

Nominal voltage $U_0/U$ (kV)	Terminations with mechanical lugs		Terminations without lugs		L (mm)
	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description	
6/10	25– 95	POLT-12C/1XI-ML-1-13	25– 95	POLT-12C/1XI	250*
	70– 150	POLT-12D/1XI-ML-2-13			300
	95– 240	POLT-12D/1XI-ML-4-13	95– 240	POLT-12D/1XI	250*
	185– 300	POLT-12E/1XI-ML-5-13			300
	240– 400	POLT-12E/1XI-ML-6-13***	240– 500	POLT-12E/1XI	300
	500– 630	POLT-12F/1XI-ML-7-17***	500– 800	POLT-12F/1XI	340*
			1000– 1200	POLT-12G/1XI	340
12/20	25– 70	POLT-24C/1XI-ML-1-13	25– 70	POLT-24C/1XI	340
	70– 150	POLT-24D/1XI-ML-2-13	70– 240	POLT-24D/1XI	340
	95– 240	POLT-24D/1XI-ML-4-13			340
	185– 300	POLT-24E/1XI-ML-5-13	185– 400	POLT-24E/1XI	340
	240– 400	POLT-24E/1XI-ML-6-13***			340
	500– 630	POLT-24F/1XI-ML-7-17***	400– 800	POLT-24F/1XI	440**
20/35	35	POLT-42C/1XI-ML-1-13	35	POLT-42C/1XI	500
	50– 120	POLT-42D/1XI-ML-2-13	50– 120	POLT-42D/1XI	500
	150– 300	POLT-42E/1XI-ML-5-13	150– 300	POLT-42E/1XI	500
	240– 400	POLT-42F/1XI-ML-6-13***	400– 500	POLT-42F/1XI	500
	500– 630	POLT-42G/1XI-ML-7-17***	500– 800	POLT-42G/1XI	560

\* Dimension L of termination with mechanical lugs is 300 mm.

\*\* Dimension L of termination with mechanical lugs is 340 mm.

\*\*\* The termination is also available with mechanical lugs for busbar connection by M20 bolts (modification code -21). The kit is not suitable for RICS adapters. For RICS application please see the chapter "Connection Systems".

**Note:** One termination kit includes material for 3 phases.

For terminations with mechanical lugs for M16 bolts use modification code -17.

Solderless earth connections for cables with tape shield have to be ordered separately.

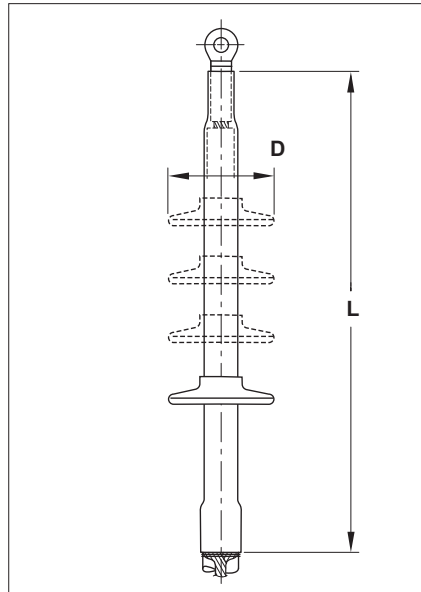
### Solderless earth connection for cables with tape shield

Cross section (mm<sup>2</sup>) for cables with nominal voltage  $U_0/U$

6/10 kV	12/20 kV	22/35 kV	Ordering description
<b>Cables with bonded aluminium tape shield without armour</b>			
25– 120	25– 120		SMOE-62609
95– 400	50– 240		SMOE-62589
<b>Cables with copper tape shield without armour</b>			
25– 70			EAKT-1655
35– 120	25– 70		EAKT-1656
95– 240	50– 150	25– 70	EAKT-1657
240– 500	120– 400	35– 300	EAKT-1658
630– 800	500– 800	240– 800	EAKT-1659
<b>Cables with copper tape shield and with aluminium wire armour</b>			
70– 240	70– 150		SMOE-62822

**Note:** The solderless earth connection kit must be ordered separately. The SMOE kits include 3 roll springs, 3 earth leads and copper mesh. The EAKT kits for copper tape include 3 roll springs and 3 earth leads. The SMOE-62822 kit for cables with wire armour includes roll springs, earth lead and sealing tubing.

# Outdoor terminations for screened, 1-core polymeric insulated cables 10 kV, 20 kV and 35 kV



## Design of termination

The design and installation is the same as for indoor terminations. In addition skirts are installed onto the tubing (see table). Solderless earth connections can be ordered separately. Kits with the modification code -13 include mechanical lugs with a busbar connection hole for M12 connection bolts, with code -17 for M16 bolts.

Dimensions L, D see table

Nominal voltage $U_0/U$ (kV)	Terminations with mechanical lugs		Terminations without lugs		Dimensions (mm)		No. of skirts
	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description	L	D	
6/10	25– 95	POLT-12C/1XO-ML-1-13	25– 95	POLT-12C/1XO	250*	85	3 x 1
	70–150	POLT-12D/1XO-ML-2-13			300	95	3 x 1
	95–240	POLT-12D/1XO-ML-4-13	95– 240	POLT-12D/1XO	250*	95	3 x 1
	240–400	POLT-12E/1XO-ML-6-13***	240– 500	POLT-12E/1XO	300	115	3 x 1
	500–630	POLT-12F/1XO-ML-7-17***	500– 800	POLT-12F/1XO	340*	135	3 x 1
			1000–1200	POLT-12G/1XO	340	135	3 x 1
12/20	25– 70	POLT-24C/1XO-ML-1-13	25– 70	POLT-24C/1XO	440	85	3 x 3
	70–150	POLT-24D/1XO-ML-2-13	70– 240	POLT-24D/1XO	440	95	3 x 3
	95–240	POLT-24D/1XO-ML-4-13			440	95	3 x 3
	185–400	POLT-24E/1XO-ML-6-13***	185– 400	POLT-24E/1XO	440	115	3 x 3
	500–630	POLT-24F/1XO-ML-7-17***	400– 800	POLT-24F/1XO	500**	135	3 x 3
20/35	35	POLT-42C/1XO-ML-1-13	35	POLT-42C/1XO	560	85	3 x 4
	50–120	POLT-42D/1XO-ML-2-13	50– 120	POLT-42D/1XO	560	95	3 x 4
	150–300	POLT-42E/1XO-ML-5-13	150– 300	POLT-42E/1XO	560	115	3 x 4
	240–400	POLT-42F/1XO-ML-6-13***	400– 500	POLT-42F/1XO	560	135	3 x 4
	500–630	POLT-42G/1XO-ML-7-17***	500– 800	POLT-42G/1XO	560	135	3 x 4

\* Dimension L of termination with mechanical lugs is 300 mm.

\*\* Dimension L of termination with mechanical lugs is 440 mm.

\*\*\* The termination is also available with mechanical lugs for busbar connection by M20 bolts (modification code -21).

**Note:** One termination kit includes material for 3 phases.

For terminations with mechanical lugs for M16 bolts use modification code -17.

Solderless earth connections for cables with tape shield have to be ordered separately.

## Solderless earth connection for cables with tape shield

Cross section (mm<sup>2</sup>) for cables with nominal voltage  $U_0/U$

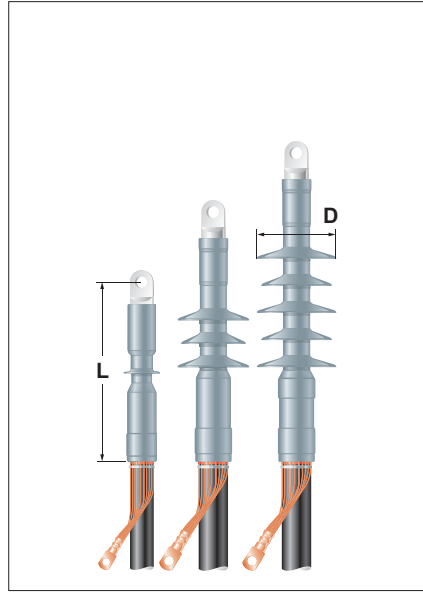
6/10 kV	12/20 kV	22/35 kV	Ordering description
<b>Cables with bonded aluminium tape shield without armour</b>			
25–120	25–120		SMOE-62609
95–400	50–240		SMOE-62589
<b>Cables with copper tape shield without armour</b>			
25– 70			EAKT-1655
35–120	25– 70		EAKT-1656
95–240	50–150	25– 70	EAKT-1657
240–500	120–400	35–300	EAKT-1658
630–800	500–800	240–800	EAKT-1659
<b>Cables with copper tape shield and with aluminium wire armour</b>			
70–240	70–150		SMOE-62822

**Note:** The solderless earth connection kit must be ordered separately.

The SMOE kits include 3 roll springs and 3 earth leads and copper mesh.

The EAKT kits for copper tape include 3 roll springs and 3 earth leads. The SMOE-62822 kit for cables with wire armour includes roll springs, earth lead and sealing tubing.

# Indoor push-on elastomeric terminations with integrated stress control for screened, 1-core polymeric insulated cables with wire screen 10 kV, 20 kV and 35 kV



Dimensions L, D see table



## Cable

The indoor termination is designed for 10 kV, 20 kV and 35 kV screened single core polymeric insulated cables with wire screen.

For example: AXEKVCE, AXEKVCEY, AXEKVCEz, CXEKVCEY, N(A)2XSY, N(A)2XS(F)2Y, CHKCU.

## Design of termination

The screen wires are embedded in sealing mastic. The termination body is made out of high quality silicone rubber that has excellent mechanical, hydrophobic, non tracking and insulating properties. The stress control cone is integrated in the termination. It has an optimal geometrical shape with high electrical performance and resistance to fungi, UV and weathering. Cable core is terminated by mechanical lug, supplied with the kit. The design of the lug and upper part of termination body assure excellent moisture sealing without any filling and sealing mastic.

## Features

- Retains performance over wide temperature range  $-55\text{ }^{\circ}\text{C}$  to  $+180\text{ }^{\circ}\text{C}$
- No shelf-life issues
- Non-flammable
- Self extinguishing

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description*	Dimensions (mm)		No. of skirts
			L	D	
6/10	25 - 95	MVTI-3121-ML-1-17	225	39	3 x 1
	95 - 240	MVTI-3131-ML-4-17	245	43	3 x 1
12/20	25 - 95	MVTI-5121-ML-1-17	270	76	3 x 3
	95 - 240	MVTI-5131-ML-4-17	290	80	3 x 3
	120 - 300	MVTI-5131-ML-5-17	290	80	3 x 3
20/35	50 - 150	MVTI-7131-ML-2-17	455	140	3 x 5
	95 - 240	MVTI-7141-ML-4-17	455	140	3 x 5
	120 - 300	MVTI-7141-ML-5-17	455	140	3 x 5
	185 - 400	MVTI-7141-ML-6-17	455	140	3 x 5

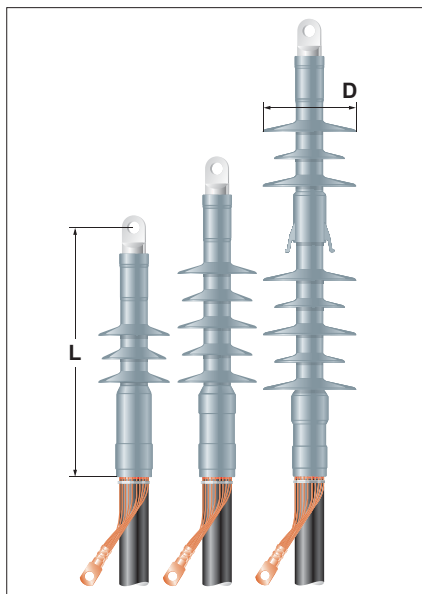
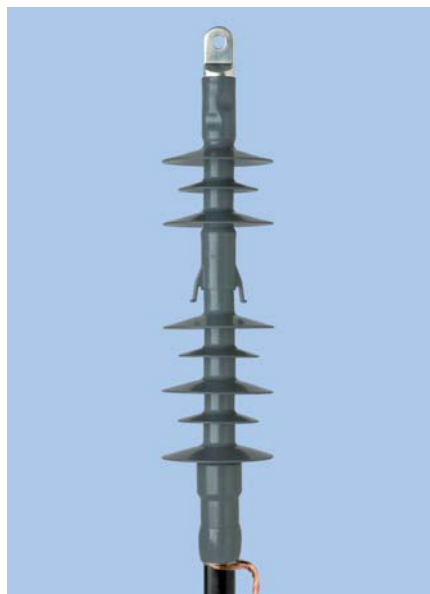
\* Kits with the modification code -17 include mechanical lugs with a busbar connection hole for M16 connection bolts. For terminations with mechanical lugs for M12 connection bolts use modification code -13.

**Note:** One termination kit includes complete material for 3 phases.

Terminations for other cross sections, voltages and cable types are available on request.



# Outdoor push-on elastomeric terminations with integrated stress control for screened, 1-core polymeric insulated cables with wire screen 10 kV, 20 kV and 35 kV



Dimensions L, D see table

## Cable

The outdoor termination is designed for 10 kV, 20 kV and 35 kV screened single core polymeric insulated cables with wire screen.

For example: AXEKVCE, AXEKVCEY, AXEKVCEz, CXEKVCEY, N(A)2XSY, N(A)2XS(F)2Y, CHKCU.

## Design of termination

The screen wires are embedded in sealing mastic. The termination body is made out of high quality silicone rubber that has excellent mechanical, hydrophobic, non tracking and insulating properties. The stress control cone is integrated in the termination. It has an optimal geometrical shape with high electrical performance and resistance to fungi, UV and weathering. Cable core is terminated by mechanical lug, supplied with the kit. The design of the lug and upper part of termination body assure excellent moisture sealing without any filling and sealing mastic.

## Features

- Retains performance over wide temperature range  $-55\text{ }^{\circ}\text{C}$  to  $+180\text{ }^{\circ}\text{C}$
- No shelf-life issues
- Non-flammable
- Self extinguishing

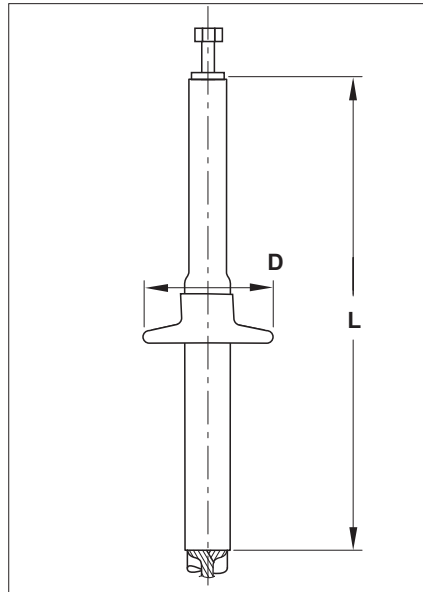
Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description*	Dimensions (mm)		No. of skirts
			L	D	
6/10	25 - 95	MVTO-3121-ML-1-17	270	61	3 x 3
	95 - 240	MVTO-3131-ML-4-17	290	76	3 x 3
12/20	25 - 95	MVTO-5121-ML-1-17	350	97	3 x 5
	95 - 240	MVTO-5131-ML-4-17	370	101	3 x 5
	120 - 300	MVTO-5131-ML-5-17	370	101	3 x 5
20/35	50 - 150	MVTO-7131-ML-2-17	655	140	3 x 8
	95 - 240	MVTO-7141-ML-4-17	660	140	3 x 8
	120 - 300	MVTO-7141-ML-5-17	660	140	3 x 8
	185 - 400	MVTO-7141-ML-6-17	660	140	3 x 8

\* Kits with the modification code -17 include mechanical lugs with a busbar connection hole for M16 connection bolts. For terminations with mechanical lugs for M12 connection bolts use modification code -13.

**Note:** One termination kit includes complete material for 3 phases.

Terminations for other cross sections, voltages and cable types are available on request.

## Terminations for screened, polymeric insulated Filter Cables up to 150 kV D.C.



Dimensions L, D see table

A heat-shrinkable non-tracking insulation tubing and shed are shrunk over the stress control system and ensure a reliable seal to the lug and the overshield. A mechanical lug covering cross sections from 35 mm<sup>2</sup> to 95 mm<sup>2</sup> or 95 mm<sup>2</sup> to 240 mm<sup>2</sup> is supplied with the kit. The mechanical lug has a M10 thread on the top for easy connection to connecting busbars.

The termination is supplied as a single phase termination. A solderless earth connection for cables with metal sheath is included in the termination kit.

### Testing and performance

Neither national nor international specifications exist for filter cable terminations. By understanding the specific operation requirements of a filter cable termination, Raychem developed a test specification and qualified the filter cable termination FCEV to these requirements. The overview of qualification tests is summarized in a table below.

### Cable

The termination is designed for screened single core polymeric insulated cables with wire shield or metal sheath, cross section from 35 mm<sup>2</sup> to 240 mm<sup>2</sup> and diameter over insulation between 26 mm and 52 mm. Cables designed for D.C. voltages 111 kV or 150 kV usually meet the dimensional requirements.

### Design of termination

The cable is prepared in the same simple and easy way as for Raychem medium voltage terminations without sanding or penciling. Based on the design of Raychem high voltage terminations, the filter cable termination consists of a staggered layer of stress control tubing and patches.

Ordering Description	Cable dimensions				Termination dimensions		
	Cross section (mm <sup>2</sup> )	Diameter of conductor (mm)	Diameter over dielectric (mm)	Max. diameter of cable (mm)	L (mm)	D (mm)	Number of sheds
FCEV-111	35– 95	6–11,5	26–38	53	500	165	1
FCEV-150	35– 95	6–11,5	26–38	53	700	165	2
FCEV-150-1	95–240	10,5–21,5	38–52	73	700	165	2

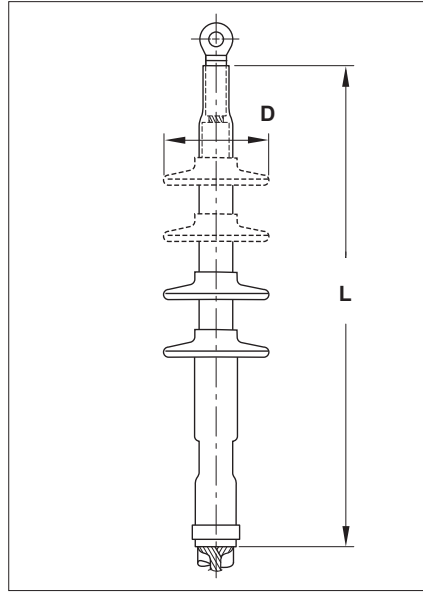
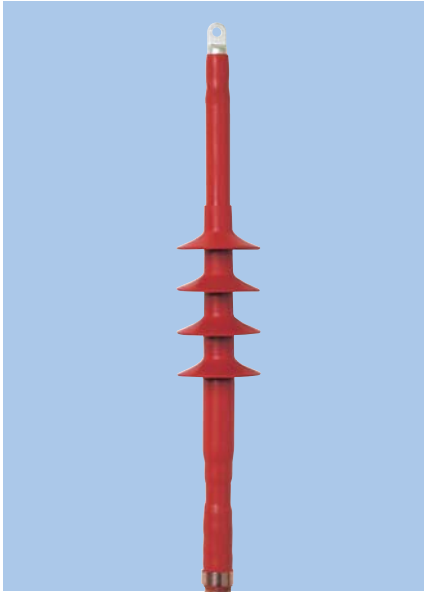
**Note:** The termination FCEV is supplied as a single phase termination. Terminations for other cable types or dimensions are available on request.

### Overview of qualification tests:

Type of test	Passed requirements	
	FCEV 111	FCEV 150
Partial discharge test	< 3 pC at 42 kV AC	< 3 pC at 60 kV AC
DC withstand test	> 8 hours at -200 kV > 8 hours at +200 kV	> 8 hours at -275 kV > 8 hours at +275 kV
Impulse test (wave shape 1,2/50 μs, chopped)	> 1000 times at -240 kV > 1000 times at +240 kV	> 1000 times at -320 kV > 1000 times at +320 kV
AC withstand test	> 10 minutes at 60 kV	> 10 minutes at 85 kV

Detailed test reports are available on request.

# Terminations for screened, polymeric insulated cables for electrified Railway systems 25 kV A.C.



Dimensions L, D see table

## Cable

The termination is designed for screened single core polymeric insulated cables with wire shield, cross section from 150 mm<sup>2</sup> to 300 mm<sup>2</sup> and diameter over insulation between 30 mm and 45 mm. Cables designed for A.C. voltages (3 phase systems)  $U_0/U_m$  of 30/52 kV or 41/72,5 kV usually meet the dimensional requirements. The termination is tested to IEEE-48-1990 which exceeds the requirements of IEC-60840-1999-2 for cables and accessories with max. system voltages  $U_m$  up to 52 kV. This covers applications in railway networks with nominal voltage of 25 kV (phase to ground) as defined in EN-50163 with  $U_{max1}$  of 27,5 kV (no time limit) and  $U_{max2}$  of 29 kV (max. 5 min).

## Design of termination

The cable is prepared in the same simple and easy way as for Raychem medium voltage terminations without sanding or penciling. Based on the design of Raychem high voltage terminations, the termination consists of a staggered layer of stress control tubing and patches. A heat-shrinkable non-tracking insulation tubing is shrunk over the stress control system and ensures a reliable seal to the lug and the oversheath. In addition skirts are separately installed onto the tubing thus allowing also upside down installations.

A mechanical lug covering cross sections from 150 mm<sup>2</sup> to 300 mm<sup>2</sup> is supplied with the kit. The palm hole of the lug allows busbar connection with M16 bolts. The termination is supplied as a single phase termination. The termination has no supporting function and needs to be fixed at top and bottom. A solderless earth connection for cables with metal sheath is available on request.

Ordering Description	Cable dimensions			Termination dimensions		
	Cross section (mm <sup>2</sup> )	Diameter over dielectric (mm)	Max. diameter of cable (mm)	L (mm)	D (mm)	Number of sheds
<b>Indoor termination</b> RWIT-25/1x150-300-ML-5-17	150–300	30–45	60	750	165	2
<b>Outdoor termination</b> RWOT-25/1x150-300-ML-5-17	150–300	30–45	60	900	165	4

**Note:** The termination is supplied as a single phase kit with mechanical lug having palm hole for busbar connection with M16 bolts.

Terminations for other cable types or dimensions are available on request.

# Connection Systems



## Connection Systems for MV gas-insulated switchgear

### Connection systems for bushings according to EN 50181 type C<sub>1</sub> (630 A) and type C<sub>2</sub> (1250 A)

Insulated T-adapter and straight adapter system for polymeric and paper insulated cables  
10 kV, 15 kV and 20 kV 46

Screened, separable T-connection system for polymeric insulated cables  
10 kV, 15 kV, 20 kV and 35 kV 48

### Connection systems for bushings according to EN 50181 type B (400 A)

Screened, separable elbow connection system for polymeric insulated cables 20 kV and 35 kV 50

### Connection systems for bushings according to EN 50181 type A (250 A)

Screened, separable elbow and straight connection system for polymeric insulated cables  
10 kV, 15 kV and 20 kV 52

# RICS, RCAB - Insulated T-adapter and straight adapter system for gas-insulated switchgears with bushings according to EN 50181 type C<sub>1</sub> (630 A) and C<sub>2</sub> (1250 A), 10 kV, 15 kV and 20 kV

The insulated adapter system provides perfect sealing, electrical insulation and an electrical connection between Raychem terminations and gas-insulated switchgear up to 24 kV. It is designed to fit bushing profiles according to EN 50181 type C. The insulating adapters are compatible with all heat-shrink Raychem terminations.

## RICS - T-adapter

Thick walled insulating body made of high quality elastomer with sealing face over the termination, bushing cone and plug. The electrical connection is made with a terminal stud and the cable lug of the termination. A special plug which allows cable testing without disconnecting the adapter is also offered.

The design of the adapter for connecting the surge arrester is basically identical. The elastomer insulating body has an additional lead-in duct for the surge arrester type RDA. Adapters for two cable connections are also available.

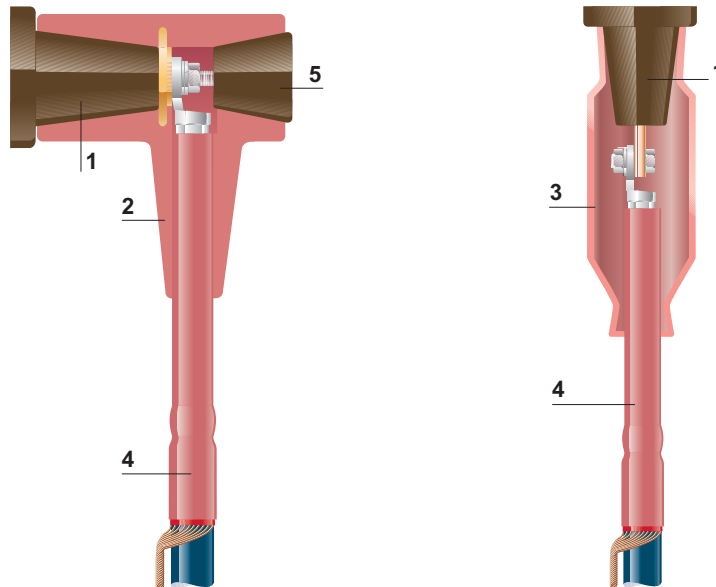
For double T-connections, the second adapter is of special design and includes connection plug, insulating body, fixing nuts, terminal stud and backplug. It can be combined with first adapters of type RICS 57x3-CU, but not with adapter for surge arresters type RICS-51x9.

## RCAB - Straight adapter

A highly flexible insulating body made of high quality elastomer provides a hermetic seal over the cone of the bushing and the termination. The cable lug of the termination is simply connected to a terminal stud with a bolt and nut. Even in confined spaces the adapter can be easily pulled down from the bushing giving access for e.g. cable testing. RCAB is supplied in a 3-phase set complete with installation instruction. Fixing bolts and nuts, terminal stud and cable lugs are not included. Terminal studs with a M16 thread can be ordered separately as EXRM-1366. The adapter is to be used in combination with Raychem terminations:

Up to 12 kV	
35-300 mm <sup>2</sup>	RCAB-4120
Up to 24 kV	
50-300 mm <sup>2</sup>	RCAB-5120

- 1 Bushing cone
- 2 RICS - adapter
- 3 RCAB - adapter
- 4 Raychem termination
- 5 Backplug



## Accessories for RICS adapter

### Test plug for cable testing:

Cables can be tested while the T-adapter and the cable are connected to the switchgear. The backplug of the RICS adapter is removed and the test plug is screwed in instead of the backplug. For phase to phase testing, test plugs of different lengths must be used.

Standard version, Length = 290 mm

**RICS-5002-50-24**

Long version, Length = 390 mm

**RICS-5002-50-25**

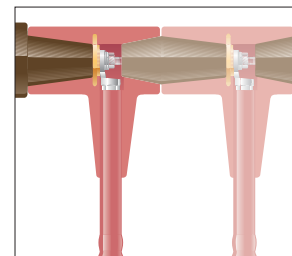
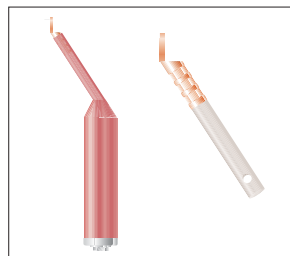
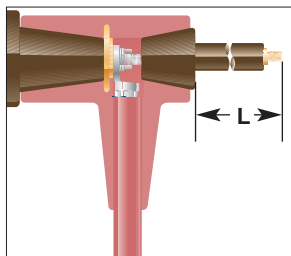
### Surge arrester type RDA

#### for T-Adapters type RICS-51x9:

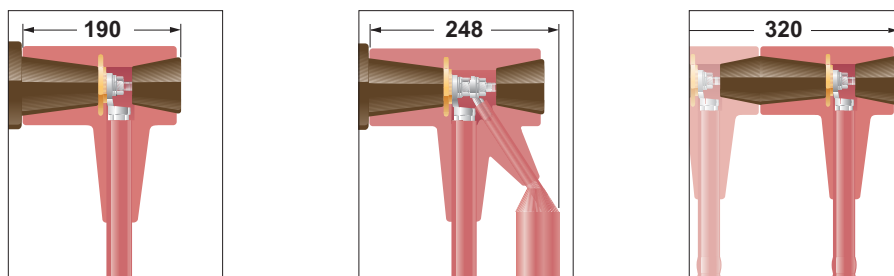
The surge arrester type RDA is specially developed for applications in gas-insulated switchgear. They are available for voltages from 6 kV to 26 kV. Detail information and technical data are available from your local Raychem products representative.

Blind Plugs type RICS-5009-50-22 can be temporarily installed instead of RDA surge arresters.

**Double T-adapters for connections to 630 A and 1250 A rated bushings with profile according to EN 505181 type C:** Each RICS adapter is rated for max. 630 A. For double T-connections, a special first adapter with M16 stud of type RICS-5733-Cu or RICS 5743-Cu must be used. Application ranges are the same as for types RICS 51x3 shown in table.



# RICS, RCAB - Insulated T-adapter and straight adapter system for gas-insulated switchgears with bushings according to EN 50181 type C<sub>1</sub> (630 A) and C<sub>2</sub> (1250 A), 10 kV, 15 kV and 20 kV



All dimensions in mm

Minimum air clearance between adaptors: 25 mm, between surge arrestors and ground: 47 mm, between adaptors and ground: 38 mm.

Type of termination	RICS – T-adapter		RICS – T-adapter for parallel connection of surge arrester type RDA		RICS – double-T-adapter	
	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description
<b>Polymeric insulated cables</b>						
1- and 3-core cables 10 kV, with comp. lugs type POLT	25– 50	RICS-5113	185–240 300	RICS-5139 RICS-5149	185–240 300	RICS-5137 RICS-5147
	70–150	RICS-5123				
	185–240	RICS-5133				
	300	RICS-5143				
1- and 3-core cables 15 kV, with comp. lugs type POLT	25– 35	RICS-5113	120–185 240–300	RICS-5139 RICS-5149	120–185 240–300	RICS-5137 RICS-5147
	50– 95	RICS-5123				
	120–185	RICS-5133				
	240–300	RICS-5143				
1- and 3-core cables 20 kV, with comp. lugs type POLT	10– 70	RICS-5123	95–185 240–300	RICS-5139 RICS-5149	95–185 240–300	RICS-5137 RICS-5147
	95–185	RICS-5133				
	240–300	RICS-5143				
1- and 3- core cables 10 kV, with mech. lugs type POLT	ML-1-13	50– 95*	95–150 150–240 240–300	RICS-5139 RICS-5149 RICS-5149	95–150 150–240 240–300	RICS-5137 RICS-5147 RICS-5147
	ML-2-17	95–150				
	ML-4-17	150–240				
	ML-5-17	240–300				
1- and 3- core cables 20 kV, with mech. lugs type POLT	ML-1-13	25– 70	70–150 150–185 240–300	RICS-5139 RICS-5149 RICS-5149	70–150 150–185 240–300	RICS-5137 RICS-5147 RICS-5147
	ML-2-17	70–150				
	ML-4-17	150–240**				
	ML-5-17	240–300				
<b>Paper insulated cables</b>						
Belted 3-core cables (MI and MIND) 10 kV type GUST, EPKT-45	35	RICS-5113	120–185 240	RICS-5139 RICS-5149	120–185 240	RICS-5137 RICS-5147
	50– 95	RICS-5123				
	120–185	RICS-5133				
	240	RICS-5143				
with mech. lugs type GUST - L16	35– 50	RICS-5123	70–120 150–240	RICS-5139 RICS-5149	70–120 150–240	RICS-5137 RICS-5147
	70–120	RICS-5133				
	150–240	RICS-5143				
Screened or belted 3-core cables (MIND) 10 kV type EPKT	35– 70	RICS-5113	185–240 300	RICS-5139 RICS-5149	185–240 300	RICS-5137 RICS-5147
	95–150	RICS-5123				
	185–240	RICS-5133				
	300	RICS-5143				
Screened 1- and 3-core cables (MIND) 10 kV type EPKT	35– 70	RICS-5113	185–240 300	RICS-5139 RICS-5149	185–240 300	RICS-5137 RICS-5147
	95–150	RICS-5123				
	185–240	RICS-5133				
	300	RICS-5143				
Screened 1- and 3-core cables (MIND) 20 kV type EPKT	25– 70	RICS-5123	95–185 240–300	RICS-5139 RICS-5149	95–185 240–300	RICS-5137 RICS-5147
	95–185	RICS-5133				
	240–300	RICS-5143				
Screened 1- and 3-core cables (MI) 10 kV type IDST	35– 95	RICS-5133-01-12	120–185 185–240			
	120–185	RICS-5133-01				
	185–240	RICS-5143-01				
Screened 1- and 3-core cables (MI) 20 kV type IDST	35– 70	RICS-5133-01-12	95–150 150–240			
	95–150	RICS-5133-01				
	150–240	RICS-5143-01				

\* For 3-core 10 kV termination with ML-1-13 mechanical lugs, RICS-5123 is suitable up to max. 70 mm<sup>2</sup> only.

\*\* For 3-core 20 kV termination with ML-4-17 mechanical lugs, RICS-5143 is suitable up to max. 185 mm<sup>2</sup> only.

**Note:** Adapters RICS-5113 and RICS-5123 are designed for use with cable lugs with 13 mm hole diameter. All other sizes are designed for use with cable lugs with the hole of 17 mm diameter. If a modification code -12 is added to these descriptions, cable lugs with the hole of 13 mm diameter can be used, e.g. RICS-5133-12. Modification code -12 products are not available for surge arrester connections or double connections. Adapters RICS with a capacitive back plug are available upon request.

**Packaging:** The insulating body, fixing nuts, terminal stud and cap are supplied in a 3-phase set complete with installation instruction. Cable terminations with lugs have to be ordered separately.

**Adapters for other types of bushing and for other cable are available on request.**

# RSTI - Screened, separable T-connection system for gas-insulated switchgears with bushings according to EN 50181 type C<sub>1</sub> (630 A) and C<sub>2</sub> (1250 A), 10 kV, 15 kV, 20 kV and 35 kV

Raychem screened separable T-connection system is designed to connect single-core or three-core (with installed trifurcation kit) polymeric insulated cables to gas-insulated switchgear or other equipment with bushings type C in accordance with EN 50181, specified up to 42 kV. Connections can be made in a right-angle configuration, also for 2 or 3 cables in parallel. All cables connected in the switchgear in parallel configuration must be individually mechanically fixed. Parallel connections to 630 A or 1250 A rated bushings with profile type C<sub>1</sub> or C<sub>2</sub> according to EN 505181 are possible with each RSTI. Maximum continuous current rating for T-connection system series RSTI-x8xx is 800 A. Parallel connections of RSTI-x8xx and RSTI-CC-x8xx can carry out 1250 A as well as single cable equipped with RSTI-x9xx.

Made of a highly modified silicone rubber and protected with an outer conductive shield connected to earth, Raychem RSTI screened T-connection system is thus suitable for both indoor and outdoor installations. Oversheath testing can be performed without removal of the RSTI system.

The modern design and material selection in combination with the Raychem designed high performance mechanical lug allows a large application range, covering most common cable sizes with just one kit.

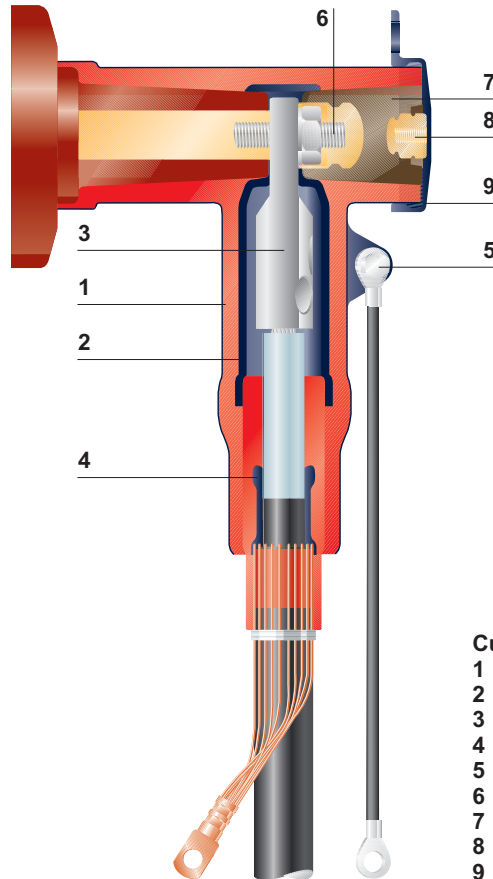
The overall and cut back dimensions are designed for use of minimum space required in the termination box, even double connections fit within most standard boxes.

Raychem RSTI screened T-connection system is equipped with a capacitive test point to determine if the circuit is energized. The capacitive test point is protected by a conductive cap.

## Surge arrester RSTI-SA for screened, separable T-connection system

The screened gapless surge arrester is designed either for a direct connection onto outer cone bushings in accordance to EN50181 with interface type C or for parallel connection mating to the rear entry of the base RSTI screened T-connection system designed for system voltage up to 35 kV. Detailed information and technical data are available on request.

The combination of screened T-connection system and surge arrester exceeds the requirements of CENELEC HD 629.1.S2 which includes BS, VDE and other international specifications.



Cut-away drawing of RSTI-58xx:

- 1 Screened body
- 2 Inner screen
- 3 Mechanical lug
- 4 Stress cone adapter
- 5 Earthing eye and ground lead
- 6 Threaded pin
- 7 Rear plug with test point
- 8 Test point
- 9 Conductive end cap

## Installation

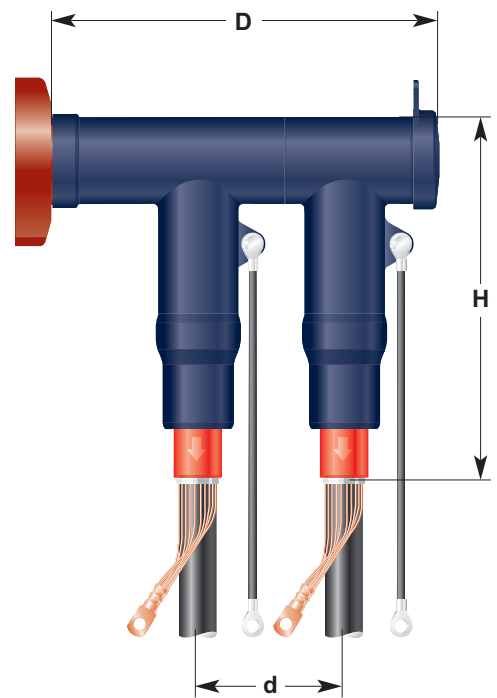
The design of T-connection system allows the use of all common cable core screen removal tools with a minimum cutback up to 40 mm. After cable preparation, the lubricated stress control adapter is simply slid into place. The high performance multi range mechanical lugs are quickly installed by shearing off the bolts. When lubricated, the screened connector body can be easily slid onto the cable end and fixed to the bushing by a threaded pin and nut. The open end is sealed by a rear plug or by a connection plug, which allows parallel connection of cables.

## Double connections

Only T-connector and coupling connector must be ordered for parallel connection of cables.

## The required installation dimensions D/d/H are as follows:

- 285/101/299 for connection of RSTI-58
- 295/101/339 for connection of RSTI-68
- 315/120/411 for connection of RSTI-x9



Configuration of RSTI-58 as double T-connection



# RSTI - Screened, separable T-connection system for gas-insulated switchgears with bushings according to EN 50181 type C1 (630 A) and C2 (1250 A), 10 kV, 15 kV, 20 kV and 35 kV

## RSTI - T-connection system

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description T-connector	Coupling connector	Diameter over core insulation (mm)
6/10	35 - 95	RSTI-5851	RSTI-CC-5851	12,7 – 25,0
	95 - 240	RSTI-5853	RSTI-CC-5853	17,0 – 32,6
	185 - 300	RSTI-5855	RSTI-CC-5855	21,3 – 34,6
	400	RSTI-3951	RSTI-CC-3951	28,9 – 36,4
	500	RSTI-3952	RSTI-CC-3952	28,9 – 36,4
	630	RSTI-3953	RSTI-CC-3953	34,0 – 45,4
8,7/15 and 12/20	35 - 70	RSTI-5851	RSTI-CC-5851	12,7 – 25,0
	95 - 240	RSTI-5854	RSTI-CC-5854	21,3 – 34,6
	185 - 300	RSTI-5855	RSTI-CC-5855	21,3 – 34,6
	400	RSTI-5951	RSTI-CC-5951	34,0 – 45,4
	500	RSTI-5952	RSTI-CC-5952	34,0 – 45,4
	630	RSTI-5953	RSTI-CC-5953	39,1 – 59,0
20/35	800	RSTI-5954	RSTI-CC-5954	39,1 – 59,0
	35 - 95	RSTI-6851	RSTI-CC-6851	22,4 – 35,5
	95 - 150	RSTI-6852	RSTI-CC-6852	22,4 – 35,5
	120 - 240	RSTI-6853	RSTI-CC-6853	28,9 – 42,0
	180 - 300	RSTI-6855	RSTI-CC-6855	28,9 – 42,0
	400	RSTI-6951	RSTI-CC-6951	34,0 – 45,4
500 - 630	RSTI-6952	RSTI-CC-6952	39,1 – 59,0	
800	RSTI-6953	RSTI-CC-6953	39,1 – 59,0	

**Scope of supply:** Screened connector body, stress control adapter, mechanical lug (suitable for aluminium and copper conductors), fixing nuts, terminal stud, backplug and lubricant supplied in a 3-phase set complete with installation instruction.

## Solderless earth connection for cables with aluminium or copper tape shield

### Cross section (mm<sup>2</sup>) for cables with nominal voltage U<sub>0</sub>/U

6/10 kV	8,7/15 kV	12/20 kV	Ordering description
35 - 120	35 - 120	35 - 120	SMOE-62871
95 - 400	70 - 300	50 - 240	SMOE-62872

**Note:** The solderless earth connection kit must be ordered separately. The SMOE kits include 3 roll springs, 3 earth leads, 3 heat shrinkable insulating tubing and copper mesh.

## Trifurcation kit for screened, 3-core polymeric insulated cables with wire shield and without armour

Dia. over core insulation (mm)	Dia. over cable (mm)	Max. tail length* (mm)	Ordering description
13,7 - 25,0	46,0 - 67,0	600	RSTI-TRF01
17,6 - 35,6	50,0 - 90,0	600	RSTI-TRF02
25,6 - 43,0	85,0 - 140,0	600	RSTI-TRF03

\* Trifurcation kits with longer tail length are available on request.

**Note:** Trifurcation kits must be ordered separately.

## RSTI system accessories

### Test rods

Cables can be tested while the RSTI connector and the cables are connected to the switchgear.

Set of 3 test rods with threading reducer

M16 / M12

**RSTI-68TRA**

2x length of 310 mm, 1x length of 460 mm.

**RSTI-68TR**

3x length of 310 mm.

**RSTI-68TRL**

3x length of 460 mm.



### Earthing plug for cable earthing

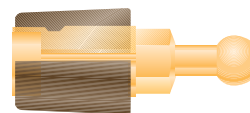
Cables can be earthed while the RSTI connector and the cable are connected to the switchgear.

**RSTI-68EA25**

Set of 3 pieces with ball diameter 25 mm.

**RSTI-68EA20**

Set of 3 pieces with ball diameter 20 mm.

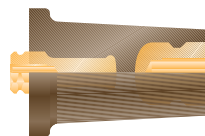


### Termination plug as live end seal

Allows termination and sealing of the RSTI connectors in case that they are not installed on a switchgear bushing. The termination plug must be installed before applying any voltage (e.g. cable system test).

**RSTI-68TP**

Set of 3 pieces.



### Insulated end cover

Insulated dead end for switchboard bushing according to EN 50181 types C.

**RSTI-N66RC**

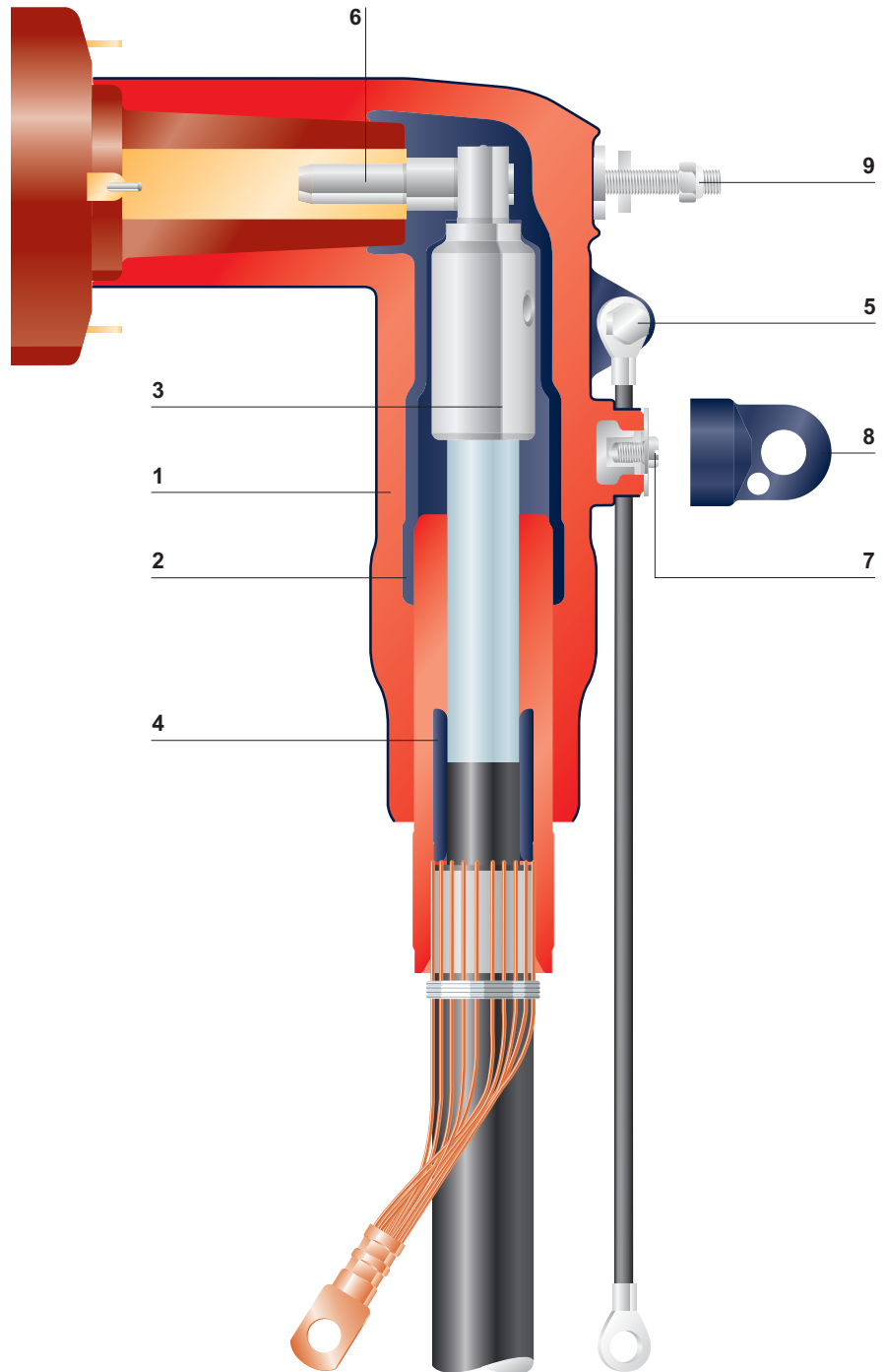
Set of 3 pieces.

# RSES-64xx - Screened, separable elbow connection system for gas-insulated switchgears with bushings according to EN 50181 type B (400 A), 20 kV and 35 kV

Raychem RSES-64xx screened, separable elbow connection system is designed to connect single- and three-core polymeric cables to medium voltage gas-insulated switchgear and other equipment using bushings type B specified for 400 A up to 35 kV in accordance with EN 50181.

Made of a highly modified silicone rubber and protected by a thin-walled outer conductive screen connected to earth, elbow connection system is equally suited for indoor and outdoor installation.

Supporting a wide application range, the design incorporates one body and two stress cone adapters to cover all cross-sections from 50 to 300 mm<sup>2</sup>. Mechanical lugs, included in the kit, accept both aluminium and copper conductors. The overall and cut back dimensions are designed to take up minimum space in the terminal box. RSES-64xx elbow connection system is equipped with a capacitive test point for determining whether the circuit is energized. A conductive cap protects this test point.



- Cut-away drawing of RSES-64xx:**
- 1 Screened body
  - 2 Inner screen
  - 3 Mechanical lug
  - 4 Stress cone adapter
  - 5 Earthing eye and ground lead
  - 6 Contact pin
  - 7 Test point
  - 8 Conductive covering cap
  - 9 Stainless steel bail

## Installation

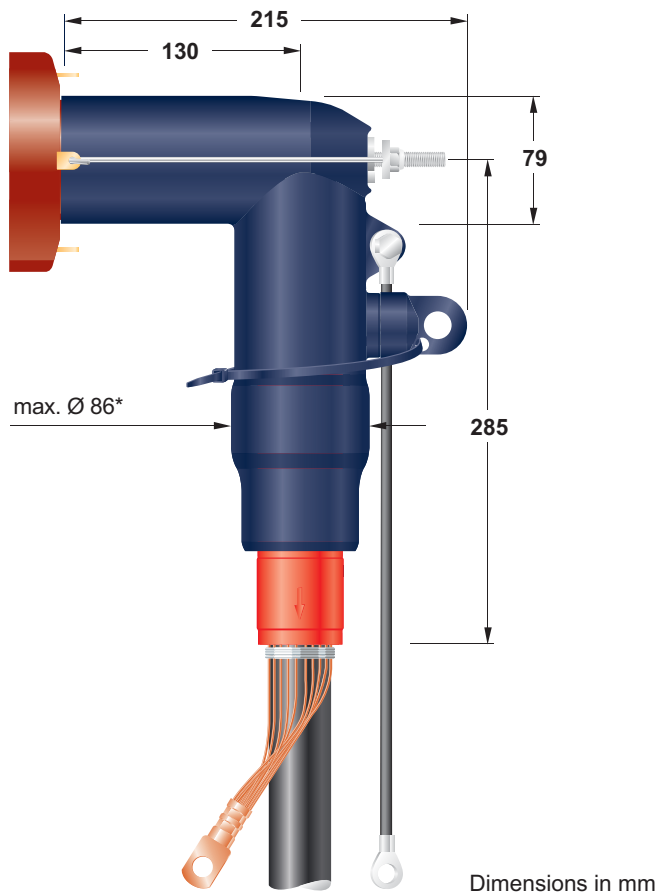
After a cable preparation and lubrication, the stress control adapter is simply slid into place and cable core terminated by mechanical lug with shear bolts. Followed by pushing the screened elbow body onto stress cone. The installation is finished by fixing the connection system on the equipment bushing with the bail. Main kit components, the stress cone and screened body of connection system, can be virtually installed under any conditions.



# RSES-64xx - Screened, separable elbow connection system for gas-insulated switchgears with bushings according to EN 50181 type B (400 A), 20 kV and 35 kV

## Applications

**Single connection**  
Material requested for 3 phases:  
1 x RSES-64xx (kit)



**Note:**

\*Plastic insulated cable, 36 kV, 300 mm<sup>2</sup>

### Screened separable elbow connection system with shear bolts mechanical lugs

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Diameter over core insulation (mm)
12/20	70 – 95	RSES-6451	22,4 – 35,5
	95 – 240	RSES-6452	22,4 – 35,5
	185 – 300	RSES-6454	22,4 – 35,5
20/35	50 – 95	RSES-6451	22,4 – 35,5
	95 – 150	RSES-6452	22,4 – 35,5
	120 – 240	RSES-6453	28,9 – 42,0
	185 – 300	RSES-6455	28,9 – 42,0

### Trifurcation kit for screened, 3-core polymeric insulated cables with wire shield and without armour

Dia. over core insulation (mm)	Dia. over cable (mm)	Max. tail length* (mm)	Ordering description
13,7 - 25,0	46,0 - 67,0	600	RSTI-TRF01
17,6 - 35,6	50,0 - 90,0	600	RSTI-TRF02
25,6 - 43,0	85,0 - 140,0	600	RSTI-TRF03

\* Trifurcation kits with longer tail length are available on request.

**Note:** Trifurcation kits must be ordered separately.

# RSES, RSSS - Screened, separable elbow and straight connection system for gas insulated switchgears and transformers with bushings according to EN 50181 type A (250 A), 10 kV, 15 kV and 20 kV

Raychem screened separable elbow RSES-52xx and straight RSSS-52xx connection systems are designed to connect single-core polymeric cables to gas-insulated switchgears or transformers up to 24 kV. The adapter seals on bushings according to EN 50181 type A (250 A).

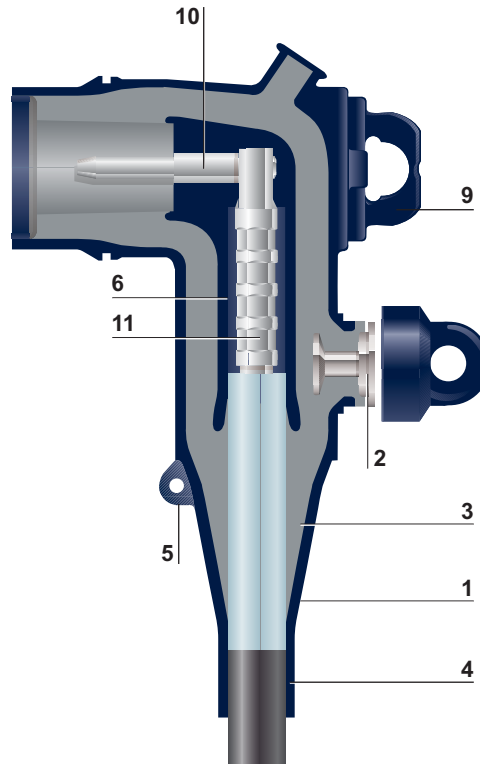
## Design

The thick walled separable connection system with an integrated stress control provides sealing and electrical connection to the cone of the bushing and the cable. Made of crosslinked EPDM and protected with a minimum 3 mm moulded conductive shield connected to the earth, the connection system is suitable for both indoor and outdoor installations. The special design and material selection of the connection system allow its use on a wide range of cable dimensions. Thus the connection system is independent of cable tolerances and special cable adapters are not required. The cable preparation and cut-back dimensions are the same for both straight and elbow connection system.

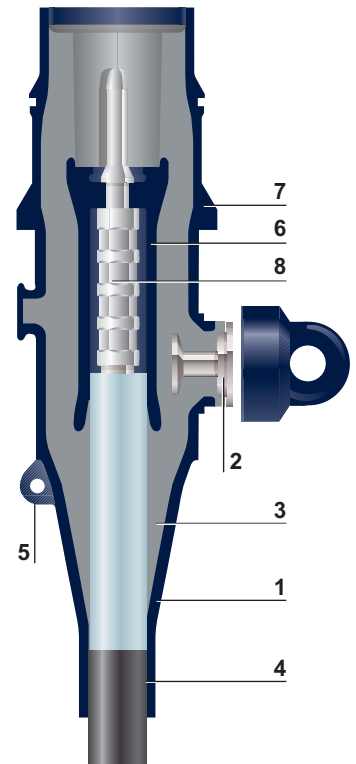
The connection system is equipped with a capacitive test point to ensure that the circuit is not energized before disconnection. The capacitive test point is protected by a conductive cap.

High strength bimetallic DIN-compression connectors tested to VDE 0220 are supplied within the kit to connect both aluminium and copper conductor cables.

Screened elbow connection system



Screened straight connection system



- 1 Screened body
- 2 Capacitive test point
- 3 Stress cone
- 4 Conductive Cable Entrance
- 5 Earthing eye
- 6 Inner Screen
- 7 Retaining Shoulder
- 8 Compression pin-connector
- 9 Lifting Eye
- 10 Pin
- 11 Compression Connector

## Installation

After a cable preparation and crimping of the connector, the connection system can be simply slid into place virtually under all conditions. For elbow connection system, the connection pin is screwed into the connector, a hexagon wrench is provided with the kit. A separable mounting system allows an easy installation of the Raychem connection system to the bushing. To provide a reliable environmental seal between the connection system and the overshield a cold-applied Rayvolve tubing or a heat-shrinkable phase marking tubing is offered.



# RSES, RSSS - Screened, separable elbow and straight connection system for gas insulated switchgears and transformers with bushings according to EN 50181 type A (250 A), 10 kV, 15 kV and 20 kV

## Scope of supply

### RSES- Elbow connection system

The screened body, compression connector (for aluminium and copper conductors), pin, hexagonal wrench, retaining clamp and lubricant supplied in a 3-phase set complete with installation instruction. Kits with modification code -R include in addition the Rayvolve sealing system, kits with modification code -P the heat-shrinkable phase marking tubing.

### RSSS - Straight connection system

The screened body, pin connector (for aluminium and copper conductors), retaining collar and lubricant supplied in a 3-phase set complete with installation instruction. Kits with modification code -R include in addition the Rayvolve sealing system, kits with modification code -P the heat-shrinkable phase marking tubing.

Nominal voltage U <sub>n</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Diameter over core insulation (mm)	Ordering description of connection system	
			Elbow	Straight
6/10	25	13,5–17,4	RSES-5202	RSSS-5202
	35	13,5–17,4	RSES-5203	RSSS-5203
	50	13,5–17,4	RSES-5205	RSSS-5205
	70	16,3–20,8	RSES-5217	RSSS-5217
	95	16,3–20,8	RSES-5219	RSSS-5219
	120	19,6–24,1	RSES-5224	
8,7/15	25	13,5–17,4	RSES-5202	RSSS-5202
	35	16,3–20,8	RSES-5213	RSSS-5213
	50	16,3–20,8	RSES-5215	RSSS-5215
	70	19,6–24,1	RSES-5227	RSSS-5227
	95	19,6–24,1	RSES-5229	RSSS-5229
	120	23,1–28,7	RSES-5234	
12/20	25	16,3–20,8	RSES-5212	RSSS-5212
	35	16,3–20,8	RSES-5213	RSSS-5213
	50	19,6–24,1	RSES-5225	RSSS-5225
	70	19,6–24,1	RSES-5227	RSSS-5227
	95	23,1–28,7	RSES-5239	
	120	23,1–28,7	RSES-5234	

Add modification code -P for connection system with heat shrinkable phase marking tubing. For example: RSES-5225-P

Add modification code -R for connection system with Rayvolve sealing tubing. For example: RSES-5225-R

**Note:** Connection systems including mechanical connectors are available on request.

### Superior environmental seal

The roll-on Rayvolve sleeve is used in conjunction with pressure sensitive mastic and is simply rolled into place to provide a reliable moisture seal.

Kits with modification code -R include the Rayvolve sealing system.

The heat-shrinkable phase marking tubing provides a moisture seal and additional phase marking. Kits with modification code -P include the phase marking tubing.



# Low Voltage Joints



## **Heat-shrinkable Low Voltage Joints**

Joints for polymeric and rubber insulated cables	56
Transition joints for polymeric insulated cables to paper insulated cables	58
Live end seals for polymeric and paper insulated cables	60
Joints for flexible, rubber insulated cables	61
Joints for polymeric insulated control cables	62
Pre-insulated connectors and terminals type DuraSeal	63
Branch joints for polymeric and paper insulated cables	64

## **PowerGel filled Low Voltage Joints**

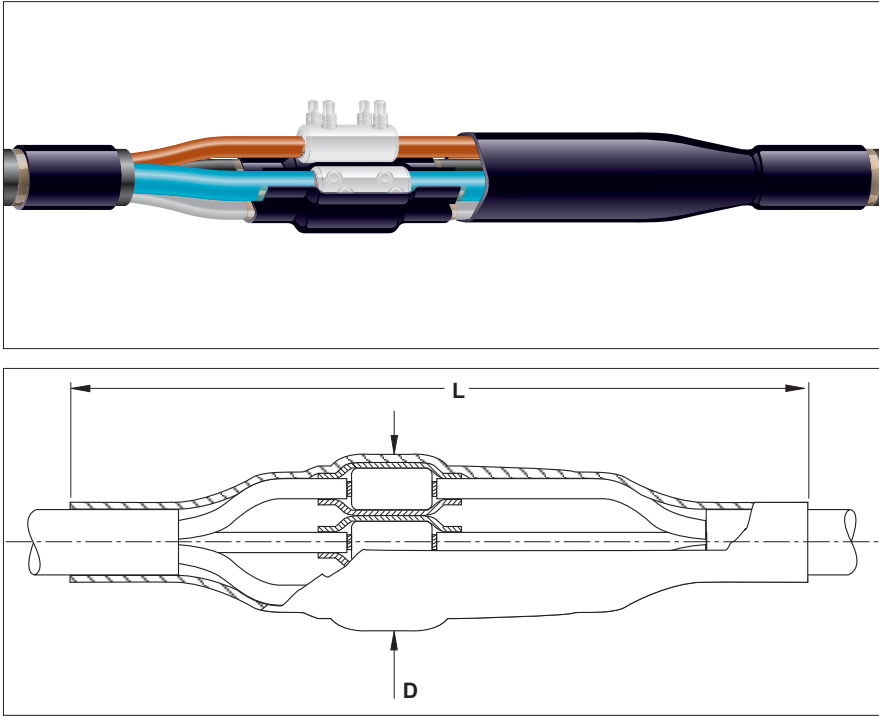
Inline and branch joints for polymeric insulated cables – RayGel, GelBox	66
Repair sleeves and inline joints for polymeric insulated single core cables – GelWrap	66

## **GUROFLEX filled Low Voltage Joints**

Joints up to 240 mm <sup>2</sup> for polymeric insulated cables	68
Branch joints up to 25 mm <sup>2</sup> for polymeric insulated cables	69
Branch joints 35 to 240 mm <sup>2</sup> for polymeric insulated cables	70
GUROFLEX – two-component environmental friendly filler material	71

<b>Mantle clamps and ring connectors</b>	<b>72</b>
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## Joints for polymeric and rubber insulated cables



Dimensions L, D see table

### Cable

The joints are designed for 3-, 3,5-, 4- and 5-core polymeric and rubber insulated cables.

For example: SZAMtKatM, KatM, N(A)YY, N(A)YBY, VVG, AVVG, BBГ, ABBГ, YAKY, YKY, YKYFty, AYKY, CYKY, PP 00, XP 00, PP 41, N(A)YC(W)Y

### Design of joints with mechanical connectors

#### For cables without armour

The joints consist of four or five mechanical shear bolt connectors and relevant quantity of inner and the one outer heat-shrinkable tubing. The connectors are insulated and sealed by thick-wall tubing which is pre-coated with a hot-melt adhesive. The outer protection and sealing is performed by thick-wall heat-shrinkable tubing. All joints are designed to allow crossing of cable cores.

#### For cables without armour and for live working

The difference to the standard kits is only the longer length of the inner insulation and the outer re-jacketing tubing and the increased cutback, according to the requirements of DIN47640.

For live-working installations please consider the special installation procedure of working under life lines given by local regulation.

### Design of joints without mechanical connectors

#### For cables with armour

The joints consist of four or five inner and of the one outer heat-shrinkable tubing as well as tinned copper mesh and roll springs. The crimp or mechanical connectors are not part of the supplied kit and their dimensions must not exceed the maximum values given in the tables at the next page. The connectors are insulated and sealed by thick-wall tubing which is pre-coated with a hot-melt adhesive. The mesh is wrapped around the jointing area and mechanically secured and electrically connected to the steel tape by the roll springs. The outer protection and sealing is performed by thick-wall heat-shrinkable tubing. All joints are designed to allow crossing of cable cores.



## Joins for polymeric and rubber insulated cables

### Joins for polymeric and rubber insulated cables without armour including mechanical connectors

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )		Ordering description 4-core cables	5-core cables		Dimensions (mm)	
						L	D
0,6/1	1,5 – 6			LJSM-5X/1.5-006		300	30
	4 – 16		LJSM-4X/004-016	LJSM-5X/004-016		360	36*
	16 – 35			LJSM-5X/016-035		450	57
	16 – 50		LJSM-4X/016-050			500	50
	35 – 95		LJSM-4X/035-095			630	68
	35 – 150		LJSM-4X/035-150			780	75
	95 – 240		LJSM-4X/095-240			950	100
<b>joins for live working</b>							
0,6/1	4 – 16		LJSM-4X/004-016-PP			420	36
	16 – 50		LJSM-4X/016-050-PP			500	50
	35 – 95		LJSM-4X/035-095-PP			710	68
	35 – 150		LJSM-4X/035-150-PP			890	75
	95 – 240		LJSM-4X/095-240-PP			1100	100

\* Diameter D of joint for 5-core cables is 44 mm.

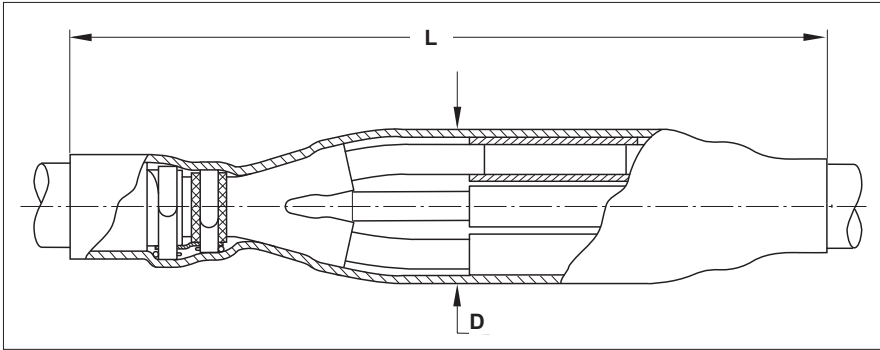
**Note:** Included mechanical shear bolt connectors are unblocked.

### Joins without connectors for polymeric insulated cables with steel tape armour or aluminium tape shield

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )		Ordering description	Dimensions (mm)		Joint	
	Crimp Connectors	Mechanical Connectors		Max. connector Length	Diameter	L	D
<b>for use with crimping and mechanical connectors</b>							
0,6/1	1,5 – 10		SMOE-81521	35	8	300	25
	6 – 25		SMOE-81522	75	12	500	40
	16 – 50		SMOE-81523	95	18	650	50
	70 – 150	70 – 120	SMOE-81524	130	26	850	80
	95 – 300	150 – 240	SMOE-81525	150	37	950	110
<b>for use with mechanical connectors</b>							
0,6/1		10 – 35	SMOE-81526	45	18	450	50
		25 – 70	SMOE-81527	60	26	600	70
		70 – 120	SMOE-81528	75	29	650	80
		150 – 240	SMOE-81529	85	38	800	110

**Note:** Dimensions of connectors must not exceed the dimensions given in the table. The cross section ranges shown in the table apply to all PVC insulated 1 kV cables with crimp connectors according to DIN standards or mechanical connectors within the given limits.

## Transition joints for polymeric insulated cables to paper insulated cables



Dimensions L, D see table

### Cable

The joints are designed for 4-core paper and polymeric insulated cables with or without armour.

For example: N(A)YY, SZAPKOV, IPO 13, NPO 13, ACHPAbI, ACEY-ABBГ, YAKY, YKY, YKYFtly, ANKOY, AYKY, PP 00, PP 41, N(A)YBY, IPO 14, NPO 14, N(A)KBA.

### Design of joints

The paper cable is transformed to a quasi polymeric insulated cable with heat-shrinkable oil resistive tubing and a breakout. The connectors are insulated and sealed with adhesive coated heat shrinkable tubing. The outer protection and sealing is performed by heat-shrinkable tubing.

### Joints including connectors

The kit includes a solderless earth and neutral connection system for lead or aluminium sheaths.

### Joints without connectors

In case of 3-core cables, a separate earth lead has to be soldered to the metal sheath (not provided within the kit).

## Transition joints for polymeric insulated cables to paper insulated cables

### Joints including mechanical connectors for 3 and 4-core paper to 4-core polymeric insulated cable

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for paper cables		Dimensions (mm)	
		3-core	4-core	L	D
0,6/1	10– 35		TRAJ-01/4x 10- 35/4SB	500	50
	25– 70	TRAJ-01/4x 25- 70/3SB	TRAJ-01/4x 25- 70/4SB	800	70
	70–120	TRAJ-01/4x 70-120/3SB	TRAJ-01/4x 70-120/4SB	900	80
	50–150		TRAJ-01/4x 50-150/4SB-PL01	900	80
	150–240	TRAJ-01/4x150-240/3SB	TRAJ-01/4x150-240/4SB	1100	110

### Joints without connectors

#### 4-core paper to 4-core unarmoured polymeric insulated cable including solderless earth connection for use with mechanical connectors

Nominal voltage U <sub>0</sub> /U (kV)	Cross section		Ordering description	Dimensions (mm) Max. connector		Joint	
	polymeric (mm <sup>2</sup> )	paper (mm <sup>2</sup> )		Length	Diameter	L	D
0,6/1	25– 95	25– 95	SMOE-81404	90	25	850	70
	95–150	50–150	SMOE-81502	130	32	1050	80
	95–240	95–240	SMOE-81400	110	38	1150	90

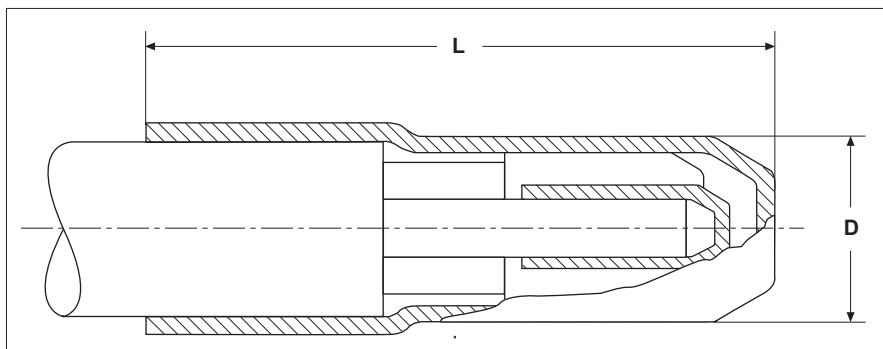
**Note:** Dimensions of connectors must not exceed the dimensions given in the table. Mechanical connectors are not included in the joints.

#### 4-core paper to 4-core polymeric insulated cable for use with compression connectors

Nominal voltage U <sub>0</sub> /U (kV)	Polymeric cables without armour		Polymeric cables with armour		Dimensions (mm)	
	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description	L	D
0,6/1	10– 16	EPKJ-0903	16– 26	EPKJ-0828	700	45
	25– 50	EPKJ-0910	35– 50	EPKJ-0835	900	60
	70–150	EPKJ-0917	70–150	EPKJ-0842	1100	75
	185–300	EPKJ-0924	185–300	EPKJ-0856	1300	100

**Note:** Connectors are not included.

## Live end seals for polymeric and paper insulated cables



Dimensions L, D see table

### Cable

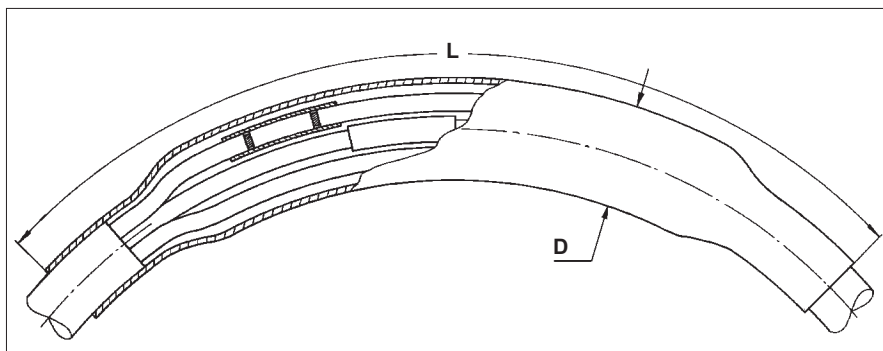
The live end seals are designed for polymeric or paper insulated cables.  
For example: SZAMtKAtM, N(A)YY, CYAbY, IPO 13, VVG, AVVG, AAbBY, ACbY, AYKY, CYKY, ANKOY, ANKOP, PP 00, XP 00, PP 41, N(A)YBY, IPO 14.

### Design of live end seal

The ends of the cores are sealed and insulated with heat-shrinkable end caps. A larger end cap protects the cores and seals to the oversheath.  
For cables with armour an additional metallic shielding is available on request.

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
0,6/1	10– 16	EPKE-0024	90	32
	25– 50	EPKE-0044	90	42
	70– 120	EPKE-0064	143	56
	150–300	EPKE-0084	163	67

## Joints for flexible, rubber insulated cables



Dimensions L, D see table

### Cable

The joints are designed for flexible, rubber insulated cables with or without shield. The maximum number of cores is five.

For example: GTB, GTBa, MCCG, H07RN-F, H07RN-FF, KГ, КГН, КПГ, OnG, Ogek, OnGbekz..., CGSG, CGTU, CGGU, CGDU, EpN 53, EpN 55, EpN 61, EpN 62, EpN (BN)76, GN 50.

### Design of joints

The connectors are insulated and sealed by flexible tubing which is pre-coated with a hot-melt adhesive. The outer protection and sealing is also performed by flexible, thick-wall heat-shrinkable tubing. The voids between the cores and the outer tubing are filled by flexible mastic. In case of shielded cables a copper mesh is wrapped around the mastic.

### Unshielded flexible cables

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
0,6/1	1,5– 2,5	EMKJ-0002	300	20
	4– 6	EMKJ-0004	350	28
	10– 16	EMKJ-0017	510	34
	25– 50	EMKJ-0027	560	55
	70– 120	EMKJ-0037	740	78

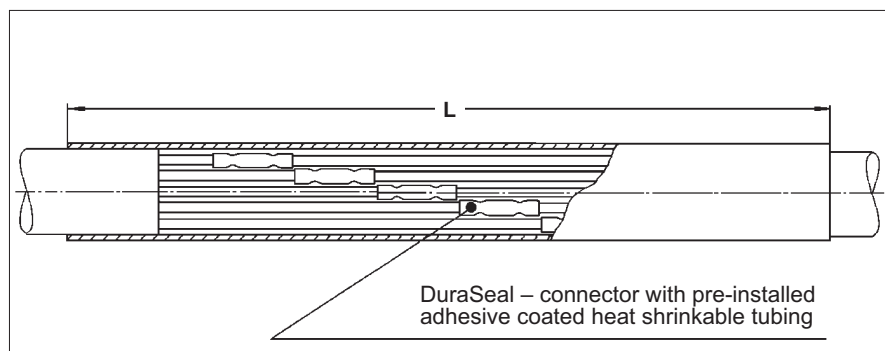
**Note:** Connectors are not included.

### Shielded flexible cables

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
0,6/1	1,5– 2,5	EMKJ-0102	300	20
	4– 6	EMKJ-0104	350	25
	10– 16	EMKJ-0117	510	36
	25– 50	EMKJ-0127	560	60
	70– 120	EMKJ-0137	740	84

**Note:** Connectors are not included.

## Joins for polymeric insulated control cables with DuraSeal connectors



Dimension L see table

### Cable

The joints are designed for polymeric insulated control cables with or without armour.

For example: NYY, KBBГ, КПсБГ, YKSY, YKSYy, YeKSY, CYKY, PP 00.

### Design of joints

#### For cables without armour

The cores are connected and sealed with DuraSeal connectors. A cardboard liner ensures a round shape over which the outer protection and sealing is performed by a thick-wall heat-shrinkable tubing.

#### For cables with steel tape armour

The inner jointing is performed as for cables without armour. In addition, a tinned grid is wrapped around the jointing area and mechanically secured and electrically connected to the steel tape by roll springs. The outer protection and sealing is performed by a thick-wall, heat-shrinkable tubing.

### Joins for polymeric insulated cables without armour

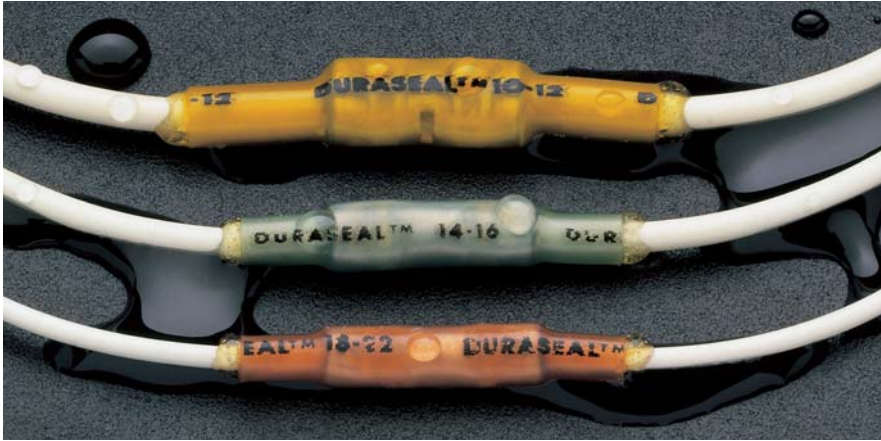
Nominal voltage $U_0/U$ (kV)	Number of conductors	Cross section (mm <sup>2</sup> )	Cable diameter (mm)		Ordering description	Dimension L (mm)
			min.	max.		
0,6/1	4– 7	1,5–2,5	8	19	SMOE-81140	300
	8–14	1,5–2,5	12	22	SMOE-81141	300
	15–21	1,5–2,5	15	27	SMOE-81142	350
	22–40	1,5–2,5	20	35	SMOE-81143	350
	41–75	1,5–2,5	28	44	SMOE-81144	400

### Joins for polymeric insulated cables with steel tape armour

Nominal voltage $U_0/U$ (kV)	Number of conductors	Cross section (mm <sup>2</sup> )	Cable diameter (mm)		Ordering description	Dimension L (mm)
			min.	max.		
0,6/1	4– 7	1,5–2,5	17,5	21	SMOE-81140-T	450
	8–14	1,5–2,5	17,5	26	SMOE-81141-T	450
	15–21	1,5–2,5	22	30	SMOE-81142-T	550
	22–40	1,5–2,5	22	39	SMOE-81143-T	550
	41–75	1,5–2,5	27	47	SMOE-81144-T	650

Joins for other cable types are available on request.

## Pre-insulated connectors and terminals type DuraSeal



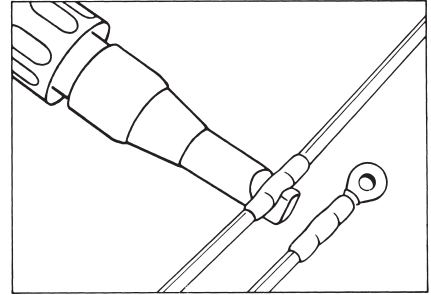
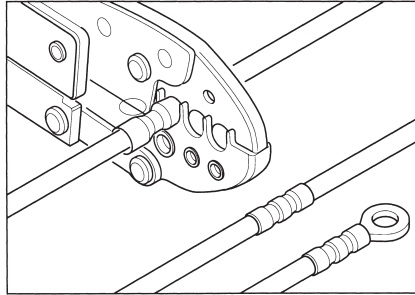
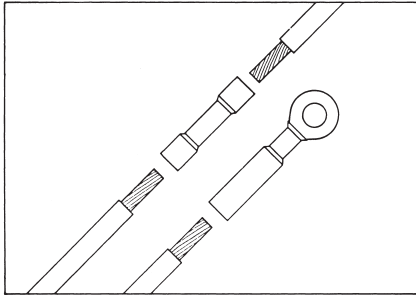
### Application

Provides an environmentally sealed core connection for installation cables. To be used in joints or as a sealed terminal.

### Construction

The connector consists of a crimp barrel and a pre-installed adhesive coated heat shrinkable tubing.

The terminal consists of a crimping lug and a pre-installed adhesive coated heat shrinkable tubing.



### Installation

Select the correct connection element. Remove the core insulation on a length of 7,5 mm. With the adhesive not being sticky at room temperature, the cores can be easily inserted into the connector.

Crimp the connector with a suitable crimping tool, for example AD-1522-1.

Heat the crimped connection area with a hot air tool until the tubing recovers and the adhesive flows. The heating tool HL2010E-230V-EURO and the reflector HL1802E-070519 are recommended.

#### Insulated connectors

Cross section (mm <sup>2</sup> )		Ordering description	Colour	Length (mm)
min.	max.			
0,5	1	D-406-0001	red	32
1,5	2,5	D-406-0002	blue	32
4	6	D-406-0003	yellow	32

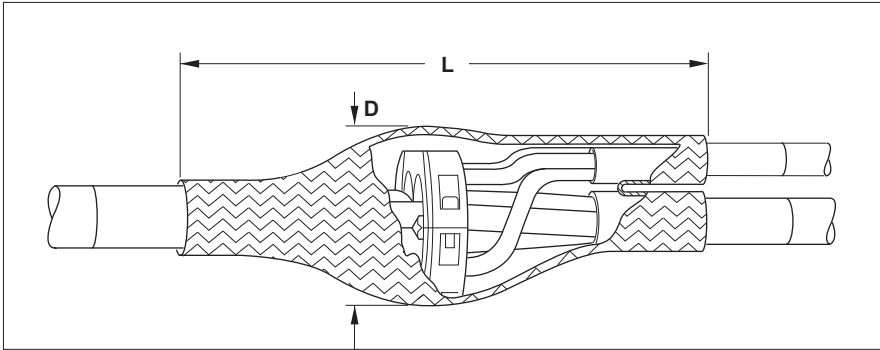
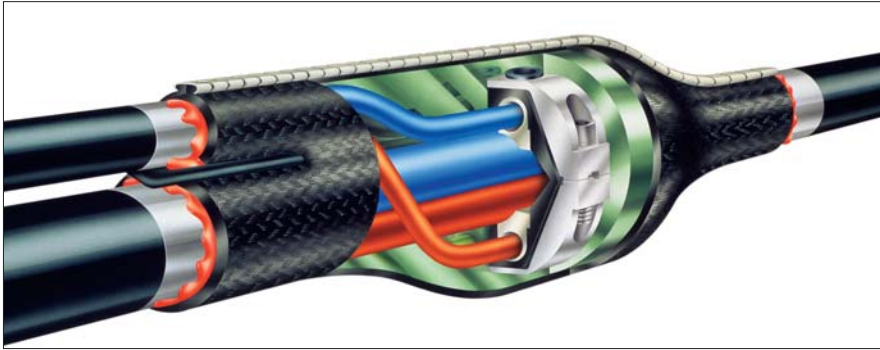
**Note:** To be ordered in boxes, a box contains 100 pcs or 50 pcs (only size 4-6 mm<sup>2</sup>).

#### Insulated terminals

Cross section (mm <sup>2</sup> )		Ordering description				Colour
min.	max.	Fork d = 4 mm	Ring d = 4 mm	d = 6 mm	d = 8 mm	
0,5	1	B-106-2401	B-106-1401	B-106-1601	B-106-1801	red
1,5	2,5	B-106-2402	B-106-1402	B-106-1602	B-106-1802	blue
4	6	B-106-2403	B-106-1403	B-106-1603	B-106-1803	yellow

**Note:** d = hole diameter

## Branch joints for polymeric and paper insulated cables



Dimensions L, D see table

### Cable

The joints are designed for 4-core paper and polymeric insulated cables with or without armour up to 240 mm<sup>2</sup>.

For example: N(A)YY, SZAPKOV, IPO 13, NPO 13, ACHPAbl, BBГ, ABBГ, YAKY, YKY, AKFtA, AYKY, CYKY, ANKOY, ANKOP, PP 00-(A), PP 41-(A), N(A)YBY, IPO 14.

### Design of joints

The joint is designed to be installed live by using compact ring connectors. Mastic around the cores and the connector seals and insulates. A fibre reinforced wraparound seals to the oversheath and provides mechanical protection. Joints for armoured cables include in addition solderless earth connections. Paper cables are sealed with additional oil-resistant mastic and a breakout for the branch cable.

### Conductors types:

sm: Sector stranded  
se: Sector solid  
rm: Round stranded  
re: Round solid



## Branch joints for polymeric and paper insulated cables

### Heat shrinkable branch joint for 4-core polymeric insulated cables including compact ring connector

Nominal voltage U <sub>0</sub> /U (kV)	Main conductor		Branch conductor		Ordering description	Dimensions		
	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )		L (mm)	D (mm)	
0,6/1		5x 2,5–10 4– 16		5x 2,5–10 4– 16	SMOE-81601*	250	50	
					SMOE-81426*	380	55	
		35– 70	50– 95	6– 50	6– 70	BMHM-1001-4B1-4874	500	135
		70–120	95–150	6– 50	6– 70	BMHM-1001-4B1-6875	500	135
		150	185se	6– 70	6– 70	BMHM-1001-4C1-6878	500	135
		185	240se	6– 70	6– 70	BMHM-1001-4D1-6879	500	155
		240sm	–	6– 70	6– 70	BMHM-1001-4D1-6880	500	155
		95–120	120–150	10– 95/ 35–120	16–120/ 50–150	BMHM-1001-4D2-6877	560	155

\* Insulated single core connectors are included.

**Note:** Additional sealing kits for double branches are available on request.

### Heat shrinkable branch joint for 3 1/2-core polymeric insulated cables including compact ring connector

Nominal voltage U <sub>0</sub> /U (kV)	Main cable phase conductor		neutral conductor		Branch conductor		Ordering description	Dimensions	
	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )		L (mm)	D (mm)
0,6/1	70–120	95–150	35–70	50–95	6–50	6–70	BMHM-1001-4B1-4875.3	500	135
	150sm	–	70sm	70	6–50*	6–50	BMHM-1001-4C1-6878.3	500	135
	185sm	–	–	95re	6–50*	6–50	BMHM-1001-4D1-6879.3	500	155
	240sm	–	–	120re	6–50*	6–50	BMHM-1001-4D1-6880.3-RE	500	155
	240sm	–	120sm	–	6–50*	6–50	BMHM-1001-4D1-6880.3-SM	500	155

\* Needs to be rounded for 50 mm<sup>2</sup> sm.

**Note:** Additional sealing kits for double branches are available on request.

### Heat shrinkable branch joint without connector

Nominal voltage U <sub>0</sub> /U (kV)	Cross section		Ordering description	Connector diameter (mm)	Dimensions	
	Main cable (mm <sup>2</sup> )	Branch cable (mm <sup>2</sup> )			L (mm)	D (mm)
<b>Branch joints for polymeric insulated cables without armour</b>						
0,6/1	16–185	6– 95	BMHM-1001-4B1	115	500	135
	95–185	6– 95	BMHM-1001-4C1	115	500	135
	95–240	6– 70	BMHM-1001-4D1	135	500	155
	95–240	6–150	BMHM-1001-4D2	135	560	155
<b>Branch joints for polymeric insulated cables with steel tape armour or aluminium tape shield</b>						
0,6/1	16–185	16– 95	BMHM-1031-4C1-CEE01 + EPPA 206-4-250*	115	560	135
	95–185	16– 95	BMHM-1031-4C1-CEE01	115	560	135
	95–240	50–120	BMHM-1031-4D1-CEE01	135	560	155
<b>Branch joints for paper insulated main cables and polymeric insulated branch cables</b>						
0,6/1	35– 95	35–95	SMOE-81551	115	560	135
	120–185	35–95	SMOE-81503	115	560	135
	120–240	35–95	SMOE-81740	135	650	155

\* EPPA-206-4-250 filler mastic must be used if the cross section is less than 95 mm<sup>2</sup>.

Compact ring connectors for cross sections up to 240 mm<sup>2</sup> are also available separately, see page 73.

## PowerGel filled joints and repair sleeves for polymeric insulated cables



**GelBox: Inline joint**



**RayGel Plus: Inline and branch joints**



**GelWrap: Inline joint and repair sleeve**

### Cable

The joints are designed for single and multi-core polymeric insulated cables without armour.

For example: SZAMtKaTm, KaTm, N(A)YY, N(A)YBY, VVG, AVVG, ÅÅÅ, ÅÅÅÅ, YAKY, YKY, YKYFty, AYKY, CYKY, PP 00, XP 00, PP 41, N(A)YC(W)Y

### Application

Indoor and outdoor use - to install cable connections in underground, direct buried and overhead applications.

### Performance tests

Joints are qualified to CENELEC EN 50393, the European specification for direct buried applications. This includes a three week heat cycling test with the joint immersed in 1 meter depth of water.

### Design of joints

#### RayGel Plus – inline and branch joints

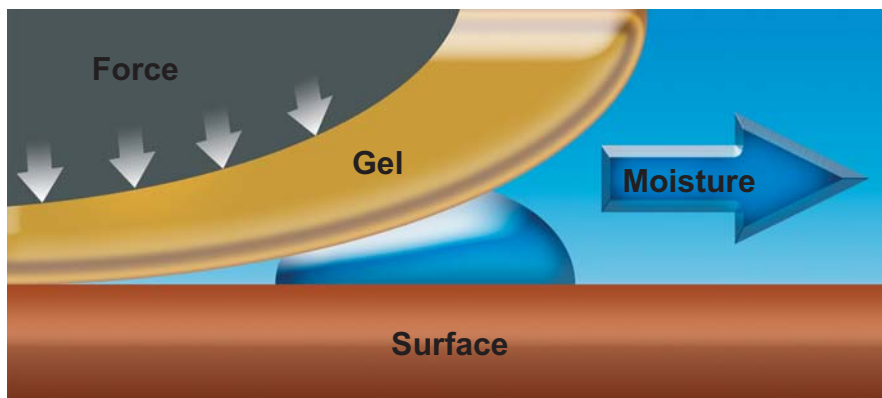
Cable connections are easily established by using the universal connector block with sliding nuts and insertion tool, included in RayGel Plus 2 and RayGel Plus 3 delivery, or using the connectors selected according to the max. dimensions given in the tables for RayGel Plus 1 and RayGel Plus 0. The unique universal connector block provides full branch capabilities without cutting of main cables. Installation is very straight forward as the block snaps into the bottom side of the PowerGel filled enclosure. The enclosure can be snap-closed by hand, due to its flexible gel barriers. A strain relief is integrated within the enclosure and quickly installed with the two cable ties. No special tools are needed and joints can be put into service immediately. For branch configurations, the branch cable and cores are positioned in parallel to the main cable and cores.

#### GelBox – inline joints

The cables are connected with a supplied piercing shear bolt mechanical connector block. Based on the piercing technology no stripping of the primary insulation is required. The connector block will be positioned in the middle of the PowerGel filled half shells. Both shells are easily snapped in to each other. Accidentally re-opening is prevented by the snap in mechanism.

#### GelWrap - inline joints

GelWrap sleeves are simply wrapped around and snapped on any cable in the given application range and completely encapsulate the connection without entering of moisture into a splice. GelWrap sleeves can be used also for insulation and cable jacket repair.



“Hydrophobic” action of PowerGel sealant.

### PowerGel sealing technology products

- Quick, easy and clean installation.
- Reliable protection against humidity and water.
- Suitable for outdoor and direct-buried applications.
- Qualified to the international joint standard CENELEC EN50393.
- Halogen-free and UV-resistant.
- Unlimited shelf life.
- Environment friendly and no subject to labeling requirements.

## PowerGel filled joints and repair sleeves for polymeric insulated cables

### GelBox inline joints with insulation piercing mechanical shear bolt connectors for cables with up to 5 cores

Nominal Voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions Length x Width x Height (mm)
0,6/1	4 x 6 – 25 (35*)	GelBox-25	270 x 100 x 45
	5 x 6 – 16**	GelBox-25-5	270 x 100 x 45
	5 x 10 – 25**	GelBox-25-5/25	270 x 100 x 45

\* 35 mm<sup>2</sup> with cable insulation removed (non-piercing application).

\*\* Includes a single mantle clamp for the earthing wire.

### RayGel Plus inline and branch joints with universal connector block for cables with up to 5 cores

Nominal Voltage U <sub>o</sub> /U (kV)	Cross section Main (mm <sup>2</sup> )	Branch (mm <sup>2</sup> )	Ordering description	Dimensions Length x Width x Height (mm)
0,6/1	3 – 5 x 1,5 – 6	3 – 5 x 1,5 – 6	RayGel Plus 2	233 x 78 x 40
	3 – 5 x 6 – 16	3 – 5 x 6 – 16	RayGel Plus 3	313 x 90 x 47

### RayGel Plus inline and branch joints without connector for cables with up to 5 cores

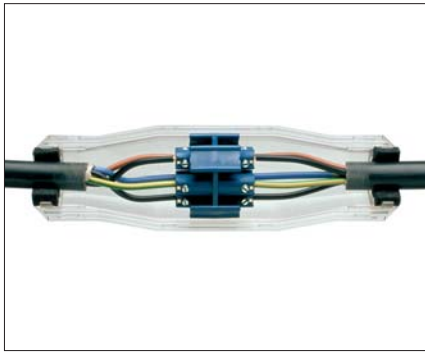
Nominal voltage U <sub>o</sub> /U (kV)	Cross section Main (mm <sup>2</sup> )	Branch (mm <sup>2</sup> )	Ordering description	Dimensions (mm) Length x Width x Height Connectors, max. Joint	
0,6/1	2 – 3 x 1,5 – 2,5*	2 – 3 x 1,5*	RayGel Plus 0	26 x 24 x 16	100 x 37 x 24
	3 – 5 x 1,5 – 2,5*	3 – 5 x 1,5*	RayGel Plus 1	26 x 38 x 16	139 x 51 x 24

\* Cross section for 1-core cables: main 1 x 10 – 50 mm<sup>2</sup>, branch 1 x 10 – 16 mm<sup>2</sup>.

### GelWrap inline joints without connector for single-core cables and repair sleeve for cable cores and cable oversheaths

Nominal voltage U <sub>o</sub> /U (kV)	Cable diameter (mm)	Ordering description	Max. length Connector or oversheath repair (mm)
0,6/1	4 – 18	GELWRAP-18/4-150	74
	4 – 18	GELWRAP-18/4-200	124
	4 – 18	GELWRAP-18/4-250	174
	10 – 33	GELWRAP-33/10-150	48
	10 – 33	GELWRAP-33/10-200	98
	10 – 33	GELWRAP-33/10-250	148
	20 – 50	GELWRAP-50/20-250	100
	20 – 50	GELWRAP-50/20-300	150

## GUROFLEX filled joints up to 240 mm<sup>2</sup> for polymeric insulated cables



BV joint including connector block



PXE joint without connector



Kit content of PXE-SUx-GD

### Cable

The joints are designed for 3-, 3,5-, 4- and 5-core polymeric insulated cables without armour up to 240 mm<sup>2</sup>.

For example: SZAMtKAtM, KAtM, N(A)YY, N(A)YBY, VVG, AVVG, BBF, ABBF, YAKY, YKY, YKYFty, AYKY, CYKY, PP 00, XP 00, PP 41, N(A)YC(W)Y.

### Design of joints

#### Including connector block

The joints consist of a shock-resistant, transparent polycarbonate snap-to-close design housing and integrated polymer foams for sealing. The robust housing is easy and quickly to assemble, cutting to the cable diameter is not needed. The GUROFLEX filler material is delivered in a double chamber bag. For details on GUROFLEX filler see page 71. The inline connector block with integrated spacing and insulation allows a quick and easy connection. A cable diameter range from 13 - 30 mm can be covered. The cable can be energized immediately after joint installation.

#### Without connectors

The joints include joint shells, two-part GUROFLEX filler material in a double chamber bag, core separator, abrasive cloth tape and sealant tape.

The clear, robust, snap to close joint shells ensure an easy positioning and filling.

During an installation the joint shells are trimmed to suit the cable size and conductors jointed by connectors (not part of the kit). The core separator is placed between the connectors, the joint shells are snapped closed and their ends sealed by the included tape. The final step of the installation is mixing and pouring GUROFLEX filler material. For details on GUROFLEX filler see page 71.

The cable can be energized immediately after joint installation.

### GUROFLEX filled inline joints including connector block

Nominal voltage U <sub>o</sub> /U (kV)	Cable diameter (mm)	Cross section (mm <sup>2</sup> )	Ordering description	Joint (mm)*	
				L	H
0,6/1	13 – 20	5 x 1,5 – 6	BV-0-GD-KS0	220	73
	16 – 25	5 x 6 – 16	BV-1-GD-KS1	230	80
	21 – 30	4 x 16 – 25	BV-2-GD-KS2	270	90

\* L = Overall length of the housing; H = Overall height of the housing.

**Note:** Cross sections are selected according to dimensions given in CENELEC HD 603.

The BV joints without connector block are available on request.

### GUROFLEX filled inline joints without connector

Nominal voltage U <sub>o</sub> /U (kV)	Cable diameter (mm)	Cross section (mm <sup>2</sup> )	Ordering description	Joint (mm)*	
				L	H
0,6/1	6 – 19	4 x 1,5 – 6	PXE-SU1-GD	160	36
	6 – 27	4 x 1,5 – 10	PXE-SU2-GD	190	48
	14 – 34	4 x 2,5 – 5 x 16	PXE-SU3-GD	240	50
	16 – 37	4 x 4 – 25	PXE-SU4-GD	270	65
	20 – 44	4 x 10 – 50	PXE-SU5-GD	360	80
	26 – 52	4 x 25 – 95	PXE-SU6-GD	430	95
	35 – 67	4 x 70 – 150**	PXE-SU7-GD	530	120

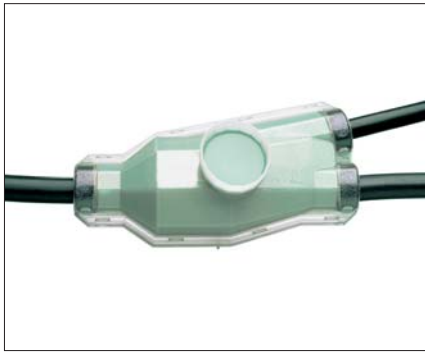
\* L = Overall length of the housing; H = Overall height of the housing.

\*\* For crimp connectors up to 240 mm<sup>2</sup>.

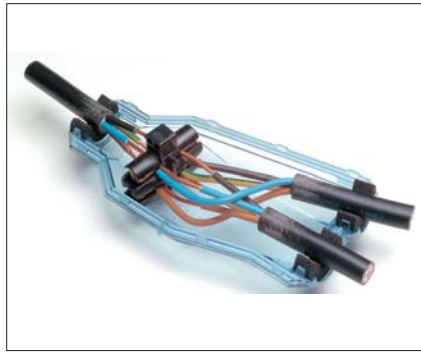
**Note:** Cross sections are selected according to dimensions given in CENELEC HD 603.

GUROFLEX filled joints for other cable types and cross sections are available on request.

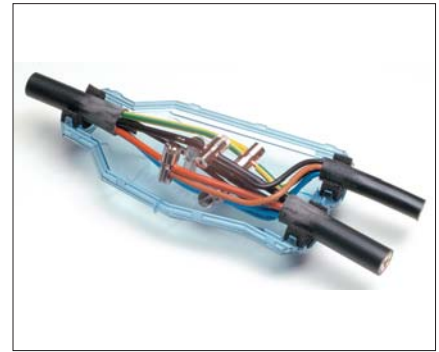
# GUROFLEX filled branch joints up to 25 mm<sup>2</sup> for polymeric insulated cables



BAV-2U



with connector block



with mantle clamps

## Cable

The joints are designed for 3,5-, 4- and 5-core polymeric insulated cables without armour up to 25 mm<sup>2</sup>.

For example: SZAMtKAtM, KAtM, N(A)YY, N(A)YBY, VVG, AVVG, BBF, ABBF, YAKY, YKY, YKYFty, AYKY, CYKY, PP 00, XP 00, PP 41, N(A)YC(W)Y.

## Design of joints

The joint consists of a shock-resistant, transparent polycarbonate snap-to-close design housing and integrated polymer foams for sealing. The robust housing is easy and quickly to assemble, cutting to the cable diameter is not needed. GUROFLEX filler material is delivered in a double chamber bag. For details on GUROFLEX filler see page 71. The branch connectors allow a quick and easy connection. Different types of branch connectors are available like single mantle clamps or connector blocks with integrated spacing and insulation. A cable diameter range from 10 - 30 mm can be covered.

### Branch joint including connector block or single mantle clamps

Nominal voltage U <sub>0</sub> /U (kV)	Cross section Main (mm <sup>2</sup> )	Branch (mm <sup>2</sup> )	Ordering description	Joint L (mm)	H (mm)
<b>with connector blocks</b>					
0,6/1	4x 6–25	4x4 –25	BAV-2U-GD-KK2/4	238	110
	5x 6–16 or 5x10–16	5x6 –16 5x2,5– 6	BAV-2U-GD-KK2/5	238	110
<b>with 5 single mantle clamps</b>					
0,6/1	5x1,5–25	5x1,5–25	BAV-2U-GD- MC25U/I	238	110
	5x 16–25	5x 16–25	BAV-2U-GD- MC25	238	110

**Note:** Cross sections are selected according to dimensions given in CENELEC HD 603.

L = Overall length of the housing; H = Overall height of the housing.

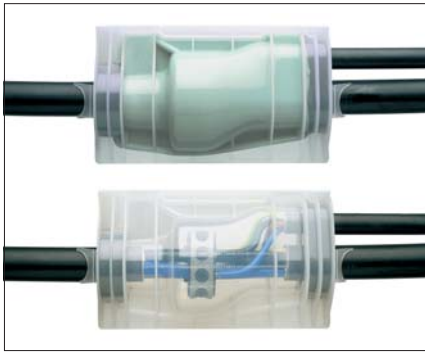
### Branch joint without connectors

Nominal voltage U <sub>0</sub> /U (kV)	Cable diameter (mm) Main/branch	Cross section Main (mm <sup>2</sup> )	Branch (mm <sup>2</sup> )	Ordering description	Joint L (mm)	H (mm)
0,6/1	10–30	3 – 5 x 1,5 – 25	3 – 5 x 1,5 – 25	BAV-2U-GD	238	110

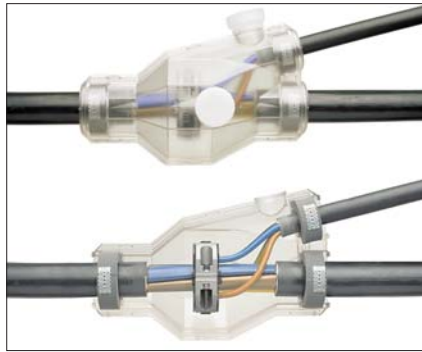
**Note:** For mantle clamps see page 72.

L = Overall length of the housing; H = Overall height of the housing.

# GUROFLEX filled branch joints 35 mm<sup>2</sup> to 240 mm<sup>2</sup> for polymeric insulated cables



MM 5, MM 7



BAV-C5, BAV-C7



Compact ring connector

## Cable

The joints are designed for 4-core polymeric insulated cables without armour up to 240 mm<sup>2</sup>.

For example: SZAMtKAtM, KAtM, N(A)YY, N(A)YBY, VVG, AVVG, BBF, ABBF, YAKY, YKY, YKYFty, AYKY, CYKY, PP 00, XP 00, PP 41, N(A)YC(W)Y.

## Design of joints

The joints consist of impact-resistant, transparent polypropylene snap-to-close design (MM 5, MM 7) or impact-resistant, transparent polycarbonate snap-to-close design (BAV) housings and polymer foams for sealing. The housings are easy and quick to assemble, no adjustment to the cable diameter needed. Joints are available with compact ring connectors. The GUROFLEX filler material is delivered in double chamber bag (D) or in cans (C). The joints allow filling in different positions. A cable diameter range from 27–65 mm can be covered.

## Conductors types:

sm: Sector stranded  
se: Sector solid  
rm: Round stranded  
re: Round solid

## Branch joints including compact ring connector

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> ) Main rm, sm / re, se	Branch rm, sm / re, se	Ordering description	Joint Length (mm)	Height (mm)
0,6/1	35– 70/ 50– 95	6– 50 / 6– 70	MM-5-GD170-4874	295	175
	70–120/ 95–150	6– 50 / 6– 70	MM-5-GD170-6875	295	175
	240sm/ –	6– 70 / 6– 70	MM-7-GC490-6880	480	230
	95–120/ 120–150	10– 95rm/ 16–120re	MM-7-GC490-6877	480	230
		35–120sm/ 50–150se			

## Branch joints without connectors

Nominal voltage U <sub>o</sub> /U (kV)	Cable diameter (mm) Main / branch	Connector diameter max. (mm)	Cross section Main (mm <sup>2</sup> )	Branch (mm <sup>2</sup> )	Ordering description	Joint Length (mm)	Height (mm)
0,6/1	27 – 55 / 16 – 36	105	4x 35 – 150	4x6 – 70	MM-5-GD170	295	175
	27 – 55 / 16 – 36	140	4x 35 – 150	4x6 – 70	BAV-C5-GD375	440	205
	37 – 60 / 16 – 57	140	4x120 – 240	4x6 – 150	MM-7-GC490	480	230
	45 – 65 / 16 – 50	140	4x120 – 240	4x6 – 150	BAV-C7-GC570	484	212

**Note:** Selecting criteria are cable diameters and connector sizes. Cross sections are selected for cables according to CENELEC HD 603 used with compact ring connectors. For compact ring connectors see page 73.

GUROFLEX filled joints for other cable types and cross sections are available on request.

# GUROFLEX - two-component environmental friendly filler material



Two-component GUROFLEX in double chamber bag



Two-component GUROFLEX in cans



Joint filled with "green" GUROFLEX

## Properties

GUROFLEX is an environmental friendly, easy to handle, two-component, cold casting material based on hydrocarbon resins. GUROFLEX can be used for all self-supporting underground cable joint systems up to 1kV. GUROFLEX is suitable for XLPE, PE, PVC and paper insulated cables. GUROFLEX has excellent insulating properties, is hydrophobic and gives excellent corrosion protection. GUROFLEX filler can be handled without any special safety precautions and allows installation at low temperatures.

## Handling

The resin is available either in double chamber bags or in cans. Preparation of GUROFLEX system takes place immediately before casting. The two components are mixed either in a double chamber bag or in the larger of two component cans to start the cross-linking process. Mixing takes about 3 minutes and can be aided by the use of a power driven stirrer. No 'topping-up' is needed and the equipment can be energized immediately after filling. The joint trench can be backfilled immediately after filling.

## Technical data

- Dielectric strength:  $U_d > 10 \text{ kV/mm}$
- Spec. Dielectric Constant:  $\epsilon_r \sim 4$
- Specific Vol. Resistance:  $Q_D > 10^{13} \Omega\text{cm}$
- Relative Density:  $\rho = 1,22 \text{ g/cm}^3$
- Min. Storage temperature:  $-20 \text{ }^\circ\text{C}$
- Min. Installation temperature:  $-10 \text{ }^\circ\text{C}$
- Hardness Shore A:  $\sim 20$
- Shelf life: 2 years @  $23 \text{ }^\circ\text{C}$
- Color: Green

Ordering description for supply in		Volume	Weight	Quantities suitable
Double chamber bags	Cans	(~ l)	(~ kg)	for joints
GUROFLEX-D035	–	0,35	0,43	BV-0, BV-1
GUROFLEX-D055	–	0,55	0,67	BV-2
GUROFLEX-D080	–	0,8	0,98	BAV-2
GUROFLEX-D140	–	1,4	1,71	MM-5
GUROFLEX-D160	GUROFLEX-C160	1,6	1,95	VMY-405, MM-5
GUROFLEX-D170	GUROFLEX-C170	1,7	2,07	MM-5
GUROFLEX-D215	GUROFLEX-C215	2,15	2,75	BAV-5
GUROFLEX-D245	GUROFLEX-C245	2,45	2,99	–
–	GUROFLEX-C385	3,85	4,84	BAV-C5
–	GUROFLEX-C490	4,9	5,98	VMP-600, MM-7
–	GUROFLEX-C570	5,7	6,95	BAV-C7, MM-7

**Note:** Volume and weight are absolute value of both components together. Other quantities available on request.

## Mantle Clamps



Universal mantle clamp with individual branch connection and insulation cap



Mantle clamp with insulation cap



Mantle clamp without insulation cap

### Universal mantle clamp with individual branch connection and insulation cap

Cross section (mm <sup>2</sup> )		Ordering description	Quantity in set (pcs)
Main	Branch		
		GURO-MC25U-I-3	3
2,5 – 25	1,5 – 25	GURO-MC25U-I-4	4
		GURO-MC25U-I-5	5

### Mantle clamps with common connection with insulation cap

Combinations of cross sections (mm <sup>2</sup> )		Ordering description	Quantity in set (pcs)
Main	Branch		
4 – 6	1,5 – 6	GURO-MC06-I-4	4
2,5 – 6	2,5 – 6	GURO-MC06-I-5	5
16	1,5 – 16	GURO-MC16-I-4	4
10 – 16	2,5 – 10	GURO-MC16-I-5	5
6 – 16	4 – 6		
25	2,5 – 25	GURO-MC25-I-4	4
16 – 25	6 – 16	GURO-MC25-I-5	5
10 – 25	10		

### Mantle clamps with common connection without insulation cap

Combinations of cross sections (mm <sup>2</sup> )		Ordering description	Quantity in set (pcs)
Main	Branch		
25	2,5 – 25	GURO-MC25-5	5
16 – 25	6 – 16		
10 – 25	10	GURO-MC25-20-INT	20



## Insulation piercing multi-core connectors

The cable ring type connector is specially designed for simple and reliable installation while ensuring maximum safety during life line work. The connectors are suitable for aluminium or copper, for stranded or solid conductors and cables with PVC or XLPE insulation. The connectors exceed requirements according to VDE 0220. The compact design allows installation in reduced size resin filled boxes and in Raychem heat-shrinkable Rayligator joints.



### Installation

#### Ring connectors type HEL

Cable oversheath is removed and the core separators placed between the cores. The two connector halves positioned over the cores and the bolts slightly tightened. Stripped ends of branch cores inserted in the branch channels and the bolts are tightened. The connector halves are closed by tightening the two outer bolts while the contact segments pierce the main cable cores. The outer metal ring is at all times insulated from the life conductors.

#### Ring connector type SRC4

The installation similar to ring connectors type HEL, but there is no need to strip even the ends of branch cores. All three tightening bolts (1 for main and 2 for branch conductors) with shear head control the optimum torque.

#### Materials:

- Body: High strength aluminium alloy
- Contact segment: electro tinned brass
- Insulation parts: Glass fibre reinforced polymer
- Bolts: Tinned steel 12.9

#### Conductors types:

- sm: Sector stranded
- se: Sector solid
- rm: Round stranded
- re: Round solid

### Cable ring type connector for 4-core cables

Ordering description	Main conductor		Branch conductor		Dimension outer circle (mm)	Width across flats (mm)	Weight (kg/100pcs)
	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )			
HEL-4874-35re	–	35re	6–50	6–70	96	6 / 5	42,4
HEL-4874	35– 70	50– 95	6–50	6–70	96	6 / 5	42,4
HEL-6874	50– 70	70– 95	6–50	6–70	96	6 / 5	42,6
HEL-6875	70– 120	95– 150	6–50	6–70	98,5	6 / 5	42,2
HEL-6876	95– 120	120– 150	6–50	6–70	96	6 / 5	44,6
HEL-6877	95– 120	120– 150	10–95rm/ 35–120sm	16–120re/ 50–150se	142	6 / 6	46,0
HEL-6878	150	185se	6–70	6–70	115	6 / 5	60,0
HEL-6879	185	240se	6–70	6–70	124	8 / 5	69,4
HEL-6880	240sm	–	6–70	6–70	124	8 / 5	69,4
HEL-6880.1	185– 240sm	185– 240se	6–70	6–70	124	8 / 5	70,0
HEL-5876	120rm	120– 150	6–50	6–70	96	6 / 5	46,0
HEL-5877	–	120– 150	10–95rm/ 35–120sm	16–120re/ 50–150se	142	6 / 6	46,0

### Cable ring type connector with shear head bolts, piercing insulation of main and branch 4-core cables

Ordering description	Main conductor		Branch conductor		Dimension outer circle (mm)	Width across flats (mm)	Weight (kg/100pcs)
	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )			
SRC4-70/150-10/70	70-120	70-150*	10-50	10-70*	105	13	38,0

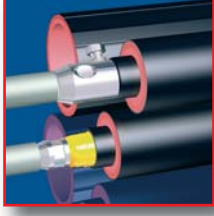
\* For Cu main conductor 70-120 mm<sup>2</sup> sm, branch conductor 10-50 mm<sup>2</sup> re/se.

### Cable ring type connector for 3,5-core cables with reduced cross section of neutral conductor

Ordering description	Main phase conductor		neutral conductor		Branch conductor		Dimension outer circle (mm)	Width across flats (mm)	Weight (kg/100pcs)
	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )	rm/sm (mm <sup>2</sup> )	re/se (mm <sup>2</sup> )			
HEL-4874.3	50sm	–	25sm	–	6–50	6–70	96	6 / 5	42,4
HEL-4875.3	70– 120sm	95– 150se	35– 70sm	50– 95se	6–50	6–70	98,5	6 / 5	42,2
HEL-6878.3	150sm	–	70sm	70	6–50*	6–50	115	6 / 5	63,8
HEL-6879.3	185sm	–	–	95re	6–50*	6–50	124	8 / 5	73,2
HEL-6880.3-ARG	185– 240sm	–	95– 120sm	–	6–50*	6–50	124	8 / 5	73,0
HEL-6880.3-RE	240sm	–	–	120re	6–50*	6–50	124	8 / 5	72,2
HEL-6880.3-SM	240sm	–	120sm	–	6–50*	6–50	124	8 / 5	72,2

\* Needs to be rounded for 50 mm<sup>2</sup> sm.

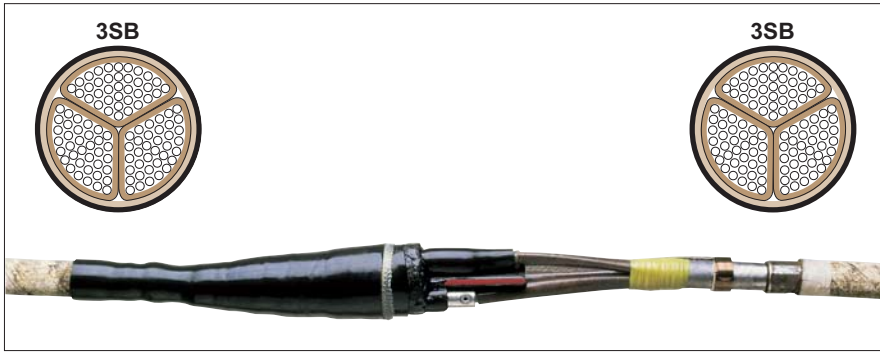
# Medium Voltage Joints



## Joins – Medium Voltage

Joins for belted or screened, 3-core paper insulated cables with one common metal sheath 6 kV, 10 kV, 15 kV, 20 kV and 35 kV	76
Joins for screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV	78
Repair joints for paper insulated cables 6 kV, 10 kV, 15 kV and 20 kV	80
Joins for unscreened, 3-core polymeric insulated cables 6 kV and 10 kV	82
Joins for screened flexible, rubber insulated cables and transition joints to 3-core unscreened polymeric insulated cables 6 kV	83
Joins and repair joints for screened, 3-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV	84
Joins and repair joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV	86
Pre-expanded elastomeric inline joints for screened, 1 core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV	88
Branch joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV and 20 kV	90
Live end seals for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV	91
Transition joints for polymeric insulated cables to 3-core belted or screened, paper insulated cables with one common metal sheath 6 kV, 10 kV, 15 kV, 20 kV and 35 kV	92
Transition joints for screened polymeric insulated cables to screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV	94

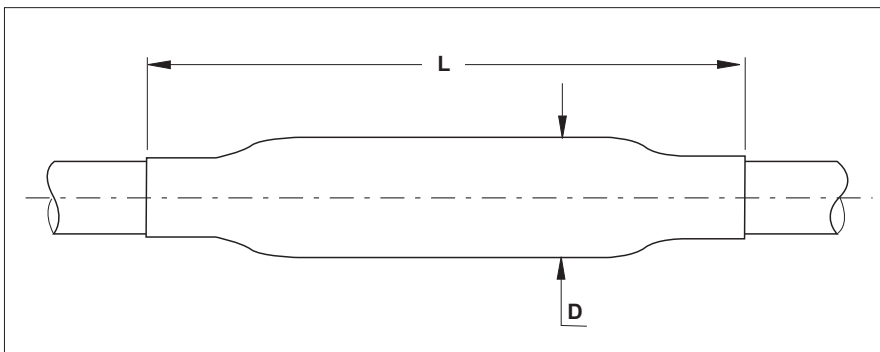
# Joints for belted or screened, 3-core paper insulated cables with one common metal sheath 6 kV, 10 kV, 15 kV, 20 kV and 35 kV



Belted cable



Belted or screened cable



Dimensions L, D see table

## Cable

The joints are designed for 3-core belted or screened paper insulated (MI, MIND) cables 6 kV, 10 kV, 15 kV, 20 kV and 35 kV with a common metal sheath.

For example: ACHPAbI, N(A)KBA, SB, ASB, SAAB, AABY, ASBY, CБ, ACБY, AABY, AAШB, ACБ-B, KftA, Akny, HAKnFtA, HknFty, Hkny, CMKOPV, CMKOY, AMKOY, ANKOPY, IPO 13, NPO 13, IPHO 13, NPHO 13, N(A)HKBA.

## Design of joints

### For belted cables

The paper cores are covered with oil barrier tubing. The crutch is filled with a stress grading, oil resistive yellow mastic. The mechanical connectors, supplied with the joint, are covered with a stress control patch. The primary insulation over the connectors is provided with proven adhesive coated, heat-shrinkable tubing. The area between and around the cores is filled with a cold applied mastic which is

fully compatible with the materials used to impregnate paper cables. Heat-shrinkable tubing seals to the metal sheath and ensures during installation that the mastic flows and fills any void. Solderless earth connection and metal tape replace the metal sheath and armour in the joint. An outer heat-shrinkable tubing provides the outer sealing and protection.

### For belted or screened cables

The paper cores are completely covered with oil barrier tubing and from the crutch area to the screen end with conductive tubing. The crutch area is filled with a stress grading, oil resistive yellow mastic and sealed with an adhesive lined, conductive breakout which is installed over the cores and the end of the metal sheath.

Thus the paper cable is transformed to a quasi polymeric cable construction and the cables jointed similarly. At the end of the conductive tubing and over the

connectors stress grading mastic is applied. The jointing area of each cable core is covered with heat-shrinkable stress control tubing. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. The metal sheath and armour are jointed with solderless connections. The armour is replaced by a metal case or a metal tape. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing.

The joints are designed to allow crossing of cable cores. Joints types GUSJ are supplied with mechanical connectors, joints type EPKJ are supplied without connectors.

## Joins for belted or screened, 3-core paper insulated cables with one common metal sheath 6 kV, 10 kV, 20 kV and 35 kV

### Joins including mechanical connectors

#### Joins for belted paper insulated cables 6 kV, 10 kV and 20 kV

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
3,5/6	25– 50	GUSJ-12/ 35- 50	1050	90
	70–120	GUSJ-12/ 70-120	1250	120
	150–240	GUSJ-12/150-240	1250	140
6/10	25– 50	GUSJ-12/ 35- 50	1050	90
	70–120	GUSJ-12/ 70-120	1250	120
	150–240	GUSJ-12/150-240	1250	140
8,7/15	70–150	GUSJ-24/ 70-150-3SB	1800	130
	120–240	GUSJ-24/120-240-3SB	1800	150
12/20	70–150	GUSJ-24/ 70-150-3SB	1800	130
	120–240	GUSJ-24/120-240-3SB	1800	150

### Joins without connectors

#### Joins for screened or belted paper insulated cables 10 kV, 20 kV and 35 kV

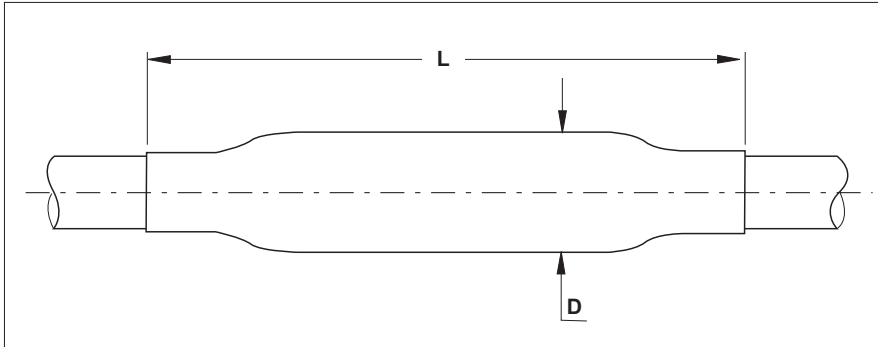
Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	35– 70	EPKJ-17A/3SB-3SB-T	2500	110
	95–185	EPKJ-17B/3SB-3SB-T	2500	130
	240–400	EPKJ-17C/3SB-3SB-T	2500	160
8,7/15	25– 50	EPKJ-17A/3SB-3SB-T	2500	110
	70–150	EPKJ-17B/3SB-3SB-T	2500	130
	185–300	EPKJ-17C/3SB-3SB-T	2500	160
12/20	35– 70	EPKJ-24B/3SB-3SB-T	2500	110
	95–240	EPKJ-24C/3SB-3SB-T	2500	130
	300–400	EPKJ-24D/3SB-3SB-T	2500	160
20/35	50– 70	EPKJ-36A/3SB-3SB-T	2500	110
	95–150	EPKJ-36B/3SB-3SB-T	2500	130
	185–400	EPKJ-36C/3SB-3SB-T	2500	160

**Note:** The joints are designed for crimp connectors. Connectors are not included in the joints.

## Joints for screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV



3-core paper insulated cable



Dimensions L, D see table

### Cable

The joints are designed for single or 3-core, screened, paper insulated (MI, MIND) cables 10 kV, 15 kV, 20 kV and 35 kV with one metal sheath per phase. For example: ACHPAbI, NAKHBA, AOSB, OSB-V, AOSB, OSB, AVVB, AVVG, APVG, OCB-B, AOCB, OCB, Hkny, HAKny, CNKOY, ANKOY, ANKTOYPV, AMKTOYPV, IPZO 13, NPZO 13, N(A)EKBA, N(A)KLEY.

### Design of joints

For three-core cables a solderless earth connection provides the connection between the armour and the metal sheaths. Heat-shrinkable breakouts and tubing seal and protect the metal sheaths. A stress grading, oil resistive yellow mastic is laid around the end of the metal sheath and the paper cores are completely covered with oil barrier tubing. A short conductive tubing rebuilds the screen from the metal sheath to the covered paper core.

Thus the paper cable is transformed to a quasi polymeric cable construction and the cables are jointed similarly. At the end of the conductive tubing and over the connectors stress grading mastic is applied. The jointing area of each cable core is covered with heat-shrinkable stress control tubing. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen.

The metal sheaths are jointed with solderless connections. For three core cables the armour is replaced by a metal tape. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing for single core cables and by a fibre-reinforced wrap-around for 3-core cables.

Joints type GUSJ are supplied with mechanical connectors, joints type RPKJ and EPKJ are supplied without connectors.

## Joins for screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV

### Joins including mechanical connectors

#### Joins for three core cables with steel tape armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	25– 70	GUSJ-24/ 25- 70-3HL	1600	90
	70–150	GUSJ-24/ 70-150-3HL	1600	120
	120–240	GUSJ-24/120-240-3HL	1600	140
8,7/15	25– 70	GUSJ-24/ 25- 70-3HL	1600	90
	70–150	GUSJ-24/ 70-150-3HL	1600	120
	120–240	GUSJ-24/120-240-3HL	1600	140
12/20	25– 70	GUSJ-24/ 25- 70-3HL	1600	90
	70–150	GUSJ-24/ 70-150-3HL	1600	120
	120–240	GUSJ-24/120-240-3HL	1600	140
20/35	35– 50	GUSJ-42/ 35- 50-3HL	2000	120
	70–120	GUSJ-42/ 70-120-3HL	2000	130
	120–240	GUSJ-42/120-240-3HL	2000	150

#### Joins for single core cables without armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
12/20	25– 70	GUSJ-24/ 25- 70-1HL	700	60
	70–150	GUSJ-24/ 70-150-1HL	700	70
	120–240	GUSJ-24/120-240-1HL	700	80
20/35	35– 50	GUSJ-42/ 35- 50-1HL	1000	70
	70–120	GUSJ-42/ 70-120-1HL	1000	80
	120–240	GUSJ-42/120-240-1HL	1000	90

### Joins without connectors

#### Joins for three core cables with steel tape armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	35– 70	RPKJ-24A/3HL-3HL-T-CEE01	1900	90
	95–185	RPKJ-24B/3HL-3HL-T-CEE01	1900	130
	185–300	RPKJ-24C/3HL-3HL-T-CEE01	1900	160
8,7/15	25– 50	RPKJ-24A/3HL-3HL-T-CEE01	1900	90
	70–150	RPKJ-24B/3HL-3HL-T-CEE01	1900	130
	150–300	RPKJ-24C/3HL-3HL-T-CEE01	1900	160
12/20	25– 95	RPKJ-24B/3HL-3HL-T-CEE01	1900	90
	95–240	RPKJ-24C/3HL-3HL-T-CEE01	1900	130
	240–400	RPKJ-24D/3HL-3HL-T-CEE01	1900	160
20/35	50– 70	EPKJ-36A/3HL-3HL-T	2250	90
	95–150	EPKJ-36B/3HL-3HL-T	2250	130
	185–400	EPKJ-36C/3HL-3HL-T	2250	160

**Note:** The joints are designed for crimp connectors. Connectors are not included in the joints.

#### Joins for single core cables without armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	35– 70	EPKJ-17A/1HL-1HL	850	60
	95–185	EPKJ-17B/1HL-1HL	950	70
	240–400	EPKJ-17C/1HL-1HL	950	80
12/20	35– 70	EPKJ-24B/1HL-1HL	850	70
	95–240	EPKJ-24C/1HL-1HL	950	80
	300–400	EPKJ-24D/1HL-1HL	950	90
20/35	50– 70	EPKJ-36A/1HL-1HL	1050	70
	95–150	EPKJ-36B/1HL-1HL	1050	80
	185–400	EPKJ-36C/1HL-1HL	1050	90

**Note:** The joints are designed for crimp connectors. Connectors are not included in the joints.

**Joins for other cable types, cross sections and voltage classes are available on request.**

# Repair joints for paper insulated cables 6 kV, 10 kV and 20 kV



Belted or screened, 3-core paper insulated cable with one common metal sheath



Screened, 3-core paper insulated cable with one metal sheath per phase



Screened, single core paper insulated cable without armour

## Cable

The repair joints are designed for single or 3-core belted or screened, paper insulated (MI, MIND) cables 6 kV, 10 kV, 15 kV and 20 kV.

For example:

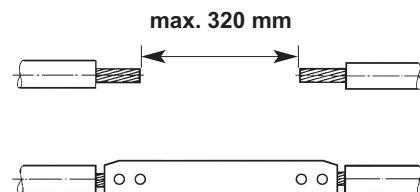
ACHPAbI, N(A)KBA, SB, ASB, SAAB, AABY, ASBY, CB, ACBY, AABY, AALШB, ACB-B, KftA, Akny, HAKnFtA, HknFty, Hkny, CMKOPV, CMKOY, AMKOY, ANKOY, IPO 13, NPO 13, IPHO 13, NPHO 13, N(A)HKBA

ACHPAbI, NAKKBA, AOSB, OSB-V, AOSB, OSB, AVVB, AVVG, APVG, OCB-B, AOCB, OCB, Hkny, HAKny, CNKOY, ANKOY, ANKTOYPV, AMKTOYPV, IPZO 13, NPZO 13, N(A)EKBA, N(A)KLEY

## Design of joints

The design and components of the repair joint is very similar to the relevant inline joint. The longer length of the repair joint allows cut the damaged part out of the cable and replace it by included mechanical repair connector. This allows repairing the cable for a length of up to 320 mm.

### Max. length of repair



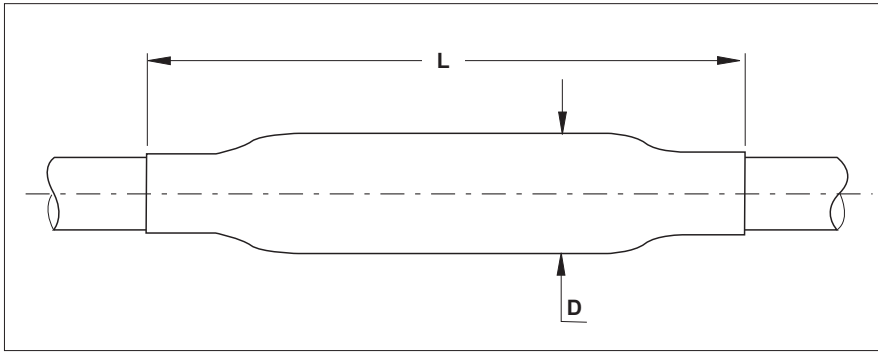
## Mechanical repair connector

- a tin plated aluminium alloy body
- torque-controlled shear head bolts
- inserts for small conductor sizes





## Repair joints for paper insulated cables 6 kV, 10 kV and 20 kV



Dimensions L, D see table

### Repair joints including mechanical repair connector

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
<b>for belted or screened, 3-core paper insulated cables with one common metal sheath</b>				
6/10	35 - 70	REPJ-17A/3SB-3SB-T-DE01	2250	90
	95 - 240	REPJ-17B/3SB-3SB-T-DE01	2250	130
12/20	95 - 240	REPJ-24C/3SB-3SB-T-DE02	2250	130
<b>for screened, 3-core paper insulated cable with one metal sheath per phase</b>				
12/20	25 - 95	REPJ-24B/3HL-3HL-T-DE01	2250	90
	95 - 240	REPJ-24C/3HL-3HL-T-DE01	2250	130
<b>for screened, single core paper insulated cable without armour</b>				
12/20	95 - 240	REPJ-24C/1HL-1HL-T-DE01	1300	65

## Joins for unscreened, 3-core polymeric insulated cables 6 kV and 10 kV



Joins type POLJ are supplied with mechanical connectors, joints type EPKJ and SMOE are supplied without connectors.

### Design of transition joints to 1-core screened polymeric insulated cables

The cores of the screened cable are covered with yellow void filling mastic and heat-shrinkable stress control tubing. The conductors are joined with a mechanical connector supplied with the joint. The connection area is covered with a stress control patch. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. The shielding is rebuilt with copper mesh and a solderless earth connection system provides the electrical connection. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing.

### Cable

The joints are designed for 3-core unscreened, polymeric insulated cables 6 kV and 10 kV with common copper tape or wire shield or with steel tape armour. For example: PP 41(A), PP 44(A), PP 45(A), NAYFGY, ABBБ, ABBГ, АПВГ, YKYFtly, YKYFoy, YAKY, YKYFtly, YKYFoy, YAKY, YKY..., AYKCYDY, AYKCY, N(A)YBY, N(A)YGY

### Design of joints

The connectors are insulated and sealed with thick-wall, heat-shrinkable tubing and mastic. The armour or copper tape shielding is rebuilt with a wraparound metal case or with copper mesh. A solderless earth connection provides the electrical connection to the armour or copper shielding. The outer protection and sealing is performed by adhesive coated heat-shrinkable tubing.

### Joins including mechanical connectors

Joins for cables with common copper tape or wire shield or with steel tape armour

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
3,5/6	25– 50	POLJ-06/3x 25- 50	1200	70
	70–120	POLJ-06/3x 70-120	1200	90
	150–240	POLJ-06/3x150-240	1200	100
6/10	25– 50	POLJ-06/3x 25- 50	1200	70
	70–150	POLJ-06/3x 70-120	1200	90
	120–240	POLJ-06/3x150-240	1200	100

### Transition joints for 3-core unscreened cables to 1-core screened cables including mechanical connectors

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )		Ordering description	Dimensions (mm)	
	Cable type			L	D
	3-core	1-core*			
3,5/6	25– 70	25– 70	POLJ-12/1x 25- 70-3U	800	90
	70–120	70–150	POLJ-12/1x 70-150-3U	800	90
	150–240	150–240	POLJ-12/1x150-240-3U	800	100
6/10	25– 70	25– 70	POLJ-12/1x 25- 70-3U	800	90
	70–120	70–150	POLJ-12/1x 70-150-3U	800	90
	120–240	150–240	POLJ-12/1x150-240-3U	800	100

\* Application ranges apply for 10 kV and 20 kV cables

### Joins without connectors

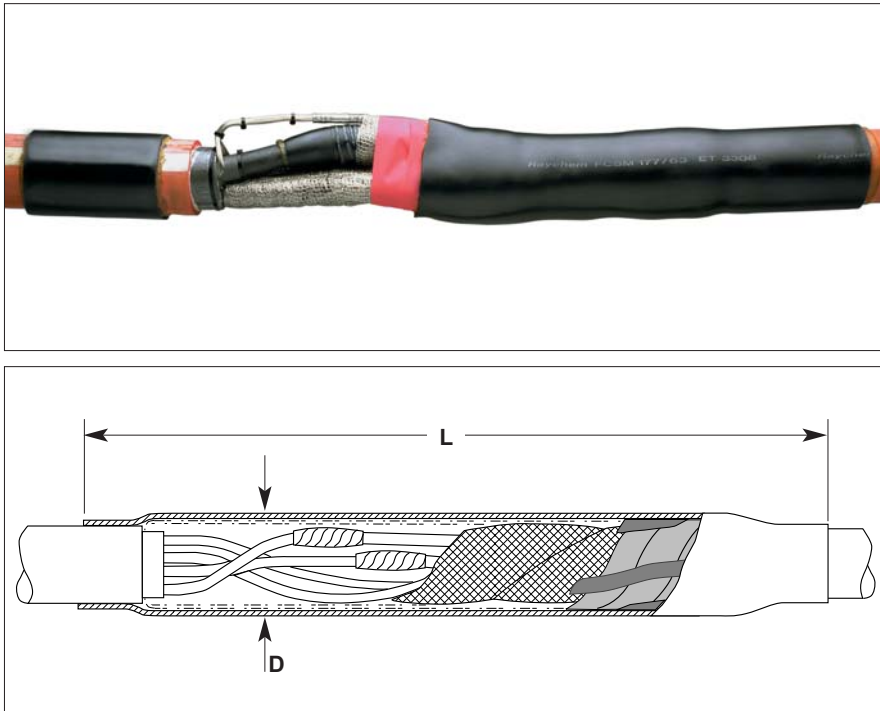
Cables with armour

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimensions (mm)	
		with tape armour	with wire armour	L	D
3,5/6 and 6/10	16– 70	EPKJ-2079-J41	EPKJ-2079	800	75
	95–150	EPKJ-2080-J42	EPKJ-2080	1000	105
	185–300	EPKJ-2081-J43	EPKJ-2081	1200	135

Cables with common copper tape shield and without armour

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
3,5/6	25– 70	SMOE-62096	800	70
	95– 185	SMOE-62095	1000	90
	240	SMOE-61302	1200	100

## Joints for screened, flexible, rubber insulated cables and transition joints to 3-core unscreened polymeric insulated cables 6 kV



Dimensions L, D see table

### Cable

The joints are designed for screened, flexible, rubber insulated cables 6 kV with one or three earth cores.

For example: EpN 64 i 65, EPN (BN) 64 i 74, NTSCE, NTSCGEWÖU, КГЭ, КГЭТ, Ogb, Ogc z YKY, YKY..., CBVU, CHCU, EpN(BN) 76 i 78, EpN(BN) 78/53.

### Design of joints for flexible cables

The connector areas are stress-graded, sealed and insulated with a void filler tape and thick-wall heat-shrinkable tubing. A semiconductive tape rebuilds the screen over the insulating tubing. The outer sealing and protection is performed by flexible, abrasive resistant, thick-wall tubing. The voids between the cores and the outer tubing are filled by flexible mastic.

### Design of transition joints for flexible cables to unscreened polymeric insulated cables

The cores of the flexible cable are stress graded at the end of the screen with a mastic tape. The connectors are insulated and sealed with thick-wall, adhesive coated, heat-shrinkable tubing. The shielding is rebuilt with copper mesh and a solderless earth connection provides the electrical connection to the shielding. The outer protection and sealing is performed by adhesive coated, heat-shrinkable tubing.

### Joints for flexible rubber insulated cables without connectors

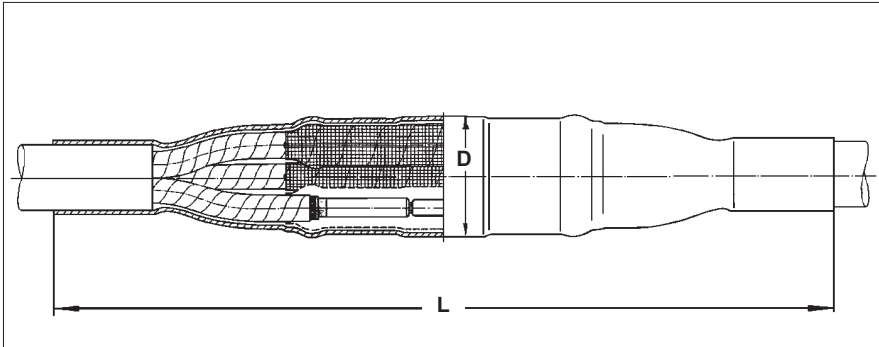
Nominal voltage $U_0/U$ (kV)	Cables with 3 earth cores		Cables with 1 earth core		Dimensions (mm)	
	Cross section (mm <sup>2</sup> )	Ordering description	Cross section (mm <sup>2</sup> )	Ordering description	L	D
3,5/6	25/10– 95/16 120/16–185/35	EMKJ-2201-CEE01	10/ 10	EMKJ-2001	750	55
		EMKJ-2211-CEE01	16/ 16– 95/ 95	EMKJ-2011	750	100
			120/120–185/185	EMKJ-2021	950	130

**Note:** The joints are designed for crimp connectors of maximal length 60 mm.

### Transition joints for flexible rubber insulated cables to unscreened polymeric insulated cables 6 kV without connectors

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
3,5/6	70–185	SMOE-62453	1000	130

## Joints and repair joints for screened, 3-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV



Dimensions L, D see table

### Cable

The joints are designed for 10 kV, 15 kV, 20 kV and 35 kV screened, three core polymeric insulated cables with or without armour.

For example: SZAQkrKVM, XHP 81, CEYSEAbY, ACYSEAbY, CYSEY, ACYSEY, BBГ, АББвШв, АBBГ, YHAKXS, XUHAKXS..., AXEKVCY, CXEKVCY, AXEKVCEY, CXEKVCY, N(A)2XSY, EpHP 81, PHP 48, PHP 84, XHP 48, N(A)YSEY.

### Design of joints with mechanical connectors

#### For cables with wire or tape screen

At the screen end yellow void filling mastic is applied and the cable end is covered with a heat-shrinkable stress control tubing. The conductors are jointed with a mechanical connector supplied with the joint. The connection area is covered with a stress control patch. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. For cables with wire screen a mechanical connector is supplied with the kit. For cables with tape screen the joint includes a solderless earth connection system. For cables with armour a metal case or a metal tape provides additional mechanical protection. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing.

#### Additional sealing kit for transition joints of 3-core to 1-core cables

The transition joint is built the same way as an inline joint for 3-core cables. A heat-shrinkable breakout ensures the sealing of the outer tubing to the 1-core cables. A solderless earth connection system allows the connection of all typical combinations of shield constructions.

### Design of joints without connectors

#### For cables with wire or tape screen

At the screen end and over the connectors yellow void filling mastic is applied. The jointing area of each cable core is covered with heat-shrinkable stress control tubing. Heat-shrinkable elastomeric tubing provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. For cables with tape screen the joint includes a solderless earth connection. For cables with armour a metal case or a metal tape provides additional mechanical protection. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing.

#### Design of repair joints

The design and components of the repair joint and the inline joint are similar. The longer length of the repair joint allows cut the damaged part out of the cable and replace it by a piece of cable core and two connectors. This allows repairing the cable for a length of up to 520 mm (see also drawing page 86).

#### Design of transition joints for 3-core to 1-core cables

The transition joint is built the same way as an inline joint for 3-core cables. Special sealing clips ensure the sealing of the outer tubing to the 1-core cables.

# Joins and repair joints for screened 3-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV

## Joins including mechanical connectors

For cables with wire or metal tape screen

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description			Dimensions (mm)	
		Cable without armour	Cable with steel tape armour	steel wire armour	L	D
6/10	25– 70	POLJ-12/3x 25- 70	POLJ-12/3x 25- 70-T	POLJ-12/3x 25- 70-W	1100	80
	70–150	POLJ-12/3x 70-150	POLJ-12/3x 70-150-T	POLJ-12/3x 70-150-W	1100	90
	120–240	POLJ-12/3x120-240	POLJ-12/3x120-240-T	POLJ-12/3x120-240-W	1100	100
8,7/15 and 12/20	25– 70	POLJ-24/3x 25- 70	POLJ-24/3x 25- 70-T		1250	90
	70–150	POLJ-24/3x 70-150	POLJ-24/3x 70-150-T		1250	100
	120–240	POLJ-24/3x120-240	POLJ-24/3x120-240-T		1250	110
20/35	70–120	POLJ-42/3x 70-120	POLJ-42/3x 70-120-T	POLJ-42/3x 70-120-W	2200	150
	120–240	POLJ-42/3x120-240	POLJ-42/3x120-240-T	POLJ-42/3x120-240-W	2200	180

**Note:** The application ranges are defined for cables with round, stranded conductors; for cables with sector shaped or solid conductors contact your TE Energy products' representative.

## Additional sealing kit for transition joints of 3-core to 1-core cables

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description
6/10, 8,7/15, 12/20	25–240	SMOE-62800

**Note:** For joints to cables with aluminium laminate (e.g. type AHXAMK-W) the solderless ground wire connection kit SMOE-62600 must be ordered separately (details see page 93).

## Joins without connectors

Joins for three core cables without armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimensions (mm)	
		with wire shield	with metal tape shield	L	D
6/10	10– 25	SXSU-4302-CEE04		1450	90
	25– 35	SXSU-4302	SXSU-4302-CEE01	1450	90
	50– 70	SXSU-4312	SXSU-4312-CEE01	1450	90
	95–185	SXSU-4322	SXSU-4322-CEE01	1450	100
	240–300	SXSU-4332	SXSU-4332-CEE01	1500	110
8,7/15	35– 50	SXSU-4312	SXSU-4312-CEE01	1450	90
	70–150	SXSU-4322	SXSU-4322-CEE01	1450	100
	185–300	SXSU-4332	SXSU-4332-CEE01	1500	110
12/20	10– 70	SXSU-5312		1450	90
	35– 95	SXSU-5322		1500	100
	95–240	SXSU-5332		1500	110
	300	SXSU-5342		1500	110

## Repair joints for three core cables without armour

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimension (mm)	
		with wire shield	with metal tape shield	L	D
6/10	35– 95	REPJ-12A/3XU	REPJ-12A/3XU-CEE01	2000	90
	120–185	REPJ-12B/3XU	REPJ-12B/3XU-CEE01	2000	100
	240–400	REPJ-12C/3XU	REPJ-12C/3XU-CEE01	2100	110
12/20	25– 50	REPJ-24A/3XU		2000	90
	70–120	REPJ-24B/3XU		2000	100
	150–240	REPJ-24C/3XU		2100	110

## Joins for three core cables with armour

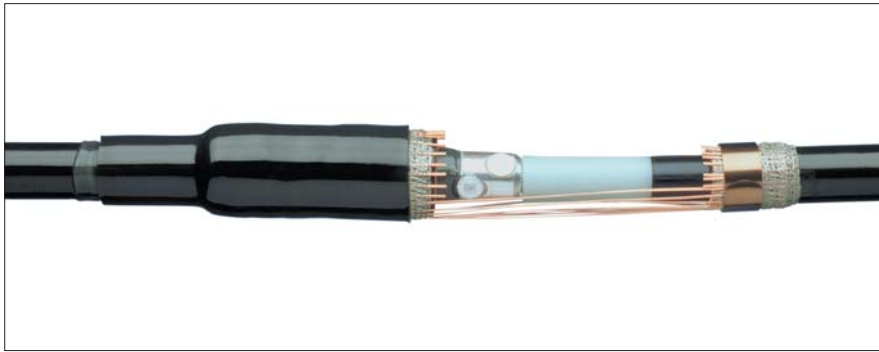
Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimension (mm)	
		with wire armour	with tape armour	L	D
6/10	25– 35	SXSW-4304	SXST-4303-CEE01	1450	100
	50– 70	SXSW-4314	SXST-4313-CEE01	1500	100
	95–185	SXSW-4324	SXST-4323-CEE01	1600	150
	240–300	SXSW-4334	SXST-4333-CEE01	1600	180

## Transition joints for three core to one core polymeric insulated cable

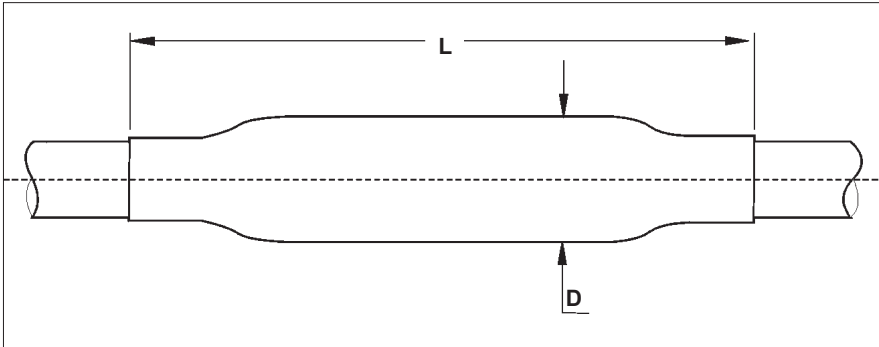
Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
6/10	35– 70	EPKJ-17A/1XU-3XU	1000	90
	95–185	EPKJ-17B/1XU-3XU	1100	130
	240–400	EPKJ-17C/1XU-3XU	1100	160
12/20	35– 70	EPKJ-24B/1XU-3XU	1100	90
	95–240	EPKJ-24C/1XU-3XU	1100	130
	300–400	EPKJ-24D/1XU-3XU	1100	160

Joins for other cable types, cross sections or voltage classes are available on request.

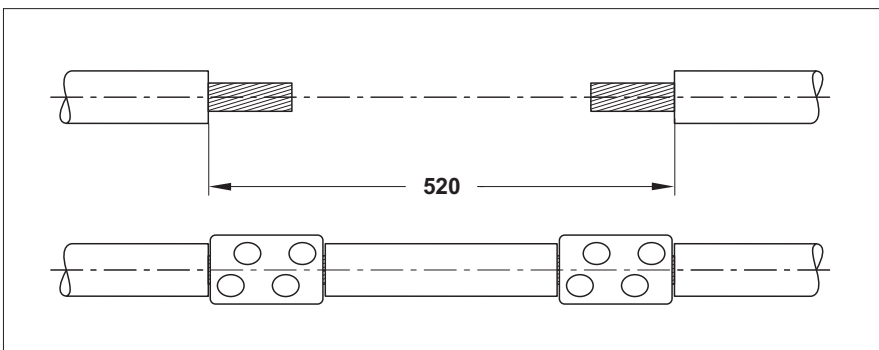
# Joints and repair joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV



Joint



Dimensions L, D see table



Repair joint

## Cable

The joints are designed 10 kV, 15 kV, 20 kV and 35 kV screened one core polymeric insulated cables.

For example: A2YSb(r)Y, A2YSY, ПвП, АПвП, ВПвП, УНАКXS, ХУНАКXS, ХУНКС, АХЕКVCEY, СХЕКVCEY, N(A)2XS, SAXKA, DISTRI, XHE 49(A), XHP 48(A), EHP 48(A), N(A)2XS(F)2Y, АНХАМК-W, NFC 33-223.

## Design of joints with mechanical connectors

### For cables with wire or tape screen

At the screen end yellow void filling mastic is applied and the cable end is covered with a heat-shrinkable stress control tubing. The conductors are jointed with a mechanical connector supplied with the joint. The connection area is covered with a stress control patch. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness

of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. For cables with wire screen an earth connection system is supplied with the kit. For cables with tape screen the joint includes a solderless earth connection system which is also suitable for cables with aluminium laminate (e.g. type АНХАМК-W). The outer sealing and protection is performed by an adhesive coated, thick-wall, heat-shrinkable tubing.

### For cables with aluminium wire screen

The inner components of the cable up to the bedding are rebuilt as for cables with wire or tape screen. The aluminium wires are connected with mechanical connectors and covered with metal tape. The outer sealing and protection is performed by an adhesive coated, thick-wall, heat-shrinkable tubing.

## Design of joints without connectors

### For cables with wire or tape screen

At the screen end and over the connector yellow, void filling mastic is applied. The entire joint area is covered with heat-shrinkable stress control tubing. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. For cables with tape screen the joint includes a solderless earth connection system which is also suitable for cables with aluminium laminate (e.g. type АНХАМК-W). The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing.

### Design of repair joints

The design and components of the repair joint and the inline joint are similar. The longer length of the repair joint allows cut the damaged part out of the cable and replace it by a piece of cable core and two connectors. This allows repairing the cable for a length of up to 520 mm (10 kV and 20 kV) or 420 mm (35 kV).

# Joins and repair joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV

## Joins including mechanical connectors

For cables with wire or metal tape screen

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimensions (mm)	
		with wire shield	with tape or wire shield *	L	D
6/10	25– 70	POLJ-12/1x 25- 70	POLJ-12/1x 25- 70-CEE01	550	45
	70–150	POLJ-12/1x 70-150	POLJ-12/1x 70-150-CEE01	550	55
	120–240	POLJ-12/1x120-240	POLJ-12/1x120-240-CEE01	550	65
	240–400	POLJ-12/1x240-400	–	650	75
	500	POLJ-12/1x500	–	700	85
	630	POLJ-12/1x630	–	700	85
8,7/15 and 12/20	800	POLJ-12/1x800	–	700	90
	25– 70	POLJ-24/1x 25- 70	POLJ-24/1x 25- 70-CEE01	550	55
	70–150	POLJ-24/1x 70-150	POLJ-24/1x 70-150-CEE01	600	65
	120–240	POLJ-24/1x120-240	POLJ-24/1x120-240-CEE01	600	70
	240–400	POLJ-24/1x240-400	–	650	80
	500	POLJ-24/1x500	–	800	90
20/35	630	POLJ-24/1x630	–	800	90
	35– 70	POLJ-42/1x 35- 70	POLJ-42/1x 35- 70-CEE01	750	65
	70–120	POLJ-42/1x 70-120	POLJ-42/1x 70-120-CEE01	750	70
	120–240	POLJ-42/1x120-240	POLJ-42/1x120-240-CEE01	750	75
	300–400	POLJ-42/1x300-400	–	800	85
	500	POLJ-42/1x500	–	900	95
	630	POLJ-42/1x630	–	900	95

\* The joints are designed for cables with copper tape shield or with aluminium laminate (e.g. type AHXAMK-W) and can also be used for cables with wire shields. For transitions of cables with wire shield to cables with Al-laminate use joints for cables with wire shield.

For cables with aluminium wire armour and wire or tape screen

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	25– 70	POLJ-12/1x 25- 70-AW	850	50
	70–150	POLJ-12/1x 70-150-AW	850	60
	120–240	POLJ-12/1x120-240-AW	900	70
8,7/15 and 12/20	25– 70	POLJ-24/1x 25- 70-AW	900	60
	70–150	POLJ-24/1x 70-150-AW	900	70
	120–240	POLJ-24/1x120-240-AW	900	75
20/35	70–120	POLJ-42/1x 70-120-AW	1250	75
	120–240	POLJ-42/1x120-240-AW	1250	80

Repair Joint for cables with wire or tape screen

Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )			Ordering description	Max. repair length (mm)	Dimensions (mm)	
	(mm <sup>2</sup> )	(mm <sup>2</sup> )	(mm <sup>2</sup> )			L	D
6/10, 8,7/15 and 12/20	6/10 kV	8,7/15 kV	12/20 kV				
	25– 70	25– 70	25– 70	REPJ-24/1x 25- 70	520	1200	50
	95–150	70–150	70–120	REPJ-24/1x 70-150	520	1200	55
	150–240	120–240	120–240	REPJ-24/1x120-240	520	1200	70
20/35	70–120			REPJ-42/1x 70-120	420	1200	55
	120–240			REPJ-42/1x120-240	420	1200	70

Joins without connectors for cables with wire or tape screen

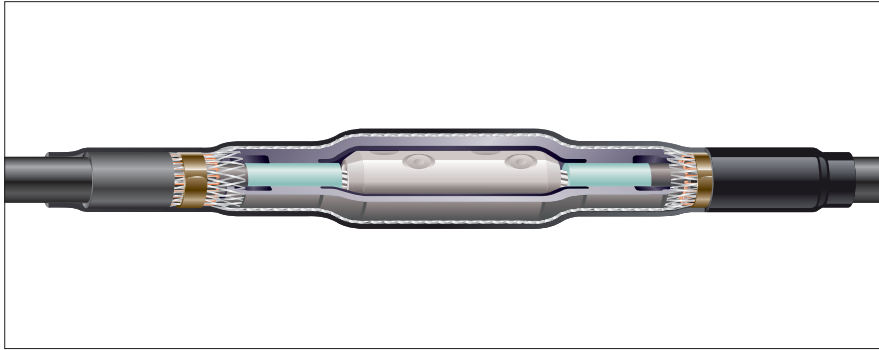
Nominal voltage U <sub>0</sub> /U (kV)	Cross section (mm <sup>2</sup> )		Ordering description for cables with wire shield	Ordering description for cables with metal tape shield *	Dimensions (mm)	
	(mm <sup>2</sup> )	(mm <sup>2</sup> )			L	D
6/10 and 8,7/15	6/10 kV	8,7/15 kV				
	50– 70	35– 50	SXSU-4111	SXSU-4111-CEE01	550	45
	95– 185	70– 120	SXSU-4121	SXSU-4121-CEE01	600	55
	185– 300	150–240	SXSU-4131	SXSU-4131-CEE01	650	65
	400– 630	300–500	SXSU-4141	SXSU-4141-CEE01	750	75
	800–1200	630–800	SXSU-4151		750	85
12/20	25– 95		SXSU-5121	SXSU-5121-CEE01	600	60
	95– 240		SXSU-5131	SXSU-5131-CEE01	650	70
	240– 500		SXSU-5141		750	80
	630– 800		SXSU-5151		750	85
20/35	35– 150		SXSU-6122		850	65
	150– 300		SXSU-6132		850	70
	400– 630		SXSU-6142		950	80

\* The joints are designed for cables with copper tape shield or with aluminium laminate (e.g. type AHXAMK-W).

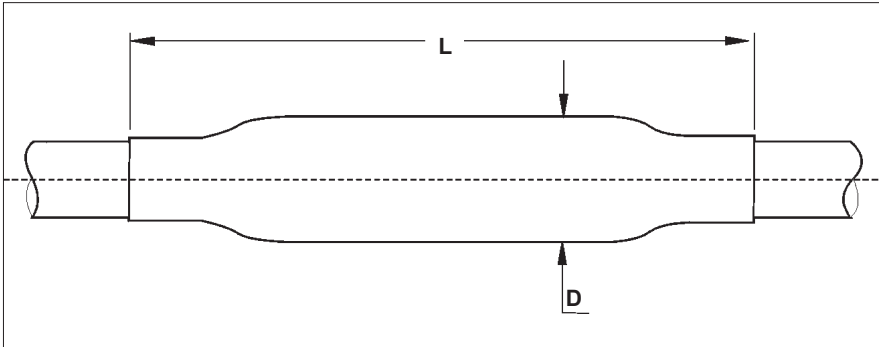
Joins for other cable types, cross sections or voltage classes are available on request.

Joins for 1-core cables include material for 1 phase.

## Pre-expanded elastomeric inline joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV



Joints with pre-installed metallic screening and oversheath tubing



Dimensions L, D see table

### Cable

The joints are designed for 10 kV, 15 kV, 20 kV and 35 kV screened single core polymeric insulated cables. For example: AXEKVCE(Y), AXEKVCEz, CXEKVCE(Y), (A)2XS(F)2Y, SAXKA, DISTRI, AHXAMK-W, XHE 49, XHP 48, EHP 48.

### Design of joint

#### with pre-installed metallic screening and oversheath tubing

All key components (joint body, the copper braid and outer tubing) are pre-expanded on one spiral holdout, which results in a very short parking length during cable preparation and offers a fast and easy-to-install system. The conductors are jointed by a mechanical connector supplied with the joint.

Electrical stress control over the screen cut area is provided by conductive cones integrated in the silicone joint body with an exactly defined geometrical design. The electrical stress control of the connector area is made with an integrated conductive shield performing as a faraday cage. Screening over the insulation is part of the joint body as well.

The silicone rubber joint body shrinks onto the insulation upon removal of the spiral holdout. The copper braid covers cable metallic screen with cross sections up to 70 mm<sup>2</sup> and it is flipped back to the cable shield and connected by roll springs. This solderless earth connection system is suitable for cables with wire or tape screen and for aluminium laminate cables as well (e.g. type AHXAMK-W). The flipped backs of the pre-installed outer tubing are rolled out on the cable jacket wrapped up with the mastic. The outer tubing builds up a reliable moisture seal and corrosion protection.

#### with separate metallic screening and outer heat-shrinkable, thick-wall re-jacketing tubing

The conductors are jointed by a mechanical connector supplied with the joint.

Electrical stress control over the screen cut area is provided by conductive cones integrated in the silicone joint body with an exactly defined geometrical design. The joint body is pre-expanded and delivered on a spiral holdout system. The joint body recovers onto the insulation upon removal of the spiral holdout. The electrical stress control of the connector area is made with an integrated conductive shield performing as a faraday cage. Screening over the insulation is part of the joint body as well.

Copper mesh wrapped around the joint area rebuilds the metallic screen. An earth connection system, for cables with wire screen, is supplied with the kit. For cables with tape screen the joint includes a solderless earth connection system which is also suitable for cables with aluminium laminate (e.g. type AHXAMK-W).

The outer sealing and protection is performed by heat-shrinkable, thick-wall re-jacketing tubing with adhesive.





## Pre-expanded elastomeric inline joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV

### Joints with pre-installed metallic screening and oversheath tubing, including mechanical connectors

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimensions (mm)	
			L	D
6/10	95 - 240	CSJA-12/1x 95-240	700	65
	185 - 300	CSJA-12/1x185-300	700	70
	240 - 400	CSJA-12/1x240-400	800	75
	500	CSJA-12/1x500	900	85
	630	CSJA-12/1x630	900	85
8,7/15 and 12/20	35 - 150	CSJA-24/1x 35-150	700	65
	95 - 240	CSJA-24/1x 95-240	700	70
	120 - 300	CSJA-24/1x120-300	700	70
	185 - 400	CSJA-24/1x185-400	800	80
	500	CSJA-24/1x500	900	85
20/35	630	CSJA-24/1x630	900	85
	95 - 240	CSJA-42/1x 95-240	800	75
	240 - 400	CSJA-42/1x240-400	900	80
	500	CSJA-42/1x500	900	90
	630	CSJA-42/1x630	900	90

**Note:** The joints can be used for cables either with copper wire or tape shield or with aluminium laminate (e.g. type AHXAMK-W).

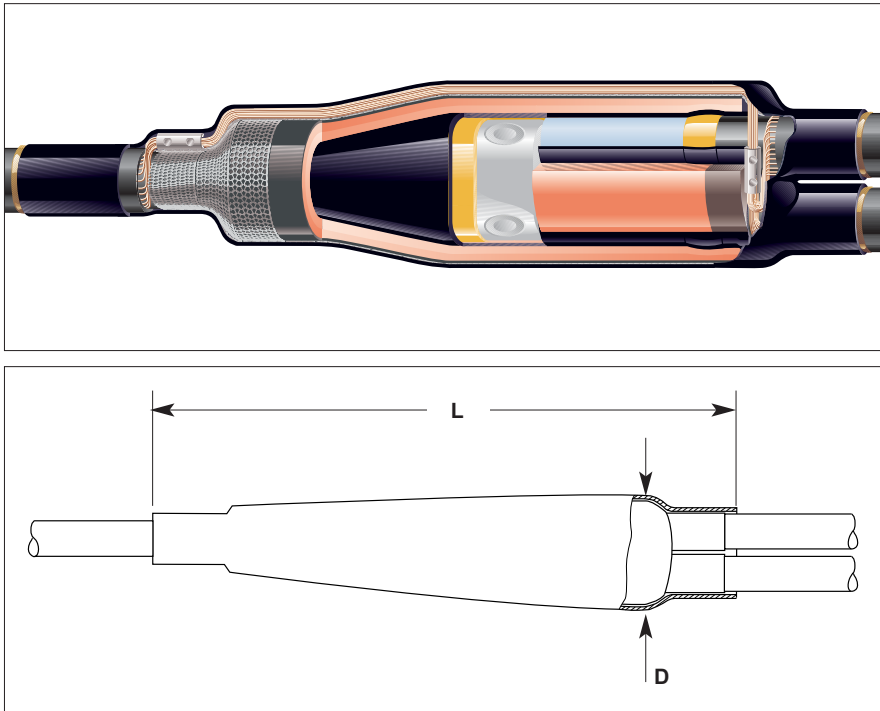
### Joints with separate metallic and outer heat-shrinkable, thick-wall re-jacketing tubing, including mechanical connectors

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description for cables		Dimensions (mm)	
		with wire shield	with tape or wire shield*	L	D
6/10	25 - 95	CSJH-12/1x 25- 95	CSJH-12/1x 25- 95-CEE01	600	60
	95 - 240	CSJH-12/1x 95-240	CSJH-12/1x 95-240-CEE01	600	65
	185 - 300	CSJH-12/1x185-300	CSJH-12/1x185-300-CEE01	600	70
	240 - 400	CSJH-12/1x240-400	CSJH-12/1x240-400-CEE01	750	70
	500	CSJH-12/1x500	CSJH-12/1x500-CEE01	800	85
	630	CSJH-12/1x630	CSJH-12/1x630-CEE01	800	85
8,7/15 and 12/20	35 - 150	CSJH-24/1x 35-150	CSJH-24/1x 35-150-CEE01	600	60
	95 - 240	CSJH-24/1x 95-240	CSJH-24/1x 95-240-CEE01	600	65
	120 - 300	CSJH-24/1x120-300	CSJH-24/1x120-300-CEE01	600	70
	240 - 400	CSJH-24/1x240-400	CSJH-24/1x240-400-CEE01	750	70
	500	CSJH-24/1x500	CSJH-24/1x500-CEE01	800	85
	630	CSJH-24/1x630	CSJH-24/1x630-CEE01	800	85
20/35	95 - 240	CSJH-42/1x 95-240	CSJH-42/1x 95-240-CEE01	750	65
	240 - 400	CSJH-42/1x240-400	CSJH-42/1x240-400-CEE01	750	70
	500	CSJH-42/1x500	CSJH-42/1x500-CEE01	800	90
	630	CSJH-42/1x630	CSJH-42/1x630-CEE01	800	90

\* The joints are designed for cables with copper tape shield or with aluminium laminate (e.g. type AHXAMK-W) and can also be used for cables with wire shields. For transitions of cables with wire shield to cables with al-laminate, use joints for cables with wire shield.

**Elastomeric inline joints for other cable types and transition joints paper/polymeric insulated cables are available on request. Joints for 1-core cables include material for 1 phase.**

## Branch joints for screened, 1-core polymeric insulated cables 10 kV, 15 kV and 20 kV



Dimensions L, D see table

Based on the well proven technology of medium voltage joints, Raychem offers a technically and commercially interesting solution to realise branch joints for single core polymeric insulated cables. A newly developed, mechanical connector integrated in the joint design allows a quick, simple and reliable installation. The branch joint is fully qualified to the Raychem test norm PPS 3013.

### Cable

The branch joint is designed for screened, single core polymeric insulated cables 10 kV and 20 kV.

For example: NAYSU, NA2XS2Y, ПвП, АПвП, УНКС, УНАКС, ХУНАКС, АХЕКВСУ, СХЕКВСЕУ, N(A)2XSU, XHE 49(A), XHP 48(A), EHP 48, N(A)2XS(F)2Y.

### Design of branch joints

The cables are prepared as for inline joints. Before connecting the cables, the screen cut is covered with the yellow stress grading filler and stress control tubing. The three cable ends are connected with a Raychem designed mechanical connector with shear-head bolts. Special moulded parts ensure the filling and sealing between the branch cables. Following, similar parts as for inline joints are used: Yellow, void filler over the connector, stress control tubing and a triple-extruded elastomeric joint body. Copper mesh and a mechanical connector for the screen wires re-establish the metallic screen. The outer sealing is provided by heat-shrinkable, thick-wall tubing and a 2-finger breakout. All connectors are supplied with the kit.

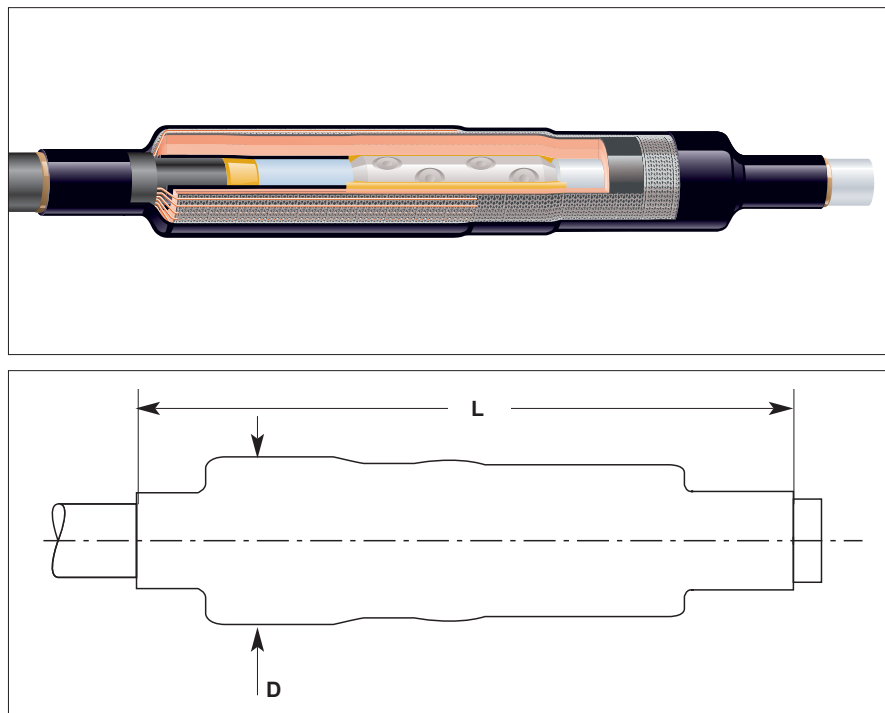
### Branch joint for cables with wire screen, including mechanical connectors

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
6/10	35– 95	EPKB-12A/1XU-2XU	550	80
	95– 150	EPKB-12B/1XU-2XU	600	90
	185–300	EPKB-12C/1XU-2XU	650	95
8,7/15	35– 95	EPKB-24A/1XU-2XU	550	80
	95– 150	EPKB-24B/1XU-2XU	600	90
	185–300	EPKB-24C/1XU-2XU	650	95
12/20	35– 95	EPKB-24A/1XU-2XU	550	80
	95– 150	EPKB-24B/1XU-2XU	600	90
	120–240*	EPKB-24C/1XU-2XU-BR02	650	95
	185–300	EPKB-24C/1XU-2XU	650	95

\* for 240 mm<sup>2</sup> main cables to branch cable 120 mm<sup>2</sup>

**Branch joints for other cable types and cross sections are available on request. Joints for 1-core cables include material for 1 phase.**

## Live end seals for screened, 1-core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV



Dimensions L, D see table

### Cable

The live end seals are designed for 10 kV, 15 kV, 20 kV and 35 kV screened single core plastic insulated cables with wire or tape shield.

For example: AXEKVCE(Y), AXEKVCEz, CXEKVCE(Y), N(A)2XSY, N(A)2XS(F)2Y, SAXKA, DISTRI, AHXAMK-W.

### Design of end seal

The cable is prepared the same way as for joints including mechanical connector.

A polypropylene insulation rod is inserted into one connector entry instead of a core of the second cable in case of jointing. The area over the screen cut and between the end of the core insulation and the rod are wrapped with yellow, stress grading filler. Similar to medium voltage joints, heat-shrinkable stress control tubing and triple-extruded elastomeric joint body are shrunk over the cable end and the insulating rod.

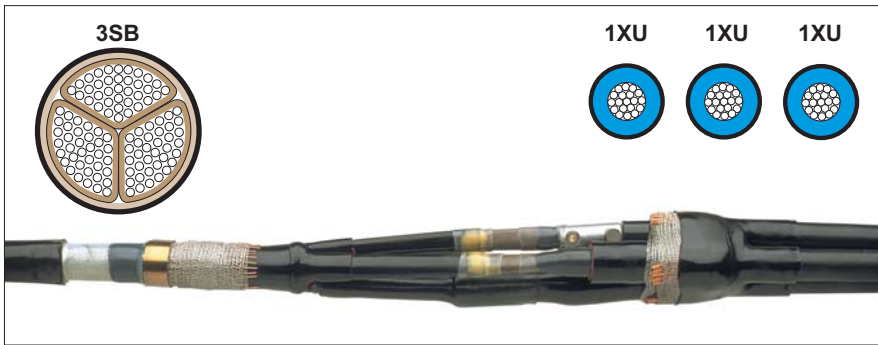
The copper mesh is applied around the joint area to re-establish the metallic screen. The outer sealing and protection is achieved by thick-wall, adhesive coated heat-shrinkable tubing.

### Live end seal for single core polymeric insulated cables with wire or tape screen, including mechanical connector

Nominal voltage $U_o/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Diameter over core insulation (mm)	Dimensions (mm)	
				L	D
6/10	95 - 240	MXSE-3131	17,6 – 29,4	600	55
	240 - 400	MXSE-3141	25,7 – 32,6	650	65
	500	MXSE-3151	33,8 – 37,2	650	70
12/20	95 - 240	MXSE-5131	21,9 – 33,6	600	60
	240 - 400	MXSE-5141	29,9 – 38,8	700	70
	500	MXSE-5151	37,2 – 41,6	700	75
20/35	95 - 240	MXSE-6131	27,8 – 37,6	700	75
	240 - 400	MXSE-6141	36,2 – 42,8	750	80
	500	MXSE-6151	40,1 – 46,6	800	90

End seals for other cross sections, voltages and cable types are available on request.

# Transition joints for polymeric insulated cables to 3-core belted or screened, paper insulated cables with one common metal sheath 6 kV, 10 kV, 15 kV, 20 kV and 35 kV



Belted or screened paper insulated cable to 1-core polymeric insulated cable



Belted or screened paper insulated cable to 3-core polymeric insulated cable

## Cable

The joints are designed for 3-core belted or screened paper insulated (MI, MIND) cables with a common metal sheath to screened one or three core polymeric insulated cables 6 kV, 10 kV, 15 kV, 20 kV and 35 kV.

For example: ACHPAbI, N(A)KBA, SB, ASB, SAAB, ASBY, A2YSb(r)Y, A2YSY, ACБ, ААБУ, ПвПГ, АПвПГ, ANKOY-XEKVC(E)Y, ANKOPV-AYKCY, ANKOY-N(A)2XSY, HATPS, IPO 13, NPO 13, IPHO 13, N(A)HKBA-XHE 49, XHP48, XHP 81, N(A)2XS(F)2Y, N(A)YSEY, EpHP 81.

## Design of joints with mechanical connectors

### For belted paper cables to one core polymeric cables

The paper cores are completely covered with oil barrier tubing and from the crutch area to the screen end with conductive tubing. The crutch area is filled with stress grading, oil resistive yellow mastic and sealed with an adhesive lined, conductive breakout and conductive tubing which are installed over the cores and the end of the metal sheath. Thus the paper cable is transformed to a quasi polymeric cable construction and the cables jointed similarly.

Yellow void filling mastic is laid around the screen end of the polymeric cables and the end of the conductive tubing of the paper cable cores. The cores of the polymeric cables are covered with stress

control tubing. The conductors are jointed with mechanical connectors supplied with the joint. The connection area is covered with a stress control patch. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation.

The metal sheath, armour and the metal screen of the polymeric cable are jointed with solderless connections. A metal tape is wrapped around the joint area to provide a metal screen and additional protection. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing and a breakout. For cables with aluminium tape shield (e.g. type AHXAMK-W) a connection kit for the ground wire has to be ordered separately.

### For belted paper cables to three core polymeric cables

The joint is designed for unscreened and screened polymeric cables. The installation and design is similar to joints for single core cables. The kit includes in addition solderless earth connections for different types of shielding and armouring.

## Design of joints without connectors

### For screened or belted paper cables to polymeric cables

The paper cores are completely covered with oil barrier tubing and from the crutch area to the screen end with conductive tubing. The crutch area is filled with a stress grading, oil resistive yellow mastic and sealed with an adhesive lined, conductive breakout and conductive tubing which are installed over the cores and the end of the metal sheath. Thus the paper cable is transformed to a quasi polymeric cable construction and the cables jointed similarly.

At the end of the conductive tubing, over the connectors and at the end of the screen of the polymeric cable yellow, void filling mastic is applied. The jointing area of each cable core is covered with heat-shrinkable, stress control tubing. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. The metal sheath, armour and the metal screen of the polymeric cable are jointed with solderless connections. The outer sealing and protection is performed by an adhesive coated, thick-wall, heat-shrinkable tubing.

Joints for single core polymeric cables include special sealing clips which ensure the sealing of the outer tubing to the 1-core cables.

The joints are supplied without connectors.

# Transition joints for polymeric insulated cables to 3-core belted or screened, paper insulated cables with one common metal sheath 6 kV, 10 kV, 15 kV, 20 kV and 35 kV

## Transition Joints including mechanical connectors

For 1-core screened polymeric insulated cables to  
3-core belted or screened paper insulated cables with common metal sheath 6 kV, 10 kV  
and to 3-core screened paper insulated cables with common metal sheath 15 kV, 20 kV

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> ) Cable Insulation		Ordering description for polymeric cables with wire shield		Dimension (mm)	
	Polymeric	Paper		metal tape shield *	L	D
3,5/6 and 6/10	35– 50	35– 50	TRAJ-12/1x 35- 50	TRAJ-12/1x 35- 50-CEE01	950	90
	70–150	70–120	TRAJ-12/1x 70-120	TRAJ-12/1x 70-120-CEE01	950	120
	150–240	150–240	TRAJ-12/1x150-240	TRAJ-12/1x150-240-CEE01	950	140
8,7/15 and 12/20	70 - 150	70 - 150	TRAJ-24/1x 70-150-3SB		1200	120
	120 - 240	120 - 240	TRAJ-24/1x120-240-3SB		1200	140

\* The joints are designed for cables with copper tape shield or with aluminium laminate (e.g. type AHXAMK-W).

For 3-core screened or unscreened polymeric insulated cables to  
3-core belted paper insulated cables with common metal sheath 6 kV, 10 kV

Nominal voltage $U_0/U$ (kV)	Cross section (mm <sup>2</sup> )	Ordering description for polymeric cable		Dimension (mm)	
		without armour	with wire armour	L	D
3,5/6 and 6/10	35– 50	TRAJ-12/3x 35- 50	TRAJ-12/3x 35- 50-W	1050	90
	70–120	TRAJ-12/3x 70-120	TRAJ-12/3x 70-120-W	1250	120
	150–240	TRAJ-12/3x150-240	TRAJ-12/3x150-240-W	1250	140

## Transition Joints without connectors

For 1-core screened polymeric insulated cables to  
3-core screened or belted paper insulated cables with common metal sheath 10 kV, 15 kV, 20 kV and 35 kV

Nominal voltage $U_0/U$ (kV)	Cable cross section (mm <sup>2</sup> )		Ordering description		Dimension (mm)		
	Polymeric	Paper	Polymeric	Paper	L	D	
6/10 and 8,7/15	$U_0/U$ (kV) = 6/10 kV		$U_0/U$ (kV) = 8,7/15 kV				
	35– 70	35– 70	25– 50	25– 50	EPKJ-17A/1XU-3SB	1450	90
	95–185	95–185	70–150	70–150	EPKJ-17B/1XU-3SB	1450	130
	240–400	240–400	185–300	185–300	EPKJ-17C/1XU-3SB	1450	160
	95–185	35– 95	70–150	35– 70	SMOE-61200	1450	130
	185–300	95–185	185–240	70–150	SMOE-61303	1450	140
12/20	35– 70	35– 70			EPKJ-24B/1XU-3SB	1450	90
	95–240	95–240			EPKJ-24C/1XU-3SB	1450	130
	300–400	300–400			EPKJ-24D/1XU-3SB	1450	160
	95–240	35– 95			SMOE-61733	1450	135
20/35	50– 70	50– 70			EPKJ-36A/1XU-3SB	1450	100
	95–150	95–150			EPKJ-36B/1XU-3SB	1450	140
	185–400	185–400			EPKJ-36C/1XU-3SB	1450	160

For 3-core screened polymeric insulated cables to  
3-core screened or belted paper insulated cables with common metal sheath 10 kV

Nominal voltage $U_0/U$ (kV)	Cable cross section (mm <sup>2</sup> )		Ordering description		Dimension (mm)		
	Polymeric	Paper	Polymeric	Paper	L	D	
6/10 and 8,7/15	$U_0/U$ (kV) = 6/10 kV		$U_0/U$ (kV) = 8,7/15 kV				
	35– 70	35– 70	25– 50	25– 50	EPKJ-17A/3XU-3SB	1450	90
	95–185	95–185	70–150	70–150	EPKJ-17B/3XU-3SB	1450	130
	240–400	240–400	185–300	185–300	EPKJ-17C/3XU-3SB	1450	160
	95–185	35– 95	70–150	25– 70	SMOE-61600	1450	150

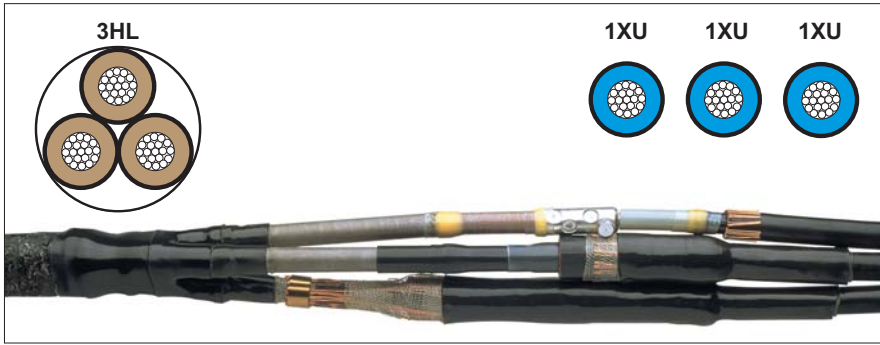
Connection kit for transition joints type TRAJ-CEE01 to the ground wire of 1-core polymeric cables with aluminium laminate (e.g. type AHXAMK-W)

Ordering description	Earth lead dimensions Length (mm)	Cross section (mm <sup>2</sup> )
SMOE-62600	800	35

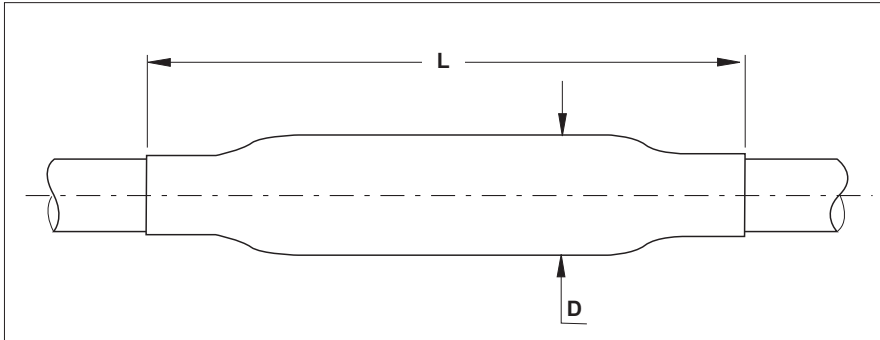
**Note:** The solderless ground wire connection kit must be ordered separately. It includes a screw connector, an insulated earth lead and insulation tubing.

Transition joints for other cross sections or cable types are available on request. Contact the local Raychem products representative for transitions of 6 kV or 10 kV paper insulated to 20 kV polymeric insulated cables.

# Transition joints for screened polymeric insulated cables to screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV



Screened, 3-core paper insulated cable to one core polymeric insulated cable



Dimensions L, D see table

## Cable

The joints are designed for single or 3-core, screened, paper insulated (MI, MIND) cables with one metal sheath per phase to screened, single or three core polymeric insulated cables 10 kV, 15 kV, 20 kV and 35 kV.

For example: АСНРАВІ, НАНКВА, АОСВ, А2YSb(r)Y, А2YSY, АОСБ-АПВП, ОСБ-ПнП, НАКнХ-УНАКXS, ЗНХ-ХУНАКXS, АНКΟΥ-АХЕКVC(E)Y, АНКТОУPV-АХЕКVC(E)Y, АНКТОУPV-N(A)2XS Y, HATPS, IZPO 13, NPZO 13, NPPO 13, NPZOP 13, N(A)HKBA-XHE 49, XHP 48, N(A)2XS(F)2Y, XHP 81, N(A)YSEY

## Design of joints with mechanical connectors

For three-core paper cables a solderless earth connection provides the connection between the armour and the metal sheaths. A heat shrinkable breakout and tubing seal and protect the metal sheaths. A stress grading, oil resistive yellow mastic is laid around the end of the metal sheath and the paper cores are completely covered with oil barrier tubing. Thus the paper cable is transformed to a quasi polymeric cable construction and the cable jointed similarly.

Yellow, void filling mastic is laid around the screen end of the polymeric cables. The cores of the polymeric cables and of the paper cables are covered with heat-shrinkable stress control tubing. The conductors are jointed with mechanical connectors supplied with the joint. Yellow void filling mastic seals the end of the paper cores and the connection area is covered with a stress control patch. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. The metal sheath and the metal screen of the plastic cable are jointed with solderless connections. The outer sealing and protection is performed by adhesive coated, thick-wall heat-shrinkable tubing over each cable core.

## Design of joints without connectors

For three-core paper cables a solderless earth connection provides the connection between the armour and the metal sheaths. A heat shrinkable breakout and tubing seal and protect the metal sheaths. A stress grading, oil resistive yellow mastic is laid around the end of the metal sheath and the paper cores are completely covered with oil barrier tubing. A short conductive tubing rebuilds the screen from the metal sheath to the covered paper core. Thus the paper cable is transformed to a quasi polymeric cable construction and the cable jointed similarly.

At the end of the conductive tubing, the screen cut of the polymeric cable and over the connectors yellow void filling mastic is applied. The jointing area of each cable core is covered with heat-shrinkable stress control tubing. Heat-shrinkable triple-extruded elastomeric joint body provides the correct thickness of insulation and the screening over the insulation. Copper mesh wrapped around the joint area rebuilds the metallic screen. The metal sheath and the metal screen of the plastic cable are jointed with solderless connections. The outer sealing and protection is performed by an adhesive coated, thick-wall, heat-shrinkable tubing over each cable core. For three core polymeric insulated cables one tubing replaces the oversheath.

## Transition joints for screened polymeric insulated cables to screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV

### Transition Joints including mechanical connectors

For 1-core screened, polymeric insulated cables to

3-core screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV

Nominal voltage U <sub>o</sub> /U (kV)	Cross sections (mm <sup>2</sup> )			Ordering description	Dimension (mm)	
	(mm <sup>2</sup> )	(mm <sup>2</sup> )	(mm <sup>2</sup> )		L	D
6/10, 8,7/15 and 12/20	6/10 kV	8,7/15 kV	12/20 kV			
	35– 70	25– 70	25– 70	TRAJ-24/1x 25- 70-3HL	1000	90
	95–150	70–150	70–150	TRAJ-24/1x 70-150-3HL	1000	120
	120–240	120–240	120–240	TRAJ-24/1x120-240-3HL	1000	140
20/35	35– 50			TRAJ-42/1x 35- 50-3HL	1250	100
	70–120			TRAJ-42/1x 70-120-3HL	1250	130
	120–240			TRAJ-42/1x120-240-3HL	1250	150

**Note:** The joints are designed for polymeric insulated cables with wire shield, copper tape shield or with aluminium laminate (e.g. type AHXAMK-W).

For 1-core screened, polymeric insulated cables to

1-core screened, paper insulated cables 20 kV and 35 kV

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
12/20	25– 70	TRAJ-24/1x 25– 70-1HL	850	60
	70–150	TRAJ-24/1x 70–150-1HL	850	65
	120–240	TRAJ-24/1x120–240-1HL	950	70
20/35	35– 50	TRAJ-42/1x 35– 50-1HL	1050	65
	70–120	TRAJ-42/1x 70–120-1HL	1050	70
	120–240	TRAJ-42/1x120–240-1HL	1050	80

### Transition Joints without connectors

For 1-core screened, polymeric insulated cables to

3-core screened, paper insulated cables with one metal sheath per phase 10 kV, 15 kV, 20 kV and 35 kV

Nominal voltage U <sub>o</sub> /U (kV)	Cross sections (mm <sup>2</sup> )			Ordering description	Dimension (mm)	
	(mm <sup>2</sup> )	(mm <sup>2</sup> )	(mm <sup>2</sup> )		L	D
6/10, 8,7/15 and 12/20	6/10 kV	8,7/15 kV	12/20 kV			
	35– 70	25– 50		RPKJ-24A/1XU-3HL-CEE01	1200	90
	95–185	70–150	25– 95	RPKJ-24B/1XU-3HL-CEE01	1200	130
	185–300	150–300	95–240	RPKJ-24C/1XU-3HL-CEE01	1200	150
			240–400	RPKJ-24D/1XU-3HL-CEE01	1200	160
20/35	50– 70			EPKJ-36A/1XU-3HL	1450	90
	95–150			EPKJ-36B/1XU-3HL	1450	130
	185–400			EPKJ-36C/1XU-3HL	1450	160

**Note:** The joints are designed for polymeric insulated cables with wire shield, copper tape shield or with aluminium laminate (e.g. type AHXAMK-W).

For 3-core screened, polymeric insulated cables to

3-core screened, paper insulated cables with one metal sheath per phase 20 kV

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
12/20	35– 70	EPKJ-24B/3XU-3HL	1700	90
	95–240	EPKJ-24C/3XU-3HL	1700	130
	300–400	EPKJ-24D/3XU-3HL	1700	160

For 1-core screened, polymeric insulated cables to 1-core screened, paper insulated cables 20 kV and 35 kV

Nominal voltage U <sub>o</sub> /U (kV)	Cross section (mm <sup>2</sup> )	Ordering description	Dimension (mm)	
			L	D
12/20	35– 70	EPKJ-24B/1XU-1HL	850	50
	95–240	EPKJ-24C/1XU-1HL	950	65
20/35	95–150	EPKJ-36B/1XU-1HL	1050	70
	185–400	EPKJ-36C/1XU-1HL	1050	80

Connection kit for transition joints type TRAJ and RPKJ to the ground wire of 1-core polymeric cables with aluminium laminate (e.g. type AHXAMK-W)

Ordering description	Earth lead dimensions Length (mm)	Cross section (mm <sup>2</sup> )
SMOE-62651	800	3 x 10

**Note:** The solderless ground wire connection kit must be ordered separately. It includes a screw connector, 3 insulated earth leads, a cable breakout and insulation tubing.

Transition joints for other cross sections or cable types are available on request.

# Sealing Systems

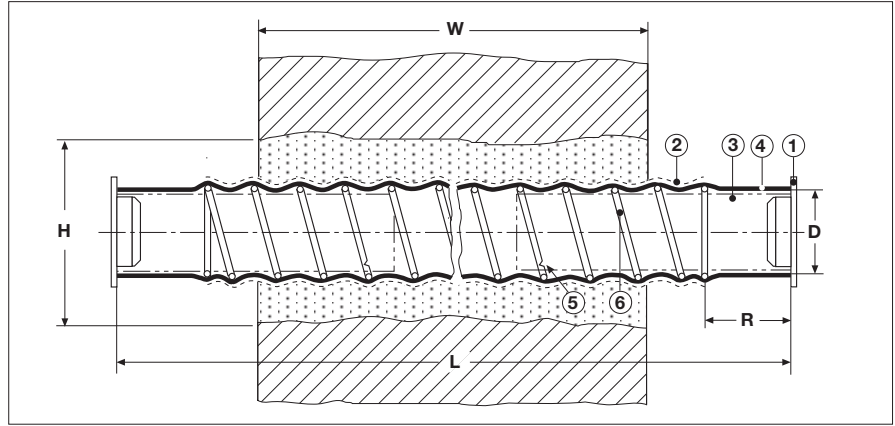




## Sealing Systems

Wall Feed-through EPAF	98
Inflatable Duct Sealing System RDSS	99
Sealing Breakouts with 2 to 5 Fingers	102
Sealing End Caps	103

# Wall feed-through EPAF



### Application

The wall feed-through EPAF provides a reliable seal against water and gas for cables brought into buildings underground. When properly installed, test reports prove a water and gas tightness at an external pressure of 0,1 MPa between the wall and the feed-through as well as between the feed-through and the cables. The design allows removal of cables and installation of new cables in the same feed-through. For exceptionally thick walls, the feed-through can be easily prolonged with another one.

### Construction

The feed-through EPAF consists of a galvanised steel spiral over which longer heat-shrinkable tubing with an adhesive coating inside is installed. An external coating of special primer improves the adhesion to various types of concrete and quick-drying cements. The ends of the tubing are protected with caps to allow cable installations at a later stage. When installing the cable, the end caps are removed and the adhesive coated tubing shrinks onto the cable. Cables are removed by cutting off the tubing at the end of the steel spiral. Upon pulling the steel spiral with a pair of pliers, it will break at a predetermined breaking point. The resulting new open end of the heat-shrinkable tubing can be shrunk onto the new cable.

### 1 Sealing cap

2 Outside sealing coating

3 Inside sealing coating

4 Heat-shrinkable tubing

5 Predetermined breaking point

6 Galvanised steel spiral

### Dimensions see table

D: Inside diameter of feed-through

L: Length

W: Wall-thickness

H: Wall-through diameter

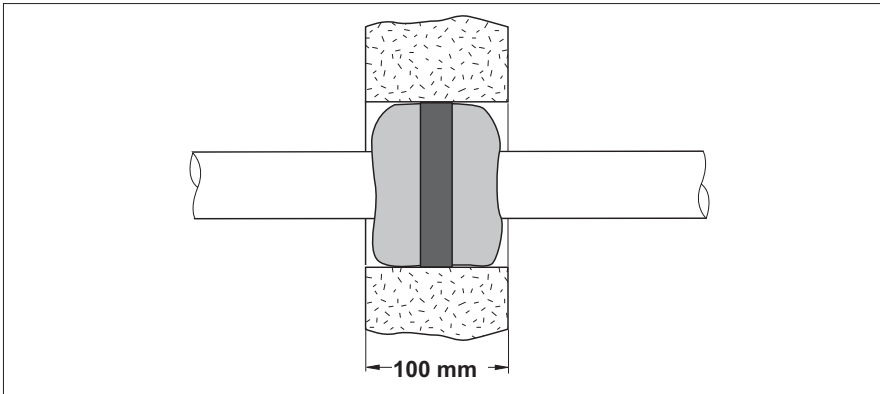
a: as delivered

b: after free recovery

Recommended application ranges (mm) Cable diameter	Dimensions (mm)		Ordering description	Dimensions (mm)			
	W (max.)*	H (min.)		D	L	R	
			a (min.)	b (max.)	± 20 mm	± 20 mm	
8 – 14	320	40	16	8	700	90	
12 – 25	320	55	28	10	700	90	
18 – 36	420	70	41	16	800	90	
29 – 56	320	90	59	26	700	90	
55 – 98	370	140	106	54	760	115	

\* For thicker walls two wall feed-throughs can be easily connected.

## Duct sealing system RDSS



Unsealed cable pipes and ducts need no longer cause dampness and flooding in substation basements, cable vaults and access manholes. In these environments rust, corrosion and a humid environment inevitably result in damage to support structures, metal work and electrical equipment. The most common route for water to enter into such installations can now be blocked simply and effectively by a new technique developed by Raychem. The Rayplate Duct Sealing System (RDSS) has been designed for use on power cables to provide a watertight seal when used with plastic, concrete or steel ducting systems.

### Clean, fast, easy sealing method

The Rayplate seal consists of an inflatable bladder of flexible, metallic laminate, coated on both sides with a sealant strip. With the sealant strips lubricated, the product is simply wrapped around the cable and easily slides into the duct. The bladder is then inflated with a gas pressure tool which presses the sealant coating against the duct wall and the cable. Upon removal of the filling tube, an automatic gel valve system reliably retains the gas pressure in the Rayplate duct seal.

The entire installation is performed within a few minutes – even in congested enclosures.

### Versatility and easy removal

The RDSS system adapts itself to any configuration and is independent of duct ovality. Each RDSS seal covers a large range of cable and duct diameters.

The versatility of the wraparound concept enables use not only for new cable installations, but also for existing applications. Unlike other methods that require dry ducts, the Rayplate seals can be installed when water is still flowing out of the duct. The duct seals can be quickly and easily removed from a duct or pipe by deflation. This allows cables to be replaced in an upgrade or repair. Since ducts are not damaged by the RDSS system, they can easily be sealed again.



### Performance tested

Tests at room temperature showed water and air tightness at static pressures of more than 0,3 bar, even in conjunction with cable bending, vibration, torsion and axial pull.

Resistance to common chemicals has been proven by immersion tests. The Rayplate system was tested with cables load-cycled at conductor temperatures of 90 °C, similar to specifications required for cable accessories. The sealing tests showed water and air tightness with internal duct pressures of 0,3 bar. Measurements and calculations of the diffusion rate indicate that a typical Rayplate duct seal will withstand a 3 m waterhead for 30 years after installation. The sealing performance after 30 years of life was confirmed by sealing tests with reduced internal bladder pressures. The test methodologies and parameters are set out in a detailed test report available from your local TE Energy products representative.

## RDSS – Selection table for duct seals and sealing clips

Each RDSS seals empty ducts (except for size 150) and ducts containing up to 2 cables. The table below shows the minimum and maximum diameter of the cable or of the sum of 2 cables depending on the duct size. All dimensions in mm.

Duct inside Ø	Product description					
	RDSS-45 cable Ø	RDSS-60 cable Ø	RDSS-75 cable Ø	RDSS-100 cable Ø	RDSS-125 cable Ø	RDSS-150 cable Ø
32,5	0–14					
35	0–18					
40	0–27					
45	0–32	0–18				
50		0–30				
55		0–38	0–28			
60		0–45	0–30			
65			0–40			
70			0–46			
75			0–56	0–45		
80				0–52		
85				0–60		
90				0–66		
95				0–74		
100				0–80	0–65	
105				0–85	0–75	
110				0–90	0–83	
115				55–95*	0–91	
120				60–100*	0–95	
125					0–103	60–100
130					70–110*	60–107
135					75–115*	60–112
140					80–120*	60–118
145					85–125*	60–123
150					90–130*	60–129
155						60–134*
160						60–139*
165						105–145*
170						110–150*
175						115–155*
180						120–160*
clip selection	RDSS-Clip-45	RDSS-Clip-75	RDSS-Clip-75	RDSS-Clip-100	RDSS-Clip-125	RDSS-Clip-150

Suitable for empty ducts

With cables only

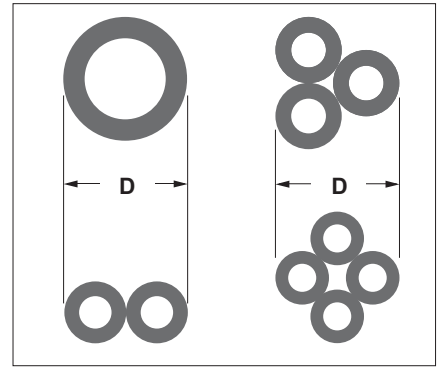
\* RDSS-clips must also be used for 2 or more cable configurations.

### Tools for easy and quick inflation

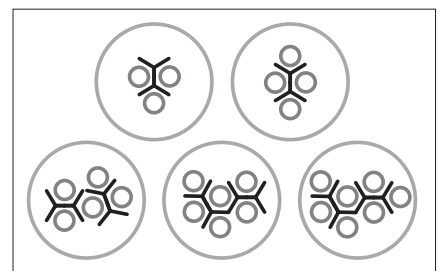
Rayflate duct seals can be installed using a wide variety of inflation tools, which have the capability to inflate the bag to 3,0 ±0,2 bar pressure.

For recommended installation tools see the chapter "Tools and Accessories":

- inflation tool RDSS-IT-16,
- gas cylinders E7512-0160.



Diameter of cable or cable bundles



If three or more cables have to be sealed, a RDSS-Clip is used in combination with the RDSS duct seal. The sealing clip has to be ordered separately.

For each clip used, subtract 5 mm from the maximum cable diameter shown in the table to determine the maximum cable bundle diameter.

One RDSS-clip seals up to 4 cables. If more cables are to be sealed, use one extra clip as shown above.

## RDSS – Adapter for large duct sizes

The RDSS-AD-210 adapter is designed to be installed together with RDSS-125 and RDSS-150 duct seals for ducts up to 210 mm in diameter.

After the sealant tape has been lubricated the RDSS-AD-210 adapter is coiled around the cable to fit the duct. The coiled adapter slides easily into the duct and when released snaps into position against the inner wall of the duct. Then the RDSS is inserted between the cable and the pre-positioned adapter and inflated in the usual way. Certain configurations may require two adapters, details are given in the selection table. The RDSS adapter performance was tested together with RDSS duct seals including watertightness even when the cables were subjected to loadcycling, vibration or bending. A detailed test report is available on request.

The table below shows the minimum and maximum diameter of the cable or cable bundle that can be accommodated in a cable duct for a specific combination of RDSS seals and RDSS-AD-210 adapter. All dimensions in mm.



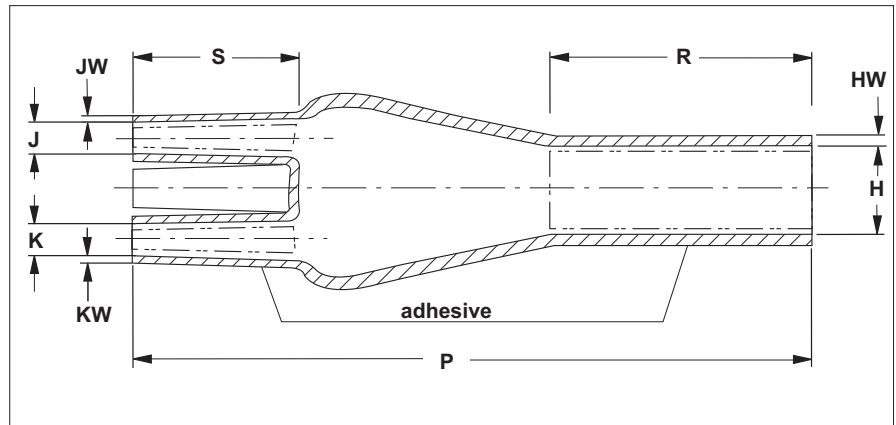
Duct inside Ø	Product combination			
	1xRDSS-AD-210 + RDSS-125 cable Ø	2xRDSS-AD-210 + RDSS-125 cable Ø	1xRDSS-AD-210 + RDSS-150 cable Ø	2xRDSS-AD-210 + RDSS-150 cable Ø
130	0*			
135	0*			
140	0– 40			
145	0– 50			
150	0– 65			
155	0– 83			
160	0– 91			
165	0–103			
170	70–110	0*	60–107	
175	75–115	0– 40	60–112	
180	80–120	0– 50	60–118	
185	90–130	0– 65	60–129	
190		0– 83	60–135	
195		0– 95	60–139	
200		0–103	105–145	60–100
205		75–115	115–155	60–112
210		80–120	120–160	60–118

For sealing of cable bundles select the appropriate RDSS-clip according to the selection table on the previous page

- Suitable for empty ducts
- With cables only

\* Empty ducts only

## Sealing Breakouts for 2 to 5 core cables and ducts



### Application

For sealing of LV multi-core cables crutches and cable entries into ducts. To seal onto all common plastics and metals, all outlets are coated with hot-melt adhesive. The breakouts are resistant to UV-light and weathering.

The breakouts are available for 2-, 3-, 4- and 5-core cables, in a variety of sizes. For dimensional details see table below.

### Dimensions see table

**H:** Diameter of large outlet  
**J:** Diameter of small outlets  
**K:** Diameter of the smallest outlet  
**P:** Length of breakout  
**R:** Length of large outlet  
**S:** Length of small outlets  
**HW:** Wall-thickness of large outlet  
**JW:** Wall-thickness of small outlets  
**KW:** Wall thickness of the smallest outlet

**a:** as delivered  
**b:** after free recovery

Recommended cross section of polymeric cables (mm <sup>2</sup> )	Ordering description	Dimensions (mm)										
		H		J		K		P	R	S	HW	JW/KW
		a	b	a	b	a	b	b	b	b	b	b
		min.	max.	min.	max.	min.	max.	±10%	±10%	±10%	±20%	±20%
<b>for 2-core cables</b>												
4 – 25	302K333/S	28	9,2	15	4,1	-	-	90	20	25	3,2	1,6
35 – 150	302K224/S	48	32	22	7	-	-	172	-	70	2,0	2,0
150 – 400	302K466/S	86	42	40	17	-	-	200	-	75	2,5	2,5
<b>for 3-core cables</b>												
4 – 35	402W533/S	38	13	16	4,2	-	-	103	45	28	2,7	1,5
50 – 150	402W516/S	63	22	26	9	-	-	180	85	40	3,5	1,5
95 – 500	402W526/S	95	28	44	13	-	-	205	90	45	3,5	2,5
-	402W248/S	115	45	52	22	-	-	240	100	60	4,0	2,5
-	402W439/S	170	60	60	30	-	-	252	90	66	4,2	2,6
<b>for 4-core cables</b>												
1,5 – 10	502S013/S	23	9,5	7	2	-	-	60	-	17	2,0	1,2
4 – 35	502K033/S	45	16,5	14	3,4	-	-	97	73	25	2,5	1,9
25 – 95	502K046/S	45	19	20	7	-	-	165	75	40	3,5	2,0
50 – 150	502K016/S	75	25	25	9	-	-	217	100	44	3,5	2,0
120 – 400	502K026/S	100	31	40	13,5	-	-	223	103	51	3,5	2,5
-	502R810/S	170	60	50	23	43	19	255	90	65	4,0	3,5
<b>for 4+1 core cables</b>												
25 – 120*	603W035/S	68	26	30	7	20	6	182	75	40	3,2	2,2
25 – 240	603W040/S	85	26	33	7	27	6	182	75	40	3,2	2,2

\* For smaller cross sections use 502K033/S with 2 cores inside of one outlet.

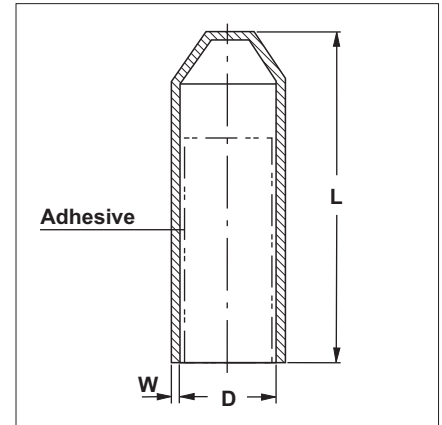
## Sealing End Caps



Non-conductive End Caps 102L



Conductive End Caps 102C



### Application

The heat-shrinkable, inside coated with hot-melt adhesive, end caps are used on plastic, paper and rubber insulated cables to seal and protect their ends during storage, transport and cable laying. The caps are resistant to UV-light and weathering.

In addition, conductive end caps prevent a generation of electrostatic charge of a sealed cable by conductive mastic coat in their top and by cap's conductivity itself.

### Dimensions see table

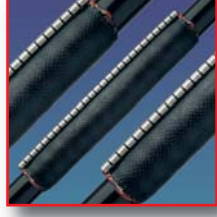
**D:** Diameter  
**W:** Wall-thickness  
**L:** Length

**a:** as delivered  
**b:** after free recovery

Recommended cable diameter (mm)	Ordering description	Dimension (mm)			
		D		L	W
		a (min.)	b (max.)	b (± 10%)	b (± 20%)
<b>Non-conductive end caps</b>					
4 – 8	102L011-R05/S	10	4	38	2,0
8 – 17	102L022-R05/S	20	7,5	55	2,8
17 – 30	102L033-R05/S	35	15	90	3,2
30 – 45	102L044-R05/S	55	25	143	3,9
45 – 65	102L048-R05/S	75	32	150	3,3
65 – 95	102L055-R05/S	100	45	162	3,8
95 – 115	102L066-R05/S	120	70	145	3,8
<b>Conductive end caps</b>					
17 – 30	102C015/244	35	15	98	3,5*
30 – 50	102C025/244	55	25	123	4,0*

\* Given wall-thickness after free recovery is with tolerance ±10%.

# Insulation Tubing and Repair Tape and Wraparounds





## **Heat-shrinkable insulation tubing**

### General purpose

Thin-wall, adhesive coated tubing EN-CGAT 106

### Halogen-free

Thick-wall, general purpose tubing WCSM 106

Medium-wall, general purpose tubing MWTM 107

### Flame retardant

Thick-wall, flexible tubing FCSM 108

Medium-wall, flexible tubing LVIT 108

Thin-wall, flexible tubing EN-CGPT 109

Thin-wall, dual-colour (green-yellow) tubing EN-DCPT 109

### Halogen-free and flame retardant

Thick-wall, general purpose tubing ZCSM 110

## **Repair tape and wraparounds**

Flame retardant, flexible tape CRPS 111

General purpose, fibre-reinforced wraparound CNSM 112

Thick-wall, fibre-reinforced wraparound RFSM 113

## General purpose heat-shrinkable polyolefin insulation tubing

### EN-CGAT

Thin-wall, heat-shrinkable tubing

### Application

General electrical insulation, sealing and corrosion protection purposes. The tubing is coated with an inner sealant wall and it is weathering and UV-resistant.



### Features

Shrink-ratio: 3:1  
 Temperature range: - 40 °C to +80 °C  
 Colour: black  
 Delivery form: on spools, adhesive coated

Recommended application diameter (mm)		Ordering description	Dimension (mm)		W b (min.)
min.	max.		a (min.)	b (max.)	
1,1	2,0	EN-CGAT- 3/ 1-0-SP	3	1	1,00
2,2	4,0	EN-CGAT- 6/ 2-0-SP	6	2	1,00
3,3	7,0	EN-CGAT- 9/ 3-0-SP	9	3	1,35
4,5	9,0	EN-CGAT-12/ 4-0-SP	12	4	1,50
7,0	16,0	EN-CGAT-18/ 6-0-SP	18	6	1,70
9,0	21,0	EN-CGAT-24/ 8-0-SP	24	8	1,95
14,5	36,0	EN-CGAT-39/13-0-SP	39	13	2,10

## Halogen-free, heat-shrinkable polyolefin insulation tubing

### WCSM

Thick-wall, halogen-free heat-shrinkable tubing

### Application

General electrical insulation and sealing purposes. The tubing is coated with an inner sealant wall. The sealant exhibits excellent bonding and sealing characteristics to all materials commonly used in the various cable insulation and sheath constructions, such as plastic, rubber, lead and aluminium. The tubing is weathering and UV-resistant.



### Features

Temperature range: - 50 °C to +90 °C  
 Dielectric strength: 170 kV/cm (1 mm wall)  
 120 kV/cm (2 mm wall)  
 Colour: black  
 Delivery form: 1 m cut lengths, adhesive coated

Recommended application diameter (mm)		Ordering description	Dimension (mm)		W	
min.	max.		a (min.)	b (max.)	a (min.)	b (min.)
3,5	10	WCSM- 12/ 3-1000/S	12	3	0,8	2,0
4,5	14	WCSM- 16/ 4-1000/S	16	4	0,9	2,4
6,5	22	WCSM- 24/ 6-1000/S	24	6	1,0	2,7
9	31	WCSM- 34/ 8-1000/S	33	8	1,3	4,0
13	44	WCSM- 48/ 12-1000/S	48	12	1,5	4,5
17,5	50	WCSM- 56/ 16-1000/S	56	16	1,5	4,4
22	63	WCSM- 70/ 20-1000/S	70	20	1,4	4,4
27	81	WCSM- 90/ 25-1000/S	90	25	1,3	4,3
33	100	WCSM-110/ 30-1000/S	110	30	1,2	4,3
38	118	WCSM-130/ 35-1000/S	130	35	1,2	4,3
55	144	WCSM-160/ 50-1000/S	160	50	1,0	4,3
55	162	WCSM-180/ 50-1000/S	180	50	1,0	4,3
55	180	WCSM-200/ 50-1000/S	200	50	n.a.	4,3
70	225	WCSM-250/ 65-1000/S	250	65	n.a.	4,3
105	295	WCSM-320/ 95-1000/S	320	95	n.a.	4,3
125	350	WCSM-390/110-1000/S	390	110	n.a.	4,3

**Note:** Maximal longitudinal change after free recovery (+5 %; -10 %)

# Halogen-free, heat-shrinkable polyolefin insulation tubing

## MWTM Medium-wall, halogen-free heat-shrinkable tubing

### Application

General electrical insulation, sealing and corrosion protection purposes. The tubing is available either with or without an inner sealant wall. The sealant exhibits excellent bonding and sealing characteristics to all materials commonly used in the various cable insulation and sheath constructions, such as plastic, rubber, lead and aluminium. The tubing is weathering and UV-resistant.



### Features

Temperature range: - 40 °C to +120 °C (uncoated)  
- 40 °C to + 90 °C (coated)

Dielectric strength: 200 kV/cm (1 mm wall)

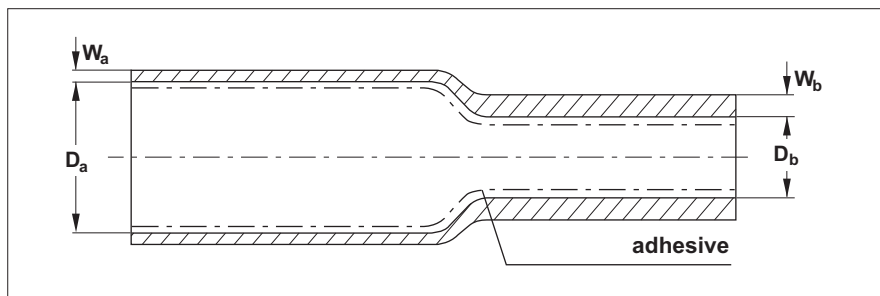
Colour: black

Delivery form: 1 m cut lengths, uncoated = 1000/U  
1 m cut lengths, adhesive coated = 1000/S  
on spools, uncoated only = A/U

Recommended application diameter (mm)		Ordering description		Dimension (mm)			
min.	max.	uncoated tubing*	adhesive coated tubing	D		W	
				a (min.)	b (max.)	a (min.)	b (min.)
3,5	9	MWTM- 10/ 3-1000/U	MWTM- 10/ 3-1000/S	10	3	0,3	1,0
5,5	14,5	MWTM- 16/ 5-1000/U	MWTM- 16/ 5-1000/S	16	5	0,3	1,4
9	22,5	MWTM- 25/ 8-1000/U	MWTM- 25/ 8-1000/S	25	8	0,4	2,0
13	31,5	MWTM- 35/ 12-1000/U	MWTM- 35/12-1000/S	35	12	0,4	2,0
18	45	MWTM- 50/ 16-1000/U	MWTM- 50/16-1000/S	50	16	0,5	2,0
21	57	MWTM- 63/ 19-1000/U	MWTM- 63/19-1000/S	63	19	0,6	2,4
24	68	MWTM- 75/ 22-1000/U	MWTM- 75/22-1000/S	75	22	0,6	2,7
28	77	MWTM- 85/ 25-1000/U	MWTM- 85/25-1000/S	85	25	0,6	2,8
32	86	MWTM- 95/ 29-1000/U	MWTM- 95/29-1000/S	95	29	0,7	3,1
37	104	MWTM-115/ 34-1000/U	MWTM-115/34-1000/S	115	34	0,7	3,1
46	126	MWTM-140/ 42-1000/U	MWTM-140/42-1000/S	140	42	0,7	3,1
55	144	MWTM-160/ 50-1000/U	MWTM-160/50-1000/S	160	50	0,7	3,2
66	162	MWTM-180/ 60-1000/U	MWTM-180/60-1000/S	180	60	0,7	3,2
88	220	MWTM-245/ 80-1000/U	-	245	80	n.a.	2,4
149	255	MWTM-285/135-1000/U	-	285	135	n.a.	1,4

\* Uncoated tubing is also available on spool (please use modification code -A/U instead of -1000/U in relevant ordering description).

**Note:** Maximal longitudinal change after free recovery (+5 %; -10 %).



### Dimensions:

**D:** Diameter  
**D<sub>a</sub>:** Diameter as delivered  
**D<sub>b</sub>:** Diameter after free recovery  
**W:** Wall-thickness  
**W<sub>a</sub>:** Wall-thickness as delivered  
**W<sub>b</sub>:** Wall-thickness after free recovery

# Flame retardant, heat-shrinkable polyolefin insulation tubing

## FCSM

**Thick-wall, flexible and flame-retarded heat-shrinkable tubing**

## Application

Electrical insulation and sealing purposes in the mining, construction and transportation industries and for similar applications, where flame retardation and flexibility are required.

The tubing is coated with an inner sealant wall and it is weathering and UV-resistant.

## Features

Temperature range: - 50 °C to +90 °C  
 Dielectric strength: 130 kV/cm  
 Flammability (IEC 60684-2 method A): self-extinguishing 60 sec. max.  
 Colour: black  
 Delivery form: 1 m cut lengths, adhesive coated



Recommended application diameter (mm)		Ordering description	Dimension (mm)		W	
min.	max.		a (min.)	b (max.)	a (min.)	b (min.)
3,5	8	FCSM- 9/ 3-1000/S	9	3	0,6	2,0
6,5	17	FCSM- 19/ 6-1000/S	19	6	0,7	2,4
10	25	FCSM- 28/ 9-1000/S	28	9	0,8	3,2
13	34	FCSM- 38/12-1000/S	38	12	1,0	4,1
17,5	46	FCSM- 51/16-1000/S	51	16	1,0	4,1
24	61	FCSM- 68/22-1000/S	68	22	1,0	4,1
33	81	FCSM- 90/30-1000/S	90	30	1,0	4,1
44	108	FCSM-120/40-1000/S	120	40	1,0	4,1
69	159	FCSM-177/63-1000/S	177	63	1,0	4,1

**Note:** Maximal longitudinal change after free recovery (+5 %; -10 %)

## LVIT

**Medium-wall, flexible and flame-retarded heat-shrinkable tubing**

## Application

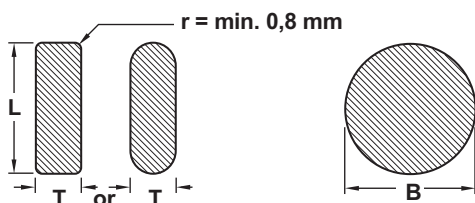
Electrical insulation, protection and sealing of flexible cables, joints, accessories, connections and variety of curved and bent busbars of both circular and rectangular cross-section. The tubing is weathering and UV-resistant.

## Features

Temperature range: - 50 °C to +105 °C  
 Dielectric strength: 130 kV/cm (2,5 mm wall)  
 Flammability (IEC 60684-2 method A): self-extinguishing 60 sec. max.  
 Colour: black  
 Delivery form: on spools, uncoated only = A/U



Recommended application (mm)				Ordering description	Dimensions (mm)			
Rectangular busbars, L+T		Round busbars, B			D		W	
min.	max.	min.	max.	a (min.)	b (max.)	a (min.)	b (min.)	
17	39	11	25	LVIT- 30/ 10-A/U	30	10	0,5	1,5
39	86	25	55	LVIT- 75/ 25-A/U	75	25	0,5	1,5
65	140	40	90	LVIT- 100/ 35-A/U	100	35	0,5	1,5
86	157	55	100	LVIT- 150/ 50-A/U	150	50	0,5	1,5
190	280	120	180	LVIT- 235/105-A/U	235	105	0,5	1,5



## Flame retardant, heat-shrinkable polyolefin insulation tubing

### EN-CGPT

Thin-wall, flexible and flame-retarded heat-shrinkable tubing

### Application

Universal electrical insulation, corrosion protection and marking purposes. The tubing is weathering and UV-resistant.

### Features

Shrink-ratio: 3:1  
 Temperature range: - 40 °C to +135 °C  
 Flammability (IEC 60684-2 method A): self-extinguishing 60 sec. max.  
 Colour: black  
 Delivery form: on spools, uncoated



Recommended application diameter (mm)		Ordering description	Dimension (mm)		W
min.	max.		a (min.)	b (max.)	b (min.)
0,6	1,3	EN-CGPT- 1,5/0,5-0-SP	1,5	0,5	0,45
1,1	2,5	EN-CGPT- 3/ 1-0-SP	3	1	0,55
2,2	5,0	EN-CGPT- 6/ 2-0-SP	6	2	0,65
3,3	8,0	EN-CGPT- 9/ 3-0-SP	9	3	0,75
4,5	10,5	EN-CGPT-12/ 4-0-SP	12	4	0,75
7,0	16,0	EN-CGPT-18/ 6-0-SP	18	6	0,85
9,0	21,5	EN-CGPT-24/ 8-0-SP	24	8	1,00
14,5	35,0	EN-CGPT-39/13-0-SP	39	13	1,15

**Note:** Tubing in other colours is available on request.

### EN-DCPT

Thin-wall, flame-retarded heat-shrinkable tubing

### Application

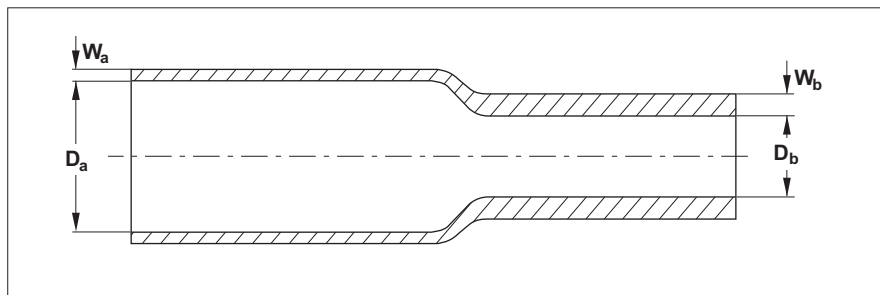
Marking and protection of grounding wires, cables and busbars. The tubing is weathering and UV-resistant.

### Features

Shrink-ratio: 2:1  
 Temperature range: - 40 °C to +135 °C  
 Flammability (IEC 60684-2 method A): self-extinguishing 60 sec. max.  
 Colour: green/yellow  
 Delivery form: on spools, uncoated



Recommended application diameter (mm)		Ordering description	Dimension (mm)		W
min.	max.		a (min.)	b (max.)	b (min.)
1,7	2,8	EN-DCPT- 3/ 1,5-45-SP	3	1,5	0,51
3,2	5,6	EN-DCPT- 6/ 3-45-SP	6	3	0,58
4,5	7,6	EN-DCPT- 8/ 4-45-SP	8	4	0,64
5,5	9,5	EN-DCPT-10/ 5-45-SP	10	5	0,64
6,5	11,5	EN-DCPT-12/ 6-45-SP	12	6	0,64
10,0	18,0	EN-DCPT-19/ 9-45-SP	19	9	0,76
14,0	25,0	EN-DCPT-26/13-45-SP	26	13	0,89
23,0	35,0	EN-DCPT-38/19-45-SP	38	19	1,00



### Dimensions:

**D:** Diameter  
**D<sub>a</sub>:** Diameter as delivered  
**D<sub>b</sub>:** Diameter after free recovery  
**W:** Wall-thickness  
**W<sub>a</sub>:** Wall-thickness as delivered  
**W<sub>b</sub>:** Wall-thickness after free recovery

# Halogen-free and flame retardant, heat-shrinkable polyolefin insulation tubing

## ZCSM Thick-wall, halogen-free and flame-retarded heat-shrinkable tubing

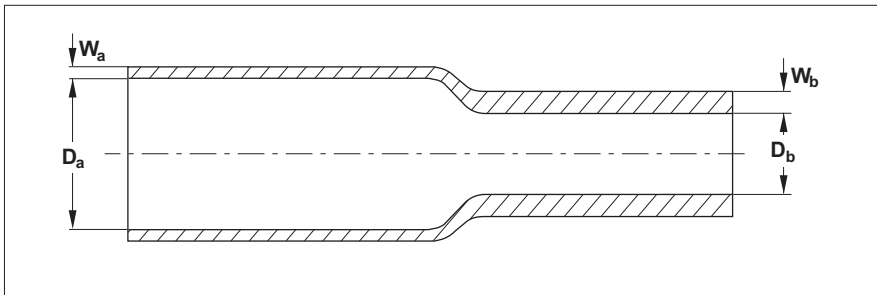
**Application**  
General electrical insulation purposes especially in low fire hazard areas.  
The tubing is weathering and UV-resistant.

### Features

Temperature range:	- 40 °C to +140 °C
Flame propagation (IEC 60332-1):	pass
Limited oxygen index (ISO 4589):	29 min.
Temperature index (ISO 4589):	250 °C min.
Smoke index (NES 711):	20 max.
Smoke density (3 m <sup>3</sup> ) (IEC 61034):	pass
Toxicity Index (NES 713):	3 per 100 g max.
Acid gas generation (IEC 60754):	1,5 % max.
Dielectric strength:	120 kV/cm (2 mm wall)
Colour:	black
Delivery form:	1 m cut lengths, uncoated



Recommended application diameter (mm)		Ordering description	Dimension (mm)		W	
min.	max.		a (min.)	b (max.)	a (min.)	b (min.)
3,5	7	ZCSM- 8/ 3-1000/U	8	3	0,6	2,0
5,5	14,5	ZCSM- 16/ 5-1000/U	16	5	0,7	2,4
9	21,5	ZCSM- 24/ 8-1000/U	24	8	0,9	2,9
13	29	ZCSM- 32/12-1000/U	32	12	1,0	4,0
17,5	40,5	ZCSM- 45/16-1000/U	45	16	1,0	4,0
24	54	ZCSM- 60/22-1000/U	60	22	1,0	4,0
27,5	63	ZCSM- 70/25-1000/U	70	25	1,0	4,0
39,5	76,5	ZCSM- 85/36-1000/U	85	36	1,0	4,0
55	108	ZCSM-120/50-1000/U	120	50	1,0	4,2
82,5	162	ZCSM-180/75-1000/U	180	75	1,0	5,6



### Dimensions:

- D:** Diameter
- D<sub>a</sub>:** Diameter as delivered
- D<sub>b</sub>:** Diameter after free recovery
- W:** Wall-thickness
- W<sub>a</sub>:** Wall-thickness as delivered
- W<sub>b</sub>:** Wall-thickness after free recovery

## Flame retardant, elastomeric repair tape

### CRPS

Flexible, flame-retardant cold applied repair tape

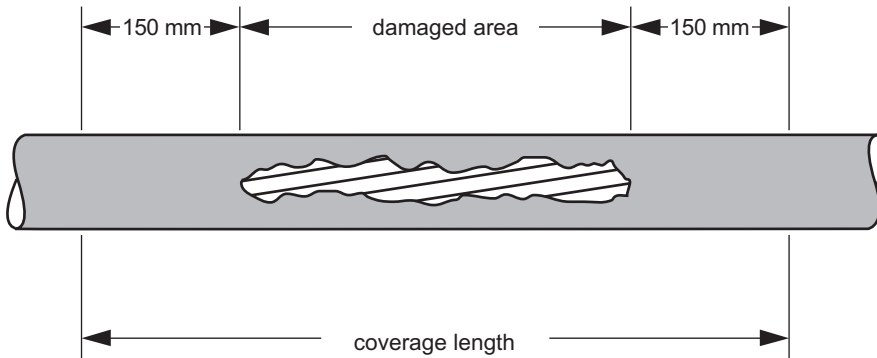
### Application

Jacket repair on mining and other flexible cables. The tape has excellent resistance to abrasion, tearing, and cutting and it is precoated with a thermoplastic sealant that provides a superb seal against moisture and corrosive elements.



Cable diameter (mm)	Ordering description	Tape length (mm)	Tape width (mm)	Max. coverage length (mm)
13				1855
19				1245
25				915
32				710
38	CRPS-2120	3050	50	610
44				510
51				480
64				330
76				305

**Note:** Max. coverage length includes 150 mm on either side of damaged area.  
For larger damaged areas, multiple strips may be used to provide continuous coverage.



# Fibre-reinforced, heat-shrinkable repair wraparound

## CNSM

General purpose, fibre-reinforced, heat shrinkable wraparound

### Application

Fast and reliable repair of polymeric or paper cable sheaths to re-establish the electrical and mechanical integrity of the cable.

The wraparound is supplied with an adhesive coating and it is weathering and UV-resistant.



### Features

Temperature range:

- 40 °C to +120 °C

Dielectric strength:

120 kV/cm (1 mm wall).

Colour:

black

Delivery form:

adhesive coated wraparound with stainless steel channel

Temperature indicating system:

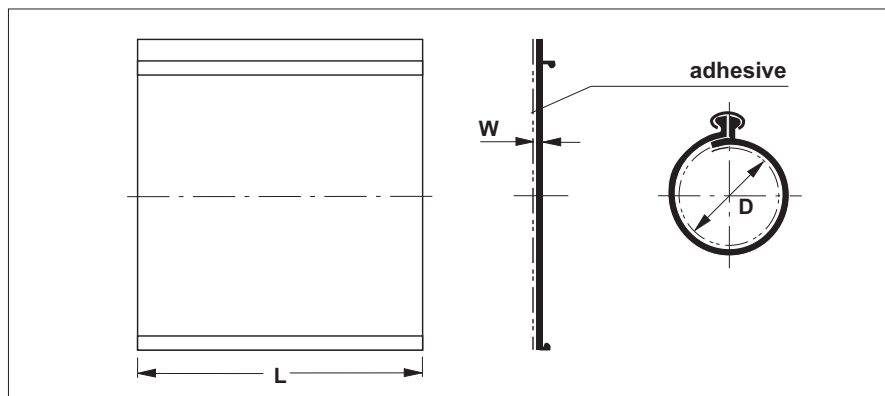
Outer surface of wraparound is treated with a temperature sensitive indicating system to facilitate uniform heating during installation. In addition, white lines are painted on the flat side of the rails, which become visible through the channel openings as installation is completed.

Recommended application diameter (mm)		Ordering description	Dimensions (mm)		W		L
min.	max.		a (nom.)	b (max.)	a (min.)	b (min.)	a (±5 mm)
8	43	CNSM- 43/ 8-1000/AC	53	8	1,1	3	1000
12	55	CNSM- 55/12-1000/AC	66	12	1,1	3	1000
15	75	CNSM- 75/15-1000/AC	84	15	1,1	3	1000
20	84	CNSM- 84/20-1000/AC	92	20	1,1	3	1000
25	100	CNSM-100/25-1000/AC	115	25	1,1	3	1000
30	125	CNSM-125/30-1000/AC	136	30	1,1	3	1000
38	146	CNSM-146/38-1000/AC	162	38	1,1	3	1000
42	164	CNSM-164/42-1000/AC	176	42	1,1	3	1000
50	200	CNSM-200/50-1000/AC	216	50	1,1	3	1000

**Note:** Maximal longitudinal change after free recovery ±5 %.

The repair wraparound and the channel can be cut to the length as required at the place of installation.

Other lengths are available on request.



### Dimensions:

**D:** Diameter

**D<sub>a</sub>:** Diameter as delivered

**D<sub>b</sub>:** Diameter after free recovery

**L:** Length

**W:** Wall-thickness

**W<sub>a</sub>:** Wall-thickness as delivered

**W<sub>b</sub>:** Wall-thickness after free recovery



# Fiber-reinforced, heat-shrinkable repair wraparound

## RFSM

Thick-wall, fibre-reinforced, heat shrinkable wraparound

### Application

Fast and reliable cable repairs in applications where high mechanical resistance is required and as an outer sheath for low and medium voltage joints. The wraparound is supplied with an adhesive coating and it is weathering and UV-resistant.



### Features

Temperature range:

- 40 °C to +120 °C

Dielectric strength:

120 kV/cm (1 mm wall)

Colour:

black

Delivery form:

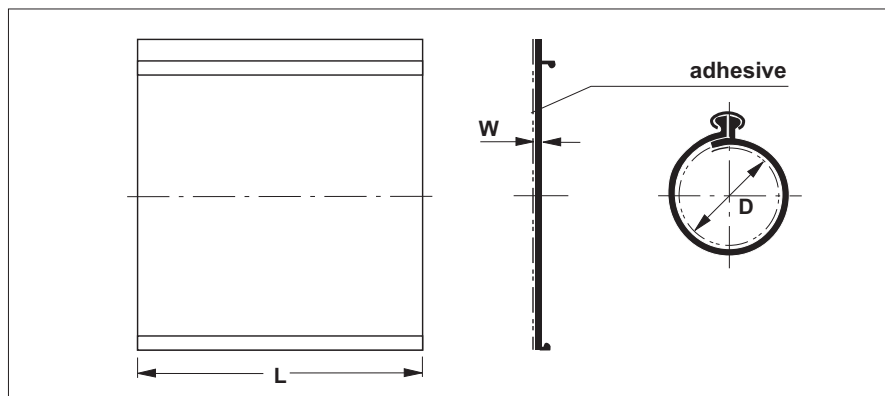
adhesive coated wraparound with stainless steel channel

Temperature indicating system:

Outer surface of wraparound is treated with a temperature sensitive indicating system to facilitate uniform heating during installation. In addition, white lines are painted on the flat side of the rails, which become visible through the channel openings as installation is completed.

Recommended application diameter (mm)		Ordering description	Dimensions (mm)		W		L
min.	max.		a (min.)	b (max.)	a (min.)	b (min.)	a (± 15 mm)
16	41	RFSM- 45/15- 500/123	50	13	1,5	4,5	500
		RFSM- 45/15- 750/123					750
22	59	RFSM- 65/20- 500/123	71	18	1,5	4,5	500
		RFSM- 65/20-1000/123					1000
33	86	RFSM- 95/30- 750/123	103	27	1,5	4,5	750
		RFSM- 95/30-1000/123					1000
		RFSM- 95/30-1500/123					1500
44	113	RFSM-125/40- 750/123	135	36	1,5	4,5	750
		RFSM-125/40-1100/123					1100
		RFSM-125/40-1500/123					1500
61	149	RFSM-165/55- 750/123	178	50	1,5	4,5	750
		RFSM-165/55-1500/123					1500
71	185	RFSM-205/65- 750/123	222	59	1,5	4,5	750
		RFSM-205/65-1500/123					1500

**Note:** Maximal longitudinal change after free recovery ±10 %.



### Dimensions:

**D:** Diameter

**D<sub>a</sub>:** Diameter as delivered

**D<sub>b</sub>:** Diameter after free recovery

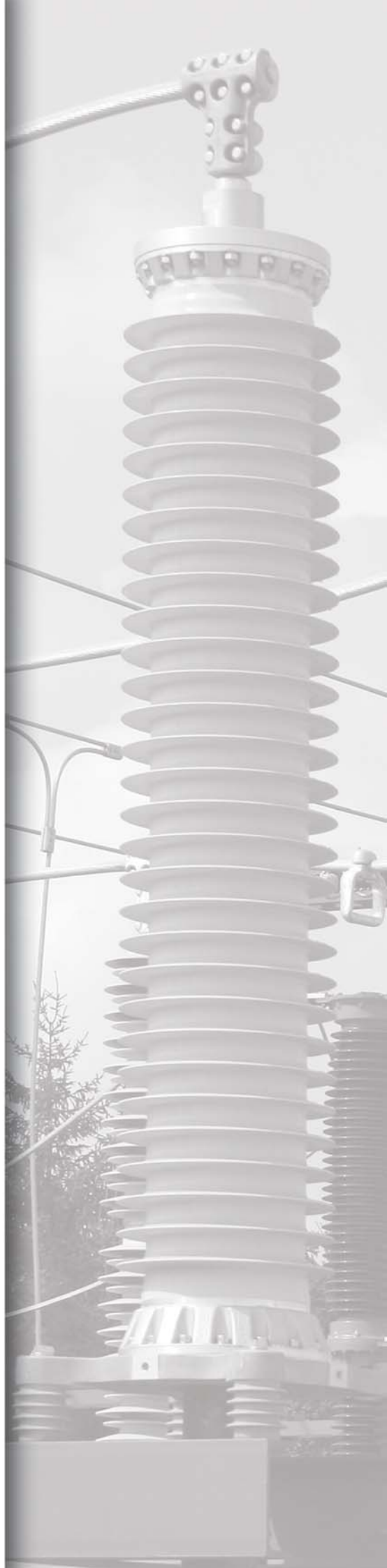
**L:** Length

**W:** Wall-thickness

**W<sub>a</sub>:** Wall-thickness as delivered

**W<sub>b</sub>:** Wall-thickness after free recovery

# High Voltage Cable Accessories



## High Voltage Cable Accessories

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## General



TE Energy is focused on development, manufacturing of cable accessories and execution of projects providing reliable operation of electric power systems. Many of the world's leading enterprises apply our cable accessories which are developed for the long-term operation in the most severe conditions of indoor and outdoor maintenance in any climatic zones and high pollution locations. Our products have a very high reliability index which warrants saving of customers capital outlays. We use experience accumulated from more than 40 years in materials science, development of new technologies, and intensive study of customers needs. We constantly improve our production technology and the quality of our products while paying attention to customers increasing requirements. Our products passed all relevant tests in independent test labs in order to comply with quality requests of International Standards like IEC, IEEE. TE Energy has technical support centers where customers can get professional assistance. Our specialists are always ready to find solutions for any specific issue of any enterprise.

## Technology

### Pre-Moulded main insulation

Push-on stress cone made of silicone rubber offers:

- wide application range
- easy installation, no pulling device required
- no holdout system required



### Solderless connection technology

Top bolts and connectors with shear-head bolts offer:

- no crimping tools required
- reproducible high electrical contact quality by preset shear-off torque
- suitable for all conductor material and design

Roll-spring or hose clips connection of cable sheath / screen offers:

- no risk of cable damage
- fast installation
- easy adaptation to cable with two or more shield layers



### Heat-shrink outer sealing system

Molecular crosslinked polymer with hot-melt and mastic coating offers:

- reliable sealing against moisture ingress
- mechanical protection of the joint body
- easy and well know installation

## Basic project information

Minimum preliminary technical data and information must be collected to prepare a quotation.

For all applications:

- system voltage
- drawing of cable
- all cable parameters like conductor and screen material, conductor and screen cross section, conductor diameter etc.

In addition for:

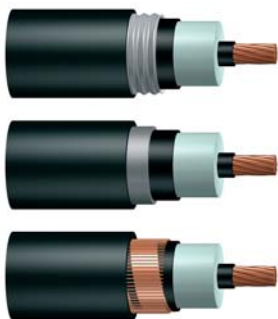
- Outdoor Composite and Dry Terminations
- accessories material, bus-bar or conductor

Switchgear and Transformer Terminations

- connection details, standard and type

Inline and Shield-break joints

- length of cable line



## Strategy, service and installation

TE Energy is an independent supplier of HV cable accessories offering its products worldwide to:

- utilities with their own installation crews
- contractors providing installation services to utilities and industrial customers
- cable manufacturers

An engineering team provides support during the planning phase of a project. Field experienced TE Energy employees and representatives support customers from the planning to the finalization of projects.

### Installations

TE Energy has well-trained and experienced jointers who are able to carry out installation at construction sites. Usually they are supported by local assistance provided by the contractor or the local utility. If there are no trained jointers available locally, ordering installation services from us is the first choice.

### Training

Jointers with longtime experience in HV cable preparation may be trained on-site during an installation. Less experience jointers should be first trained in our labs. In both cases, well experienced supervisors demonstrate how to install our products to ensure the high performance expected is maintained over the whole life time of our products. At the end of the training the jointers will be able to carry out installations without or at least with a minimum of help provided by our supervisors.

### Supervision

Jointers, who have been trained by TE Energy supervisors prior to an installation but haven't yet had sufficient on-site experience in installing of TE Energy accessories, may need the help of a supervisor on-site. We recommend ordering this service for the first installations. This ensures that all accessories are installed according to the instructions provided with the accessories.



## TE Energy high voltage products

Wide range of reliable and cost-effective solutions is continuously expanding through the field knowledge, customer's feedback and research-driven product development.

### TE Energy transmission line and substation competence

- cable terminations and joints
- link boxes
- insulation enhancement system
- surge arresters and surge counters
- connectors up to 800 kV
- hollow core polymeric and porcelain insulators
- spacer and dampers
- hardware and fittings
- suspension clamps
- mechanical dead ends
- earthing and grounding systems
- fibre reinforced components



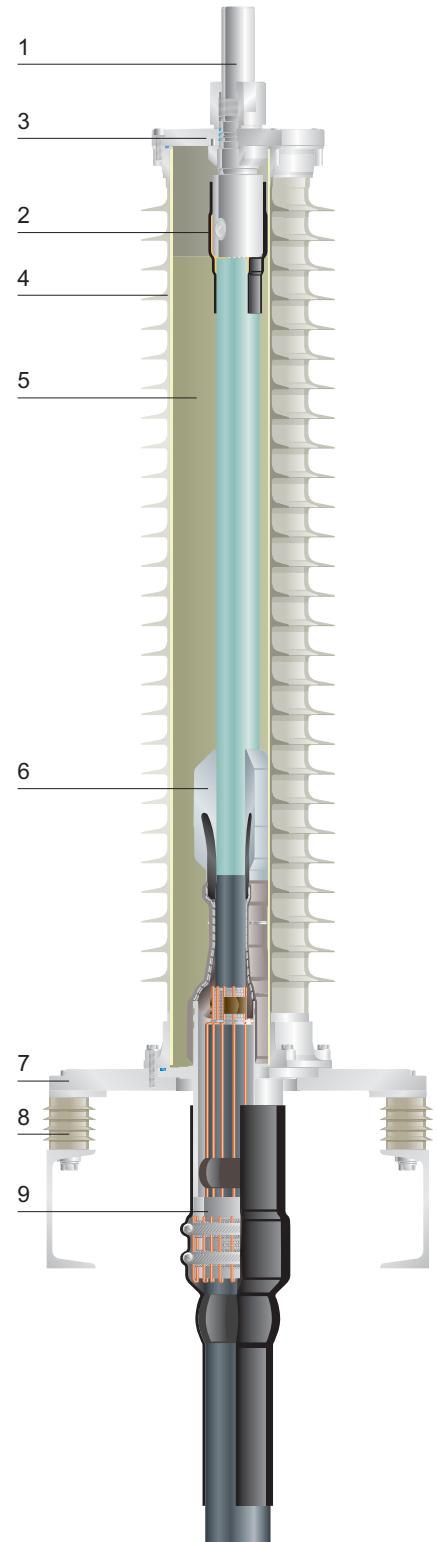
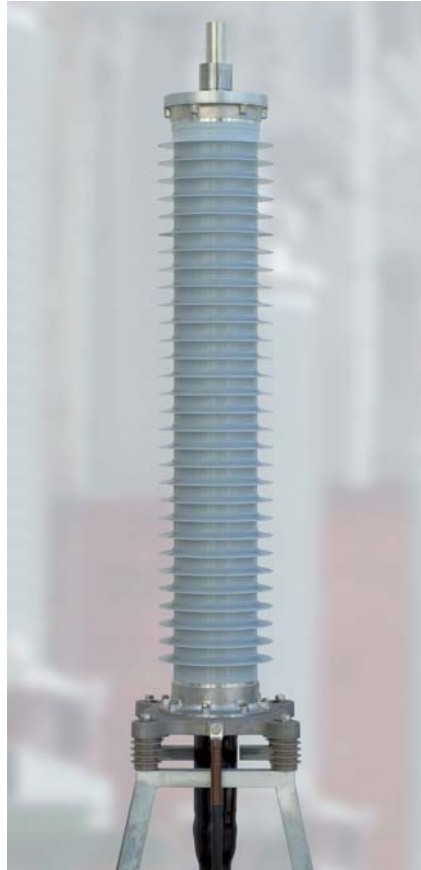
# Outdoor Composite Termination OHVT-C for 72 kV up to 245 kV

## Application

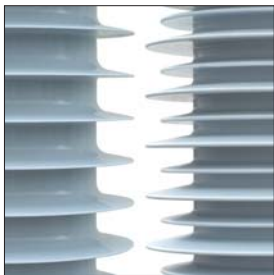
The termination is designed for voltage classes up to 245 kV and to operate under severe environmental conditions. Polymeric insulated cables of various designs can be adopted with respect to shielding and metal sheath. Composite housings with different creepage lengths up to 50 mm/kV are available covering the most common and also extreme pollution levels.

## Features

- Designed in accordance to IEC-60071-1, IEC-60071-2 and IEEE-1313.1
- Pressure-tight and light weight composite housing
- Pre-fabricated and factory tested silicone rubber stress cone
- Torque-controlled conductor bolt
- Heat-shrink components used for sealing
- No special tools required to install the termination
- Si-oil filling without preheating (filling from the top)
- Isolated base plate for sectionalization
- Fittings made of corrosion resistant alloy
- Type tested according to IEC-60840 and IEEE-48 standards



## Model variations



### Creepage

Variations according to individual requirements

- pollution class
- normal sheds
- alternating sheds

## System Add ons



### Adapter

Variations to customize the termination contact bolt



### Cable lug

Different types of cable lugs available

- mechanical with defined torque
- crimp octant or hexagonal



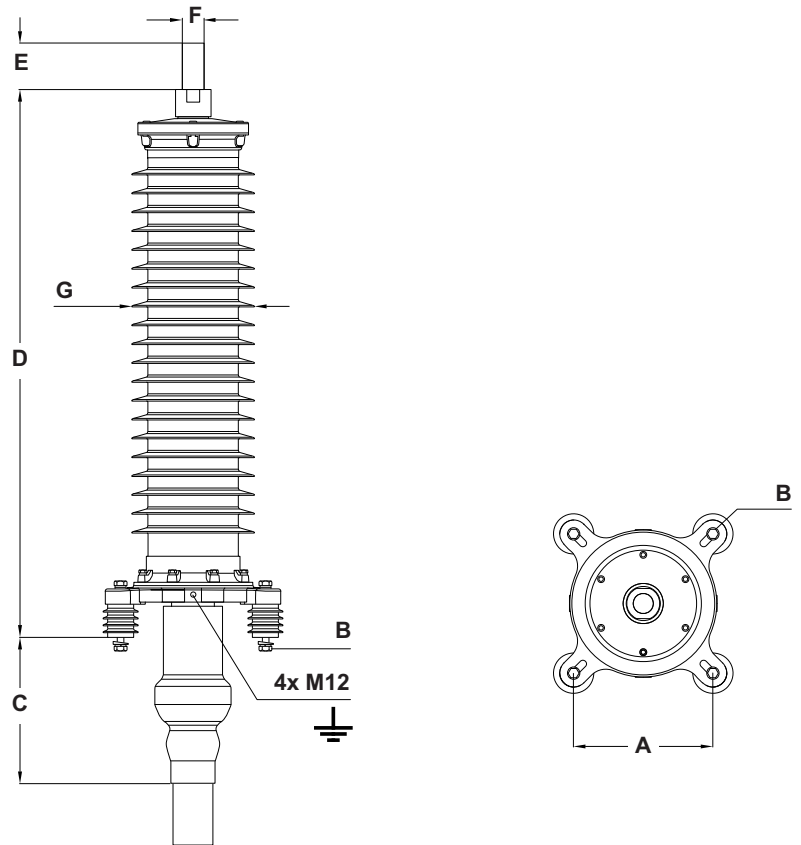
### Arcing horn

To adjust the arcing distance

## Cut-away drawing of OHVT-C

- 1 Connector (mechanical or crimp)
- 2 Sealing system
- 3 Upper metal fitting
- 4 Composite housing
- 5 Oil-filling
- 6 Stress cone
- 7 Base plate
- 8 Support insulators
- 9 Gland and sealing

## Outdoor Composite Termination OHVT-C for 72 kV up to 245 kV



Type of termination	OHVT-72C	OHVT-145C	OHVT-170C	OHVT-245C
<b>Technical data</b>				
Max. operating voltage $U_m$ (kV)	72,5	145	170	245
Standards	IEC-60840 IEC-60815	IEC-60840 IEC-60815	IEC-60840 IEC-60815	IEC-62067 IEC-60815
Rated voltage $U$ (kV)	60 – 69	132 – 138	150 – 161	220 – 230
Rated lightning impulse 1,2/50 $\mu$ s withstand voltage (BIL) (kV)	325	650	750	1050
Min. creepage distance (mm)	2164 – 2383	3392 – 8047	3829 – 9436	5161 – 10171
Partial discharge measurement (pC)	< 5	< 5	< 5	< 5
Max. continuous operating temperature ( $^{\circ}$ C)	90	90	90	90
Max. conductor emergency temperature ( $^{\circ}$ C)	150	150	150	150
Conductor short circuit temperature ( $^{\circ}$ C)	250	250	250	250
Short circuit current (sheath) (kA/s)	40	40	40	40
Withstand voltage support insulators (AC/DC) (kV)	10/20	10/20	10/20	10/20
<b>Application Range</b>				
Conductor cross section Cu/Al ( $\text{mm}^2$ )	95 – 2500	95 – 2500	95 – 2500	300 – 2500
Diameter over cable insulation (mm)	34 – 97	34 – 97	43 – 108	77 – 119
Max. diameter over cable sheath (mm)	110	110	135	170
<b>Dimensions</b>				
A (mm)	345	345	345	345
B	M16	M16	M16	M16
C (mm)	350	350	350	350
D (mm)	1072 – 1276	1771 – 2608	2028 – 2854	2523 – 3227
E (mm)	100/130	100/130	100/130	110/130
F (mm)	30/40/50	30/40/50	30/40/50	50/60
G (mm)	294/304	294/304	345/355	402/410

**Note:** All listed dimensions are standard size to serve the common application of these terminations. Special applications, bigger cable sizes and more detailed information are available on request.

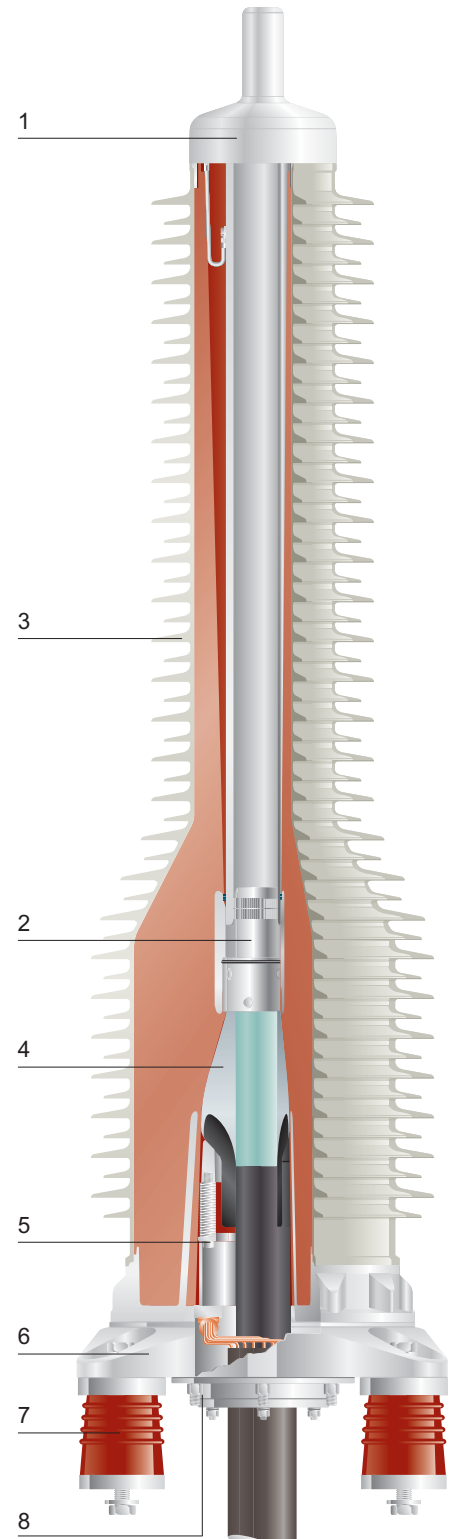
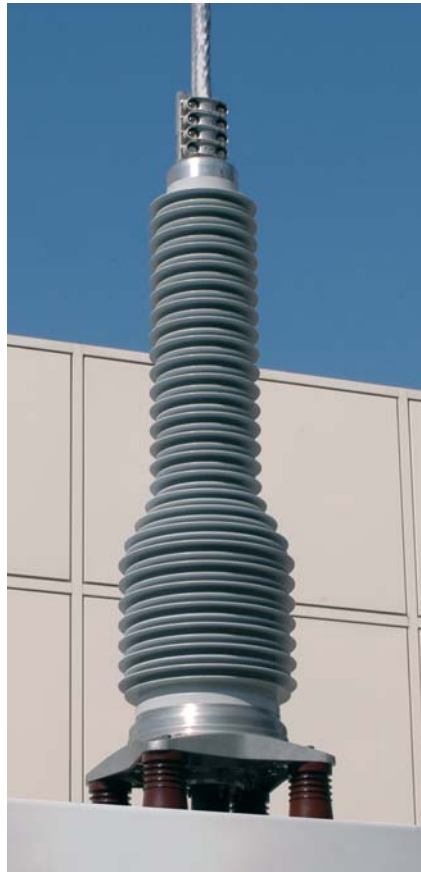
## Dry Self-Supporting Outdoor Termination OHVT-D for 145 kV

### Application

The dry self-supporting termination is designed for voltage class 145 kV and operation under severe environmental conditions. It is free from any insulating liquid or gel. Polymeric insulated cables of various designs can be adopted with respect to shielding and metal sheath. The termination is easily separable and consists of a plug-in part and an epoxy resin insulator protected with a directly moulded silicone shed housing. Due to the short cable cut-back dimensions of the plug-in the time required to install the termination is very short and can be further reduced by pre-installing the plug-in on the shop floor. The plug-in is similar to the plug-in used with our dry switchgear/transformer termination.

### Features

- Dry interface, no oil-filling
- Self-supporting
- Pre-fabricated and factory tested silicone rubber stress cone
- Torque-controlled multi-contact conductor bolt
- Fast and simple installation combining gas-insulated switchgear plug-in technology with polymeric insulators
- No special tools required to install the termination
- Isolated cable gland for sectionalization
- Type tested according to IEC-60840

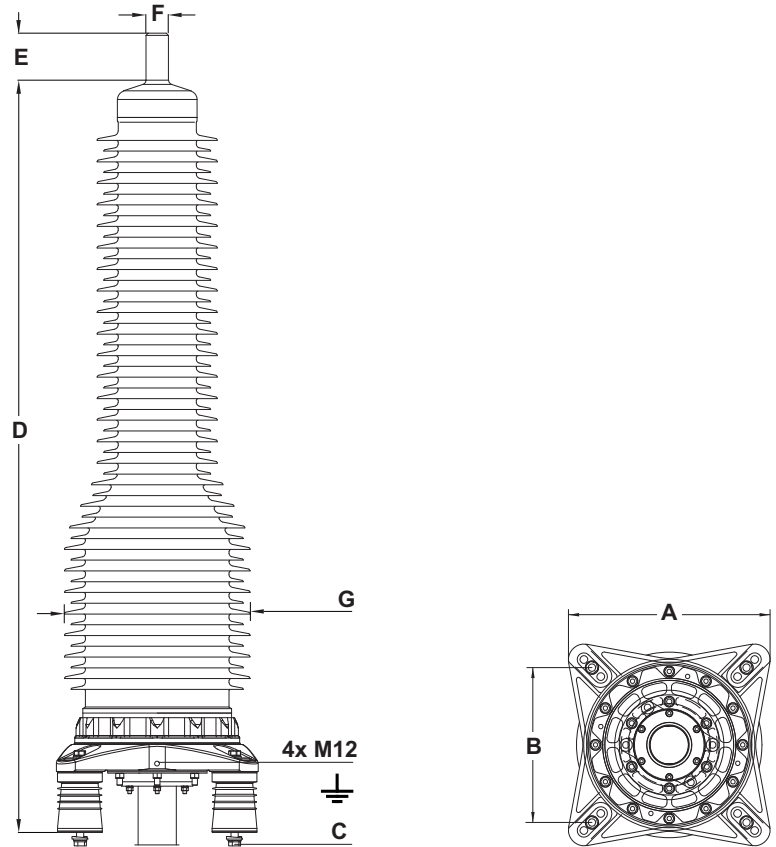
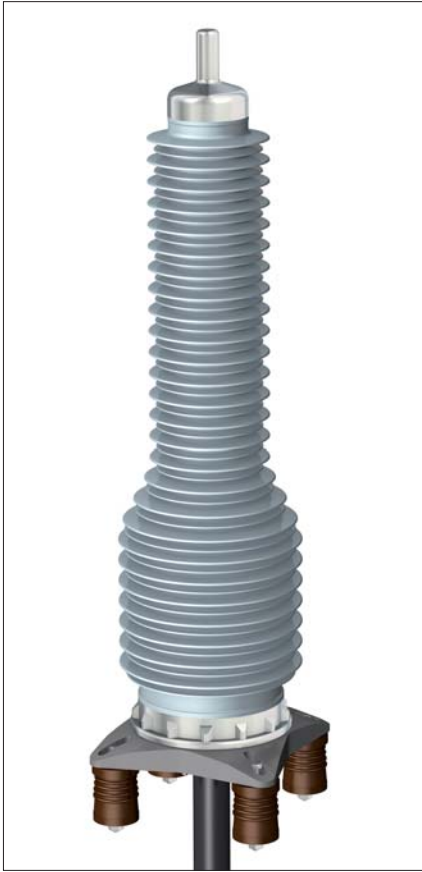


### Cut-away drawing of OHVT-D

- 1 Upper metal fitting
- 2 Mechanical connector
- 3 Resin body with silicone shed housing
- 4 Stress cone
- 5 Spring-loaded compression ring
- 6 Base plate
- 7 Support insulators
- 8 Gland and sealing



## Dry Self-Supporting Outdoor Termination OHVT-D for 145 kV



### Type of termination

OHVT-145D

### Technical data

Max. operating voltage  $U_m$  (kV)  
Standards

145  
IEC-60840  
IEC-60815

Rated voltage  $U$  (kV)  
Rated lightning impulse 1,2/50  $\mu$ s  
withstand voltage (BIL) (kV)  
Min. creepage distance (mm)  
Partial discharge measurement (pC)  
Cantilever force (N)  
Weight approximately (kg)  
Withstand voltage support  
insulators (AC/DC) (kV)

132 – 138  
650  
4680  
< 5  
5000  
130  
10/20

### Application Range

Conductor cross section Cu/Al (mm<sup>2</sup>)  
Diameter over cable insulation (mm)  
Max. diameter over cable sheath (mm)

95 – 1200  
34 – 78  
99

### Dimensions

A (mm)  
B (mm)  
C  
D (mm)  
E (mm)  
F (mm)  
G (mm)

450  
345  
M16  
1783  
100  
30  
410

**Note:** Special applications, bigger cable sizes and more detailed information are available on request.

# Dry Compact Switchgear and Transformer Termination PHVS and PHVT for 72 kV up to 245 kV

## Application

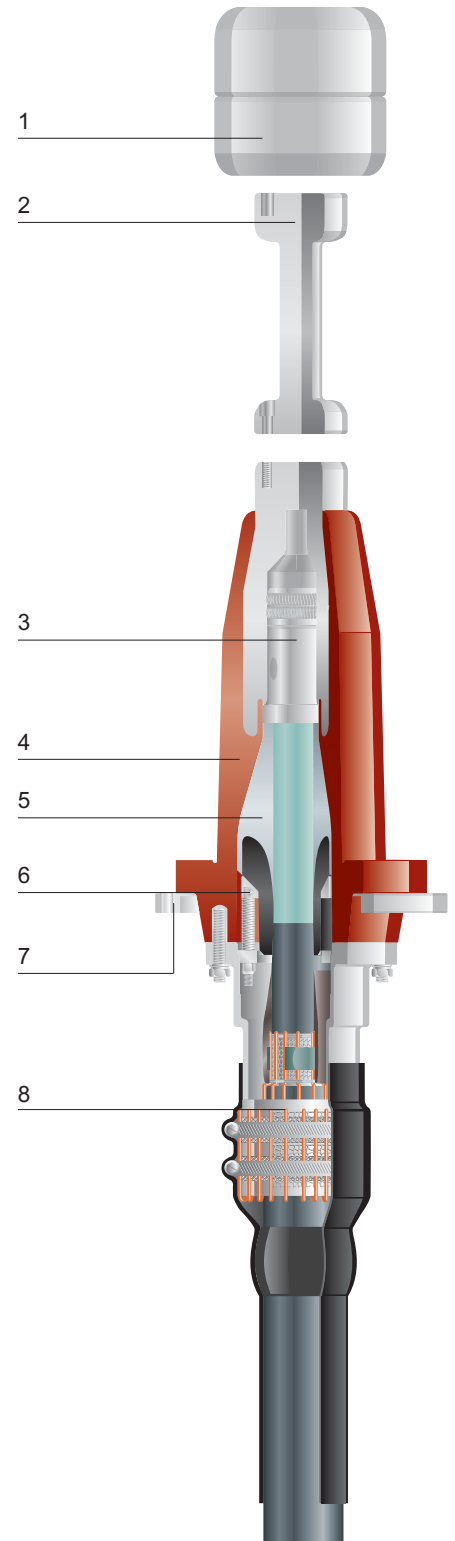
The dry compact switchgear termination for voltage classes up to 245 kV is designed to be installed in cable entry housings of gas-insulated switchgear (GIS). It complies with IEC-62271-209 standard, which essentially specifies the interfaces between the termination and the switchgear. Therefore the termination will fit into all GIS complying with IEC-62271-209. Adapters are available to match the dimensions of wet (oil-filled) type terminations and older designs specified in IEC-60859.

The termination operates in SF<sub>6</sub> but also in insulating liquids like transformer oil. A corona shield at the top of the termination then provides the necessary shielding of the terminal.

The termination is easily separable and consists of a plug-in part and an epoxy resin insulator. The insulator can be installed by the GIS or transformer manufacturer already at the factory saving installation time onsite and reducing the risk of contamination of the cable entry housing. In case of short cable links and due to the short length and light weight of the plug-in part it can be also preinstalled by the cable manufacturer further reducing the time required to install a substation.

## Features

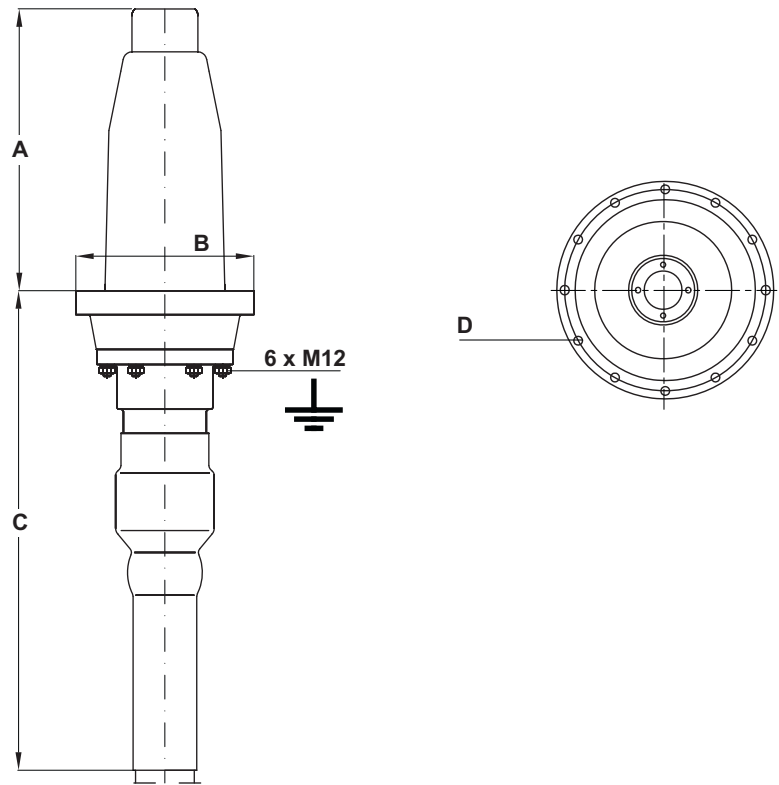
- Dry interfaces, no oil-filling
- Dimensions comply with IEC-62271-209
- Pressure-tight resin housing
- Operates in SF<sub>6</sub> and insulating liquids
- Pre-fabricated and factory tested silicone rubber stress cone
- Multi-contact mechanical connector with shear-head bolts with predetermined shear torque
- No special tools required to install the termination
- Isolated cable gland for sectionalization
- Type tested according to IEC-60840, IEC-62067 and IEC-62271-209 standards



## Cut-away drawing of PHVS and PHVT

- 1 Corona shield (PHVT only)
- 2 Adapter (optional)
- 3 Mechanical connector
- 4 Resin housing
- 5 Stress cone
- 6 Spring-loaded compression ring
- 7 Fixing ring
- 8 Gland and sealing

## Dry Compact Switchgear and Transformer Termination PHVS and PHVT for 72 kV up to 245 kV



Type of termination	PHVS(T)-72	PHVS(T)-145	PHVS(T)-245
<b>Technical data</b>			
Max. operating voltage $U_m$ (kV)	72,5	145	245
Standards	IEC-60840 IEC-62271-209	IEC-60840 IEC-62271-209	IEC-62067 IEC-62271-209
Rated voltage $U$ (kV)	60 – 69	132 – 138	220 – 230
Rated lightning impulse 1,2/50 $\mu$ s withstand voltage (BIL) (kV)	325	650	1050
Min. creepage distance (mm)	255	414	519
Partial discharge measurement (pC)	< 5	< 5	< 5
<b>Application Range</b>			
Conductor cross section Cu/Al (mm <sup>2</sup> )	95 – 1200	95 – 1200	300 – 2500
Diameter over cable insulation (mm)	34 – 78	34 – 78	77 – 119
Max. diameter over cable sheath (mm)	120	120	160
<b>Dimensions</b>			
A (mm)	310	470	620
B (mm)	245	297	454
C (mm)	800	800	860
D (mm)	8 x 12	12 x 14,5	16 x 13

**Note:** Special applications, bigger cable sizes and more detailed information are available on request.

# One-piece Joint EHVS-S up to 245 kV

## Application

The joint is a pre-fabricated one-piece design for voltage classes up to 245 kV. Polymeric insulated cables of various designs can be adapted with respect to shielding and metal sheath. The silicone rubber joint body with integrated geometrical stress control provides proven electrical function. The joint components combine electrical performance, stress control and moisture sealing to provide the important functions required for all high voltage products.

## Features

- Premoulded one-piece joint body
- Mechanical connector with shear-head bolts with predetermined shear torque
- Choice of outer sealing and protection systems
- Joint fits on all polymeric cable constructions
- Proven shield continuity concept
- Factory-tested silicone rubber body
- Special silicone rubber provides perfect compression force for optimised electrical performance
- Simple assembly
- No tension set of push on joint body
- Moulded thick outer conductive screen
- Geometrical electrical stress control by moulded conductive deflectors
- Type tested according to IEC-60840, IEC-62067, IEEE-404 and GB-11017 Standards

## Joint shield conductivity

- Solderless grounding connection
- Typical shield wire cross sections can be easily connected by either mechanical or compression connectors



Straight through connection



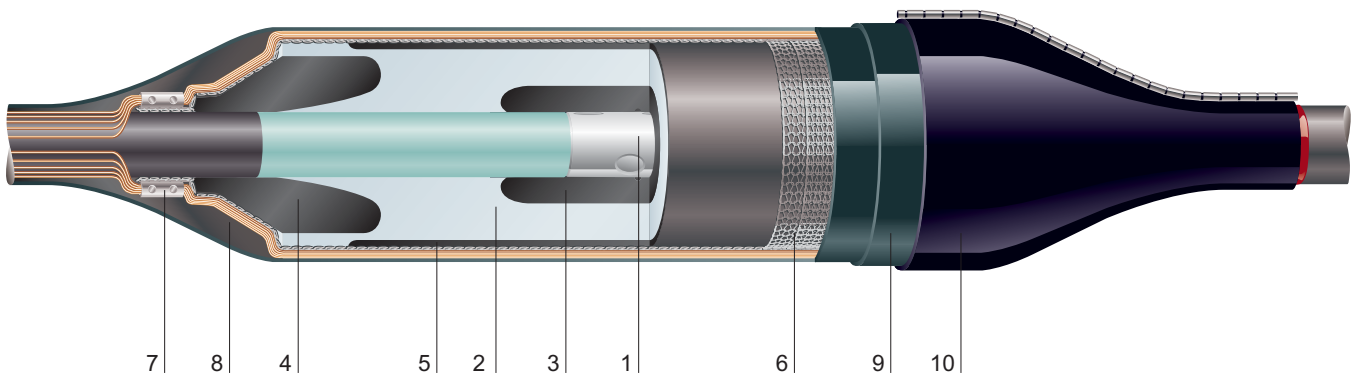
Grounded connection



Shield break connection

## Cut-away drawing of EHVS-S

- 1 Mechanical connector
- 2 Silicone rubber body
- 3 Inner electrode
- 4 Deflector
- 5 Outer electrode
- 6 Copper mesh
- 7 Solderless shield connection
- 8 Sealant/mastic
- 9 Insulating tubes
- 10 Outer protection with integrated moisture barrier



## One-piece Joint EHVS-S up to 245 kV



Inline joint



Shield break joint

Type of joint	EHVS-145S	EHVS-245S
<b>Technical data</b>		
Max. operating voltage $U_m$ (kV)	145	245
Standards	IEC-60840	IEC-62067
Rated voltage $U$ (kV)	132 – 138	220 – 230
Rated lightning impulse 1,2/50 $\mu$ s withstand voltage (BIL) (kV)	650	1050
Partial discharge measurement (pC)	< 5	< 5
<b>Application Range</b>		
Conductor cross section Cu/Al (mm <sup>2</sup> )	500 – 1200	300 – 2500
Diameter over cable insulation (mm)	56 – 78	77 – 119
Max. diameter over cable sheath (mm)	110	140
<b>Dimensions</b>		
Length (mm)	2400	2600
Diameter (mm)	220	280
<b>Screen Treatment</b>		
Inline	√	√
Shield break	√	√
Grounded	√	---

**Note:** All listed dimensions are standard size to serve the common application of these joints.  
Special applications, bigger cable sizes and more detailed information are available on request.

# Tree-piece Joint EHVS-T up to 170 kV

## Application

The joint is a pre-fabricated three piece design for voltage classes up to 170 kV. Polymeric insulated cables of various designs can be adapted with respect to shielding and metal sheath. The silicone rubber joint parts with integrated geometrical stress control provide proven electrical function. The joint components combine electrical performance, stress control and moisture sealing to provide the important functions required for all high voltage products.

## Features

- Premoulded three piece joint design
- Mechanical connector with shear-head bolts with predetermined shear torque
- Joint fits on all polymeric cable constructions
- Proven shield continuity concept
- Factory-tested silicone rubber bodies
- Special silicone rubber provides perfect compression force for optimized electrical performance
- Short cut-back dimensions
- No special tools required to install the joint
- Cable size transition possible
- No tension set of push on joint body
- Moulded outer conductive screen
- Geometrical electrical stress control by moulded conductive deflectors
- Type tested according to IEC-60840 and IEEE-404 Standards

## Joint shield conductivity

- Solderless grounding connection
- Typical shield wire cross sections can be easily connected by either mechanical or compression connectors



Straight through connection



Grounded connection

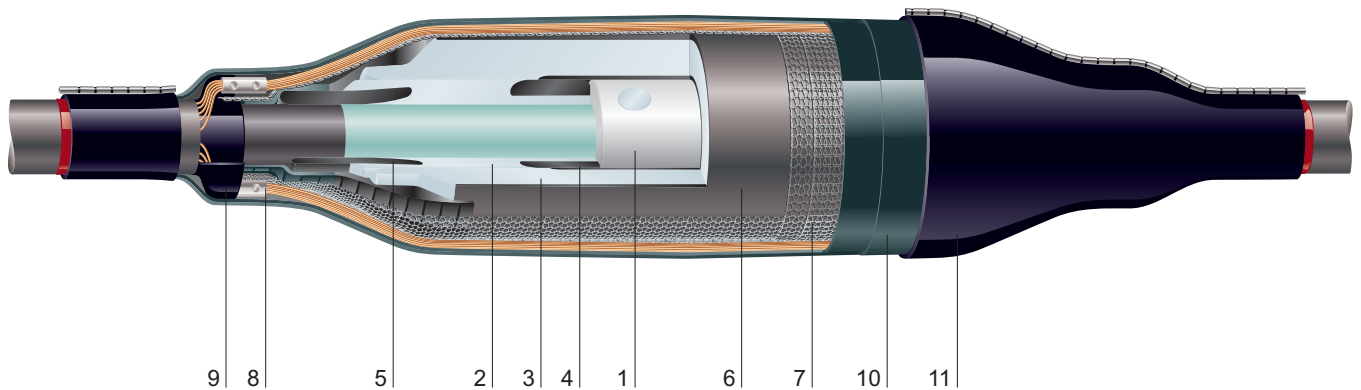
## Main joint components

- Mechanical connector
- Silicone rubber adapter body
- Silicone rubber main body



## Cut-away drawing of EHVS-T

- 1 Mechanical connector
- 2 Silicone rubber adapter body
- 3 Silicone rubber main body
- 4 Inner electrode
- 5 Deflector
- 6 Outer screen
- 7 Copper mesh
- 8 Solderless shield connection
- 9 Sealant/mastic
- 10 Insulating tubes
- 11 Outer protection with integrated moisture barrier



## Tree-piece Joint EHVS-T up to 170 kV



Inline joint



Shield break joint

Type of joint	EHVS-145T	EHVS-170T
<b>Technical data</b>		
Max. operating voltage $U_m$ (kV)	145	245
Standards	IEC-60840	IEC-60840
Rated voltage $U$ (kV)	132 – 138	150 – 161
Rated lightning impulse 1,2/50 $\mu$ s withstand voltage (BIL) (kV)	650	750
Partial discharge measurement (pC)	< 5	< 5
<b>Application Range</b>		
Conductor cross section Cu/Al (mm <sup>2</sup> )	185 – 1600	240 – 2500
Diameter over cable insulation (mm)	43 – 83	60 – 110
Max. diameter over cable sheath (mm)	105	112
<b>Dimensions</b>		
Length (mm)	2000	2000
Diameter (mm)	200	250
<b>Screen Treatment</b>		
Inline	√	√
Shield break	√	√
Grounded	√	√

**Note:** All listed dimensions are standard size to serve the common application of these joints.  
Special applications, bigger cable sizes and more detailed information are available on request.

# Tools and Accessories





## **Tools and Accessories**

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## Gas torch assembly FH-1630

The FH-1630 torch assembly for rapid installation of heat-shrinkable materials offers maximum burning efficiency and the best available balance of surface preheat.

All system components are fully compatible.

### Torch box with contents FH-1630-S-MC10

Torch box with nozzles BN28, BN38 and PN17, torch handle HSZ, constant pressure regulator R1, automatic cut-off valve CV, 4 m long high pressure hose SW4.

Weight: 4,8 kg

Dimensions: 470 x 210 x 74 mm



### Torch handle FH-1630-S-HNZ FH-1630-S-HSZ

Torch handle with holder and shut-off valve for use on all FH-1630-S nozzles. Handle HSZ has in addition a pilot/full flame lever. Nozzle connection thread: R 3/8", right  
Hose connection thread: R 3/8", left



### Nozzles for FH-1630-S

	Flame Diameter (mm)	Gas consumption (kg/h)	Stern length (mm)
FH-1630-S-BN 28	28	0,46	195
FH-1630-S-BN 38	38	0,90	195
FH-1630-S-BN 50	50	2,00	195
For Plumbing FH-1630-S-PN 17	17	0,24	195



### Torch box with contents FH-1630-PIE-MC10

Torch box with nozzles BN28, BN38, BN50 and PN18, torch handle FH-1630-PIE with piezo ignition, safety regulator LGS, 4 m long high pressure hose SW4.

Weight: 4,8 kg

Dimensions: 450 x 210 x 74 mm



### Torch handle with piezo ignition FH-1630-PIE

Torch handle with piezo ignition, gas supply only while handle is pressed. Nozzle connection: bayonet socking.  
Hose connection thread: R 3/8", left



### Nozzles for FH-1630-PIE

	Flame Diameter (mm)	Gas consumption (kg/h)	Stern length (mm)
FH-1630-PIE-BN 28	28	0,46	195
FH-1630-PIE-BN 38	38	0,90	195
FH-1630-PIE-BN 50	50	2,00	195
For Plumbing FH-1630-PIE-PN 18	18	0,24	210



## Accessories for gas torch assembly FH-1630

### Constant pressure regulator FH-1630-PIE-R1

Applicable on propane gas tanks with a capacity of 5 kg or 11 kg. Thread connection fits to all FH-1630 high pressure hoses.

Gas flow: max. 6 kg/h

Constant pressure: 2 bar

Hose connection thread: R 3/8", left

Gas bottle connection thread:

W 21,8 x 1/14", left (DIN-Kombi)



### Automatic cut-off valve FH-1630-PIE-CV

The automatic cut-off valve is fitted between the hoses SW4, SW5 or SW10 and the constant pressure regulator and cuts off the gas supply in the event of damage to the hose or torch handle.

Connection threads: R 3/8", left



### Safety regulator FH-1630-PIE-LGS

The safety regulator with integrated constant pressure regulator (2 bar, 2 kg/h) and automatic cut-off valve is fitted between the hose and the gas bottle.

Hose connection thread: R 3/8", left

Gas bottle connection thread:

W 21,8 x 1/14", left (DIN-Kombi)



### High pressure hoses

Fitted with screw connections for FH-1630 constant pressure regulator and torch handle.

Connection threads: R 3/8", left

Internal diameter: 4 mm

Colour: orange

FH-1630-PIE-SW 4 (length: 4 m)

FH-1630-PIE-SW 5 (length: 5 m)

FH-1630-PIE-SW 10 (length: 10 m)



### Torch assembly FH-1630-S-TS1

Torch assembly of nozzle BN38, torch handle FH-1630-S-HNZ and 5 m long pressure hose SW5.



## Tool Sets

### Complete tool kit IT-1000-001-CEE02

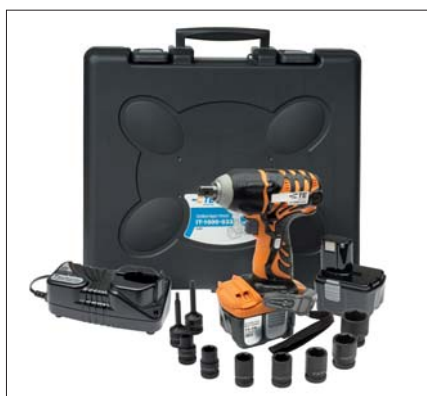


The tool kit contains all basic tools usually required for the cable preparation and the installation of accessories. Following tool sets are assembled in a leather case:

Ordering description	Contents
IT-1000-003	1 x Wedge positioner for spreading cable cores
IT-1000-005	1 x Hammer, 300 g
	1 x Screwdriver, 3,5 mm
	1 x Screwdriver, 6,5 mm
	1 x Hacksaw 1 x Hacksaw junior
IT-1000-006	1 x Pipe wrench, 250 mm
	1 x Side cutter, 160 mm
	1 x Pincers, 180 mm
	1 x Blunt nose pliers, 180 mm
	1 x Scissors, 200 mm
IT-1000-007	1 x Folding ruler, 2 m
	1 x Wire brush
	1 x Hook knife
	1 x Cable knife
	1 x Sharpening stone, 125x100 mm 1 x File set, medium size
IT-1000-008	1 x Control mirror, 100x100 mm
	1 x Spreader 3 way
	2 x Core separator
	6 x Cleaning tissues 1 x Refillable solvent bottle (empty), 0,4 litre
IT-1000-010	1 x Diameter tape, 2 m
IT-1000-011	1 x Scoring tool for easy-strip screens
IT-1000-012	1 x Leather tool case, 400x125x280 mm
IT-1000-015	1 x Tee-handle spinner wrench, 300 mm
	1 x Hexagon insert socket for wrenches, 13 mm
	1 x Hexagon insert socket for wrenches, 17 mm
	1 x Hexagon insert socket for wrenches, 19 mm
	1 x Hexagon insert socket for wrenches, 22 mm

The individual tool sets can be also ordered separately.

### Cordless impact wrench IT-1000-033



The ergonomic cordless impact wrench allows safe, fast and convenient installation of mechanical connectors and lugs using shear-head bolts. The wrench can be used for shear-head bolts up to 100 Nm. It is equipped with belt hook with integrated LED work light and delivered in stable compartmented carrying case.

The content of the case:

- 1 x Cordless impact wrench
- 1 x Battery charger
- 2 x Li-ion battery 3,0 Ah (14,4 V)
- 8 x 1/2" hexagonal socket: 10; 13; 16; 17; 19; 22; 24; 27 mm
- 1 x Adapter to 1/4" hexagonal drive
- 4 x Allen key insert: H5x65, H6x38, H6x65 and H8x65 mm
- 1 x Installation instruction

**Spare parts:**

- IT-1000-033-BAT-LI-ION** - battery Li-ion 3,0 Ah (14,4 V)
- IT-1000-033-CHRG-220V** - charger for battery

## Cable Preparation Tools

**Cable knife  
EXRM-0607**

Cable knife with fixed blade  
Length: 175 mm



**Hook knife  
EXRM-0947**

Cable knife for oversheath stripping for cables with an outer diameter > 20 mm. Hook form of the blade ensures an easy and safe dismantling.



**Scoring tool for easy strip screens  
IT-1000-011**

Fixed blade scoring tool for easy strip conduct layer.

Ordering description	Scriber depth (mm)
IT-1000-011	0,4
IT-1000-011-0.6	0,6



**Ratchet type cutter  
KR 600**

Ratchet type cable cutter for aluminium and copper conductors, stranded or solid up to 400 mm<sup>2</sup>.  
Application range: Ø max. 52 mm



**Insulation stripping pliers  
EXRM-1004**

Insulation stripping tool for paper insulated cables.  
Length: 190 mm  
Application range: Ø 15–50 mm



**Insulation stripping string  
EXRM-0764**

Insulation stripping string for plastic insulated cables.  
Length: 2000 mm



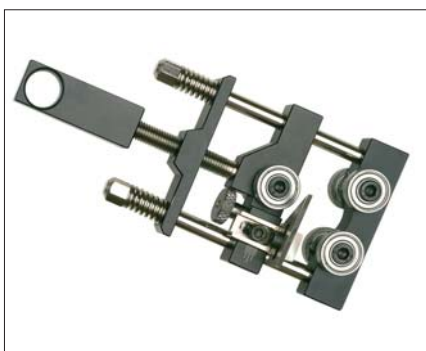
**Insulation and oversheath stripping tool  
IT-1000-024**



Designed for insulation removing and oversheath stripping of plastic insulated cables, ranging from 35 mm<sup>2</sup> 10 kV to 500 mm<sup>2</sup> 35 kV. The automatic feed (2 steps) and the 0 position, for a radial cut, allow a quick, safe and exact cutting of the cable oversheath and insulation. The special shape of the knife lifts the sheath at the cutting point and thus prevents damage to any components underneath. Tool is supplied completely with an operating manual in a box.

Application range: Ø 15 - 50 mm, thickness up to 10 mm  
**Spare blade: IT-1000-024-01** (set of 5 pieces)

**Screen removal tool  
IT-1000-017**



Designed for screen removing of round plastic insulated conductors with coextruded and bonded semi-conductive screen. It is continuously adjustable to the core diameters within given range. Cutting depth easily changed with a knurled head screw. Delivered completely with operating manual, hexagonal allen key and a spare blade in a tool box.

Application ranges	Ordering description		
	IT-1000-017-1	IT-1000-017-2	IT-1000-017-3
Over semi-conductive layer	Ø 16-34 mm	Ø 19-45 mm	Ø 26-48 mm
Rated Voltages U <sub>0</sub> /U (U <sub>m</sub> ) (kV)	Cable Cross Section (mm <sup>2</sup> ) according to IEC 502		
6 / 10 (12)	25 - 300	70 - 630	120 - 800
8,7 / 15 (17,5)	25 - 240	50 - 630	70 - 800
12 / 20 (24)	25 - 185	25 - 500	50 - 630
18 / 30 (36)	35 - 120	35 - 400	35 - 500
20 / 35 (42)	35 - 95	35 - 300	35 - 400

**Spare blade: EXRM-1606**

**Stripping tool  
HVIA-STRIPPER**



Stripping tool for coextruded and bonded cable screens and primary insulation for HV cables. Completely delivered in a heavy-duty plastic case, with operating manual and one set of coated blades.

Ordering description	Cable Diameter (mm)	
	min.	max.
HVIA-STRIPPER-35/ 90	35	90
HVIA-STRIPPER-75/150	75	150

## Miscellaneous Tools and Accessories

### Hexagon insert socket EXRM-1228

Extra long hexagon insert socket wrench is used for the installation of RICS adapters.  
Insert socket size: 24 mm  
Length: 90 mm



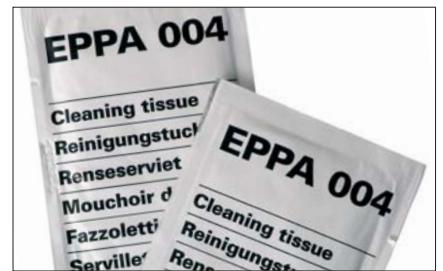
### Installation tool IT-1000-019

Tool for holding mechanical connectors in position while tightening the bolts.  
Length of handle: 205 mm  
Application range: Ø 15 - 60 mm



### Cleaning tissues EPPA-004

Tissues impregnated with water-soluble cleaning solution. For cleaning and degreasing of metal and plastic surfaces.  
Size: 145 x 140 mm folded to 80 x 60 mm  
Packaging: 50 pieces in a box



### Refillable bottle for solvent EXRM-0945-0,4

Refillable aluminium bottle with yellow cap for degreasing solution (empty), 0,4 litre.

### Core bend-out tool EXRM-2014-CBT-16

Wedge side of the tool used for quick and easy spreading of LV cable cores and integrated claw on the other tool's side designed for bending out and proper positioning of cable cores for branch joints.

Application range: 4 -16 mm<sup>2</sup>  
Material: highly impact resistant reinforced plastic



### Core separator B 6340 B 7060

Wedge core separator made of an impact resistant plastic material. The LV cable cores' separating with the B 7060 is done in two very simple steps: wedge in and twist.

Cable cross section (mm <sup>2</sup> )	Ordering description
25–150	B 6340
50–185	B 7060



### Channel pulling tool IT-1000-014

Tool used for installation and securing of closing channels on heat-shrinkable wraparounds such as CRSM, MRSM and RFSM.



**Inflation tool  
RDSS-IT-16**

Inflation tool for RDSS duct seals complete with ON/OFF switch and an automatic pressure monitoring system. The required CO<sub>2</sub> gas cylinders (E7512-0160) must be ordered separately.



**CO<sub>2</sub> gas cylinder  
E7512-0160**

Gas cylinder for inflation of RDSS duct seals by installation tool RDSS-IT-16. Each gas cylinder inflates about 5 pieces of RDSS-100.

Content: 16 g of CO<sub>2</sub>  
Packaging: 10 cylinders in a box



**Assembly lubricant  
EPPA-064-60**

Lubricant for installation of RSTI screened T-connection system for gas-insulated switchgears.

Content: 60 g in a plastic tube with sponge top and cap closure



**Fluorosilicone grease  
EXRM-0956-45**

Fluorosilicone grease for installation of RICS insulated T-adapter and RCAB straight adapter system for gas-insulated switchgears.

Content: 4,5 ml (6,6 g) in a bag  
Dimensions: 40 x 85 mm



**Funnel  
EPPA-017**

Funnel to fill draining oil (MI) cable terminations with insulating oils, i.e. EPPA 016-1-10.

**Insulating oil  
EPPA-016**

Insulating oil is used to fill the crutch of draining oil cable terminations, e.g. type IDST and EPKT.

Description	Content
EPPA-016-1-10	1,0 liter
EPPA-016-1-17	1,7 liter





## Accessories for solderless earth connections

### Roll Springs

Constant force roll springs used for solderless shield and armour connections.

Ordering Description	Application Diameter (mm)		Width (mm)
	min.	max.	
EPPA-034-E	17	29	25
EPPA-034-F	30	39	25
EPPA-034-G	40	60	25
EPPA-034-H	50	75	30



### Ligarex pliers IT-1000-004

These special pliers are used for tightening the Ligarex ties. The Ligarex ties are used in earth connections of paper cables with metal sheaths.



### Ligarex ties

Ordering Description	Length (mm)
EXRM-0302-500	500
EXRM-0302-800	800

## Sealing and filler tapes

### Filler tape EPPA-206

EPPA-206 is a black mastic and mainly used as filling and shimming tape.

Ordering description	Width (mm)	Thickness (mm)	Length (mm)
EPPA-206-2-1500	50	2,0	1500
EPPA-206-4- 250	50	4,0	250



### Sealing tape S1052

S1052 is a black; heat activated high flow sealant used for sealing, corrosion protection and large void filling.

Ordering description	Width (mm)	Thickness (mm)	Length (mm)
S1052-1-500	35	1,0	500





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