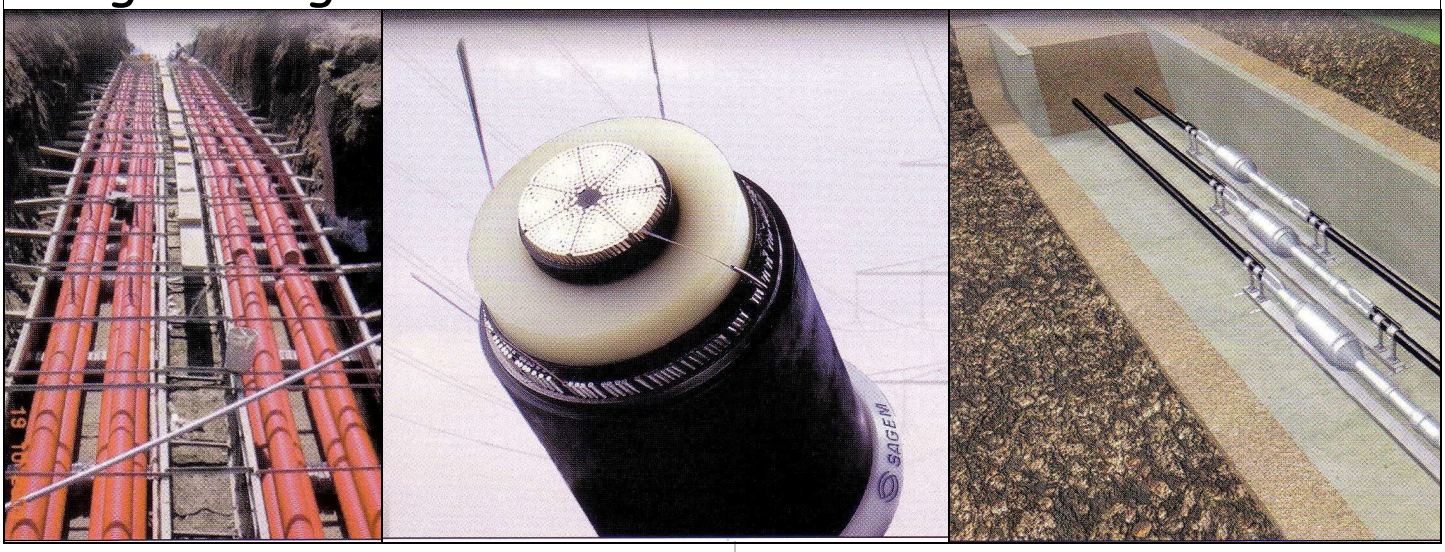
ONE-PIECE PREMOLDED JOINT FOR EXTRUDED CABLES FROM 63 TO 500kV

Engineering Cables Accessories



SILEC CABLE, the world's leading manufacturer of Extra High Voltage cables with synthetic insulation.

SILEC CABLE offers complete 63 to 500kV XLPE Power Cable Systems, comprising cables, accessories and related design and installation services

A long lasting connection

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ONE PIECE PREMOLDED JOINT FOR EXTRUDED CABLES FROM 63 TO 500 kV

1- DESIGN CRITERIA

A joint is the insulated and fully protected connection between two cables.
The design requirements common to each type of joint (straight joint, transition joint,...) are :

- a high current connection between conductors,
- a joint insulation which meets the same performance standards as the cable,
- a high current connection to permit the flow of short circuit current between the two cable sheaths or screen wires,
- a screen connection electrically insulated from earth potential to match the insulating integrity of the cable oversheath,
- a protection of the joint and cable insulation against the ingress of water,
- a protection against corrosion of the joint metal work,
- other options are available : flame retardant protection, anti-termite protection, etc.

2 - SILEC CABLE EXPERTISE

For more than four decades, SILEC CABLE has been the world-wide leader in the design and manufacture of high voltage and extra high voltage transmission extruded cables and corresponding accessories.

SILEC CABLE's global projects have required the company to produce and/or to install more than **9100 km (5 650 miles) of 63 to 500 kV extruded cable, 25 000 terminations and over 12 000 joints**.

Prefabricated accessories (terminations and joints) for HV and EHV extruded cables have been developed by SILEC CABLE more than 20 years ago and are available for XLPE cables ranging from 63 to 500 kV.

For transmission cables rated 63 to 500 kV, "one-piece premolded joints" (including interruption shield option for cross-bonded systems) are proposed for direct burial, steel pipes or manhole applications, etc.

Factory molded using **a special high-performance EPDM material** and factory tested, these premolded joints offer the most reliable solution and can fit any solid dielectric cable.

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3- JOINT DESIGN

The joint design is shown on figure 1 :

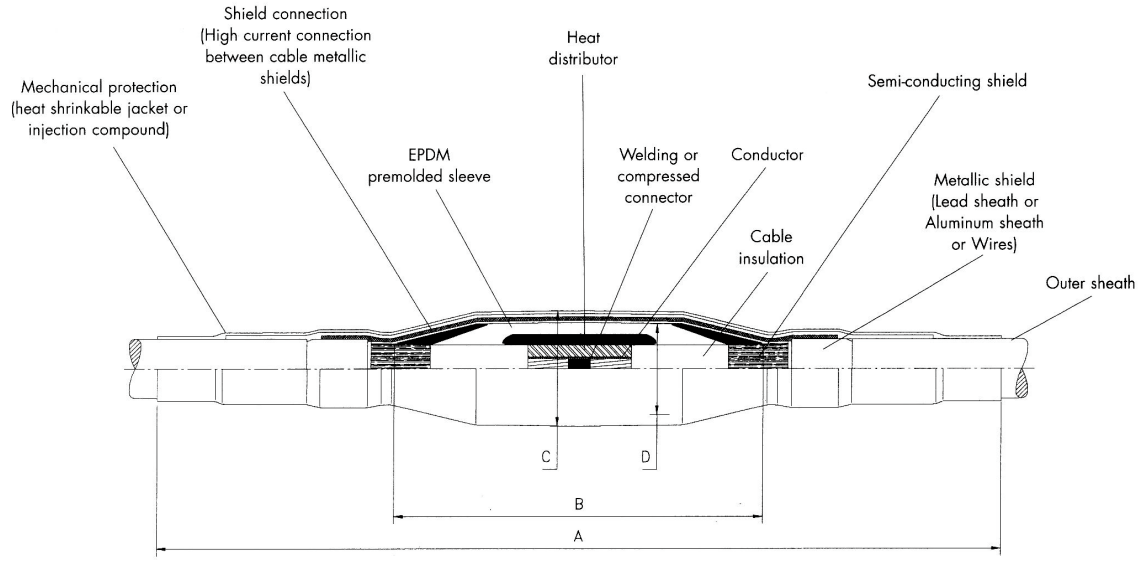

Fig. 1 : Premolded joint

The main component is the insulating premolded sleeve which allows to rebuild the cable insulation;
its main dimensions are given in table 1.

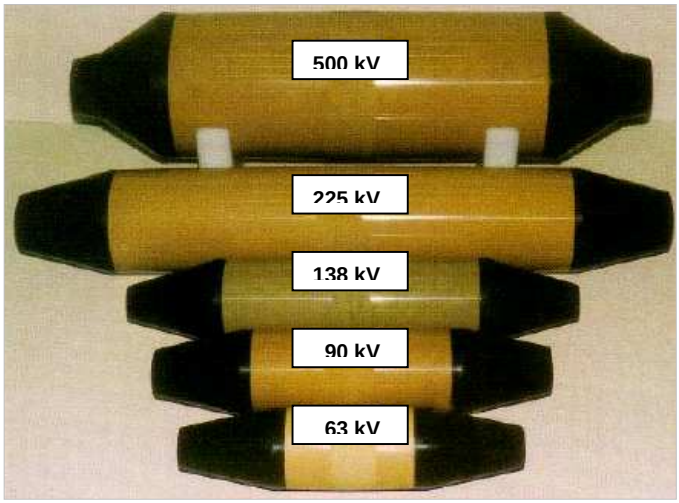

Fig 2 : One piece type premolded joints

Fig. 3 : Direct buried 400 kV premolded joints

The whole range of **premolded joints allows the connection of cable with rated voltages ranging from 63 to 500 kV**.
Figure 3 shows an example of **directly buried 400 kV joints**.

The watertightness and the mechanical protection of the joint is insured by a metallic barrier covered by a heat shrinkable jacket or an injection compound polymerised at ambient temperature. According to specific environments or requests, other designs of the mechanical protection are available.

TABLE 1 : PREMOLDED JOINT DIMENSIONS

VOLTAGE CLASS Nominal System Voltage	MAXIMUM SYSTEM VOLTAGE	PREMOLDED BLOCK DIMENSIONS Overall dimensions (mm)	
kV	kV	Diameter "C" - mm	Max Length "A" - mm
63-69	72.5	185	2000
90	100	185	2000
110-115	123	185	2000
132-138	145	185	2000
150-161	170	225	2800
220-230	245	225	2800
330-345	362	320	3000
400	420	320	3000
500	550	320	3000

4- JOINT PERFORMANCES

In order to guarantee full operational service life, premolded joints have been type tested with corresponding cables according to the most severe standards, in particular to the international standards IEC 60840, IEC 62067 and French standard NF C 33-253 which include long-term tests.

For each class of joint, **long-term tests** at a voltage between conductor and metallic shield equal to 1.7 times the corresponding phase to ground system voltage have been carried out on **cable systems including joints, cable and terminations** to verify the complete compatibility of cable and accessories, **in normal and overload operating conditions**.

In addition, shield connections have been type-tested in **short-circuit conditions (up to 63 kA).**

Routine tests :
All premolded blocks are tested in factory according to the international standards including AC voltage test and Partial Discharges measurement.

Fig. 4 : Type test of 500 kV premolded joint
Partial Discharges Measurement

Fig. 5 : Routine test area

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TABLE 2 : TECHNICAL DATA

RATINGS									
Nominal system voltage (kV)	63-69	90	110-115	132-138	150-161	220-230	330-345	400	500
Maximum system voltage (kV)	72.5	100	123	145	170	245	362	420	550
B.I.L. (kV peak 10 pulses ±)	350	450	550	650	750	1050	1175	1425	1550
Minimum A.C withstand test (voltage level and duration)	130 kV 24 h	180 kV 24 h	180 kV 24 h	200 kV 24 h	350 kV 24 h	350 kV 24 h	430 kV 24 h	500 kV 24 h	625 kV 24 h
Rated current	Same current rating as the cable up to 2500 mm^2 conductor size								
Thermal (temperature of the cable conductor during impulse test in ℃)	90℃								
Short-circuit current (kA)	31.5-40	31.5-40	31.5-40	31.5-40	31.5-40	40-63	40-63	40-63	40-63

5- INSTALLATION PROCEDURE

The main installation phases are described here below :

a) for safe operation of the system, cable ends should have been straightened before installing the joint.

b) after straightening, cable ends are prepared, cut and smoothed at the required level.
Then the joint installation can start.

c) before connecting the cable conductors by mechanical connector or welding, the joint block has been put in temporary position using a plain pulling tool.

d) after connection, the heat distributor is positioned on the connector.

e) then the joint block is pulled back in its final position and the insulation screen is applied.

f) shield connections are made taking into account the short circuit rating of cable and using appropriate method.

g) the joint is finally sealed using aluminium protection and heat shrinkable jacket or injection compound.

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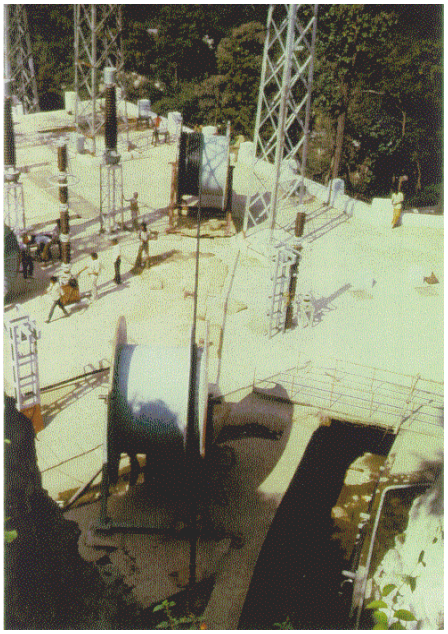
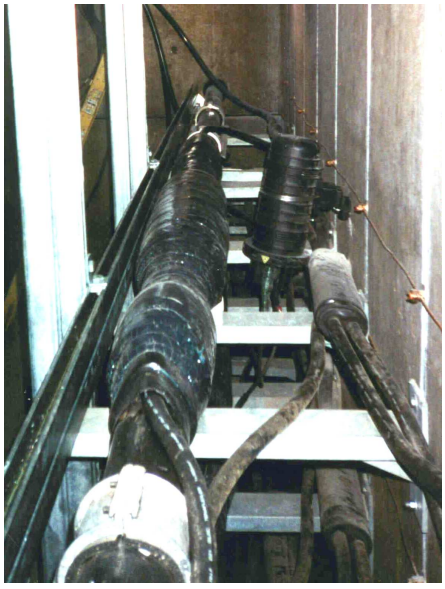
6- SERVICES

SILEC CABLE provides a whole set of services for High Voltage and Extra High Voltage cable systems, including design and engineering, testing and commissioning, maintenance, after sales services and **turnkey projects**.



Installation of cable in a vertical shaft

Outdoor terminations in a substation



Premolded joints

◄ with shield interruption and cable incorporated optical fibre (cable thermal monitoring)

joints with earthing in tunnel ►

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